

ELEVENTH EDITION

CAMPBELL
BIOLOGY
URRY • CAIN • WASSERMAN
MINORSKY • REECE



Test Bank

1.1 Multiple-Choice Questions

1) Cells are _____.

- A) only found in pairs, because single cells cannot exist independently
- B) limited in size to 200 and 500 micrometers in diameter
- C) characteristic of eukaryotic but not prokaryotic organisms
- D) characteristic of prokaryotic and eukaryotic organisms

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.1

2) In comparison to eukaryotes, prokaryotes _____.

- A) are more structurally complex
- B) are larger
- C) are smaller
- D) do not have membranes

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.1

3) Which of the following types of cells utilize deoxyribonucleic acid (DNA) as their genetic material but do not have their DNA encased within a nuclear envelope?

- A) animal
- B) plant
- C) archaean
- D) fungi

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 1.1

4) To understand the chemical basis of inheritance, we must understand the molecular structure of DNA. This is an example of the application of which concept to the study of biology?

- A) evolution
- B) emergent properties
- C) reductionism
- D) feedback regulation

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 1.1

5) A localized group of organisms that belong to the same species is called a _____.

- A) community
- B) population
- C) ecosystem
- D) family

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.1

6) Which of the following statements is *true* regarding the complexity of biological systems?

- A) An understanding of the interactions between different components within a living system is an approach towards understanding reductionism.
- B) Knowing the function of a component of a living system can provide insights into the structure and organization of the living system.
- C) Understanding the chemical structure of DNA reveals how it directs the functioning of a living cell.
- D) An ecosystem displays complex properties of the biotic component only.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 1.1

7) Which of the following order is correct in terms of the hierarchy of the organization?

- A) Ecosystem → Biosphere → Population → Community → Organism
- B) Biosphere → Ecosystem → Population → Community → Organism
- C) Ecosystem → Community → Biosphere → Population → Organism
- D) Biosphere → Ecosystem → Community → Population → Organism

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 1.1

8) When your body temperature rises on a hot day, the neural and hormonal mechanisms activate sweating. Evaporation of sweat leads to cooling of the body surface. This is an example of _____.

- A) positive feedback regulation
- B) negative feedback regulation
- C) chemical cycling
- D) emergent properties

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 1.1

9) Characters are transmitted from parents to offspring. _____ are the units of inheritance.

- A) Genes
- B) Proteins
- C) RNA
- D) DNA

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.1

10) As letters are to English language, _____ is/are to genetic information.

- A) proteins
- B) nucleotides
- C) DNA double helix
- D) A and B

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.1

11) The process by which the information in a gene directs the synthesis of a protein is called _____.

- A) gene expression
- B) replication
- C) post translation modification
- D) cloning

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 1.2

12) Which of the following statements is true?

- A) mRNA is the only type of RNA found in the living system
- B) All forms of life employ the same genetic code
- C) A typical human liver cell has one set of chromosomes
- D) Organisms interact but do not affect their environment

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.2

13) Plants convert _____.

- A) chemical energy to mechanical energy.
- B) sunlight to mechanical energy.
- C) sunlight to chemical energy.
- D) mechanical energy to chemical energy.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.2

14) Which of these provides evidence of the common ancestry of all life?

- A) near universality of the genetic code
- B) structure of the nucleus
- C) structure of cilia
- D) structure of chloroplasts

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 1.2

15) Which branch of biology is concerned with the naming and classifying of organisms?

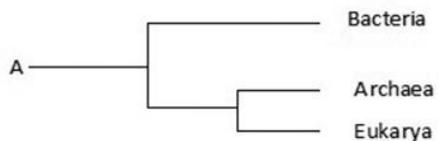
- A) informatics
- B) taxonomy
- C) genomics
- D) evolution

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.2

16) Use the following figure to answer the question.



The phylogenetic tree _____.

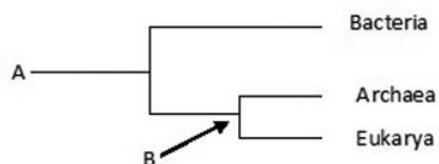
- A) depicts that Archaea is closer to Bacteria than Eukarya
- B) depicts that Eukarya is closer to Bacteria than Archaea
- C) includes unicellular and some forms of multicellular life, but not complex animals and plants
- D) includes every single life form on this earth

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 1.2

17) Use the following figure to answer the question.



"A" is _____; "B" is _____.

- A) the most recent species to evolve on Earth; an ancestor of group "A"
- B) the most recent species to evolve on Earth; the last common ancestor of Archaea and Eukarya
- C) the common ancestor of all life; the common ancestor of Bacteria and Archaea
- D) the common ancestor of all life; the last common ancestor of Archaea and Eukarya

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 1.2

18) You are suffering from *Streptococcus* throat infection. You share the following with the bacteria that is responsible for your condition.

- A) You both belong to the same domain.
- B) You both are made up of cells.
- C) You both have genetic material in your nucleus.
- D) You and *Streptococcus* have nothing in common.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 1.2

19) Which of the following is true of natural selection?

- A) It requires genetic variation.
- B) It results in descent with modification.
- C) It involves differential reproductive success.
- D) It requires genetic variation, results in descent with modification, and involves differential reproductive success.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.2

20) Which of the following is *not* one of Charles Darwin's observations?

- A) Individuals in a population vary in their traits.
- B) Many of the traits in an individual are heritable.
- C) A population avoids competition by producing only as many offspring as can successfully reproduce on their own.
- D) Species generally are adapted to their environments.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.2

21) The evolution of one species into two or more species as a result of different populations becoming reproductively isolated from each other is best termed as _____.

- A) adaptive radiation
- B) creationism
- C) natural selection
- D) prototype

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.2

22) Cotton-topped tamarins are small primates with tufts of long white hair on their heads. While studying these creatures, you notice that males with longer hair get more opportunities to mate and father more offspring. To test the hypothesis that having longer hair is adaptive in these males, you should _____.

- A) test whether other traits in these males are also adaptive
- B) look for evidence of hair in ancestors of tamarins
- C) determine if hair length is heritable
- D) test whether males with shaved heads are still able to mate

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 1.2

23) Following a scientific method, which of the following is the correct order of steps?

- A) Observation → Analysis → Hypothesis → Conclusion → Communicate results → Experiment
- B) Observation → Hypothesis → Experiment → Communicate results → Analysis → Conclusion
- C) Experiment → Hypothesis → Observation → Analysis → Conclusion → Communicate results
- D) Observation → Hypothesis → Experiment → Analysis → Conclusion → Communicate results

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.3

24) Which of the following questions is considered a thought-provoking scientific query?

- A) How long ago did the Pterosaurs live on this planet?
- B) Does the amount of solute in water affect the boiling point of the solution?
- C) Who invented the telescope?
- D) How many tigers are left in India?

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 1.1

25) The following experiment is used for the following question.

A researcher discovered a species of moth that lays its eggs on oak trees. Eggs are laid at two distinct times of the year: early in spring when the oak trees are flowering and in midsummer when flowering is past. Caterpillars from eggs that hatch in spring feed on oak flowers and look like oak flowers, but caterpillars that hatch in summer feed on oak leaves and look like oak twigs.

How does the same population of moths produce such different-looking caterpillars on the same trees? To answer this question, the biologist caught many female moths from the same population and collected their eggs. He put at least one egg from each female into eight identical cups. The eggs hatched, and at least two larvae from each female were maintained in one of the four temperature and light conditions listed below.

Temperature	Day Length
Springlike	Springlike
Springlike	Summerlike
Summerlike	springlike
Summerlike	summerlike

In each of the four environments, one of the caterpillars was fed oak flowers, the other oak leaves. Thus, there were a total of eight treatment groups (4 environments × 2 diets).

- Which one of the following is *not* a plausible hypothesis that can be tested in this experiment?
- A) The longer day lengths of summer trigger the development of twig-like caterpillars.
 - B) The cooler temperatures of spring trigger the development of flowerlike caterpillars.
 - C) Differences in air pressure, due to differences in elevation, trigger the development of different types of caterpillars.
 - D) Differences in diet trigger the development of different types of caterpillars.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 1.3

26) The following experiment is used for the following question.

A researcher discovered a species of moth that lays its eggs on oak trees. Eggs are laid at two distinct times of the year: early in spring when the oak trees are flowering and in midsummer when flowering is past. Caterpillars from eggs that hatch in spring feed on oak flowers and look like oak flowers, but caterpillars that hatch in summer feed on oak leaves and look like oak twigs.

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Temperature	Day Length
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In each of the four environments, one of the caterpillars was fed oak flowers, the other oak leaves. Thus, there were a total of eight treatment groups (4 environments × 2 diets).

In every case, caterpillars that feed on oak flowers look like oak flowers. In every case, caterpillars that were raised on oak leaves looked like twigs. These results support which of the following hypotheses?

- A) The longer day lengths of summer trigger the development of twig-like caterpillars.
- B) Differences in air pressure, due to elevation, trigger the development of different types of caterpillars.
- C) Differences in diet trigger the development of different types of caterpillars.
- D) The differences are genetic. A female will either produce all flowerlike caterpillars or all twig-like caterpillars.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 1.3

27) The following experiment is used for the following question.

A researcher discovered a species of moth that lays its eggs on oak trees. Eggs are laid at two distinct times of the year: early in spring when the oak trees are flowering and in midsummer when flowering is past. Caterpillars from eggs that hatch in spring feed on oak flowers and look like oak flowers, but caterpillars that hatch in summer feed on oak leaves and look like oak twigs.

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In each of the four environments, one of the caterpillars was fed oak flowers, the other oak leaves. Thus, there were a total of eight treatment groups (4 environments × 2 diets).

Recall that eggs from the same female were exposed to each of the eight treatments used. This aspect of the experimental design tested which of the following hypotheses?

- A) The longer day lengths of summer trigger the development of twig-like caterpillars.
- B) Differences in air pressure, due to elevation, trigger the development of different types of caterpillars.
- C) Differences in diet trigger the development of different types of caterpillars.
- D) The differences are genetic. A female will either produce all flowerlike caterpillars or all twig-like caterpillars.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 1.3

28) The following experiment is used for the following question.

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Springlike	Springlike
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In each of the four environments, one of the caterpillars was fed oak flowers, the other oak leaves. Thus, there were a total of eight treatment groups (4 environments \times 2 diets).

Recall that in the experiment, caterpillars born in the spring looked like flowers, and caterpillars born in the summer looked like twigs. What is the most likely selective advantage for this difference in body shape?

- A) Looking like their food sources allows the caterpillars to move through their environment more efficiently.
- B) Development into the adult moth form is faster for caterpillars shaped like twigs than like flowers.
- C) Looking like their food source lets the caterpillars blend into their surroundings, reducing predation.
- D) Looking like their food source will increase the caterpillars' feeding efficiency; this would increase their growth rate and survival rate.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 1.3

29) How does a scientific theory differ from a scientific hypothesis?

- A) Theories are proposed to test scientific hypotheses.
- B) Theories are usually an explanation for a more general phenomenon; hypotheses typically address more specific issues.
- C) Hypotheses are usually an explanation for a more general phenomenon; theories typically address more specific issues.
- D) Confirmed theories become scientific laws; hypotheses become theories.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.3

30) A friend of yours calls to say that his car would not start this morning. He asks for your help. You say that you think the battery must be dead. If so, then jump-starting the car from a good battery will solve the problem. In doing so, you are _____.

- A) testing a theory for why the car will not start
- B) making observations to inspire a theory for why the car will not start
- C) stating a hypothesis and using that hypothesis to make a testable prediction
- D) comparing multiple hypotheses for why the car will not start

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 1.3

31) *Agrobacterium* infects plants and causes them to form tumors. You are asked to determine how long a plant must be exposed to these bacteria to become infected. Which of the following experiments will provide the best data to address that question?

- A) Determine the survival rate of *Agrobacterium* when exposed to different concentrations of an antibiotic.
- B) Measure the number of tumors formed on a plant when exposed to various concentrations of *Agrobacterium*.
- C) Measure the concentration of *Agrobacterium* in different soil environments where the plants grow.
- D) Measure the number of tumors formed on plants, which are exposed to *Agrobacterium* for different lengths of time.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 1.3

32) *Agrobacterium* infects plants and causes them to form tumors. You determine that tumor formation requires a large amount of the plant's energy for tissue formation. How might this change the number of offspring a plant produces, and what is the most likely explanation for this change?

- A) The number of offspring should increase because in general, illness increases the reproductive output of organisms.
- B) The number of offspring should increase because the bacteria will provide energy for the plant.
- C) The number of offspring should decrease because the plant will divert energy from reproduction to tumor formation.
- D) There should be no effect of infection on offspring production because energy for reproduction is independent of infection.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 1.3

33) Use the following information when answering the following question.

In 1668, Francesco Redi performed a series of experiments on spontaneous generation. He began by putting similar pieces of meat into eight identical jars. Four jars were left open to the air, and four were sealed. He then did the same experiment with one variation: Instead of sealing four of the jars completely, he covered them with gauze (the gauze excluded the flies while allowing the meat to be exposed to air). In both experiments, he monitored the jars and recorded whether or not maggots (young flies) appeared in the meat.

What hypothesis was being tested in the initial experiment with open versus sealed jars?

- A) Spontaneous generation is more likely during the long days of summer.
- B) The type of meat used affects the likelihood of spontaneous generation.
- C) Maggots do not arise spontaneously, but from eggs laid by adult flies.
- D) Spontaneous generation can occur only if meat is exposed to air.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 1.3

34) Use the following information when answering the following question.

In 1668, Francesco Redi performed a series of experiments on spontaneous generation. He began by putting similar pieces of meat into eight identical jars. Four jars were left open to the air, and four were sealed. He then did the same experiment with one variation: Instead of sealing four of the jars completely, he covered them with gauze (the gauze excluded the flies while allowing the meat to be exposed to air). In both experiments, he monitored the jars and recorded whether or not maggots (young flies) appeared in the meat.

In both experiments, flies appeared in all of the open jars and only in the open jars. Which one of the following statements is correct?

- A) The experiment was inconclusive because Redi used only one kind of meat.
- B) The experiment was inconclusive because it did not run long enough.
- C) The experiment supports the hypothesis that spontaneous generation occurs in rotting meat.
- D) The experiment supports the hypothesis that maggots arise only from eggs laid by adult flies.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 1.3

35) The best experimental design _____.

- A) includes a large sample size for each condition
- B) includes a control
- C) alters only one condition between the controls and the experimental condition
- D) includes a large sample size and a control, and alters only one condition between the controls and the experimental condition

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.3

36) A controlled experiment _____.

- A) is repeated many times to ensure that the results are accurate
- B) includes at least two groups, one of which does not receive the experimental treatment
- C) includes at least two groups, one differing from the other by two or more variables
- D) includes one group for which the scientist controls all variables

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.3

37) Which of the following are qualities of any good scientific hypothesis?

- I. It is testable.
- II. It is falsifiable.
- III. It produces quantitative data.
- IV. It produces results that can be replicated.

- A) I only
- B) III only
- C) I and II
- D) III and IV

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.3

38) The temperature at which an alligator's egg is incubated will determine the sex of the offspring. The dependent and the independent variables in this experiment are _____.

- A) sex of the baby alligator and temperature respectively
- B) temperature and sex of the baby alligator respectively
- C) size of the incubator and size of the baby alligator respectively
- D) number of offspring and temperature in the incubator respectively

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 1.3

39) In presenting data that result from an experiment, a group of students show that most of their measurements fall on a straight diagonal line on their graph. However, two of their data points are "outliers" and fall far to one side of the expected relationship. What should they do?

- A) Do not show these points because clearly something went wrong in the experiment.
- B) Average several trials, rule out the improbable results, and do not show them in the final work.
- C) Show all results obtained and then try to explore the reason(s) for these outliers.
- D) Change the details of the experiment until they can obtain the expected results.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 1.3

40) A scientist, who wants to study the effects of nitrogen on wheat plants, sets up an experiment with 4 groups of wheat plants: group A gets 20 pounds per acre, group B gets 40 pounds per acre, group C gets 60 pounds per acre, and group D gets 0 pounds per acre. Which of the following is the control group?

- A) group A
- B) group B
- C) group C
- D) group D

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 1.3

41) Which of these is an example of inductive reasoning?

- A) Hundreds of individuals of a species have been observed and all are photosynthetic; therefore, the species is photosynthetic.
- B) These organisms live in sunny regions. Therefore, they are using photosynthesis.
- C) If protists are all single-celled, then they are incapable of aggregating.
- D) If two species are members of the same genus, they are more alike than each of them could be to a different genus.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 1.3

42) The application of scientific knowledge for some specific purpose is known as _____.

- A) technology
- B) deductive science
- C) inductive science
- D) pure science

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.4

43) Which of the following best describes a model organism?

- A) It is often pictured in textbooks and is easy for students to imagine.
- B) It is well studied, it is easy to grow, and results are widely applicable.
- C) It is small, inexpensive to raise, and lives a long time.
- D) It has been chosen for study by early biologists.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 1.4

- 44) Why is a scientific topic best discussed by people of varying points of view, from different subdisciplines, and representing diverse cultures?
- A) Robust and critical discussion between diverse groups improves scientific thinking.
 - B) Scientists can coordinate with others to conduct experiments in similar ways.
 - C) This is a way of ensuring that everyone gets the same results.
 - D) People need to exchange their ideas with other disciplines and cultures because everyone has a right to an opinion in science.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 1.4

1.2 Student Edition End-of-Chapter Questions

- 1) All the organisms on your campus make up
- A) an ecosystem.
 - B) a community.
 - C) a population.
 - D) a taxonomic domain.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 2) Systems biology is mainly an attempt to
- A) analyze genomes from different species.
 - B) simplify complex problems by reducing the system into smaller, less complex units.
 - C) understand the behavior of entire biological systems by studying interactions among its component parts.
 - D) build high-throughput machines for the rapid acquisition of biological data.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 3) Which of the following best demonstrates the unity among all organisms?
- A) emergent properties
 - B) descent with modification
 - C) the structure and function of DNA
 - D) natural selection

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 4) A controlled experiment is one that
- A) proceeds slowly enough that a scientist can make careful records of the results.
 - B) tests experimental and control groups in parallel.
 - C) is repeated many times to make sure the results are accurate.
 - D) keeps all variables constant.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 5) Which of the following statements best distinguishes hypotheses from theories in science?
- A) Theories are hypotheses that have been proved.
 - B) Hypotheses are guesses; theories are correct answers.
 - C) Hypotheses usually are relatively narrow in scope; theories have broad explanatory power.
 - D) Theories are proved true; hypotheses are often contradicted by experimental results.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 6) Which of the following is an example of qualitative data?
- A) The fish swam in a zigzag motion.
 - B) The contents of the stomach are mixed every 20 seconds.
 - C) The temperature decreased from 20°C to 15°C.
 - D) The six pairs of robins hatched an average of three chicks each.

Answer: A

Bloom's Taxonomy: Application/Analysis

- 7) Which sentence best describes the logic of scientific inquiry?
- A) If I generate a testable hypothesis, tests and observations will support it.
 - B) If my prediction is correct, it will lead to a testable hypothesis.
 - C) If my observations are accurate, they will support my hypothesis.
 - D) If my hypothesis is correct, I can expect certain test results.

Answer: D

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 2 The Chemical Context of Life

2.1 Multiple-Choice Questions

1) About 25 of the 92 natural elements are known to be essential to life. Which 4 of these 25 elements make up approximately 96% of living matter?

- A) carbon, sodium, hydrogen, nitrogen
- B) carbon, oxygen, phosphorus, hydrogen
- C) oxygen, hydrogen, calcium, nitrogen
- D) carbon, hydrogen, nitrogen, oxygen

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.1

2) Trace elements are those required by an organism in only minute quantities. Which of the following is a trace element that is required by humans and other vertebrates, but not by other organisms such as bacteria or plants?

- A) calcium
- B) iodine
- C) sodium
- D) phosphorus

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.1

3) Which of the following statements is TRUE?

- A) Carbon, hydrogen, oxygen, and calcium are the most abundant elements of living matter.
- B) Some naturally occurring elements are toxic to organisms.
- C) All life requires the same essential elements.
- D) A patient suffering from a goiter should not consume seafood.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 2.1

4) Which of the following are compounds?

- A) H₂O, O₂, and CH₄
- B) H₂O and O₂
- C) O₂ and CH₄
- D) H₂O and CH₄, but not O₂

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 2.1

5) Atoms have no electric charge because they have _____.

- A) uncharged neutrons in their nuclei
- B) an equal number of protons and neutrons
- C) an equal number of protons and electrons
- D) an equal number of charged and uncharged subatomic particles

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 2.2

6) An ion with six protons, seven neutrons, and a charge of 2+ has an atomic number of _____.

- A) four
- B) five
- C) six
- D) seven

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 2.2

7) Molybdenum has an atomic number of 42. Several common isotopes exist, with mass numbers from 92-100. Which of the following can be true?

- A) Molybdenum atoms can have between 50 and 58 neutrons.
- B) Molybdenum atoms can have between 50 and 58 protons.
- C) Molybdenum atoms can have between 50 and 58 electrons.
- D) Isotopes of molybdenum have different numbers of electrons.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.2

8) Carbon-14 has the same _____.

- A) atomic number and atomic mass as carbon-12
- B) atomic number and thus number of neutrons as carbon-13
- C) atomic mass as both carbon-12 and carbon-13
- D) number of protons but more neutrons than carbon-12

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 2.2

9) A(n) _____ has charge but negligible mass, whereas a(n) _____ has mass but no charge.

- A) proton; neutron
- B) neutron; proton
- C) neutron; electron
- D) electron; neutron

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.2

10) The atomic number of nitrogen is 7. Nitrogen-15 has a greater mass number than nitrogen-14 because the atomic nucleus of nitrogen-15 contains _____.

- A) 7 neutrons
- B) 8 neutrons
- C) 8 protons
- D) 15 protons

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.2

11) The left to right order of elements in the periodic table is based on their _____.

- A) atomic mass
- B) atomic number
- C) electric charge of the atom
- D) the number of neutrons

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.2

12) A neutral atom has two, eight, eight electrons in its first, second, and third energy levels.

This information _____.

- A) does not tell us about the atomic number of the element
- B) does not tell us about the chemical properties of the element
- C) does not tell us about the atomic mass of the element
- D) does not tell us about the size of the element

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 2.2

13) In a chemical reaction, the element ^{13}Al will most preferably _____.

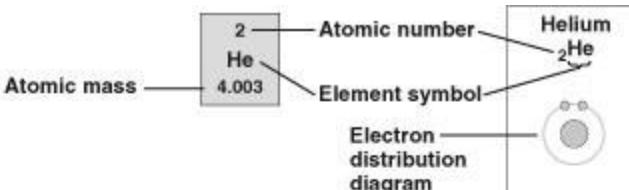
- A) lose three electrons and become positively charged
- B) gain five electrons and become negatively charged
- C) lose five electrons and become positively charged
- D) gain three electrons and become positively charged

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 2.2

Refer to the following figure (first three rows of the periodic table) to answer the questions below.

	Hydrogen $_1\text{H}$ 	 <p>Atomic number Element symbol Atomic mass Electron distribution diagram</p>							
First shell									
Second shell	Lithium $_3\text{Li}$ 	Beryllium $_4\text{Be}$ 	Boron $_5\text{B}$ 	Carbon $_6\text{C}$ 	Nitrogen $_7\text{N}$ 	Oxygen $_8\text{O}$ 	Fluorine $_9\text{F}$ 	Neon $_{10}\text{Ne}$ 	
Third shell	Sodium $_{11}\text{Na}$ 	Magnesium $_{12}\text{Mg}$ 	Aluminum $_{13}\text{Al}$ 	Silicon $_{14}\text{Si}$ 	Phosphorus $_{15}\text{P}$ 	Sulfur $_{16}\text{S}$ 	Chlorine $_{17}\text{Cl}$ 	Argon $_{18}\text{Ar}$ 	

14) What element does not prefer to react with other elements?

- A) hydrogen
- B) helium
- C) beryllium
- D) both hydrogen and beryllium

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 2.2

15) Which pair of elements would likely have similar valency and thus similar chemical behavior?

- A) nitrogen and phosphorus
- B) carbon and nitrogen
- C) sodium and chlorine
- D) hydrogen and helium

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 2.2

Refer to the following figure to answer the questions below.

Atomic mass →	12 C	16 O	1 H	14 N	32 S	31 P
Atomic number →	6	8	1	7	16	15

16) How many electrons are present in a Phosphorus 3+ atom?

- A) 16
- B) 12
- C) 19
- D) 34

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.2

17) How many electrons will a single atom of sulfur with no charge and no bonds have in its valence shell?

- A) 6
- B) 8
- C) 16
- D) 32

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.2

18) Oxygen has an atomic number of 8 and, most commonly, a mass number of 16. Thus, what is the atomic mass of an oxygen atom?

- A) approximately 8 grams
- B) approximately 8 daltons
- C) approximately 16 grams
- D) approximately 16 daltons

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.2

19) Elements ^{72}Zn , ^{75}As , and ^{74}Ge have the _____.

- A) same number of protons
- B) same number of protons and electrons
- C) same number of neutrons
- D) same number of neutrons and electrons

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 2.2

20) Can the atomic mass of an element vary?

- A) No, it is fixed; otherwise a new element will be formed.
- B) Yes. Adding or losing electrons will substantially change the atomic mass.
- C) Yes. Adding or losing protons will change the atomic mass without forming a different element.
- D) Yes. Adding or losing neutrons will change the atomic mass without forming a different element.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.2

21) Which of the following is the best description of an atom's physical structure?

- A) An atom is a solid mass of material.
- B) The particles that form an atom are equidistant from each other.
- C) Atoms are little bubbles of space with mass concentrated at the center of the bubble.
- D) Atoms are little bubbles of space with mass concentrated on the outside surface of the bubble.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.2

22) When are atoms most stable?

- A) when they have the fewest possible valence electrons
- B) when they have the maximum number of unpaired electrons
- C) when all of the electron orbitals in the valence shell are filled
- D) when all electrons are paired

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.2

23) A salamander relies on hydrogen bonding to stick to various surfaces. Therefore, a salamander would have the greatest difficulty clinging to a _____.

- A) slightly damp surface
- B) surface of hydrocarbons
- C) surface of mostly carbon-oxygen bonds
- D) surface of mostly carbon-nitrogen bonds

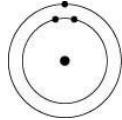
Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

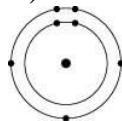
Section: 2.3

24) Which one of the atoms shown would be most likely to form a cation with a charge of +1?

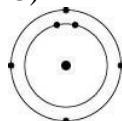
A)



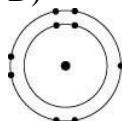
B)



C)



D)



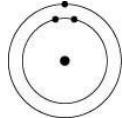
Answer: A

Bloom's Taxonomy: Application/Analysis

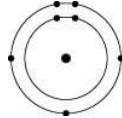
Section: 2.3

25) Which one of the atoms shown would be most likely to form an anion with a charge of -1?

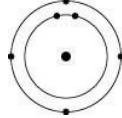
A)



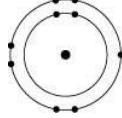
B)



C)



D)



Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 2.3

26) A covalent chemical bond is one in which _____.

- A) electrons are removed from one atom and transferred to another atom so that the two atoms become oppositely charged
- B) protons and neutrons are shared by two atoms so as to satisfy the requirements of both atoms
- C) outer-shell electrons of two atoms are shared so as to satisfactorily fill their respective orbitals
- D) outer-shell electrons of one atom are transferred to fill the inner electron shell of another atom

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

27) What is the maximum number of covalent bonds that an oxygen atom with atomic number 8 can make with hydrogen?

- A) 1
- B) 2
- C) 4
- D) 6

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

28) Nitrogen (N) is more electronegative than hydrogen (H). Which of the following is a correct statement about the atoms in ammonia (NH_3)?

- A) Each hydrogen atom has a partial positive charge; the nitrogen atom has a partial negative charge.
- B) Ammonia has an overall positive charge.
- C) Ammonia has an overall negative charge.
- D) The nitrogen atom has a partial positive charge; each hydrogen atom has a partial negative charge.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

29) Bonds between two atoms that are equally electronegative are _____.

- A) hydrogen bonds
- B) polar covalent bonds
- C) nonpolar covalent bonds
- D) ionic bonds

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

30) In the following structure where A and B represent two different elements, the valency of A is _____ and B is _____.



- A) one; three
- B) one; five
- C) three; five
- D) eight; eight

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

31) A covalent bond is likely to be polar when _____.

- A) one of the atoms sharing electrons is more electronegative than the other atom
- B) the two atoms sharing electrons are equally electronegative
- C) carbon is one of the two atoms sharing electrons
- D) the two atoms sharing electrons are of the same elements

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

32) What is the difference between covalent bonds and ionic bonds?

- A) Covalent bonds involve the sharing of pairs of electrons between atoms; ionic bonds involve the sharing of single electrons between atoms.
- B) Covalent bonds involve the sharing of electrons between atoms; ionic bonds involve the electrical attraction between charged atoms.
- C) Covalent bonds involve the sharing of electrons between atoms; ionic bonds involve the sharing of protons between charged atoms.
- D) Covalent bonds involve the transfer of electrons between charged atoms; ionic bonds involve the sharing of electrons between atoms.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

33) The atomic number of chlorine is 17. The atomic number of magnesium is 12. What is the formula for magnesium chloride?

- A) MgCl
- B) MgCl₂
- C) Mg₂Cl
- D) MgCl₃

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 2.3

34) How many electron pairs are shared between carbon atoms in a molecule that has the formula C₂H₄?

- A) one
- B) two
- C) three
- D) four

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 2.3

35) Which bond or interaction would be difficult to disrupt when compounds are put into water?

- A) covalent bonds between carbon atoms
- B) hydrogen bonds
- C) ionic bonds
- D) ionic and hydrogen bonds

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 2.3

36) Which of the following is broken when water evaporates?

- A) nonpolar covalent bonds
- B) ionic bonds
- C) hydrogen bonds
- D) polar covalent bonds

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

37) Van der Waals interactions may result when _____.

- A) electrons are not symmetrically distributed in a molecule
- B) molecules held by ionic bonds react with water
- C) two polar covalent bonds react
- D) a hydrogen atom loses an electron

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

38) What is the maximum number of hydrogen atoms that can be covalently bonded in a molecule containing two carbon atoms?

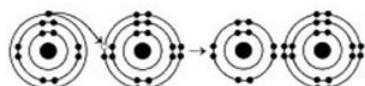
- A) two
- B) four
- C) six
- D) eight

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 2.3

Refer to the following figure to answer the questions below.



39) What results from the chemical reaction in the illustration? The reactants have no charge.

- A) a cation with a net charge of +1 and an anion with a net charge of +1
- B) a cation with a net charge of -1 and an anion with a net charge of -1
- C) a cation with a net charge of -1 and an anion with a net charge of +1
- D) a cation with a net charge of +1 and an anion with a net charge of -1

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

40) What is the atomic number of the cation formed in the reaction in the illustration?

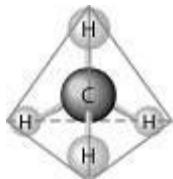
- A) 8
- B) 10
- C) 11
- D) 16

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 2.3

Refer to the following figure to answer the questions below.



41) What causes the shape of the molecule shown?

- A) the shape of the two p orbitals in the carbon atom
- B) the shape of the one s orbital in the carbon atom
- C) the shape of the sp^3 hybrid orbitals of the electrons shared between the carbon and hydrogen atoms
- D) hydrogen bonding configurations between the carbon and hydrogen atoms

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

42) How many electrons are involved in a triple covalent bond?

- A) 3
- B) 6
- C) 9
- D) 12

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

43) Based on electron configuration, which of the elements in the figure would exhibit a chemical behavior most like that of oxygen?

- A) carbon
- B) nitrogen
- C) sulfur
- D) phosphorus

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 2.2

44) If an atom has a charge of +1, which of the following must be true?

- A) It has two more protons than neutrons.
- B) It has the same number of protons as electrons.
- C) It has one more electron than it does protons.
- D) It has one more proton than it does electrons.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 2.3

45) Elements found on the left side of the periodic table contain outer shells that are _____; these elements tend to form _____ in solution.

- A) almost empty; cations
- B) almost empty; anions
- C) almost full; cations
- D) almost full; anions

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 2.3

46) An atom has four electrons in its valence shell. What types of covalent bonds is it capable of forming?

- A) single, double, or triple
- B) single and double only
- C) single bonds only
- D) double bonds only

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 2.3

47) When the atoms involved in a covalent bond have the same electronegativity, what type of bond results?

- A) an ionic bond
- B) a hydrogen bond
- C) a nonpolar covalent bond
- D) a polar covalent bond

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

48) Nitrogen (N) normally forms three covalent bonds with a valence of five. However, ammonium has four covalent bonds, each to a different hydrogen (H) atom (H has a valence of one). What do you predict to be the charge on ammonium?

- A) +1
- B) -1
- C) +2
- D) -2

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 2.3

49) You are asked to indicate the type and number of atoms in a molecule. Which representation would work best?

- A) molecular formula
- B) structural formula
- C) ball-and-stick model
- D) space-filling model

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

50) How is a single covalent bond formed?

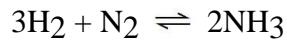
- A) Two atoms share two pairs of electrons.
- B) Two atoms share two electrons.
- C) Two atoms share one electron.
- D) One atom loses a pair of electrons to the other.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.3

Refer to the following figure to answer the questions below.



51) Which of the following is true for the reaction?

- A) The reaction is nonreversible.
- B) Hydrogen and nitrogen are the reactants of the reverse reaction.
- C) Ammonia is being formed and decomposed simultaneously.
- D) Only the forward or reverse reactions can occur at one time.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.4

52) Which of the following factors will increase the rate of reaction in the forward direction?

- A) addition of nitrogen
- B) addition of ammonia
- C) addition of hydrogen
- D) addition of both nitrogen and hydrogen

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.4

53) Which of the following correctly describes *chemical equilibrium*?

- A) Forward and reverse reactions continue with no net effect on the concentrations of the reactants and products.
- B) Concentrations of products are higher than the concentrations of the reactants.
- C) There are equal concentrations of products and reactants while forward and reverse reactions continue.
- D) There are equal concentrations of reactants and products, and the reactions have stopped.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 2.4

2.2 Student Edition End-of-Chapter Questions

1) In the term *trace element*, the adjective *trace* means that

- A) the element is required in very small amounts.
- B) the element can be used as a label to trace atoms through an organism's metabolism.
- C) the element is very rare on Earth.
- D) the element enhances health but is not essential for the organism's long-term survival.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

2) Compared with ^{31}P , the radioactive isotope ^{32}P has

- A) a different atomic number.
- B) one more proton.
- C) one more electron.
- D) one more neutron.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

3) The reactivity of an atom arises from

- A) the average distance of the outermost electron shell from the nucleus.
- B) the existence of unpaired electrons in the valence shell.
- C) the sum of the potential energies of all the electron shells.
- D) the potential energy of the valence shell.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Which statement is true of all atoms that are anions?
- A) The atom has more electrons than protons.
 - B) The atom has more protons than electrons.
 - C) The atom has fewer protons than does a neutral atom of the same element.
 - D) The atom has more neutrons than protons.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 5) Which of the following statements correctly describes any chemical reaction that has reached equilibrium?
- A) The concentrations of products and reactants are equal.
 - B) The reaction is now irreversible.
 - C) Both forward and reverse reactions have halted.
 - D) The rates of the forward and reverse reactions are equal.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 6) We can represent atoms by listing the number of protons, neutrons, and electrons—for example, $2p^+, 2n^0, 2e^-$ for helium. Which of the following represents the ^{18}O isotope of oxygen?

- A) $7p^+, 2n^0, 9e^-$
- B) $8p^+, 10n^0, 8e^-$
- C) $9p^+, 9n^0, 9e^-$
- D) $10p^+, 8n^0, 9e^-$

Answer: B

Bloom's Taxonomy: Application/Analysis

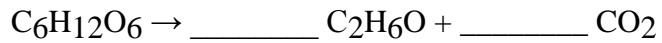
- 7) The atomic number of sulfur is 16. Sulfur combines with hydrogen by covalent bonding to form a compound, hydrogen sulfide. Based on the number of valence electrons in a sulfur atom, predict the molecular formula of the compound.

- A) HS
- B) HS₂
- C) H₂S
- D) H₄S

Answer: C

Bloom's Taxonomy: Application/Analysis

8) What coefficients must be placed in the following blanks so that all atoms are accounted for in the products?



- A) 2; 1
- B) 3; 1
- C) 1; 3
- D) 2; 2

Answer: D

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 3 Water and Life

3.1 Multiple-Choice Questions

1) In a single molecule of water, two hydrogen atoms are bonded to a single oxygen atom by _____.

- A) hydrogen bonds
- B) nonpolar covalent bonds
- C) polar covalent bonds
- D) ionic bonds

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.1

2) The partial negative charge at one end of a water molecule is attracted to the partial positive charge of another water molecule. What is this attraction called?

- A) a covalent bond
- B) a hydrogen bond
- C) an ionic bond
- D) a van der Waals interaction

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.1

3) The partial negative charge in a molecule of water occurs because _____.

- A) the oxygen atom donates an electron to each of the hydrogen atoms
- B) the electrons shared between the oxygen and hydrogen atoms spend more time around the oxygen atom nucleus than around the hydrogen atom nucleus
- C) the oxygen atom has two pairs of electrons in its valence shell that are not neutralized by hydrogen atoms
- D) one of the hydrogen atoms donates an electron to the oxygen atom

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.1

4) Sulfur is in the same column of the periodic table as oxygen, but has electronegativity similar to carbon. Compared to water molecules, molecules of H₂S will _____.

- A) have greater cohesion to other molecules of H₂S
- B) have a greater tendency to form hydrogen bonds with each other
- C) have a higher capacity to absorb heat for the same change in temperature
- D) not form hydrogen bonds with each other

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 3.1

5) Water molecules can form hydrogen bonds with _____.

- A) compounds that have polar covalent bonds
- B) oils
- C) oxygen gas (O_2) molecules
- D) chloride ions

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 3.1

6) Cohesion, surface tension, and adhesion are the properties of water molecules that _____.

- A) increase when temperature increases
- B) increase when pH increases
- C) are a result of hydrogen bonding
- D) are a result of polar covalent bonding

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.2

7) Liquid water _____.

- A) is less dense than ice
- B) has a specific heat lower than that of most other substances
- C) has a heat of vaporization higher than that of most other substances
- D) is nonpolar

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.2

8) Which of the following can be attributed to water's high specific heat?

- A) Oil and water do not mix well.
- B) A lake heats up more slowly than the air around it.
- C) Ice floats on water.
- D) Sugar dissolves in hot tea faster than in iced tea.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 3.2

9) The cities of Portland, Oregon, and Minneapolis, Minnesota, are at about the same latitude, but Minneapolis has much hotter summers and much colder winters than Portland. Why?

- A) They are not at the same exact latitude.
- B) The ocean near Portland moderates the temperature.
- C) Fresh water is more likely to freeze than salt water.
- D) Minneapolis is much windier, due to its location in the middle of North America.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 3.2

10) To act as an effective coolant in a car's radiator, a substance has to have the capacity to absorb a great deal of heat. You have a reference book with tables listing the physical properties of many liquids. In choosing a coolant for your car, which table would you check first?

- A) pH
- B) density at room temperature
- C) heat of vaporization
- D) specific heat

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 3.2

11) Water has many exceptional and useful properties. Which is the rarest property among compounds?

- A) Water is a solvent.
- B) Solid water is less dense than liquid water.
- C) Water has a high heat capacity.
- D) Water has surface tension.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.2

12) Which of the following effects can occur because of the high surface tension of water?

- A) Lakes cannot freeze solid in winter, despite low temperatures.
- B) A raft spider can walk across the surface of a small pond.
- C) Organisms can resist temperature changes, although they give off heat due to chemical reactions.
- D) Sweat can evaporate from the skin, helping to keep people from overheating.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.2

13) Thermal energy of the water in a bathtub is _____ than in a freshly brewed coffee pot because of its _____.

- A) higher; greater volume
- B) higher; high kinetic energy
- C) lower; low temperature
- D) lower; low density

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 3.2

14) Low humidity in the atmosphere on a hot day _____.

- A) helps in cooling because skin absorbs water from the atmosphere
- B) does not help in cooling because water evaporates from the skin faster
- C) helps in cooling because water evaporates from the skin faster
- D) does not help in cooling because skin absorbs water from the atmosphere

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.2

15) A dietary Calorie equals 1 kilocalorie. One kilocalorie equals _____.

- A) 1000 calories, or the amount of heat required to raise the temperature of 1 g of water by 1°C
- B) 10,000 calories, or the amount of heat required to raise the temperature of 1 kg of water by 1°F
- C) 1000 calories, or the amount of heat required to raise the temperature of 1 kg of water by 1°C
- D) 1000 calories, or the amount of heat required to raise the temperature of 100 g of water by 100°C

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.2

16) Why does ice float in liquid water?

- A) The high surface tension of liquid water keeps the ice on top.
- B) The ionic bonds between the molecules in ice prevent the ice from sinking.
- C) Stable hydrogen bonds keep water molecules of ice farther apart than water molecules of liquid water.
- D) The crystalline lattice of ice causes it to be denser than liquid water.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.2

17) Hydrophobic substances such as vegetable oil are _____.

- A) nonpolar substances that repel water molecules
- B) nonpolar substances that have an attraction for water molecules
- C) polar substances that repel water molecules
- D) polar substances that have an affinity for water

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.2

18) Why is a steam burn more severe than a hot water burn?

- A) Burns caused by liquids are always milder.
- B) Steam can penetrate into the skin.
- C) Steam contains more energy than water.
- D) Water evaporates and leaves the surface faster and helps in cooling.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 3.2

19) Melting of ice and thus reduced feeding opportunities for polar bears is occurring because of the _____.

- A) increase in phytoplankton population
- B) drying up of lakes and streams
- C) constant breaking and reforming of hydrogen bonds in water
- D) increase in CO₂ and other greenhouse gases in the atmosphere

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.2

20) One mole (mol) of glucose (molecular mass = 180 daltons) is _____.

- A) 180×10^{23} molecules of glucose
- B) 1 kilogram of glucose dissolved in 1 liter of solution
- C) 180 mL of dissolved glucose
- D) 180 grams of glucose

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 3.2

21) When an ionic compound such as sodium chloride (NaCl) is placed in water, the component atoms of the NaCl crystal dissociate into individual sodium ions (Na⁺) and chloride ions (Cl⁻). In contrast, the atoms of covalently bonded molecules (e.g., glucose, sucrose, glycerol) do not generally dissociate when placed in aqueous solution. Which of the following solutions would be expected to contain the greatest number of solute particles (molecules or ions)?

- A) 1 liter of 0.5 M NaCl
- B) 1 liter of 1.0 M NaCl
- C) 1 liter of 1.0 M glucose
- D) 1 liter of 1.0 M NaCl and 1 liter of 1.0 M glucose will contain equal numbers of solute particles.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 3.2

22) The molar mass of glucose is 180 grams per mole (g/mol). Which of the following procedures should you carry out to make a 1 M solution of glucose? In 0.8 liter (L) of water, dissolve _____.

- A) 1 g of glucose, and then add more water until the total volume of the solution is 1 L
- B) 18 g of glucose, and then add more water until the total volume of the solution is 1 L
- C) 180 g of glucose, and then add 0.2 L more of water
- D) 180 g of glucose, and then add more water until the total volume of the solution is 1 L

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 3.2

23) You have a freshly prepared 0.1 M sucrose (molecular mass 342) solution, which means _____.

- A) 6.02×10^{23} of sucrose molecules are present in the solution
- B) 6.02×10^{22} of sucrose molecules are present in the solution
- C) 34.2 g of sucrose is present in the solution
- D) 6.02×10^{22} of sucrose molecules or 34.2 g of sucrose is present in the solution

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 3.2

24) How does 0.5 M sucrose (molecular mass 342) solution compare to 0.5 M glucose (molecular mass 180) solution?

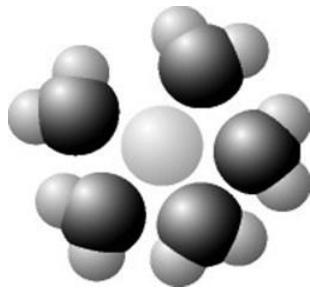
- A) Both have 6.02×10^{23} molecules.
- B) Sucrose has 171 molecules, whereas glucose has 90.
- C) Both have 3.01×10^{23} molecules.
- D) Sucrose has 171 mg/L, whereas glucose has 90 mg/L.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 3.2

25) Use the following figure to answer the question.



Based on your knowledge of the polarity of water molecules, the solute molecule depicted is most likely _____.

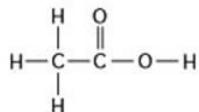
- A) positively charged
- B) negatively charged
- C) without charge
- D) nonpolar

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 3.2

26) Use the following figure to answer the question.



Two moles of the compound in the figure would weigh how many grams? (Note: The atomic masses, in daltons, are approximately 12 for carbon, 1 for hydrogen, and 16 for oxygen.)

- A) 30
- B) 60
- C) 90
- D) 120

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 3.2

27) How many grams of the compound in the figure are required to make 1 liter of a 0.5 M solution? (Note: The atomic masses, in daltons, are approximately 12 for carbon, 1 for hydrogen, and 16 for oxygen.)

- A) 30
- B) 60
- C) 90
- D) 120

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 3.2

28) How much of 0.5 M glucose (molecular mass 180) is needed to provide 100 mg of glucose?

- A) 1.11 mL
- B) 0.11 mL
- C) 100 mL
- D) 10 mL

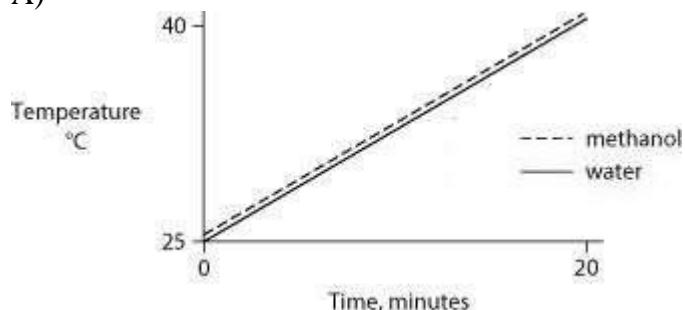
Answer: A

Bloom's Taxonomy: Application/Analysis

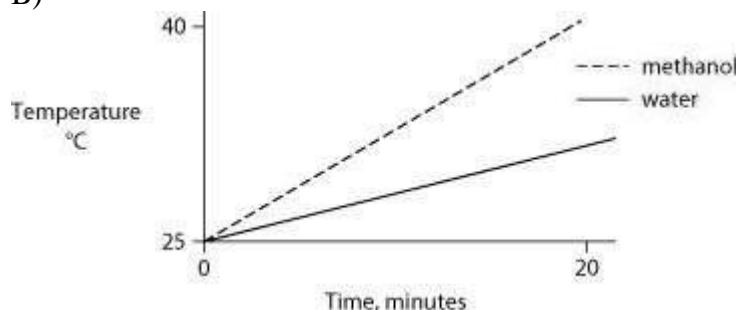
Section: 3.2

29) Identical heat lamps are arranged to shine on two identical containers, one containing water and one methanol (wood alcohol), so that each liquid absorbs the same amount of energy minute by minute. The covalent bonds of methanol molecules are nonpolar, so there are no hydrogen bonds among methanol molecules. Which of the following graphs correctly describes what will happen to the temperature of the water and the methanol?

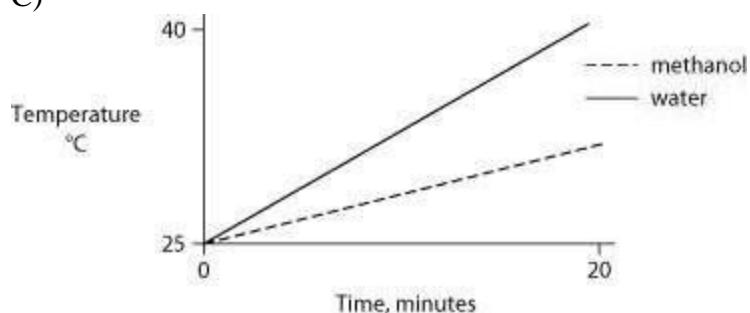
A)



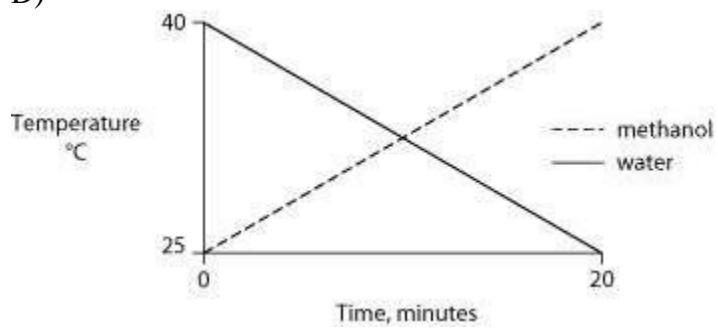
B)



C)



D)



Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 3.2

30) Rank, from low to high, the pH of blood, stomach acid, and urine.

- A) blood, urine, and stomach acid
- B) stomach acid, blood, and urine
- C) urine, blood, stomach acid
- D) stomach acid, urine, blood

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.3

31) A solution with a pH of 2 has how many more protons in it than a solution with a pH of 4?

- A) 5 times more
- B) 10 times more
- C) 100 times more
- D) 1000 times more

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 3.3

32) Consider the following reaction at equilibrium: $\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{H}_2\text{CO}_3$. What would be the effect of adding additional H_2O ?

- A) It would drive the equilibrium dynamics to the right.
- B) It would drive the equilibrium dynamics to the left.
- C) Nothing would happen because the reactants and products are in equilibrium.
- D) Reactions in both the directions will slow down.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 3.3

33) Which of the following is considered to be a strong base (alkali)?

- A) $\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$
- B) $\text{NH}_3 + \text{H}^+ \rightleftharpoons \text{NH}_4^+$
- C) $\text{H}_2\text{CO}_3 \rightleftharpoons \text{HCO}_3^- + \text{H}^+$
- D) $\text{NaOH} \rightarrow \text{Na}^+ + \text{OH}^-$

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.3

34) A 0.01 M solution of a substance has a pH of 2. What can you conclude about this substance?

- A) It is a strong acid that dissociates completely in water.
- B) It is a strong base that dissociates completely in water.
- C) It is a weak acid.
- D) It is a weak base.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 3.3

35) A solution contains 0.0000001 (10^{-7}) moles of hydrogen ions [H^+] per liter. Which of the following best describes this solution?

- A) acidic: H^+ acceptor
- B) basic: H^+ acceptor
- C) acidic: H^+ donor
- D) neutral

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.3

36) What is the pH of a solution with a hydroxyl ion (OH^-) concentration of $10^{-10} M$?

- A) pH 2
- B) pH 4
- C) pH 10
- D) pH 12

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 3.3

37) What is the hydroxyl ion (OH^-) concentration of a solution of pH 8?

- A) 8 M
- B) $8 \times 10^{-6} M$
- C) $10^{-8} M$
- D) $10^{-6} M$

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 3.3

38) Which of the following statements is true about buffer solutions?

- A) They maintain a constant pH of 7.
- B) They maintain a constant pH when acids are added to them but not when bases are added to them.
- C) They fluctuate in pH when either acids or bases are added to them.
- D) They maintain a relatively constant pH when either acids or bases are added to them.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.3

39) One of the buffers that contribute to pH stability in human blood is carbonic acid (H_2CO_3).

Carbonic acid is a weak acid that, when placed in an aqueous solution, dissociates into a bicarbonate ion (HCO_3^-) and a hydrogen ion (H^+). (See figure.)



If the pH of blood drops, one would expect _____.

- A) a decrease in the concentration of H_2CO_3 and an increase in the concentration of HCO_3^-
- B) the concentration of bicarbonate ions (HCO_3^-) to increase
- C) the HCO_3^- to act as a base and remove excess H^+ by the formation of H_2CO_3
- D) the HCO_3^- to act as an acid and remove excess H^+ by the formation of H_2CO_3

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.3

40) Carbon dioxide in the atmosphere dissolves with the raindrops. The pH of raindrops is _____.

- A) slightly acidic
- B) slightly basic
- C) same as pure water
- D) depends on the altitude where rain drops are formed

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 3.1 and 3.3

41) Assume that acid rain has lowered the pH of a particular lake to pH 5.0. What is the hydroxide ion concentration of this lake?

- A) 1×10^{-9} mol of hydroxide ions per liter of lake water
- B) 1×10^{-5} mol of hydroxide ions per liter of lake water
- C) 5.0 M hydroxide ion
- D) 5.0×10^{-5} mol of hydroxide ions per liter of lake water

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 3.3

42) Consider two solutions: solution X has a pH of 4; solution Y has a pH of 7. From this information, we can reasonably conclude that _____.

- A) solution Y has no free hydrogen ions (H^+)
- B) the concentration of hydrogen ions in solution Y is 1000 times as great as the concentration of hydrogen ions in solution X
- C) the concentration of hydrogen ions in solution X is 3 times as great as the concentration of hydrogen ions in solution Y
- D) the concentration of hydrogen ions in solution X is 1000 times as great as the concentration of hydrogen ions in solution Y

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 3.3

43) As the $[H_3O^+]$ of the solution decreases, the $[OH^-]$ _____.

- A) increases and thus pH increases
- B) increases and thus pH decreases
- C) decreases and thus the pH decreases
- D) decreases and thus the pH increases

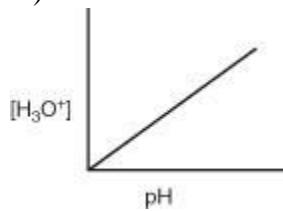
Answer: A

Bloom's Taxonomy: Application/Analysis

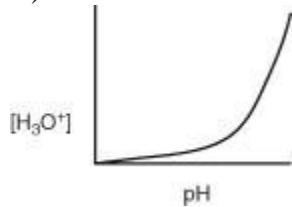
Section: 3.3

44) Which of the following graphs describes the relationship between $[H_3O^+]$ and pH?

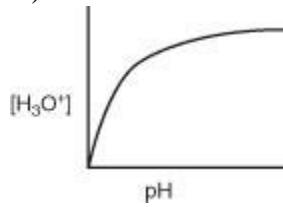
A)



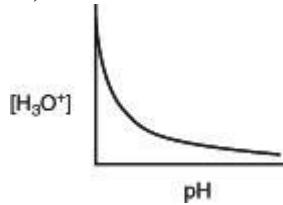
B)



C)



D)



Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 3.3

45) A beaker contains 100 milliliters (mL) of NaOH solution at pH = 13. A technician carefully pours into the beaker 10 mL of HCl at pH = 1. Which of the following statements correctly describes the result of this mixing?

- A) The concentration of Na^+ ions will rise.
- B) The pH of the beaker's contents will increase.
- C) The pH of the beaker's contents will be neutral.
- D) The pH of the beaker's contents will decrease.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 3.3

46) Increased atmospheric CO₂ concentrations might have what effect on seawater?

- A) Seawater will become more alkaline, and carbonate concentrations will decrease.
- B) There will be no change in the pH of seawater, because carbonate will turn to bicarbonate.
- C) Seawater will become more acidic, and carbonate concentrations will decrease.
- D) Seawater will become more acidic, and carbonate concentrations will increase.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.3

47) How would acidification of seawater affect marine organisms? Acidification of seawater would _____.

- A) increase dissolved carbonate concentrations and promote faster growth of corals and shell-building animals
- B) decrease dissolved carbonate concentrations and promote faster growth of corals and shell-building animals
- C) increase dissolved carbonate concentrations and hinder growth of corals and shell-building animals
- D) decrease dissolved carbonate concentrations and hinder growth of corals and shell-building animals

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 3.3

48) If the cytoplasm of a cell is at pH 7, and the mitochondrial matrix is at pH 8, then the concentration of H⁺ ions _____.

- A) is 10 times higher in the cytoplasm than in the mitochondrial matrix
- B) is 10 times higher in the mitochondrial matrix than in the cytoplasm
- C) in the cytoplasm is 7/8 the concentration in the mitochondrial matrix
- D) in the cytoplasm is 8/7 the concentration in the mitochondrial matrix

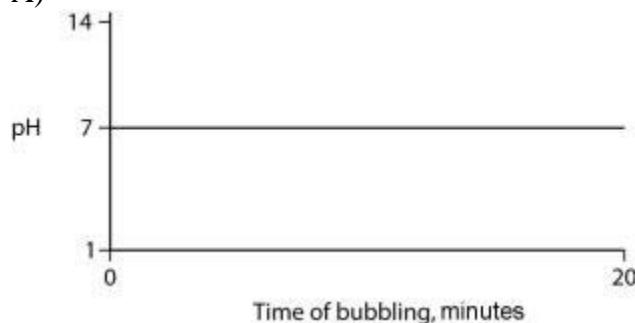
Answer: A

Bloom's Taxonomy: Application/Analysis

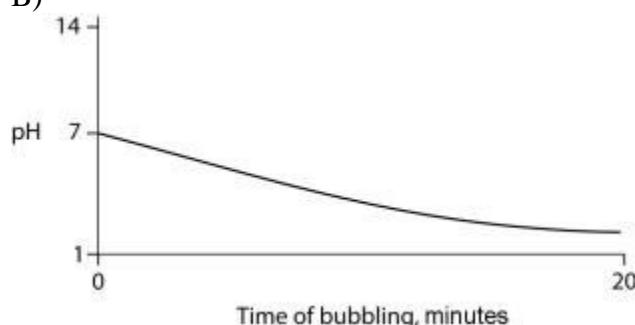
Section: 3.3

49) Carbon dioxide (CO_2) is readily soluble in water, according to the equation $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{H}_2\text{CO}_3$. Carbonic acid (H_2CO_3) is a weak acid. If CO_2 is bubbled into a beaker containing pure, freshly distilled water, which of the following graphs correctly describes the results?

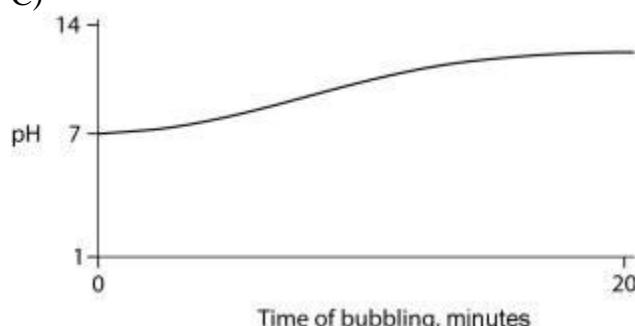
A)



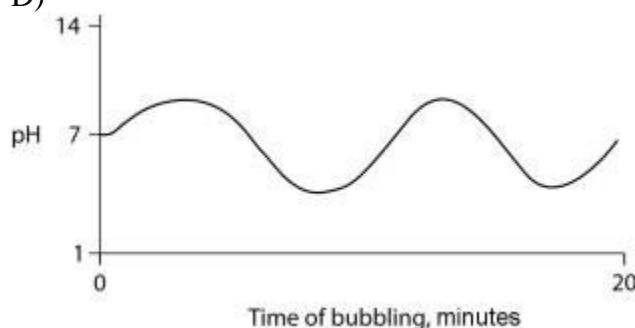
B)



C)



D)



Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 3.3

50) The loss of water from a plant by transpiration cools the leaf. Movement of water in transpiration requires both adhesion to the conducting walls and wood fibers of the plant and cohesion of the molecules to each other. A scientist wanted to increase the rate of transpiration of a crop species to extend its range into warmer climates. The scientist substituted a nonpolar solution with an atomic mass similar to that of water for hydrating the plants. What do you expect the scientist's data will indicate from this experiment?

- A) The rate of transpiration will be the same for both water and the nonpolar substance.
- B) The rate of transpiration will be slightly lower with the nonpolar substance as the plant will not have evolved with the nonpolar compound.
- C) Transpiration rates will fall to zero as nonpolar compounds do not have the properties necessary for adhesion and cohesion.
- D) Transpiration rates will increase as nonpolar compounds undergo adhesion and cohesion with wood fibers more readily than water.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 3.2

3.2 Student Edition End-of-Chapter Questions

1) Which of the following is a hydrophobic material?

- A) paper
- B) table salt
- C) wax
- D) sugar

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

2) We can be sure that a mole of table sugar and a mole of vitamin C are equal in their

- A) mass.
- B) volume.
- C) number of atoms.
- D) number of molecules.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

3) Measurements show that the pH of a particular lake is 4.0. What is the hydrogen ion concentration of the lake?

- A) 4.0 M
- B) 10-10 M
- C) 10^{-4} M
- D) 10^4 M

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

4) Measurements show that the pH of a particular lake is 4.0. What is the hydroxide ion concentration of the lake?

A) 10^{-10} M

B) 10^{-4} M

C) 10^{-7} M

D) 10.0 M

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

5) A slice of pizza has 500 kcal. If we could burn the pizza and use all the heat to warm a 50-L container of cold water, what would be the approximate increase in the temperature of the water?
(Note: A liter of cold water weighs about 1 kg.)

A) 50°C

B) 5°C

C) 100°C

D) 10°C

Answer: D

Bloom's Taxonomy: Application/Analysis

4.1 Multiple-Choice Questions

1) The element present in all organic molecules is _____.

- A) hydrogen
- B) oxygen
- C) carbon
- D) nitrogen

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.1

2) The complexity and variety of organic molecules is due to _____.

- A) the chemical versatility of carbon atoms
- B) the variety of rare elements in organic molecules
- C) the diverse bonding patterns of nitrogen
- D) their interaction with water

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.1

3) The experimental approach taken in current biological investigations presumes that _____.

- A) simple organic compounds can be synthesized in the laboratory from inorganic precursors, but complex organic compounds like carbohydrates and proteins can be synthesized only by living organisms
- B) a life force ultimately controls the activities of living organisms, and this life force cannot be studied by physical or chemical methods
- C) living organisms are composed of the same elements present in nonliving things, plus a few special trace elements found only in living organisms or their products
- D) living organisms can be understood in terms of the same physical and chemical laws that can be used to explain all natural phenomena

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.1

4) Differences among organisms are caused by differences in the _____.

- A) elemental composition from organism to organism
- B) types and relative amounts of organic molecules synthesized by each organism
- C) sizes of the organic molecules in each organism
- D) types of inorganic compounds present in each organism

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.1

5) Stanley Miller's 1953 experiments supported the hypothesis that _____.

- A) life on Earth arose from simple inorganic molecules
- B) organic molecules can be synthesized abiotically under conditions that may have existed on early Earth
- C) life on Earth arose from simple organic molecules, with energy from lightning and volcanoes
- D) the conditions on early Earth were conducive to the origin of life

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.1

6) Miller's classic experiment demonstrated that a discharge of sparks through a mixture of gases could result in the formation of a large variety of organic compounds. Miller did not use _____ as one of the gases in his experiment.

- A) methane
- B) oxygen
- C) water
- D) ammonia

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.1

7) Which of the following is true of carbon?

- A) It forms only polar molecules.
- B) It can form a maximum of three covalent bonds with other elements.
- C) It is highly electronegative.
- D) It can form both polar and nonpolar bonds.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

8) The kind and number of bonds an atom can form depends on _____.

- A) its atomic number
- B) its electron configuration
- C) its atomic mass
- D) the number of particles in its nucleus

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

9) Why is carbon so important in biology?

- A) It is a common element on Earth.
- B) It has very little electronegativity, making it a good electron donor.
- C) It bonds to only a few other elements.
- D) It can form a variety of carbon skeletons and host functional groups.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

10) How many electrons does one atom of carbon share to complete its valence shell?

- A) 2
- B) 3
- C) 4
- D) 8

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

11) A carbon atom has 6 electrons however, its valency is 4. This is because the carbon atom _____.

- A) donates its 2 electrons to another atom
- B) shares its 2 electrons and bonds with another atom
- C) has 4 electrons in its first shell and 2 in the second shell
- D) has only 2 electrons in its first shell and 4 in the second shell

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 4.2

12) In an ethane (C_2H_6) molecule, each carbon atom is bonded to _____ hydrogen atoms.

- A) two
- B) three
- C) four
- D) six

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

13) A carbon atom is most likely to form what kind of bond(s) with other atoms?

- A) ionic
- B) hydrogen
- C) covalent
- D) ionic bonds, covalent bonds, and hydrogen bonds

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

14) Why are hydrocarbons insoluble in water?

- A) The majority of their bonds are polar covalent carbon-to-hydrogen linkages.
- B) The majority of their bonds are nonpolar covalent carbon-to-hydrogen linkages.
- C) They exhibit considerable molecular complexity and diversity.
- D) They are less dense than water.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

15) Which of the following statements correctly describes *cis-trans* isomers?

- A) They have variations in arrangement around a double bond.
- B) They have an asymmetric carbon that makes them mirror images.
- C) They have the same chemical properties.
- D) They have different molecular formulas.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

16) Each bond in carbon dioxide represents _____.



- A) one resonating electron
- B) a pair of shared electrons
- C) two pairs of shared electrons
- D) a pair of protons

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

17) Research indicates that ibuprofen, a drug used to relieve inflammation and pain, is a mixture of two enantiomers; that is, molecules that _____.

- A) have identical chemical formulas but differ in the branching of their carbon skeletons
- B) are mirror images of each other
- C) differ in the location of their double bonds
- D) differ in the arrangement of atoms around their double bonds

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

18) What determines whether a carbon atom's covalent bonds to other atoms are in a tetrahedral configuration or a planar configuration?

- A) the presence or absence of bonds with oxygen atoms
- B) the presence or absence of double bonds between the carbon atom and other atoms
- C) the polarity of the covalent bonds between carbon and other atoms
- D) the solvent in which the organic molecule is dissolved

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 4.2

19) Which of the following carbon molecules does *not* have the bond angle of 109.5° ?

- A) CH₄
- B) C₂H₄
- C) C₂H₆
- D) C₃H₈

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 4.2

20) Compared to a hydrocarbon chain where all the carbon atoms are linked by single bonds, a hydrocarbon chain with the same number of carbon atoms but with one or more double bonds will _____.

- A) be more flexible in structure
- B) be more constrained in structure
- C) be more polar
- D) have more hydrogen atoms

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 4.2

21) Organic molecules with only hydrogens and five carbon atoms cannot _____.

- A) have a branching carbon skeleton
- B) have different combinations of double bonds between carbon atoms
- C) have different positions of double bonds between carbon atoms
- D) form enantiomers

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 4.2

22) Some carbon skeletons have different numbers and locations of double bonds to _____.

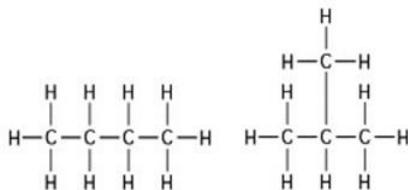
- A) add molecular complexity and diversity that characterize living matter
- B) be more flexible that makes the molecule stronger
- C) stay in its liquid state
- D) increase its solubility in water

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

23) Use the following figure to answer the question.



The two molecules shown in the figures are best described as _____.

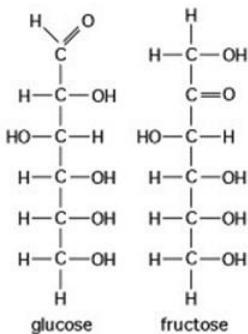
- A) enantiomers
- B) structural isomers
- C) *cis-trans* isomers
- D) chain length isomers

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

24) Use the following figure to answer the question.



The figure shows the structures of glucose and fructose. These two molecules differ in the _____.

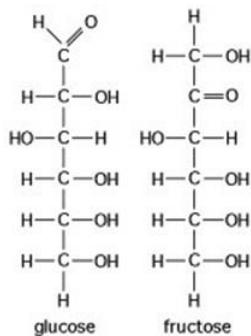
- A) number of carbon, hydrogen, and oxygen atoms
- B) types of carbon, hydrogen, and oxygen atoms
- C) arrangement of carbon, hydrogen, and oxygen atoms
- D) number of oxygen atoms joined to carbon atoms by double covalent bonds

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

25) Use the following figure to answer the question.



The figure shows the structures of glucose and fructose. These two molecules are _____.

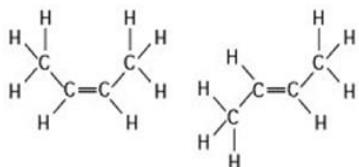
- A) isotopes
- B) enantiomers
- C) *cis-trans* isomers
- D) structural isomers

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

26) Use the following figure to answer the question.



The two molecules shown in the figure are best described as _____.

- A) enantiomers
- B) radioactive isotopes
- C) structural isomers
- D) *cis-trans* isomers

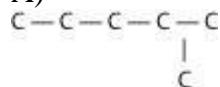
Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

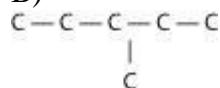
Section: 4.2

27) Which of the following illustrations is *not* a structural isomer of an organic compound with the molecular formula C₆H₁₄? For clarity, only the carbon skeletons are shown; hydrogen atoms that would be attached to the carbons have been omitted.

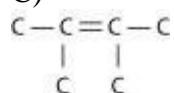
A)



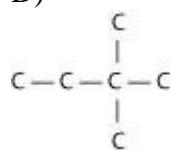
B)



C)



D)



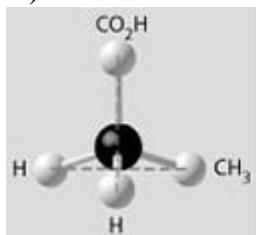
Answer: C

Bloom's Taxonomy: Application/Analysis

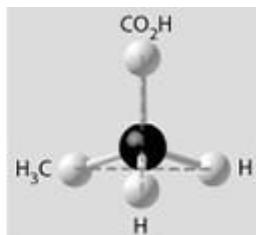
Section: 4.2

28) Which of the pairs of molecular structures shown depict enantiomers (enantiomeric forms) of the same molecule?

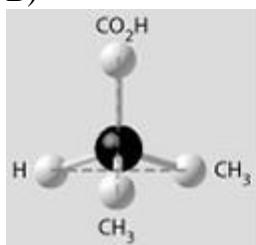
A)



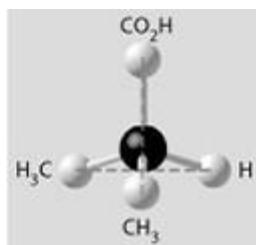
and



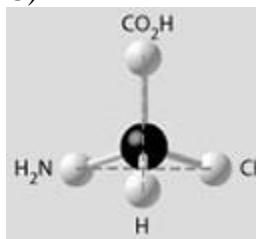
B)



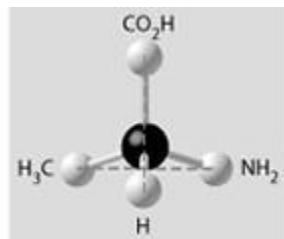
and



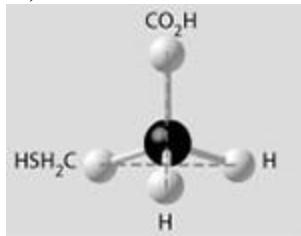
C)



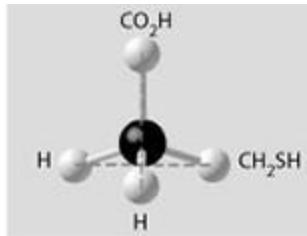
and



D)



and

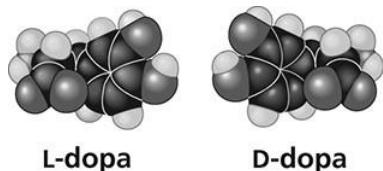


Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 4.2

29) Use the figure to answer the question.



Thalidomide and L-dopa (see figure) are examples of pharmaceutical drugs that occur as enantiomers, or molecules that _____.

- A) have identical three-dimensional shapes
- B) are mirror images of one another
- C) are mirror images of one another and have the same biological activity
- D) are *cis-trans* isomers

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.2

30) Which of the following molecules is polar?



- A) $\text{C}_3\text{H}_7\text{OH}$ and $\text{C}_2\text{H}_5\text{COOH}$ are both polar molecules.
- B) Neither $\text{C}_2\text{H}_5\text{COOH}$ or $\text{C}_3\text{H}_7\text{OH}$ is polar.
- C) $\text{C}_2\text{H}_5\text{COOH}$ is polar, but $\text{C}_3\text{H}_7\text{OH}$ is not polar.
- D) $\text{C}_2\text{H}_5\text{COOH}$ is not polar, but $\text{C}_3\text{H}_7\text{OH}$ is polar.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 4.3

31) Which of the functional groups is not reactive but serves as a recognizable tag on the DNA molecule and alter the expression of genes in the cells.

- A) amino
- B) methyl
- C) carboxyl
- D) hydroxyl

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 4.3

32) A compound contains hydroxyl groups as its predominant functional group. Therefore, this compound _____.

- A) lacks an asymmetric carbon and is probably a fat or lipid
- B) should dissolve in water
- C) should dissolve in a nonpolar solvent
- D) will not form hydrogen bonds with water

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

33) Which two functional groups are *always* found in amino acids?

- A) carbonyl and amino groups
- B) carboxyl and amino groups
- C) amino and sulphydryl groups
- D) hydroxyl and carboxyl groups

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 4.3

34) Amino acids are acids because they always possess _____ as the functional group?

- A) amino
- B) carbonyl
- C) carboxyl
- D) phosphate

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 4.3

35) Testosterone and estradiol are male and female sex hormones, respectively, in many vertebrates. In what way(s) do these molecules differ from each other? Testosterone and estradiol _____.

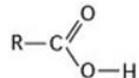
- A) are structural isomers but have the same molecular formula
- B) are *cis-trans* isomers but have the same molecular formula
- C) have different functional groups attached to the same carbon skeleton
- D) are enantiomers of the same organic molecule

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

36) Use the figure to answer the question.



What is the name of the functional group shown in the figure?

- A) carbonyl
- B) ketone
- C) aldehyde
- D) carboxyl

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

37) Use the figures to answer the question.

- A. $-\text{OH}$
- B. $\begin{array}{c} \text{O} \\ || \\ -\text{C}-\text{O}-\text{H} \end{array}$
- C. $-\text{NH}_2$
- D. $-\text{SH}$

Which functional group shown can pick up protons and raise the pH of the surrounding solution?

- A) A
- B) B
- C) C
- D) D

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

38) Use the figures to answer the question.

- A. $-\text{OH}$
- B. $\begin{array}{c} \text{O} \\ || \\ -\text{C}-\text{O}-\text{H} \end{array}$
- C. $-\text{NH}_2$
- D. $-\text{SH}$

Which of the functional groups shown helps stabilize proteins by forming covalent cross-links within or between protein molecules?

- A) A
- B) B
- C) C
- D) D

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

39) Use the figures to answer the question.

- A. $-\text{OH}$ C. $-\text{NH}_2$
B. $\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{O}-\text{H} \end{array}$ D. $-\text{SH}$

Which of the functional groups shown is present in ethanol but not in ethane?

- A) A
B) B
C) C
D) D

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

40) Use the figures to answer the question.

- A. $-\text{OH}$ C. $-\text{NH}_2$
B. $\begin{array}{c} \text{O} \\ \parallel \\ -\text{C}-\text{O}-\text{H} \end{array}$ D. $-\text{SH}$

Which of the groups is an acidic functional group that can dissociate and release H^+ into a solution?

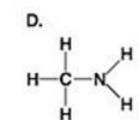
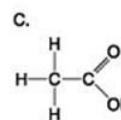
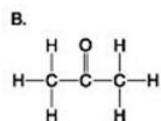
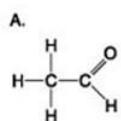
- A) A
B) B
C) C
D) D

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

41) Use the figures to answer the question.



Which molecule(s) shown is (are) ionized in a cell?

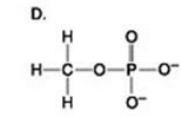
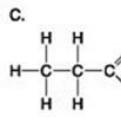
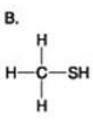
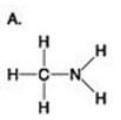
- A) A
- B) B and D
- C) C and D
- D) D

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 4.3

42) Use the figures to answer the question.



Which molecules shown contain a carbonyl group?

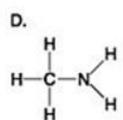
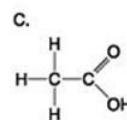
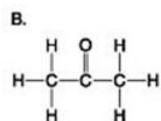
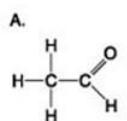
- A) A and B
- B) B and C
- C) B, C, and D
- D) C and D

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

43) Use the figures to answer the question.



Which molecule has at least one carbon atom attached to three different chemical groups?

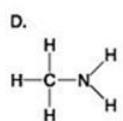
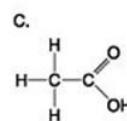
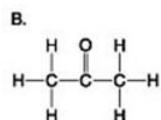
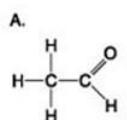
- A) A
- B) B
- C) D
- D) A and B

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

44) Use the figures to answer the question.



Which molecule shown has a carbonyl functional group in the form of an aldehyde?

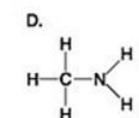
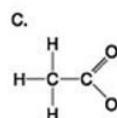
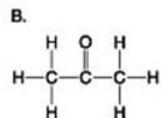
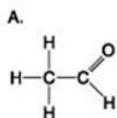
- A) A
- B) B
- C) C
- D) D

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

45) Use the figures to answer the question.



Which molecule shown contains a carboxyl group?

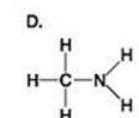
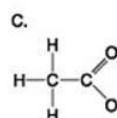
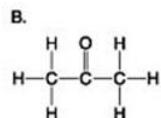
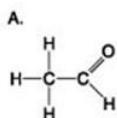
- A) A
- B) B
- C) C
- D) D

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

46) Use the figures to answer the question.



Which molecule shown can increase the concentration of hydrogen ions in a solution and is therefore an organic acid?

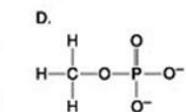
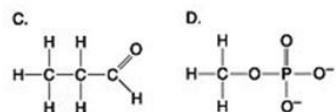
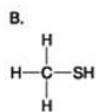
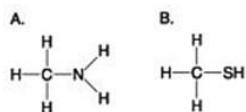
- A) A
- B) B
- C) C
- D) D

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

47) Use the figures to answer the question.



Which molecule can be a result of mercaptoethanol reduction of a disulfide bridge?

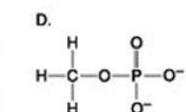
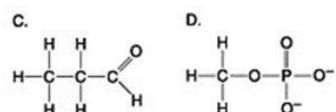
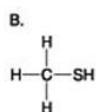
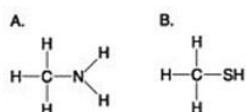
- A) A
- B) B
- C) C
- D) D

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 4.3

48) Use the figures to answer the question.



Which molecule shown is a thiol?

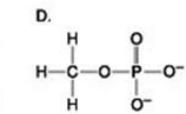
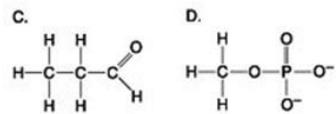
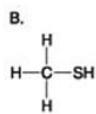
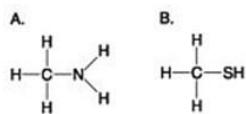
- A) A
- B) B
- C) C
- D) D

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

49) Use the figures to answer the question.



Which molecule shown above contains a functional group that is a part of the molecule known as the "energy currency of living organisms"?

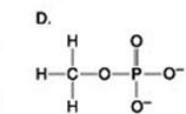
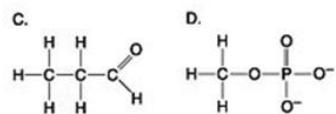
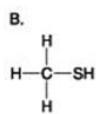
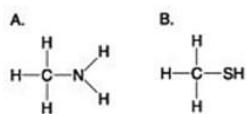
- A) A
- B) B
- C) C
- D) D

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 4.3

50) Use the figures to answer the question.



Which molecule shown above can contribute negative charge when positioned in a chain?

- A) A
- B) B
- C) C
- D) D

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 4.3

51) Which of the following statements is true?

- A) ADP contains more energy than ATP.
- B) Following hydrolysis, ATP can give off one phosphate, whereas ADP cannot.
- C) ADP can have two positive charges.
- D) ATP can have four negative charges.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 4.3

52) Which of the following molecules is a part of ATP?

- A) adenosine
- B) cytosine
- C) guanine
- D) uracil

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 4.3

4.2 Student Edition End-of-Chapter Questions

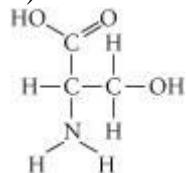
1) Organic chemistry is currently defined as

- A) the study of compounds made only by living cells.
- B) the study of carbon compounds.
- C) the study of natural (as opposed to synthetic) compounds.
- D) the study of hydrocarbons.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

2)



Which functional group is *not* present in this molecule?

- A) carboxyl
- B) sulphydryl
- C) hydroxyl
- D) amino

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

3) Which chemical group is most likely to be responsible for an organic molecule behaving as a base?

- A) hydroxyl
- B) carbonyl
- C) amino
- D) phosphate

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

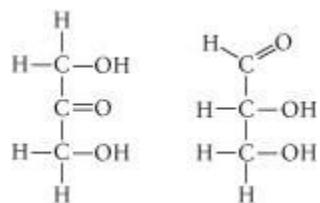
4) Visualize the structural formula of each of the following hydrocarbons. Which hydrocarbon has a double bond in its carbon skeleton?

- A) C₃H₈
- B) C₂H₆
- C) C₂H₄
- D) C₂H₂

Answer: C

Bloom's Taxonomy: Application/Analysis

5) Choose the term that correctly describes the relationship between these two sugar molecules:



- A) structural isomers
- B) *cis-trans* isomers
- C) enantiomers
- D) isotopes

Answer: A

Bloom's Taxonomy: Application/Analysis

6) Which action could produce a carbonyl group?

- A) the replacement of the -OH of a carboxyl group with hydrogen
- B) the addition of a thiol to a hydroxyl
- C) the addition of a hydroxyl to a phosphate
- D) the replacement of the nitrogen of an amine with oxygen

Answer: A

Bloom's Taxonomy: Application/Analysis

5.1 Multiple-Choice Questions

1) Which of the following is *not* a polymer?

- A) glucose
- B) starch
- C) RNA
- D) DNA

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.1

2) How many molecules of water are released during the polymerization of a 20 monomer-long cellulose molecule?

- A) 10
- B) 19
- C) 20
- D) 40

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 5.1

3) Which of the following best summarizes the relationship between dehydration reactions and hydrolysis?

- A) Dehydration reactions assemble polymers; hydrolysis reactions break polymers apart.
- B) Dehydration reactions eliminate water from membranes; hydrolysis reactions add water to membranes.
- C) Dehydration reactions and hydrolysis reactions assemble polymers from monomers.
- D) Hydrolysis reactions create polymers, and dehydration reactions create monomers.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.1

4) The molecular formula for glucose is C₆H₁₂O₆. What would be the molecular formula for a molecule made by linking three glucose molecules together by dehydration reactions?

- A) C₁₈H₃₆O₁₈
- B) C₁₈H₃₂O₁₆
- C) C₆H₁₀O₅
- D) C₁₈H₃₀O₁₅

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 5.1

5) The difference between an aldose sugar and a ketose sugar is _____.

- A) the number of carbon atoms
- B) the position of the hydroxyl groups
- C) the position of the carbonyl group
- D) the ring form and the linear chain

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.2

6) Maltose is a disaccharide that can easily be digested into glucose molecules. The glycosidic linkage between glucose molecules in maltose is _____.

- A) β 1—4
- B) α 1—2
- C) α 1—4
- D) β 1—2

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.2

7) You would like to lose weight. Which of the following should be your preferred food group?

- A) Lactose and glucose
- B) Sucrose and starch
- C) Starch and fructose
- D) Cellulose and fructose

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 5.2

8) What is the major structural difference between starch and glycogen?

- A) the types of monosaccharide subunits in the molecules
- B) the type of glycosidic linkages in the molecule
- C) whether glucose is in the α or β form
- D) the amount of branching that occurs in the molecule

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.2

9) Starch is composed of _____.

- A) branched amylopectin and branched amylose
- B) unbranched amylopectin and unbranched amylose
- C) branched amylopectin and unbranched amylose
- D) unbranched amylopectin and branched amylose

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.2

10) Which polysaccharide is an important component in the structure of many animals and fungi?

- A) chitin
- B) cellulose
- C) amylopectin
- D) amylose

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.2

11) What does the term *insoluble fiber* refer to on food packages?

- A) cellulose
- B) polypeptides
- C) starch
- D) amylopectin

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.2

12) A molecule with the chemical formula C₆H₁₂O₆ is probably a _____.

- A) fatty acid
- B) polysaccharide
- C) nucleic acid
- D) monosaccharide

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.2

13) In carbohydrates, the ratio of hydrogen (H) to oxygen (O) is _____.

- A) 1:1
- B) 2:1
- C) 3:1
- D) 4:1

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.2

14) People who are lactose intolerant cannot extract energy from milk because _____.

- A) they are missing an enzyme
- B) lactose is too big to be digested by the enzymes
- C) milk is fermented to a by-product, which cannot be digested
- D) they are missing the bacteria that can digest lactose

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 5.2

15) Starch and cellulose _____.

- A) are polymers of glucose
- B) are *cis* and *trans* isomers of each other
- C) are used for energy storage in plants and animals
- D) are structural components of the plant cell wall

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.2

16) Humans can digest starch but not cellulose because _____.

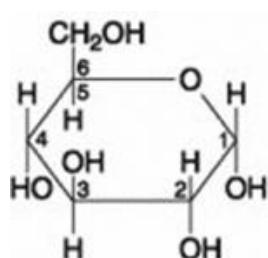
- A) humans have enzymes that can hydrolyze the α -glycosidic linkages of starch but not the β -glycosidic linkages of cellulose
- B) starch monomers are joined by covalent bonds, and cellulose monomers are joined by ionic bonds
- C) the monomer of starch is glucose, while the monomer of cellulose is galactose
- D) Starch is softer than cellulose

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.2

17) Use the following figure to answer the question.



The molecule shown is _____.

- A) a hexose
- B) a pentose
- C) fructose
- D) maltose

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.2

18) A glycosidic linkage is analogous to which of the following in proteins?

- A) an amino group
- B) a peptide bond
- C) a disulfide bond
- D) a β pleated sheet

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 5.2 / 5.4

19) Which of the following statements is true for lipids?

- A) Lipids are true polymers.
- B) Waxes and pigments are not lipids.
- C) Lipids mix poorly with water.
- D) Lipids are true polymers and mix poorly with water.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.3

20) What makes lipids/fats hydrophobic?

- A) their long carbon skeleton
- B) the carboxyl group at one end of the molecule
- C) the glycerol moiety
- D) presence of relatively nonpolar C—H bonds

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.3

21) Cooking oil and gasoline (a hydrocarbon) are not amphipathic molecules because they _____.

- A) do not have a polar or charged region
- B) do not have a nonpolar region
- C) have hydrophobic and hydrophilic regions
- D) are highly reduced molecules

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 5.3

22) For lipids to be fluid at room temperature, they should have _____.

- A) single bonds only
- B) a higher number of glycerol molecules
- C) a higher number of *cis* double bonds
- D) a longer carbon chain

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 5.3

23) How do phospholipids interact with water molecules?

- A) The polar heads avoid water; the nonpolar tails attract water (because water is polar and opposites attract).
- B) Phospholipids do not interact with water because water is polar and lipids are nonpolar.
- C) The polar heads interact with water; the nonpolar tails do not.
- D) Phospholipids dissolve in water.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.3

24) Phospholipids and triglycerides both _____.

- A) contain serine or some other organic compound
- B) have three fatty acids
- C) have a glycerol backbone
- D) have a phosphate

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.3

25) Saturated fats _____.

- A) are more common in plants than in animals
- B) have multiple double bonds in the carbon chains of their fatty acids
- C) are generally liquid at room temperature
- D) contain more hydrogen than unsaturated fats that consist of the same number of carbon atoms

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.3

26) The label on a container of margarine lists "hydrogenated vegetable oil" as the major ingredient. Hydrogenated vegetable oil _____.

- A) is solid at room temperature
- B) has more "kinks" in the fatty acid chains
- C) has fewer *trans* fatty acids
- D) is less likely to clog arteries

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.3

27) Which of the following could be responsible for atherosclerosis and should be eliminated from diet for health reasons?

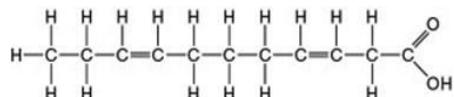
- A) butter
- B) olive oil
- C) liver and kidney organ meat
- D) butter, liver, and kidney organ meat

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 5.3

28) Use the following figure to answer the question.



The molecule illustrated in the figure _____.

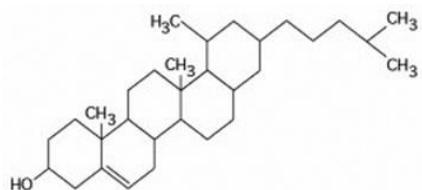
- A) is a saturated fatty acid
- B) stores genetic information
- C) will be liquid at room temperature
- D) is a carbohydrate

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 5.3

29) Use the following figure to answer the question.



The molecule shown in the figure is a _____.

- A) fatty acid
- B) steroid
- C) triacylglycerol
- D) phospholipid

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.3

30) Which parts of the amino acids X and Y are involved in the formation of a peptide bond?

X—Y

- A) amino group of X and carboxyl group of Y
- B) carboxyl group of X and amino group of Y
- C) carboxyl group of X and side chain of Y
- D) side chains of both X and Y

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 5.4

31) A tripeptide has _____.

- A) three amino acids and two peptide bonds
- B) three amino acids and three peptide bonds
- C) two amino acids and three peptide bonds
- D) four amino acids and three peptide bonds

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 5.3

32) What component of amino acid structure varies among different amino acids?

- A) the long carbon-hydrogen tails of the molecule
- B) the presence of a central C atom
- C) the components of the R group
- D) the glycerol molecule that forms the backbone of the amino acid

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.4

33) You disrupt all hydrogen bonds in a protein. What level of structure will be preserved?

- A) primary structure
- B) secondary structure
- C) tertiary structure
- D) quaternary structure

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 5.4

34) Which of the following statements is true about proteins?

- A) Denaturation leads to bond disruption, and the molecule turns into liquid
- B) Denaturation is always irreversible
- C) Final folded structure can reveal the steps of protein folding
- D) Some proteins form a complete 3-D structure only when they interact with their targets

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.4

35) You have just sequenced a new protein found in mice and observe that sulfur-containing cysteine residues occur at regular intervals. What is the significance of this finding?

- A) Cysteine residues are required for the formation of α helices and β pleated sheets.
- B) It will be important to include cysteine in the diet of the mice.
- C) Cysteine residues are involved in disulfide bridges that help form tertiary structure.
- D) Cysteine causes bends, or angles, to occur in the tertiary structure of proteins.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 5.4

36) Use the following information to answer the question.

"The native structure of hemoglobin (Hb) comprises of two α and two β subunits, each of which carries a heme group. There appear to be no previous studies that report the in-vitro folding and assembly of Hb from highly unfolded α and β globin in a 'one-pot' reaction. One difficulty that has to be overcome for studies of this kind is the tendency of Hb to aggregate during refolding. This work demonstrates that denaturation of Hb in 40% acetonitrile at pH 10.0 is reversible." (J Am Soc Mass Spectrum 2007, 18, 8-16)

Hemoglobin is _____.

- A) a tertiary protein with two polypeptides
- B) a quaternary protein with two polypeptides
- C) a tertiary protein with four polypeptides
- D) a quaternary protein with four polypeptides

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 5.4

37) Use the following information to answer the question.

"The native structure of hemoglobin (Hb) comprises of two α and two β subunits, each of which carries a heme group. There appear to be no previous studies that report the in-vitro folding and assembly of Hb from highly unfolded α and β globin in a 'one-pot' reaction. One difficulty that has to be overcome for studies of this kind is the tendency of Hb to aggregate during refolding. This work demonstrates that denaturation of Hb in 40% acetonitrile at pH 10.0 is reversible." (J Am Soc Mass Spectrum 2007, 18, 8-16)

How many heme groups are present in three hemoglobin protein molecules?

- A) 3
- B) 4
- C) 9
- D) 12

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 5.4

38) In sickle-cell disease, as a result of a single amino acid change, the mutant hemoglobin tetramers associate with each other and assemble into large fibers. Based on this information alone, we can conclude that sickle-cell hemoglobin exhibits _____.

- A) only altered primary structure
- B) only altered tertiary structure
- C) only altered quaternary structure
- D) altered primary structure and altered quaternary structure; the secondary and tertiary structures may or may not be altered

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 5.4

39) Use the following information to answer the question.

"The native structure of hemoglobin (Hb) comprises of two α and two β subunits, each of which carries a heme group. There appear to be no previous studies that report the in-vitro folding and assembly of Hb from highly unfolded α and β globin in a 'one-pot' reaction. One difficulty that has to be overcome for studies of this kind is the tendency of Hb to aggregate during refolding. This work demonstrates that denaturation of Hb in 40% acetonitrile at pH 10.0 is reversible." (J Am Soc Mass Spectrum 2007, 18, 8-16)

Hemoglobin, when subjected to 40% acetonitrile at pH 10.0, loses its quaternary structure, which means the _____.

- A) four α and β polypeptides dissociate
- B) peptide bonds between amino acids break
- C) α and β polypeptides lose their 3-D structure
- D) four α and β polypeptides dissociate, peptide bonds between amino acids, and α and β polypeptides lose their 3-D structure

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 5.4

40) Which of the following provides the information necessary to stipulate a protein's 3-D shape?

- A) peptide bonds between different amino acids
- B) sequence of amino acids in the polypeptide chain
- C) side chains of various amino acids
- D) number of water molecules in the vicinity

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 5.4

41) Misfolding of polypeptides is a serious problem in cells. Which of the following diseases are associated with an accumulation of misfolded polypeptides?

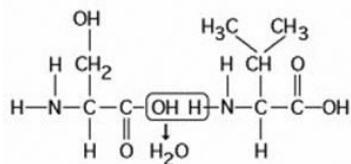
- A) Alzheimer's
- B) Parkinson's
- C) diabetes mellitus
- D) Alzheimer's and Parkinson's

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.4

42) Use the following figure to answer the question.



The chemical reaction illustrated _____.

- A) is a hydrolysis reaction
- B) results in a peptide bond
- C) joins two fatty acids together
- D) links two polymers to form a monomer

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 5.4

43) The relation between amino acid and polypeptide is similar to the relation between _____.

- A) nucleotide and nucleic acid
- B) triglycerides and steroids
- C) phospholipid and plasma membrane
- D) glycogen and glucose

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.5

44) Which of the following is a major difference between RNA and DNA?

- A) type of sugar
- B) type of phosphate
- C) type of purines
- D) type of glycosidic bond

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.5

45) When nucleotides polymerize to form a nucleic acid, _____.

- A) a covalent bond forms between the sugar of one nucleotide and the phosphate of a second
- B) a hydrogen bond forms between the sugar of one nucleotide and the phosphate of a second
- C) covalent bonds form between the bases of two nucleotides
- D) hydrogen bonds form between the bases of two nucleotides

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.5

46) Which of the following statements about the 5' end of a polynucleotide strand of RNA is correct?

- A) The 5' end has a hydroxyl group attached to the number 5 carbon of ribose.
- B) The 5' end has a phosphate group attached to the number 5 carbon of ribose.
- C) The 5' end has phosphate attached to the number 5 carbon of the nitrogenous base.
- D) The 5' end has a carboxyl group attached to the number 5 carbon of ribose.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.5

47) One of the primary functions of RNA molecules is to _____.

- A) transmit genetic information to offspring
- B) function in the synthesis of proteins
- C) make a copy of itself, thus ensuring genetic continuity
- D) act as a pattern or blueprint to form DNA

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.5

48) If ¹⁴C-labeled uracil is added to the growth medium of cells, what macromolecules will be labeled?

- A) DNA
- B) RNA
- C) both DNA and RNA
- D) polypeptides

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 5.5

49) Which of the following descriptions best fits the class of molecules known as nucleotides?

- A) a nitrogenous base and a phosphate group
- B) a nitrogenous base and a sugar
- C) a nitrogenous base, a phosphate group, and a sugar
- D) a sugar and a purine or pyrimidine

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.5

50) In an RNA sample, _____.

- A) the number of thiamine may or may not equal the number of adenine
- B) the number of purine always equals the number of pyrimidine
- C) the number of thiamine always equals the number of uracil
- D) the number of purine may or may not equal the number of and pyrimidine

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 5.5

51) If one strand of a DNA molecule has the sequence of bases 5'-ATTGCA-3', the mRNA synthesized following the template will be _____.

- A) 5'-TAACGT-3'
- B) 5'-TGCAAT-3'
- C) 3'-UAACGU-5'
- D) 5'-UGCAAU-3'

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 5.5

52) The central rule of molecular biology states that _____.

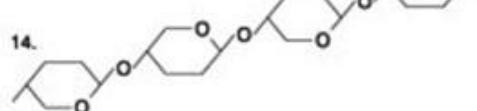
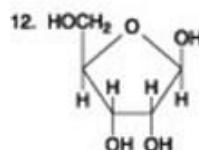
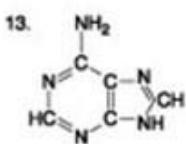
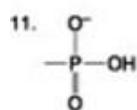
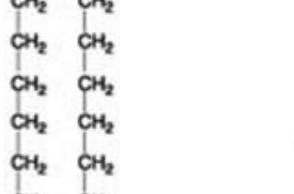
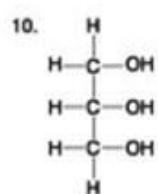
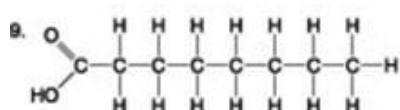
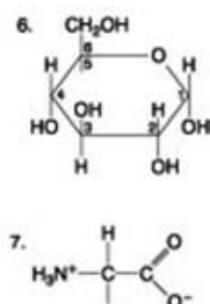
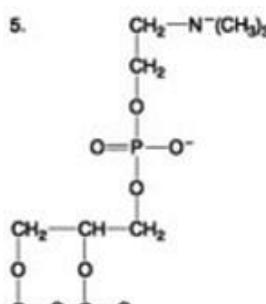
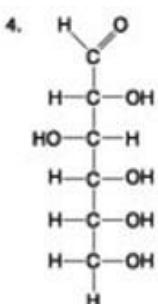
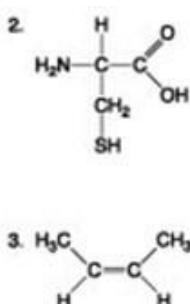
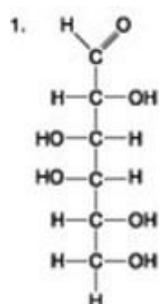
- A) DNA is transcribed into RNA, which is translated into protein
- B) DNA is translated into protein
- C) DNA is translated into RNA, which is transcribed into protein
- D) RNA is transcribed into protein

Answer: A

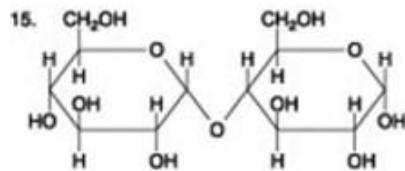
Bloom's Taxonomy: Application/Analysis

Section: 5.5

53) The following question is based on the 15 molecules illustrated in the figure.



CH₃



Which molecule has both hydrophilic and hydrophobic properties and is found in plasma membranes?

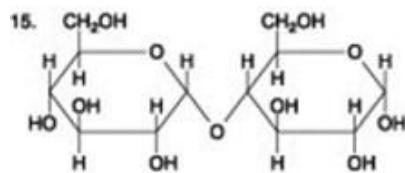
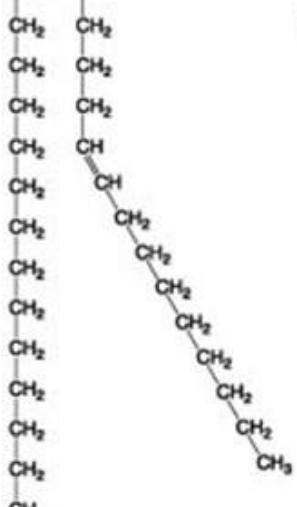
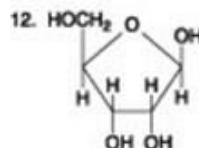
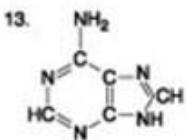
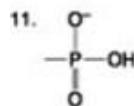
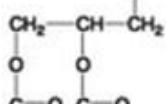
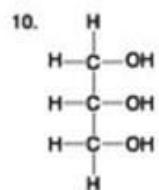
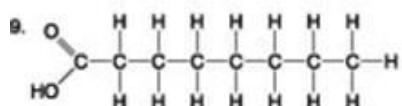
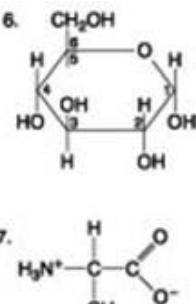
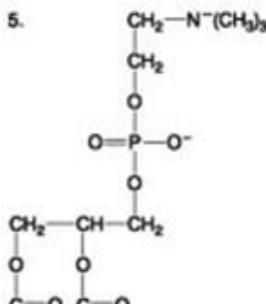
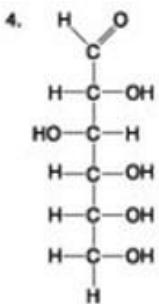
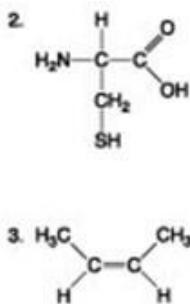
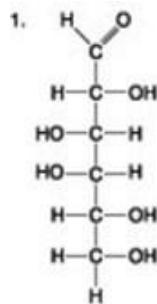
- A) 1
- B) 5
- C) 12
- D) 14

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 5.3

54) The following question is based on the 15 molecules illustrated in the figure.



Which of the following combinations of molecules illustrated could be linked to form a nucleotide?

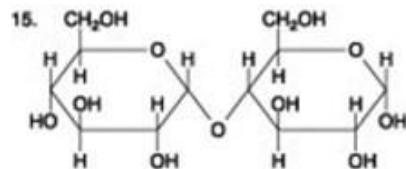
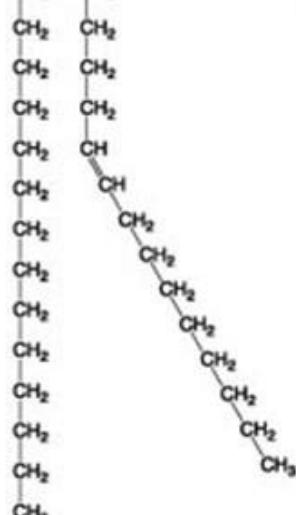
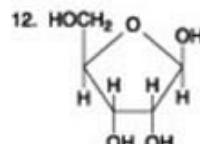
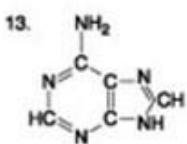
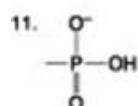
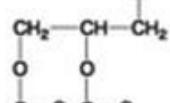
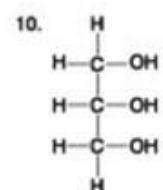
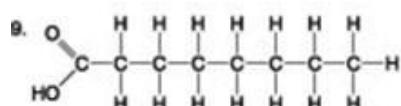
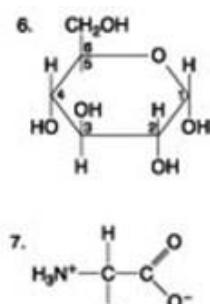
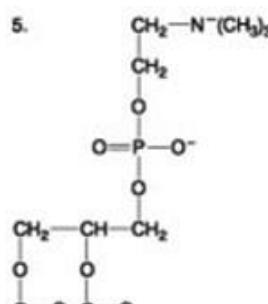
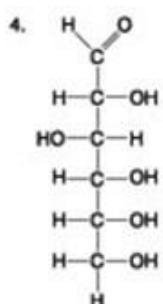
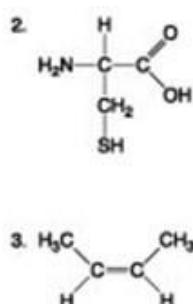
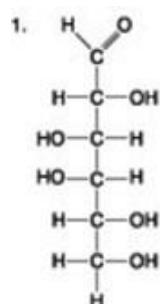
- A) 1, 2, and 11
- B) 3, 7, and 8
- C) 5, 9, and 10
- D) 11, 12, and 13

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 5.5

55) The following question is based on the 15 molecules illustrated in the figure.



Which molecule is a saturated fatty acid?

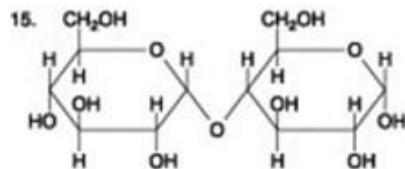
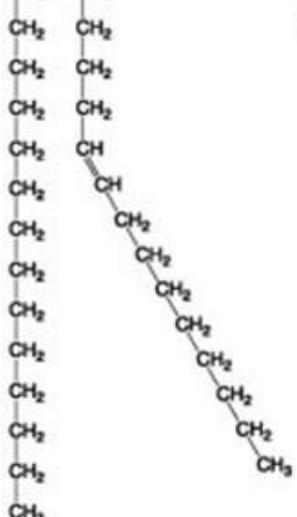
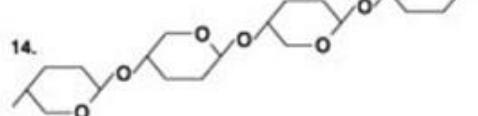
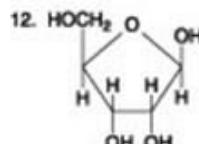
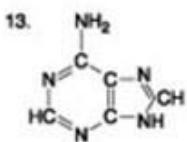
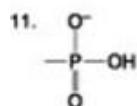
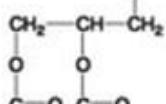
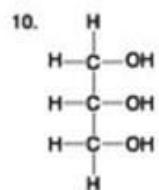
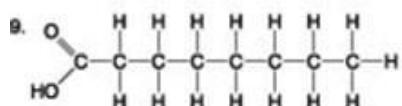
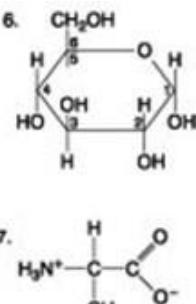
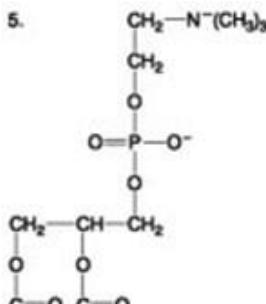
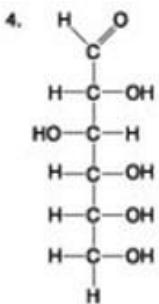
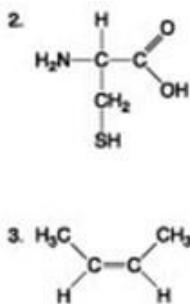
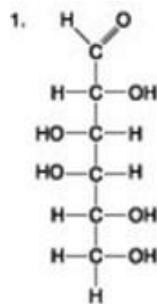
- A) 1
- B) 5
- C) 8
- D) 9

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.3

56) The following question is based on the 15 molecules illustrated in the figure.



Which of the following molecules is a purine nitrogenous base?

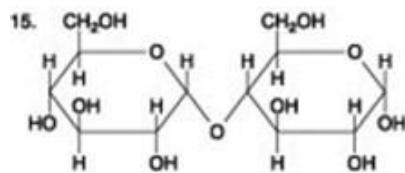
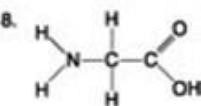
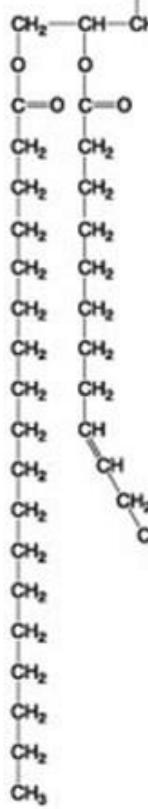
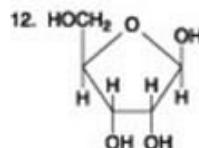
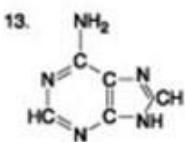
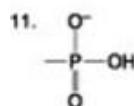
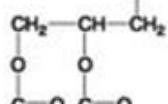
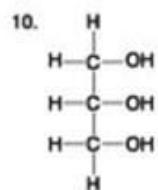
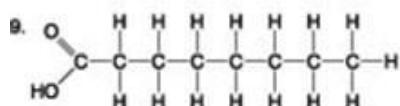
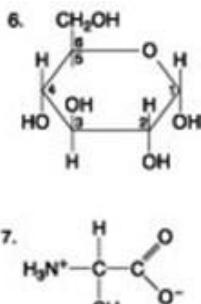
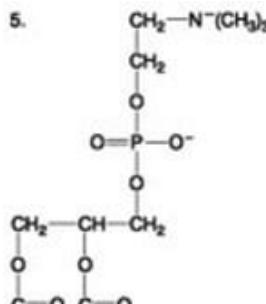
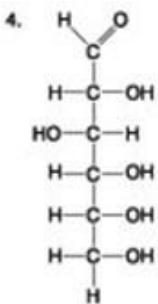
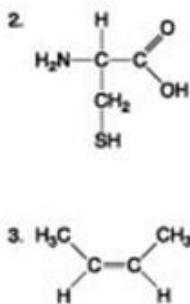
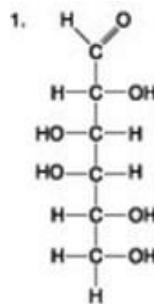
- A) 2
- B) 5
- C) 12
- D) 13

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.5

57) The following question is based on the 15 molecules illustrated in the figure.



Which of the following molecules act as building blocks (monomers) of polypeptides?

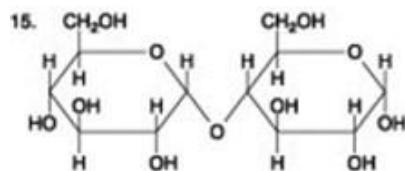
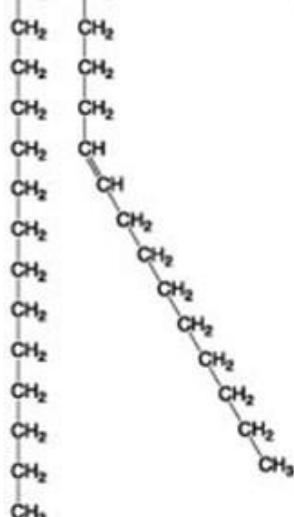
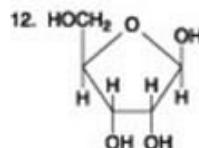
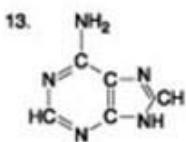
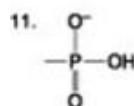
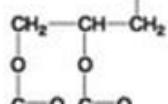
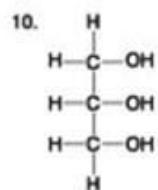
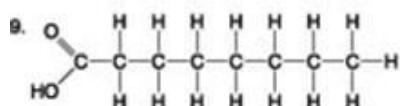
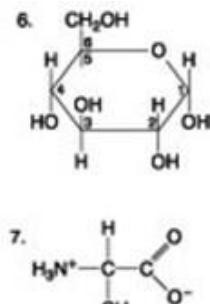
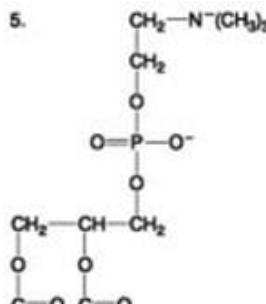
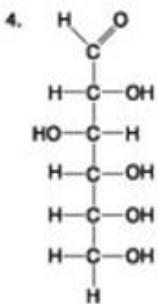
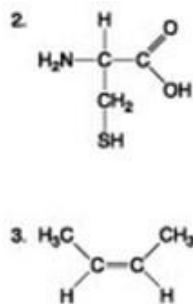
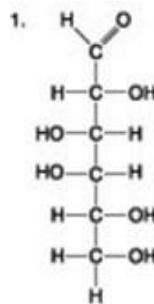
- A) 1, 4, and 6
- B) 2, 7, and 8
- C) 7, 8, and 13
- D) 11, 12, and 13

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 5.4

58) The following question is based on the 15 molecules illustrated in the figure.



Which of the following pairs of molecules could be joined together by a peptide bond in a dehydration reaction?

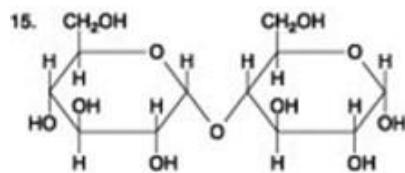
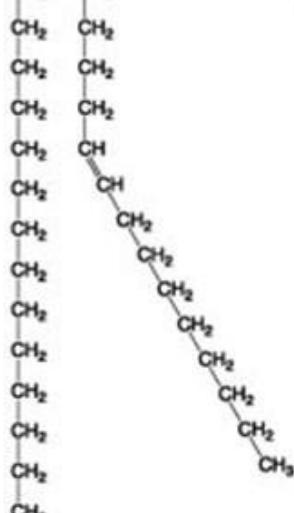
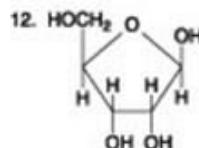
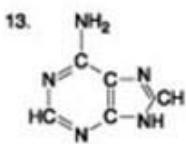
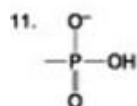
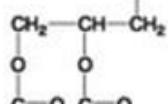
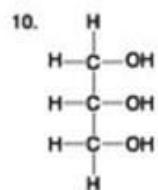
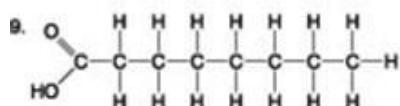
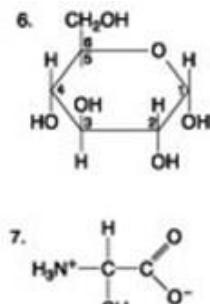
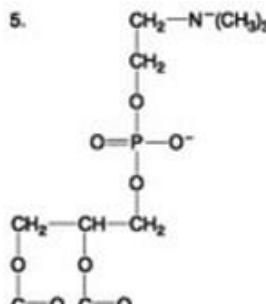
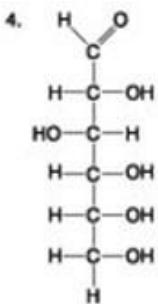
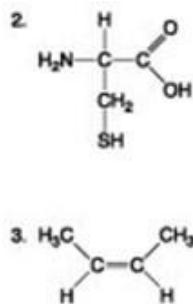
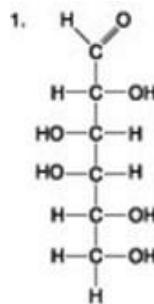
- A) 2 and 3
- B) 7 and 8
- C) 8 and 9
- D) 12 and 13

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 5.4

59) The following question is based on the 15 molecules illustrated in the figure.



A fat (or triacylglycerol) would be formed as a result of a dehydration reaction between _____.

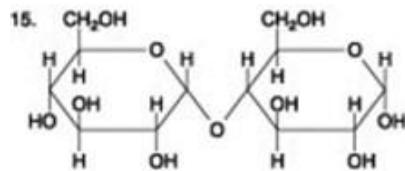
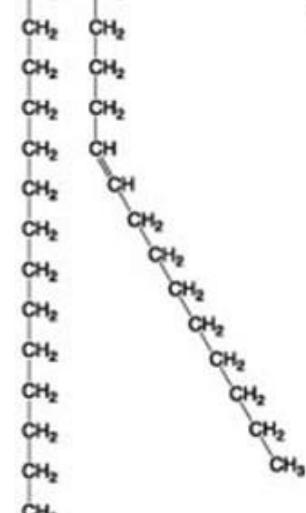
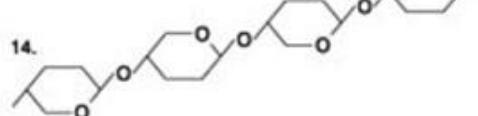
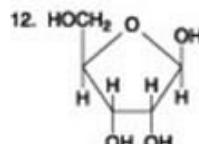
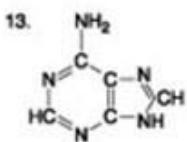
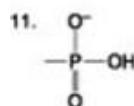
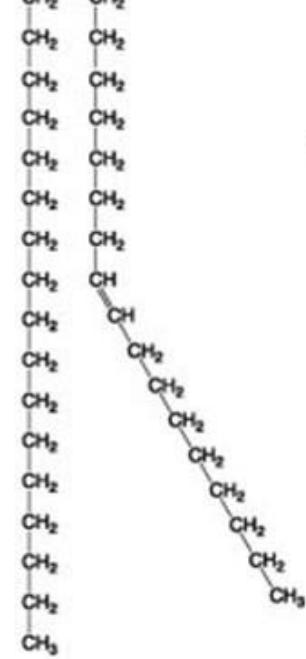
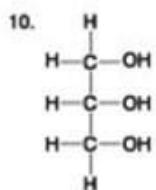
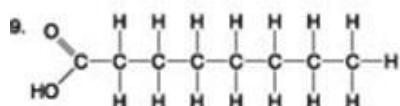
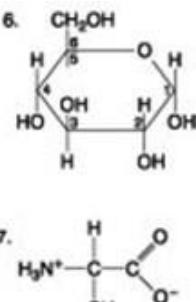
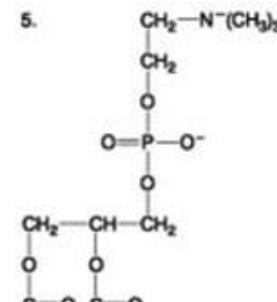
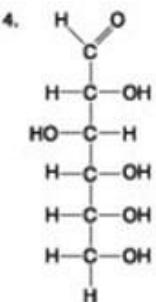
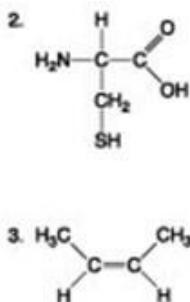
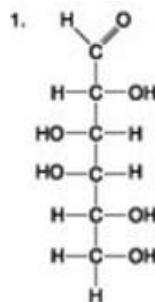
- A) one molecule of 9 and three molecules of 10
- B) three molecules of 9 and one molecule of 10
- C) one molecule of 5 and three molecules of 9
- D) one molecule of 5 and three molecules of 10

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 5.3

60) The following question is based on the 15 molecules illustrated in the figure.



Which of the following molecules is the pentose sugar found in RNA?

- A) 1
- B) 6
- C) 12
- D) 13

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 5.5

61) A new organism is discovered in the forests of Costa Rica. Scientists there determine that the polypeptide sequence of hemoglobin from the new organism has 72 amino acid differences from humans, 65 differences from a gibbon, 49 differences from a rat, and 5 differences from a frog. These data suggest that the new organism is more closely related to _____.

- A) humans than to frogs
- B) frogs than to humans
- C) rats than to frogs
- D) gibbons than to rats

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 5.6

62) *Homo sapiens* have 23 pairs of chromosomes. This implies that _____.

- A) 46 double-stranded DNA molecules are present in each somatic cell
- B) 23 single-stranded DNA molecules are present in each somatic cell
- C) 23 double-stranded DNA molecules are present in each somatic cell
- D) several hundreds of genes are present on DNA but not on the chromosomes

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 5.6

63) Absorbance at Various pH Levels

Time (sec)	pH 4	pH 5	pH 6	pH 7	pH 8	pH 9
20	0.003	0.025	0.055	0.146	0.005	0.004
40	0.009	0.109	0.152	0.300	0.015	0.008
60	0.012	0.195	0.255	0.432	0.038	0.010
80	0.020	0.215	0.341	0.552	0.065	0.012
100	0.023	0.333	0.413	0.659	0.081	0.013
120	0.025	0.360	0.478	0.755	0.090	0.013

The table represents the results of an experiment where the effects of pH buffers on an enzyme found in saliva (amylase) were studied. A spectrophotometer set at 500 nm was used to measure absorbance at the various pH levels every 20 seconds for 2 minutes. The higher absorbance values would indicate greater enzyme activity. All experiments were conducted at the same temperature.

- Which statement correctly identifies the result that the optimum pH for amylase function is 7?
- A) The pH with the lowest absorbance values would indicate the optimum pH for amylase since this pH does not affect the structure or function of the protein.
 - B) The pH with the highest absorbance values would indicate the optimum pH for amylase since this pH does not affect the structure or function of the protein.
 - C) At pH 9, the enzyme is denatured and will lose its function, but not its structure.
 - D) At pH 4, the structure of the enzyme will be altered, and the enzyme would not be able to catalyze the reaction.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 5.4

5.2 Student Edition End-of-Chapter Questions

- 1) Which of the following categories includes all others in the list?

- A) disaccharide
- B) polysaccharide
- C) starch
- D) carbohydrate

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 2) The enzyme amylase can break glycosidic linkages between glucose monomers only if the monomers are in the form. Which of the following could amylase break down?

- A) glycogen, starch, and amylopectin
- B) glycogen and cellulose
- C) cellulose and chitin
- D) starch, chitin, and cellulose

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 3) Which of the following is true of *unsaturated* fats?
- A) They are more common in animals than in plants.
 - B) They have double bonds in their fatty acid chains.
 - C) They generally solidify at room temperature.
 - D) They contain more hydrogen than do saturated fats having the same number of carbon atoms.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 4) The structural level of a protein *least* affected by a disruption in hydrogen bonding is the
- A) primary level.
 - B) secondary level.
 - C) tertiary level.
 - D) quaternary level.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 5) Enzymes that break down DNA catalyze the hydrolysis of the covalent bonds that join nucleotides together. What would happen to DNA molecules treated with these enzymes?
- A) The two strands of the double helix would separate.
 - B) The phosphodiester linkages of the polynucleotide backbone would be broken.
 - C) The pyrimidines would be separated from the deoxyribose sugars.
 - D) All bases would be separated from the deoxyribose sugars.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 6) The molecular formula for glucose is C₆H₁₂O₆. What would be the molecular formula for a polymer made by linking ten glucose molecules together by dehydration reactions?
- A) C₆₀H₁₂₀O₆₀
 - B) C₆₀H₁₀₂O₅₁
 - C) C₆₀H₁₀₀O₅₀
 - D) C₆₀H₁₁₁O₅₁

Answer: B

Bloom's Taxonomy: Application/Analysis

- 7) Which of the following pairs of base sequences could form a short stretch of a normal double helix of DNA?
- A) 5'-AGCT-3' with 5'-TCGA-3'
 - B) 5'-GCGC-3' with 5'-TATA-3'
 - C) 5'-ATGC-3' with 5'-GCAT-3'
 - D) All of these pairs are correct.

Answer: C

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 6 A Tour of the Cell

6.1 Multiple-Choice Questions

1) Which of the following is the smallest structure that would most likely be visible with a standard (not super-resolution) research-grade light microscope?

- A) mitochondrion
- B) microtubule
- C) ribosome
- D) virus

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.1

2) One primary advantage of light microscopy over electron microscopy is that _____.

- A) light microscopy provides for higher magnification than electron microscopy
- B) light microscopy provides for higher resolution than electron microscopy
- C) light microscopy allows the visualization of dynamic processes in living cells
- D) light microscopy provides higher contrast than electron microscopy

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.1

3) In the fractionation of homogenized cells using differential centrifugation, which of the following will require the greatest speed to form pellets at the bottom of the tube?

- A) nuclei
- B) mitochondria
- C) chloroplasts
- D) ribosomes

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 6.1

4) What is the explanation for how a modern transmission electron microscope (TEM) can achieve a resolution of about 0.2 nanometers, whereas a standard light microscope has a maximum resolution of about 200 nanometers?

- A) Glass lenses in light microscopes refract light, which reduces resolution.
- B) Contrast is enhanced by staining with atoms of heavy metal.
- C) Electron beams have much shorter wavelengths than visible light.
- D) The electron microscope has a much greater ratio of image size to real size.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.1

5) Which of the following would be the most appropriate method to observe the movements of condensed chromosomes during cell division?

- A) a hand lens (magnifying glass)
- B) standard light microscopy
- C) scanning electron microscopy
- D) transmission electron microscopy

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 6.1

6) Which of the following would be most appropriate method to observe and measure the size of ribosomes in a eukaryotic cell?

- A) a hand lens (magnifying glass)
- B) standard light microscopy
- C) scanning electron microscopy
- D) transmission electron microscopy

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 6.1

7) Which of the following would be most appropriate method to observe the three-dimensional structure and organization of microvilli on an intestinal cell?

- A) a hand lens (magnifying glass)
- B) standard light microscopy
- C) scanning electron microscopy
- D) transmission electron microscopy

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 6.1

8) A newspaper ad for a local toy store indicates that an inexpensive toy microscope available for a small child is able to magnify specimens nearly as much as the more costly microscope available in your college lab. What is the primary reason for the price difference?

- A) The toy microscope does not have the same fine control for focus of the specimen.
- B) The toy microscope magnifies a good deal, but has low resolution and therefore poor quality images.
- C) The toy microscope produces less contrast in the specimens.
- D) The toy microscope usually uses a different wavelength of light source.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 6.1

9) A newly discovered unicellular organism isolated from acidic mine drainage is found to contain a cell wall, a plasma membrane, two flagella, and peroxisomes. Based just on this information, the organism is most likely _____.

- A) a nonmotile prokaryote
- B) a motile bacterium
- C) a motile archaea
- D) a nonmotile eukaryote
- E) a motile eukaryote

Answer: E

Bloom's Taxonomy: Application/Analysis

Section: 6.2

10) Which of the following frequently imposes a limit on cell size?

- A) the absence of a nucleus
- B) the number of mitochondria in the cytoplasm
- C) ratios of surface area to volume
- D) the volume of the endomembrane system

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.2

11) Which of the following is a major difference between prokaryotic cells and eukaryotic cells?

- A) Prokaryotic cells have cell walls, while eukaryotic cells do not.
- B) Eukaryotic cells have flagella, while prokaryotic cells do not.
- C) Eukaryotic cells have membrane-bound organelles, while prokaryotic cells do not.
- D) Prokaryotic cells are generally larger than eukaryotic cells.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.2

12) You have a cube of modeling clay in your hands. Which of the following changes to the shape of this cube of clay will decrease its surface area relative to its volume?

- A) Pinch the edges of the cube into small folds.
- B) Flatten the cube into a pancake shape.
- C) Round the clay up into a sphere.
- D) Stretch the cube into a long, shoebox shape.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 6.2

13) Which of the following will have the greatest ratio of surface area to volume?

- A) A box that is $2 \times 2 \times 2$.
- B) A box that is $1 \times 1 \times 1$.
- C) A box that is $2 \times 2 \times 1$.
- D) A box that is $1 \times 1 \times 2$.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 6.2

14) Which domains of life are classified as prokaryotes?

- A) Bacteria and Eukarya
- B) Bacteria and Archaea
- C) Archaea and Fungi
- D) Bacteria and Protista

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.2

15) Which structure is common to plant *and* animal cells?

- A) chloroplast
- B) central vacuole
- C) mitochondrion
- D) centriole

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.2

16) Which of the following are found in plant, animal, and bacterial cells?

- A) mitochondria
- B) ribosomes
- C) chloroplasts
- D) endoplasmic reticulum

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.2

17) In bacteria, DNA will be found in _____.

- A) a membrane-enclosed nucleus
- B) mitochondria
- C) the nucleoid
- D) ribosomes

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.2

- 18) What is the function of the nuclear pore complex found in eukaryotes?
- A) It regulates the movement of proteins and RNAs into and out of the nucleus.
 - B) It synthesizes the proteins required to copy DNA and make mRNA.
 - C) It synthesizes secreted proteins.
 - D) It assembles ribosomes from raw materials that are synthesized in the nucleus.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.3

- 19) Which of the following macromolecules leave the nucleus of a eukaryotic cell through pores in the nuclear membrane?

- A) DNA
- B) amino acids
- C) mRNA
- D) phospholipids

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.3

- 20) Which of the following macromolecules enter the nucleus of a eukaryotic cell through pores in the nuclear membrane?

- A) ribosomal proteins
- B) mRNA
- C) rRNA
- D) phospholipids

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 6.3

- 21) Which of the following statements correctly describes some aspect of protein secretion from prokaryotic cells?

- A) Prokaryotes cannot secrete proteins because they lack an endomembrane system.
- B) Proteins secreted by prokaryotes are likely synthesized on ribosomes bound to the cytoplasmic surface of the plasma membrane.
- C) The mechanism of protein secretion in prokaryotes is probably the same as that in eukaryotes.
- D) Prokaryotes cannot secrete proteins because they lack rough endoplasmic reticulum.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 6.4

22) Examination of a cell by transmission electron microscopy reveals a high density of ribosomes in the cytoplasm. This observation suggests that this cell is actively producing large amounts of which of the following molecules?

- A) polysaccharides
- B) proteins
- C) lipids
- D) nucleic acids

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 6.3

23) The nuclear lamina is an array of intermediate filaments that line the inner side of the nuclear membrane. If a chemical treatment caused the lamina to disassemble, what would you expect to be the most likely immediate consequence?

- A) closing of nuclear pores
- B) the inability of the nucleus to divide during cell division
- C) a loss of genetic information from chromosomes
- D) a change in the shape of the nucleus

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 6.3

24) A cell with a predominance of rough endoplasmic reticulum is most likely _____.

- A) producing large quantities of proteins for secretion
- B) producing large quantities of proteins in the cytosol
- C) producing large quantities of carbohydrates to assemble an extensive cell wall matrix
- D) producing large quantities of carbohydrates for storage in the vacuole

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 6.4

25) Which organelle often takes up much of the volume of a plant cell?

- A) lysosome
- B) central vacuole
- C) Golgi apparatus
- D) chloroplast

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.4

26) A cell with a predominance of smooth endoplasmic reticulum is likely specialized to _____.

- A) store large quantities of water
- B) import and export large quantities of protein
- C) actively secrete large quantities of protein
- D) synthesize large quantities of lipids

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 6.4

27) Which structure below is independent of the endomembrane system?

- A) nuclear envelope
- B) chloroplast
- C) Golgi apparatus
- D) plasma membrane

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.5

28) Tay-Sachs disease is a human genetic abnormality that results in cells accumulating and becoming clogged with very large, complex, undigested lipids. Which cellular organelle is most likely defective in this condition?

- A) the lysosome
- B) the Golgi apparatus
- C) the smooth endoplasmic reticulum
- D) the rough endoplasmic reticulum

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 6.4

29) The liver is involved in detoxification of many poisons and drugs. Which of the following structures is primarily involved in this process and, therefore, abundant in liver cells?

- A) rough endoplasmic reticulum
- B) smooth endoplasmic reticulum
- C) Golgi apparatus
- D) nuclear envelope

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.4

30) Which of the following organelles produces and modifies polysaccharides that will be secreted?

- A) lysosome
- B) mitochondrion
- C) Golgi apparatus
- D) peroxisome

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.4

31) Which of the following is the most common pathway taken by a newly synthesized protein that will be secreted by a cell?

- A) rough ER → Golgi → transport vesicle → nucleus
- B) Golgi → rough ER → lysosome → transport vesicle → plasma membrane
- C) rough ER → Golgi → transport vesicle → plasma membrane
- D) rough ER → lysosome → transport vesicle → plasma membrane

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 6.4

32) Asbestos is a material that was once used extensively in construction. One risk from working in a building that contains asbestos is the development of asbestosis caused by the inhalation of asbestos fibers. Cells will take up asbestos by phagocytosis, but are not able to degrade it. As a result, asbestos fibers accumulate in _____.

- A) the Golgi apparatus
- B) nuclei
- C) peroxisomes
- D) lysosomes

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 6.4

33) Which organelle is the primary site of ATP synthesis in eukaryotic cells?

- A) lysosome
- B) mitochondrion
- C) Golgi apparatus
- D) peroxisome

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.5

34) Thylakoids, DNA, and ribosomes are all components found in _____.

- A) chloroplasts
- B) mitochondria
- C) lysosomes
- D) nuclei

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.5

35) If plant cells are grown on media containing radioactively labeled thymine for one generation, radioactively labeled macromolecules will be detected in which of the following?

- A) only in the nucleus
- B) only in the nucleus and mitochondria
- C) only in the nucleus and chloroplasts
- D) in the nucleus, mitochondria, and chloroplasts

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 6.5

36) In a liver cell detoxifying alcohol and some other poisons, the enzymes of the peroxisome remove hydrogen from these molecules and _____.

- A) combine the hydrogen with water molecules to generate hydrogen peroxide
- B) combine the hydrogen with oxygen molecules to generate hydrogen peroxide
- C) combine the hydrogen with hydrogen peroxide to generate oxygen
- D) combine the hydrogen with hydrogen peroxide to generate oxygen and water

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 6.5

37) The evolution of eukaryotic cells most likely involved _____.

- A) endosymbiosis of an oxygen-using bacterium in a larger bacterial host cell—the endosymbiont evolved into chloroplasts
- B) endosymbiosis of a photosynthetic archaeal cell in a larger bacterial host cell to escape toxic oxygen—the anaerobic archaea evolved into chloroplasts
- C) endosymbiosis of an oxygen-using bacterium in a larger bacterial host cell—the endosymbiont evolved into mitochondria
- D) evolution of an endomembrane system and subsequent evolution of mitochondria from a portion of the smooth endoplasmic reticulum

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.5

38) Where are proteins produced other than on ribosomes free in the cytosol or ribosomes attached to the endoplasmic reticulum?

- A) in lysosomes
- B) in the Golgi apparatus
- C) in the nucleolus
- D) in mitochondria

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 6.5

39) Suppose a cell has the following molecules and structures: enzymes, DNA, ribosomes, plasma membrane, and mitochondria. It could be a cell from _____.

- A) a bacterium, but not a eukaryote
- B) an animal, but not a plant
- C) nearly any eukaryotic organism
- D) a plant, but not an animal

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 6.5

40) Cyanide binds with at least one molecule involved in producing ATP. If a cell is exposed to cyanide, most of the bound cyanide is likely to be localized within the _____.

- A) mitochondria
- B) peroxisomes
- C) lysosomes
- D) smooth endoplasmic reticulum

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 6.5

41) Suppose a young boy is always tired and fatigued, suffering from a metabolic disease. Which of the following organelles is most likely malfunctioning in this disease?

- A) lysosomes
- B) Golgi apparatus
- C) mitochondria
- D) smooth endoplasmic reticulum

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 6.5

42) Motor proteins provide for molecular motion in cells by interacting with what types of cellular structures?

- A) membrane proteins of the inner nuclear envelope
- B) free ribosomes and ribosomes attached to the ER
- C) components of the cytoskeleton
- D) cellulose fibers in the cell wall

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.6

43) A characteristic 9 + 2 arrangement of microtubules, consisting of nine doublets of microtubules surrounding a pair of single microtubules is associated with _____.

- A) bacterial flagella
- B) eukaryotic flagella and motile cilia
- C) eukaryotic flagella, motile cilia, and nonmotile cilia
- D) centrioles and basal bodies

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.6

44) Vinblastine, a drug that inhibits microtubule polymerization, is used to treat some forms of cancer. Cancer cells given vinblastine would be unable to _____.

- A) form cleavage furrows during cell division
- B) migrate by amoeboid movement
- C) separate chromosomes during cell division
- D) maintain the shape of the nucleus

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 6.6

45) Amoebae move by crawling over a surface (cell crawling), which involves _____.

- A) growth of actin filaments to form bulges in the plasma membrane
- B) assembly of microtubule extensions that vesicles can follow in the direction of movement
- C) reinforcement of the pseudopod with intermediate filaments
- D) localized contractions driven by myosin and microtubules

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.6

46) Researchers investigating the mechanism of vesicular transport assembled a cell-free system that included microtubule tracks, vesicles, and ATP. However, they observed no movement of transport of vesicles in this system. What were they missing?

- A) an axon
- B) contractile microfilaments
- C) intermediate filaments
- D) motor proteins

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 6.6

47) Cilia and flagella bend because of _____.

- A) conformational changes in ATP that thrust microtubules laterally
- B) a motor protein called radial spokes
- C) contraction by myosin
- D) a motor protein called dynein

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.6

48) Spherocytosis is a human blood disorder associated with a defective cytoskeletal protein in the red blood cells (RBCs). What do you suspect is the consequence of such a defect?

- A) abnormally shaped RBCs
- B) an insufficient supply of ATP in the RBCs
- C) an insufficient supply of oxygen-transporting proteins in the RBCs
- D) adherence of RBCs to blood vessel walls, causing plaque formation

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 6.6

49) Cytochalasin D is a drug that prevents actin polymerization. A cell treated with cytochalasin D will still be able to carry out which of the following processes?

- A) divide in two
- B) contract muscle fibers
- C) extend pseudopodia
- D) move vesicles within a cell

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 6.6

50) Cells require which of the following to form cilia or flagella?

- A) tubulin
- B) laminin
- C) actin
- D) intermediate filaments

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.6

51) Which of the following statements about the cytoskeleton is true?

- A) The cytoskeleton of eukaryotes is a static structure most resembling scaffolding used at construction sites.
- B) Although microtubules are common within a cell, actin filaments are rarely found outside of the nucleus.
- C) Movement of cilia and flagella is the result of motor proteins causing microtubules to move relative to each other.
- D) Chemicals that block the assembly of the cytoskeleton would have little effect on a cell's response to external stimuli.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 6.6

52) The cell walls of bacteria, fungi, and plant cells, and the extracellular matrix of animal cells are all external to the plasma membrane. Which of the following characteristics are common to all of these extracellular structures?

- A) They must block water and small molecules to regulate the exchange of matter and energy with their environment.
- B) They must provide a rigid structure that maintains an appropriate ratio of cell surface area to volume.
- C) They are constructed of materials that are synthesized in the cytoplasm and then transported out of the cell for assembly.
- D) They are composed of a mixture of lipids and nucleotides.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 6.7

53) A mutation that disrupts the ability of an animal cell to add polysaccharide modifications to proteins would most likely cause defects in which of the following organelles or structures?

- A) nuclear matrix and extracellular matrix
- B) mitochondria and Golgi apparatus
- C) Golgi apparatus and extracellular matrix
- D) nuclear pores and secretory vesicles

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 6.7

54) What is a primary function of integrins?

- A) connecting intermediate filaments to microtubules involved in vesicular transport
- B) linking the primary and secondary cell walls in plants
- C) transmitting signals from the extracellular matrix to the cytoskeleton
- D) transmitting chemical signals from the Golgi apparatus to the plasma membrane

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.7

55) Which of the following structures form cytoplasmic channels that connect adjacent plant cells through the cell walls?

- A) desmosomes
- B) gap junctions
- C) plasmodesmata
- D) tight junctions

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.7

56) Ions can travel directly from the cytoplasm of one animal cell to the cytoplasm of an adjacent cell through _____.

- A) plasmodesmata
- B) tight junctions
- C) desmosomes
- D) gap junctions

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.7

57) In plant cells, the middle lamella _____.

- A) glues adjacent cells together
- B) prevents dehydration of adjacent cells
- C) connects the cytoplasm of adjacent cells
- D) prevents excessive uptake of water by plant cells

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 6.7

58) A defect in which of the following intercellular junctions would allow partially digested material to leak passively between the cells of the small intestine into the abdominal cavity?

- A) desmosomes
- B) gap junctions
- C) plasmodesmata
- D) tight junctions

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 6.7

59) H. V. Wilson worked with sponges to gain some insight into exactly what was responsible for holding adjacent cells together. He exposed two species of differently pigmented sponges to a chemical that disrupted intercellular junctions, and the cells of the sponges dissociated. Wilson then mixed the cells of the two species and removed the chemical that caused the cells to dissociate. Wilson found that the sponges reassembled into two separate species. The cells from one species did not interact or form associations with the cells of the other species.

How do you explain the results of Wilson's experiments?

- A) The two species of sponge had different enzymes that functioned in the reassembly process.
- B) The molecules responsible for cell-cell adhesion (cell junctions) were irreversibly destroyed during the experiment.
- C) The molecules responsible for cell-cell adhesion (cell junctions) differed between the two species of sponge.
- D) One cell functioned as an organizer for each organism, thereby attracting only cells of the same species.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 6.7

60) Gaucher disease is the most common of lipid storage diseases in humans. It is caused by a deficiency of an enzyme necessary for the breakdown of lipids. This leads to the accumulation of fatty material in organs of the body including the spleen, liver, kidneys, lungs, brain, and bone marrow.

Using your knowledge of the structure of eukaryotic cells, identify the statement below that best explains how internal membranes and the organelles of cells may be involved in Gaucher disease.

- A) The mitochondria are most likely defective and do not produce adequate amounts of ATP needed for cellular energy.
- B) The rough endoplasmic reticulum contains too many ribosomes, which results in an overproduction of the enzyme involved in lipid breakdown.
- C) The lysosomes lack sufficient amounts of enzymes necessary for the metabolism of lipids.
- D) The Golgi apparatus produces vesicles with faulty membranes, which fail to be transported to the plasma membrane for secretion.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 6.4

61) Both the volume and the surface area for three different cells were measured. These values are listed in the following table:

	Volume	Surface Area
Cell 1	$9.3 \mu\text{m}^3$	$26.5 \mu\text{m}^2$
Cell 2	$12.2 \mu\text{m}^3$	$37.1 \mu\text{m}^2$
Cell 3	$17.6 \mu\text{m}^3$	$40.6 \mu\text{m}^2$

Using data from the table above, select the best explanation for why that cell will be able to eliminate waste most efficiently?

- A) Cell 1, since it has the smallest volume and will not produce as much waste as the other cells.
- B) Cell 2, since it has the highest ratio of surface area to volume, which facilitates the exchange of materials between a cell and its environment.
- C) Cell 3, since it has the largest surface area, which will enable it to eliminate all of its wastes efficiently.
- D) Cell 3, because it is big enough to allow wastes to easily diffuse through the plasma membrane.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 6.2

6.2 Student Edition End-of-Chapter Questions

1) Which structure is *not* part of the endomembrane system?

- A) nuclear envelope
- B) chloroplast
- C) Golgi apparatus
- D) plasma membrane

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

2) Which structure is common to plant *and* animal cells?

- A) chloroplast
- B) central vacuole
- C) mitochondrion
- D) centriole

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

3) Which of the following is present in a prokaryotic cell?

- A) mitochondrion
- B) ribosome
- C) nuclear envelope
- D) chloroplast

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

4) Cyanide binds to at least one molecule involved in producing ATP. If a cell is exposed to cyanide, most of the cyanide will be found within the

- A) mitochondria.
- B) ribosomes.
- C) peroxisomes.
- D) lysosomes.

Answer: A

Bloom's Taxonomy: Application/Analysis

5) Which cell would be best for studying lysosomes?

- A) muscle cell
- B) nerve cell
- C) bacterial cell
- D) phagocytic white blood cell

Answer: D

Bloom's Taxonomy: Application/Analysis

7.1 Multiple-Choice Questions

1) For a protein to be an integral membrane protein, it would have to be _____.

- A) hydrophilic
- B) hydrophobic
- C) amphipathic, with at least one hydrophobic region
- D) exposed on only one surface of the membrane

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 7.1

2) A phospholipid bilayer with equal amounts of saturated and unsaturated fatty acids displays a specific permeability to glucose. What effect will increasing the proportion of unsaturated fatty acids in the bilayer have on the membrane's permeability to glucose?

- A) Permeability to glucose will increase.
- B) Permeability to glucose will decrease.
- C) Permeability to glucose will stay the same.
- D) Permeability will decrease initially then increase as the bilayer fills with glucose.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 7.1

3) According to the fluid mosaic model of cell membranes, phospholipids _____.

- A) can move laterally along the plane of the membrane
- B) frequently flip-flop from one side of the membrane to the other
- C) occur in an uninterrupted bilayer, with membrane proteins restricted to the surface of the membrane
- D) have hydrophilic tails in the interior of the membrane

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.1

4) The membranes of winter wheat are able to remain fluid when it is extremely cold by _____.

- A) increasing the proportion of unsaturated phospholipids in the membrane
- B) decreasing the percentage of cholesterol molecules in the membrane
- C) decreasing the number of hydrophobic proteins in the membrane
- D) increasing the proportion of glycolipids in the membrane

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 7.1

5) According to the fluid mosaic model, a membrane _____.

- A) is composed of a fluid bilayer of phospholipids between two layers of hydrophilic proteins
- B) is composed of a single layer of fluid phospholipids between two layers of hydrophilic proteins
- C) is composed of a mosaic of fluid polysaccharides and amphipathic proteins
- D) is composed of a fluid bilayer of phospholipids with embedded amphipathic proteins

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.1

6) An animal cell lacking carbohydrates on the external surface of its plasma membrane would likely be impaired in which function?

- A) transporting ions against an electrochemical gradient
- B) cell-cell recognition
- C) attaching the plasma membrane to the cytoskeleton
- D) establishing a diffusion barrier to charged molecules

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.1

7) Which of the following types of molecules are hydrophilic and therefore excluded from the hydrophobic portion of the phospholipid bilayer?

- A) transmembrane proteins
- B) integral membrane proteins
- C) peripheral membrane proteins
- D) cholesterol

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.1

8) Which of the following types of molecules lack hydrophilic domains?

- A) transmembrane proteins
- B) integral membrane proteins
- C) peripheral membrane proteins
- D) cholesterol

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 7.1

9) Why are lipids and proteins free to move laterally in membranes?

- A) The interior of the membrane is filled with liquid water.
- B) Lipids and proteins repulse each other in the membrane.
- C) Hydrophilic portions of the lipids are in the interior of the membrane.
- D) There are only weak hydrophobic interactions in the interior of the membrane.

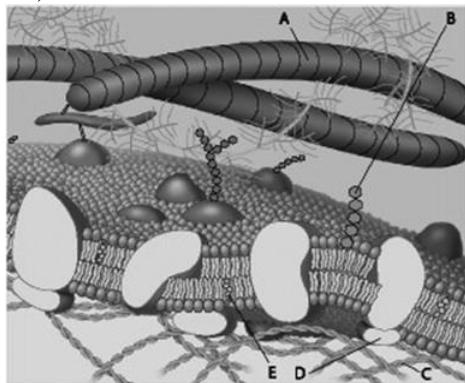
Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.1

For the following questions, match the labeled component of the cell membrane in the figure with its description.

10)



Which component in the accompanying figure is hydrophilic?

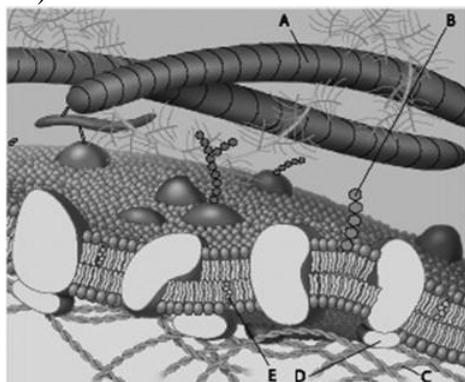
- A) A
- B) B
- C) C
- D) D

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 7.1

11)



Which component in the accompanying figure is cholesterol?

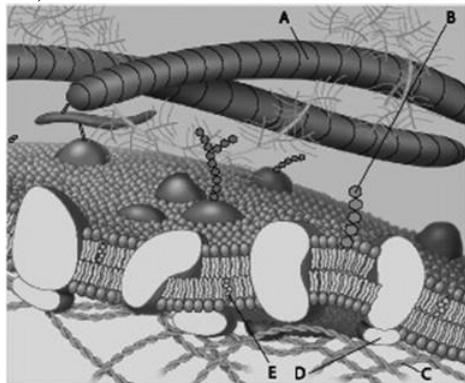
- A) B
- B) C
- C) D
- D) E

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.1

12)



Which component in the accompanying figure is a protein fiber of the extracellular matrix?

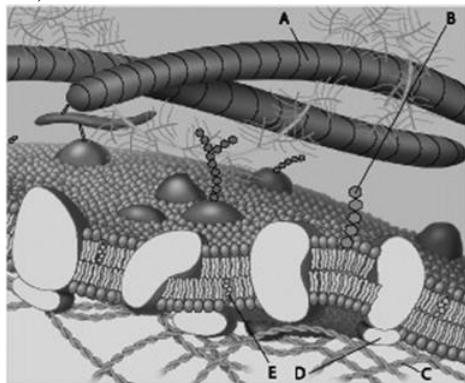
- A) A
- B) B
- C) C
- D) E

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.1

13)



Which component in the accompanying figure is a microfilament (actin filament) of the cytoskeleton?

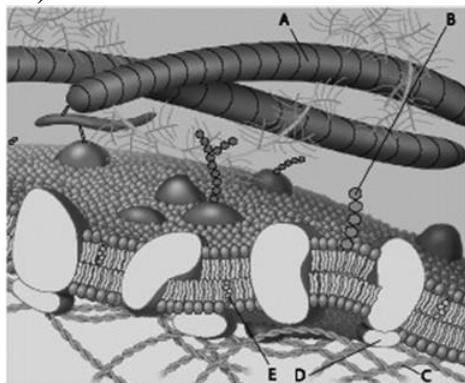
- A) A
- B) B
- C) C
- D) D

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.1

14)



Which component in the accompanying figure plays a critical role in cell-cell recognition?

- A) A
- B) B
- C) C
- D) E

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.1

15) Cell membranes have distinct inside and outside faces. Which of the following statements is the most likely explanation for the membrane's asymmetrical nature?

- A) Since the cell membrane forms a border between one cell and another in tightly packed tissues such as epithelium, the membrane must be asymmetrical.
- B) Since cell membranes communicate signals from one organism to another, the cell membranes must be asymmetrical.
- C) The two sides of a cell membrane face different environments and carry out different functions.
- D) Proteins only function on the cytoplasmic side of the cell membrane, which results in the membrane's asymmetrical nature.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 7.1

16) In what way do the membranes of a eukaryotic cell vary?

- A) Phospholipids are found only in certain membranes.
- B) Certain proteins are unique to each membrane.
- C) Only certain membranes of the cell are selectively permeable.
- D) Some membranes have hydrophobic surfaces exposed to the cytoplasm while others have hydrophilic surfaces facing the cytoplasm.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.1

- 17) Which of the following statements is a reasonable explanation for why unsaturated fatty acids help keep a membrane more fluid at lower temperatures?
- A) The double bonds form kinks in the fatty acid tails, preventing adjacent lipids from packing tightly.
 - B) Unsaturated fatty acids have a higher cholesterol content, which prevents adjacent lipids from packing tightly.
 - C) Unsaturated fatty acids are more nonpolar than saturated fatty acids.
 - D) The double bonds block interaction among the hydrophilic head groups of the lipids.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.1

- 18) What kinds of molecules pass through a cell membrane most easily?

- A) large and hydrophobic
- B) small and hydrophobic
- C) large polar
- D) small and ionic

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.2

- 19) Which of the following are *least* likely to diffuse through the phospholipid bilayer of a cell membrane?

- A) large hydrophobic molecules
- B) small hydrophobic molecules
- C) carbon dioxide
- D) small ions

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.2

- 20) Which of the following statements describes a characteristic feature of a carrier protein in a plasma membrane?

- A) It exhibits specificity for a particular type of molecule.
- B) It requires the expenditure of cellular energy to function.
- C) It works against diffusion.
- D) It has no hydrophobic regions.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.2

21) Which of the following would likely diffuse through the lipid bilayer of a plasma membrane most rapidly?

- A) sucrose
- B) an amino acid
- C) O₂
- D) Na⁺

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 7.2

22) Which of the following molecules dramatically increases the rate of diffusion of water across cell membranes?

- A) the sodium-potassium pump
- B) aquaporins
- C) gated ion channels
- D) ATP

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.2

23) A research team is working on the design of a new drug for the treatment of lung cancer. To be most effective, this drug must specifically enter the cytoplasm of lung cells while not entering the cells of other tissues. Which of the following characteristics would likely enhance the specificity of this drug?

- A) the relative hydrophobicity of the drug molecule
- B) phospholipid composition of lung cell plasma membranes
- C) specificity of the drug molecule for binding to the extracellular matrix of lung cells
- D) similarity of the drug molecule to other molecules normally transported lung cells

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 7.2

24) Which of the following statements about diffusion is true?

- A) It is very rapid over long distances.
- B) It requires an expenditure of energy by the cell.
- C) It is an active process in which molecules move from a region of lower concentration to a region of higher concentration.
- D) It is a passive process in which molecules move from a region of higher concentration to a region of lower concentration.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.3

25) Which of the following processes includes all of the others?

- A) osmosis
- B) facilitated diffusion
- C) passive transport
- D) transport of an ion down its electrochemical gradient

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 7.3

26) When a cell is in equilibrium with its environment, which of the following processes occurs for substances that can diffuse through the plasma membrane?

- A) There is directed movement of substances into and out of the cell.
- B) There is random movement of substances into and out of the cell.
- C) There is no movement of substances into or out of the cell.
- D) All movement of molecules across the plasma membrane occurs by active transport.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.3

27) Which of the following statements correctly describes *osmosis*?

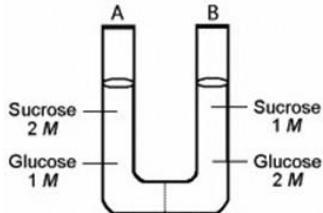
- A) Osmosis only takes place in red blood cells.
- B) Osmosis is an energy-demanding or "active" process.
- C) In osmosis, water moves across a membrane from areas of lower solute concentration to areas of higher solute concentration.
- D) In osmosis, solutes move across a membrane from areas of lower water concentration to areas of higher water concentration.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.3

28) The solutions in the two arms of this U-tube are separated by a membrane that is permeable to water and glucose but not to sucrose. Side A is half-filled with a solution of 2 M sucrose and 1 M glucose. Side B is half-filled with 1 M sucrose and 2 M glucose. Initially, the liquid levels on both sides are equal.



In the U-tube illustrated above, _____.

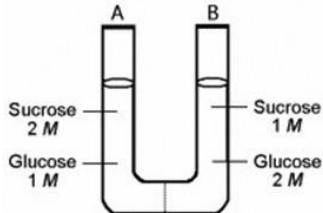
- A) side A is hypertonic to side B
- B) side A is hypotonic to side B
- C) side A is isotonic to side B
- D) side A is more turgid than side B

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 7.3

29) The solutions in the two arms of this U-tube are separated by a membrane that is permeable to water and glucose but not to sucrose. Side A is half-filled with a solution of 2 M sucrose and 1 M glucose. Side B is half-filled with 1 M sucrose and 2 M glucose. Initially, the liquid levels on both sides are equal.



Which of the following will be true when the system illustrated above reaches equilibrium?

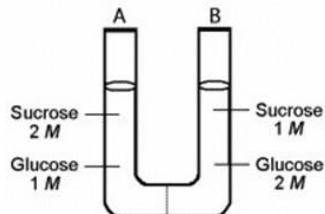
- A) The concentration of sucrose on side A will be greater than the concentration of sucrose on side B.
- B) The water level will be higher in side A than in side B.
- C) The water levels will be unchanged.
- D) The water level will be higher in side B than in side A.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.3

30) The solutions in the two arms of this U-tube are separated by a membrane that is permeable to water and glucose but not to sucrose. Side A is half-filled with a solution of 2 M sucrose and 1 M glucose. Side B is half-filled with 1 M sucrose and 2 M glucose. Initially, the liquid levels on both sides are equal.



When the system illustrated above reaches equilibrium, the sugar concentrations on both sides of the U-tube will be _____.

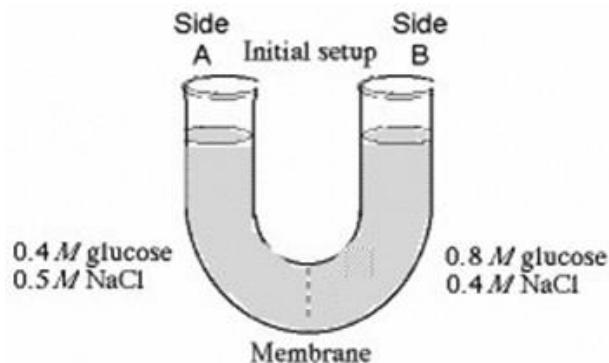
- A) 2 M sucrose, 1 M glucose
- B) 1 M sucrose, 2 M glucose
- C) 1 M sucrose, 1 M glucose
- D) 1.5 M sucrose, 1.5 M glucose

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 7.3

31) The solutions in the arms of a U-tube are separated at the bottom of the tube by a selectively permeable membrane. The membrane is permeable to sodium chloride but not to glucose. Side A is filled with a solution of 0.4 M glucose and 0.5 M sodium chloride (NaCl), and side B is filled with a solution containing 0.8 M glucose and 0.4 M sodium chloride. Initially, the volume in both arms is the same.



At the beginning of the U-tube experiment illustrated above, which of the following statements is true?

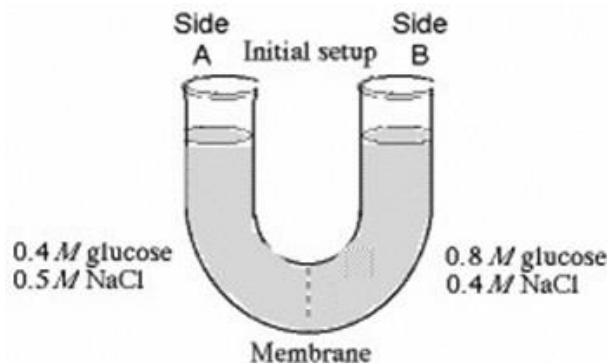
- A) Side A is hypertonic to side B.
- B) Side A is hypotonic to side B.
- C) Side A is hypertonic to side B with respect to glucose.
- D) Side A is hypotonic to side B with respect to NaCl.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.3

32) The solutions in the arms of a U-tube are separated at the bottom of the tube by a selectively permeable membrane. The membrane is permeable to sodium chloride but not to glucose. Side A is filled with a solution of 0.4 M glucose and 0.5 M sodium chloride (NaCl), and side B is filled with a solution containing 0.8 M glucose and 0.4 M sodium chloride. Initially, the volume in both arms is the same.



In the U-tube experiment illustrated above, which of the following statements correctly describes side B at equilibrium?

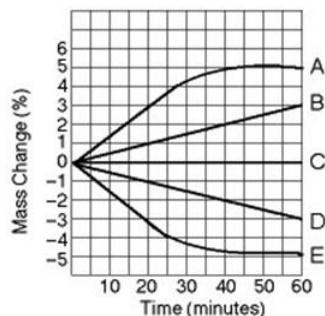
- A) The concentration of NaCl and glucose will decrease, and the water level will increase.
- B) The concentration of NaCl will increase, the concentration of glucose will decrease, and the water level will increase.
- C) The concentration of NaCl will increase, the concentration of glucose will decrease, and the water level will decrease.
- D) The concentration of NaCl and glucose will increase, and the water level will decrease.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.3

33) Five dialysis bags, constructed of a type of membrane that is permeable to water and impermeable to sucrose, were filled with various concentrations of sucrose and then placed in separate beakers containing an initial concentration of 0.6 M sucrose solution. At 10-minute intervals, the bags were massed (weighed), and the percent change in mass of each bag was graphed.



Which line in the graph represents the bag that contained a solution isotonic to the 0.6 M solution at the beginning of the experiment?

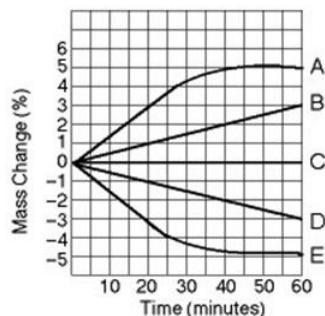
- A) A
- B) B
- C) C
- D) D

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 7.3

34) Five dialysis bags, constructed of a type of membrane that is permeable to water and impermeable to sucrose, were filled with various concentrations of sucrose and then placed in separate beakers containing an initial concentration of 0.6 M sucrose solution. At 10-minute intervals, the bags were massed (weighed), and the percent change in mass of each bag was graphed.



Which line in the graph represents the bag with the highest initial concentration of sucrose?

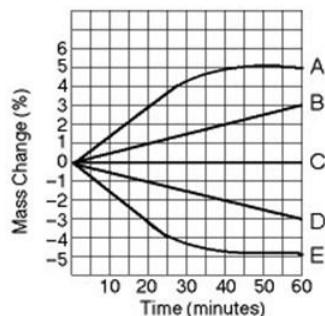
- A) A
- B) B
- C) C
- D) D

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 7.3

35) Five dialysis bags, constructed of a type of membrane that is permeable to water and impermeable to sucrose, were filled with various concentrations of sucrose and then placed in separate beakers containing an initial concentration of 0.6 M sucrose solution. At 10-minute intervals, the bags were massed (weighed), and the percent change in mass of each bag was graphed.



Which line or lines in the graph represent(s) bags that contain a solution that is hypertonic at 50 minutes?

- A) A and B
- B) B
- C) D
- D) D and E

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.3

36) Celery stalks that are immersed in fresh water for several hours become stiff. Similar stalks left in a 0.15 M salt solution become limp. From this we can deduce that the fresh water _____.

- A) and the salt solution are both hypertonic to the cells of the celery stalks
- B) is hypotonic and the salt solution is hypertonic to the cells of the celery stalks
- C) is hypertonic and the salt solution is hypotonic to the cells of the celery stalks
- D) is isotonic and the salt solution is hypertonic to the cells of the celery stalks

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.3

37) What will happen to a red blood cell (RBC), which has an internal ion content of about 0.9%, if it is placed into a beaker of pure water?

- A) The cell would shrink because the water in the beaker is hypotonic relative to the cytoplasm of the RBC.
- B) The cell would shrink because the water in the beaker is hypertonic relative to the cytoplasm of the RBC.
- C) The cell would swell because the water in the beaker is hypotonic relative to the cytoplasm of the RBC.
- D) The cell will remain the same size because the solution outside the cell is isotonic.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 7.3

38) Which of the following statements correctly describes the normal tonicity conditions for typical plant and animal cells? The animal cell is in _____.

- A) a hypotonic solution, and the plant cell is in an isotonic solution
- B) an isotonic solution, and the plant cell is in a hypertonic solution
- C) a hypertonic solution, and the plant cell is in an isotonic solution
- D) an isotonic solution, and the plant cell is in a hypotonic solution

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.3

39) In which of the following environments would there be the greatest need for osmoregulation?

- A) an animal connective tissue cell bathed in isotonic body fluid
- B) a salmon moving from a river into an ocean
- C) a red blood cell surrounded by plasma
- D) a plant being grown hydroponically in a watery mixture of designated nutrients

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.3

40) When a plant cell, such as one from a tulip leaf, is submerged in a hypertonic solution, what is likely to occur?

- A) The cell will burst.
- B) Plasmolysis will shrink the interior of the cell.
- C) The cell will become flaccid.
- D) The cell will become turgid.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.3

- 41) A sodium-potassium pump _____.
A) moves three potassium ions out of a cell and two sodium ions into a cell while producing ATP for each cycle
B) moves three sodium ions out of a cell and two potassium ions into a cell using energy from ATP hydrolysis
C) moves three potassium ions out of a cell and two sodium ions into a cell using energy from ATP hydrolysis
D) move three sodium ions out of a cell and two potassium ions into a cell and generates an ATP in each cycle

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.4

- 42) The sodium-potassium pump is called an electrogenic pump because it _____.
A) pumps equal quantities of Na^+ and K^+ across the membrane in opposite directions
B) is used to drive the transport of glucose against a concentration gradient
C) decreases the voltage difference across the membrane
D) generates voltage across the membrane

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.4

- 43) Which of the following membrane activities requires energy from ATP hydrolysis?
A) facilitated diffusion of chloride ions across the membrane through a chloride channel
B) movement of Na^+ ions from a lower concentration in a mammalian cell to a higher concentration in the extracellular fluid
C) movement of glucose molecules into a bacterial cell from a medium containing a higher concentration of glucose than inside the cell
D) movement of carbon dioxide out of a paramecium

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.4

- 44) The voltage across a membrane is called the _____.
A) chemical gradient
B) membrane potential
C) osmotic potential
D) electrochemical gradient

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.4

- 45) Diffusion of ions across membranes through specific ion channels is driven by _____.
A) active transport pumps
B) ion concentration gradients only
C) electrical gradients only
D) ion electrochemical gradients

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.4

- 46) Which of the following structures would decrease the electrochemical gradient across a membrane?
A) an aquaporin
B) a proton pump
C) a potassium channel
D) both a proton pump and a sodium channel

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 7.4

- 47) The phosphate transport system in bacteria imports phosphate into the cell even when the concentration of phosphate outside the cell is much lower than the cytoplasmic phosphate concentration. Phosphate import depends on a pH gradient across the membrane—more acidic outside the cell than inside the cell. In this bacterial cell, phosphate transport is an example of _____.
A) passive diffusion
B) facilitated diffusion
C) active transport
D) cotransport

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 7.4

- 48) In some cells, there are many ion electrochemical gradients across the plasma membrane even though there are usually only one or two proton pumps present in the membrane. The gradients of the other ions are most likely accounted for by _____.
A) cotransport proteins
B) ion channels
C) pores in the plasma membrane
D) passive diffusion across the plasma membrane

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 7.4

- 49) Which of the following statements is most likely true of a protein that cotransports glucose and sodium ions into the intestinal cells of an animal?
- A) Sodium and glucose compete for the same binding site in the cotransporter.
 - B) Glucose entering the cell down its concentration gradient provides energy for uptake of sodium ions against the electrochemical gradient.
 - C) Sodium ions can move down their electrochemical gradient through the cotransporter whether or not glucose is present outside the cell.
 - D) A substance that blocks sodium ions from binding to the cotransport protein will also block the transport of glucose.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 7.4

- 50) Proton pumps are used in various ways by members of every domain of organisms: Bacteria, Archaea, and Eukarya. What does this fact most probably mean?
- A) Proton gradients across a membrane were used by cells that were the common ancestor of all three domains of life.
 - B) The high concentration of protons in the ancient atmosphere must have necessitated a pump mechanism.
 - C) Cells of each domain evolved proton pumps independently when oceans became more acidic.
 - D) Proton pumps are necessary to all cell membranes.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 7.4

- 51) Several epidemic microbial diseases of earlier centuries incurred high death rates because they resulted in severe dehydration due to vomiting and diarrhea. Today they are usually not fatal because we have developed which of the following types of treatments?
- A) antiviral medications that are efficient and work well with most viruses
 - B) intravenous feeding techniques
 - C) medications to slow blood loss
 - D) hydrating drinks with high concentrations of salt and glucose

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.4

- 52) The force driving simple diffusion is _____, while the energy source for active transport is _____.
- A) a concentration gradient; ADP
 - B) a concentration gradient; ATP hydrolysis
 - C) transmembrane pumps; an electrochemical gradient
 - D) phosphorylated carrier proteins; ATP

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.4

53) An organism with a cell wall would most likely be unable to take in materials through _____.

- A) osmosis
- B) active transport
- C) phagocytosis
- D) facilitated diffusion

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 7.5

54) White blood cells engulf bacteria using _____.

- A) phagocytosis
- B) pinocytosis
- C) osmosis
- D) receptor-mediated exocytosis

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.5

55) Familial hypercholesterolemia is characterized by _____.

- A) defective LDL receptors on the cell membranes
- B) poor attachment of the cholesterol to the extracellular matrix of cells
- C) a poorly formed lipid bilayer that cannot incorporate cholesterol into cell membranes
- D) inhibition of the cholesterol active transport system in red blood cells

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.5

56) The difference between pinocytosis and receptor-mediated endocytosis is that _____.

- A) pinocytosis brings only water molecules into the cell, but receptor-mediated endocytosis brings in other molecules as well
- B) pinocytosis increases the surface area of the plasma membrane, whereas receptor-mediated endocytosis decreases the plasma membrane surface area
- C) pinocytosis is nonselective in the molecules it brings into the cell, whereas receptor-mediated endocytosis offers more selectivity
- D) pinocytosis can concentrate substances from the extracellular fluid, but receptor-mediated endocytosis cannot

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.5

57) In receptor-mediated endocytosis, receptor molecules initially project to the outside of the cell. Where do they end up after endocytosis?

- A) on the outside of vesicles
- B) on the inside surface of the cell membrane
- C) on the inside surface of the vesicle
- D) on the outer surface of the nucleus

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.5

58) A bacterium engulfed by a white blood cell through phagocytosis will be digested by enzymes contained in _____.

- A) lysosomes
- B) Golgi vesicles
- C) vacuoles
- D) secretory vesicles

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 7.5

59) A patient was involved in a serious accident and lost a large quantity of blood. In an attempt to replenish body fluids, distilled water—equal to the volume of blood lost—is added to the blood directly via one of his veins. What will be the most probable result of this transfusion?

- A) The patient's red blood cells will shrivel up because the blood has become hypotonic compared to the cells.
- B) The patient's red blood cells will swell and possibly burst because the blood has become hypotonic compared to the cells.
- C) The patient's red blood cells will shrivel up because the blood has become hypertonic compared to the cells.
- D) The patient's red blood cells will burst because the blood has become hypertonic compared to the cells.

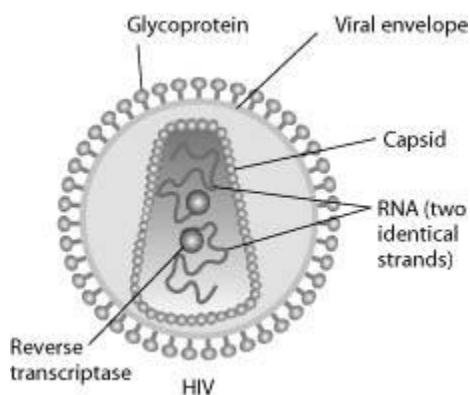
Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.3

Use the paragraph and accompanying figure to answer the following questions.

Human immunodeficiency virus (HIV) infects cells that have both CD4 and CCR5 cell surface molecules. The viral nucleic acid molecules are enclosed in a protein capsid, and the protein capsid is itself contained inside an envelope consisting of a lipid bilayer membrane and viral glycoproteins. One hypothesis for viral entry into cells is that binding of HIV membrane glycoproteins to CD4 and CCR5 initiates fusion of the HIV membrane with the plasma membrane, releasing the viral capsid into the cytoplasm. An alternative hypothesis is that HIV gains entry into the cell via receptor-mediated endocytosis, and membrane fusion occurs in the endocytotic vesicle. To test these alternative hypotheses for HIV entry, researchers labeled the lipids on the HIV membrane with a red fluorescent dye.



60) In an HIV-infected cell producing HIV virus particles, the viral glycoprotein is expressed on the plasma membrane. How do the viral glycoproteins get to the plasma membrane? They are synthesized _____.

- A) on ribosomes on the plasma membrane
- B) by ribosomes in the rough ER and arrive at the plasma membrane in the membrane of secretory vesicles
- C) on free cytoplasmic ribosomes and then inserted into the plasma membrane
- D) by ribosomes in the rough ER, secreted from the cell, and inserted into the plasma membrane from the outside

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.5

61) What would be observed by live-cell fluorescence microscopy immediately after HIV entry if HIV is endocytosed first, and then later fuses with the endocytotic vesicle membrane?

- A) A spot of red fluorescence will be visible on the infected cell's plasma membrane, marking the site of membrane fusion and HIV entry.
- B) The red fluorescent dye-labeled lipids will appear in the infected cell's interior.
- C) A spot of red fluorescence will diffuse in the infected cell's cytoplasm.
- D) A spot of red fluorescence will remain outside the cell after delivering the viral capsid.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.5

62) Three lab groups carried out an experiment to identify the concentration of sucrose in six solutions. Each unknown contained one of the following sucrose concentrations: 0.0 M , 0.2 M , 0.4 M , 0.6 M , 0.8 M , and -1.0 M . Cubes of sweet potato (1 cm^3) were soaked for 24 hours in each solution and weighed to determine the change in mass. Each data entry represents the average of three sample replicates expressed as percent change in mass following a 24-hour soak in the unknown solutions. From the data given, which statement most accurately describes what is occurring in response to a particular unknown solution?

Unknown	Percent change in mass	Percent change in mass	Percent change in mass
	Group 1	Group 2	Group 3
A	6.6	7.8	7.5
B	3.1	3.7	2.9
C	-2.7	-3.5	-2.5
D	0.7	0.5	1.1
E	-11.6	-12.3	-12.6
F	-5.2	-6.2	-4.9

- A) Unknown solution E contains the highest concentration of sucrose, and the change in mass is due to the active transport of sucrose out of the cell.
- B) Osmosis of water molecules from unknown solution B likely caused the increase in mass observed.
- C) Passive transport of sucrose out of the potato cells explains the change in mass observed for unknown solution F.
- D) Unknown solution C represents a sucrose concentration slightly higher than the molarity of sweet potato cells, thus water is transported out of the cells.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.3

63) Three lab groups carried out an experiment to identify the concentration of sucrose in six solutions. Each unknown contained one of the following sucrose concentrations: 0.0 M, 0.2 M, 0.4 M, 0.6 M, 0.8 M, and 1.0 M. Cubes of sweet potato (1 cm^3) were soaked for 24 hours in each solution and weighed to determine the change in mass. Each data entry represents the average of three sample replicates expressed as percent change in mass following a 24-hour soak in the unknown solutions.

Unknown	Percent change in mass	Percent change in mass	Percent change in mass
	Group 1	Group 2	Group 3
A	6.6	7.8	7.5
B	3.1	3.7	2.9
C	-2.7	-3.5	-2.5
D	0.7	0.5	1.1
E	-11.6	-12.3	-12.6
F	-5.2	-6.2	-4.9

Based on the data provided, the intracellular molarity of dissolved solutes in sweet potato cells is approximately _____.

- A) 0.2 M
- B) 0.4 M
- C) 0.6 M
- D) 0.8 M

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 7.3

7.2 Student Edition End-of-Chapter Questions

1) In what way do the membranes of a eukaryotic cell vary?

- A) Phospholipids are found only in certain membranes.
- B) Certain proteins are unique to each membrane.
- C) Only certain membranes of the cell are selectively permeable.
- D) Only certain membranes are constructed from amphipathic molecules.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

2) According to the fluid mosaic model of membrane structure, proteins of the membrane are mostly

- A) spread in a continuous layer over the inner and outer surfaces of the membrane.
- B) confined to the hydrophobic interior of the membrane.
- C) embedded in a lipid bilayer.
- D) randomly oriented in the membrane, with no fixed inside-outside polarity.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

3) Which of the following factors would tend to increase membrane fluidity?

- A) a greater proportion of unsaturated phospholipids
- B) a greater proportion of saturated phospholipids
- C) a lower temperature
- D) a relatively high protein content in the membrane

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

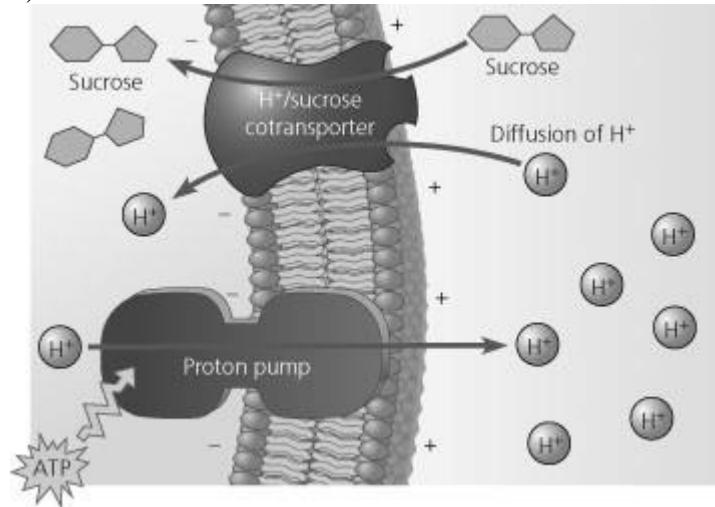
4) Which of the following processes includes all the others?

- A) osmosis
- B) diffusion of a solute across a membrane
- C) passive transport
- D) transport of an ion down its electrochemical gradient

Answer: C

Bloom's Taxonomy: Application/Analysis

5)



Based on Figure 7.18, which of these experimental treatments would increase the rate of sucrose transport into a plant cell?

- A) decreasing extracellular sucrose concentration
- B) decreasing extracellular pH
- C) decreasing cytoplasmic pH
- D) adding a substance that makes the membrane more permeable to hydrogen ions

Answer: B

Bloom's Taxonomy: Application/Analysis

8.1 Multiple-Choice Questions

1) Which of the following statements is true of metabolism in its entirety in all organisms?

- A) Metabolism depends on a constant supply of energy from food.
- B) Metabolism uses all of an organism's resources.
- C) Metabolism consists of all the energy transformation reactions in an organism.
- D) Metabolism manages the increase of entropy in an organism.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.1

2) Which of the following is an example of potential rather than kinetic energy?

- A) water rushing over Niagara Falls
- B) light flashes emitted by a firefly
- C) a molecule of glucose
- D) a crawling beetle foraging for food

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.1

3) Most cells cannot harness heat to perform work because _____.

- A) heat is not a form of energy
- B) temperature is usually uniform throughout a cell
- C) heat can never be used to do work
- D) heat must remain constant during work

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.1

4) A decrease in entropy is associated with which type of reaction?

- A) dehydration
- B) catabolic
- C) depolymerization
- D) hydrolysis

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 8.1

5) Which of the following terms most precisely describes the cellular process of breaking down large molecules into smaller ones?

- A) catabolism (catabolic pathways)
- B) metabolism
- C) anabolism (anabolic pathways)
- D) dehydration

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.1

6) Which of the following statements about anabolic pathways is true?

- A) They are usually spontaneous chemical reactions.
- B) They consume energy to build up polymers from monomers.
- C) They release energy by degrading polymers to monomers.
- D) They decrease the entropy of the organism and its environment.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 8.1

7) Which of the following statements describes the first law of thermodynamics?

- A) Energy cannot be created or destroyed.
- B) The entropy of the universe is decreasing.
- C) The entropy of the universe is constant.
- D) Energy cannot be transferred or transformed.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.1

8) Which of the following statements is an important consequence of the first law of thermodynamics for a living organism?

- A) The energy content of an organism is constant.
- B) An organism ultimately must obtain all of the necessary energy for life from its environment.
- C) The entropy of an organism decreases with time as the organism grows in complexity.
- D) Organisms grow by converting energy into organic matter.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 8.1

9) Living organisms increase in complexity as they grow, resulting in a decrease in the entropy of an organism. How does this relate to the second law of thermodynamics?

- A) Living organisms do not obey the second law of thermodynamics, which states that the entropy of an organism increases with each energy transformation.
- B) The decrease in entropy is associated with growth of an organism. As a consequence of growth, organisms cause a greater increase in entropy in their environment than the decrease in entropy associated with their increased complexity.
- C) As a consequence of growth, the decrease in entropy of the organism is associated with a corresponding decrease in the entropy of the universe.
- D) Living organisms are able to transform chemical energy into entropy.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 8.1

10) Which of the following statements is a logical consequence of the second law of thermodynamics?

- A) If the entropy of a system increases, there must be a corresponding decrease in the entropy of the universe.
- B) If the entropy of a system decreases, there must be a corresponding decrease in the entropy of the universe.
- C) If there is an increase in the energy of a system, there must be a corresponding decrease in the energy of the rest of the universe.
- D) Each chemical reaction in an organism must increase the total entropy of the universe.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 8.1

11) Which of the following statements is consistent with the second law of thermodynamics?

- A) A gain of free energy in a system is always associated with conversion of energy from one form to another.
- B) A constant input of energy is required to maintain the high level of cellular organization.
- C) Without an input of energy, the entropy of an organism would tend to decrease over time.
- D) Every energy transformation performed by an organism decreases the entropy of the universe.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 8.1

12) Which of the following types of reactions would decrease the entropy within a cell?

- A) anabolic reactions
- B) hydrolysis
- C) digestion
- D) catabolic reactions

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 8.1

- 13) Which of the following statements about the evolution of life on Earth, from simple prokaryote-like cells to multicellular eukaryotic organisms, is true?
- A) By resulting in such diversity and complexity of life, it is an exception to the second law of thermodynamics.
 - B) It has occurred in accordance with the laws of thermodynamics and resulted in a substantial increase in the entropy of the planet.
 - C) It has occurred in accordance with the laws of thermodynamics and resulted in a substantial increase in the total energy in the universe.
 - D) It has occurred in accordance with the laws of thermodynamics and resulted in a substantial decrease in the entropy of the planet.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 8.1

- 14) The mathematical expression for the change in free energy of a system is $\Delta G = \Delta H - T\Delta S$. Which of the following statements is correct?
- A) ΔS is the change in enthalpy, a measure of randomness.
 - B) ΔH is the change in entropy, the energy available to do work.
 - C) ΔG is the change in free energy.
 - D) T is the temperature in degrees Celsius.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.2

- 15) Which of the following statements is true for a system at chemical equilibrium?
- A) The system consumes energy at a steady rate.
 - B) The system releases energy at a steady rate.
 - C) The kinetic energy of the system is zero.
 - D) The system can do no work.
- Answer: D
- Bloom's Taxonomy: Knowledge/Comprehension
- Section: 8.2
- 16) Which of the following statements is true for all exergonic reactions?
- A) The products have more total energy than the reactants.
 - B) The reaction proceeds with a net release of free energy.
 - C) The reaction goes only in a forward direction: all reactants will be converted to products, but no products will be converted to reactants.
 - D) A net input of energy from the surroundings is required for the reactions to proceed.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.2

17) A chemical reaction that has a positive ΔG is best described as _____.

- A) endergonic
- B) enthalpic
- C) spontaneous
- D) exergonic

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.2

18) Chemical equilibrium is relatively rare in living cells because metabolic pathways are interconnected. Which of the following statements describes an example of a reaction that may be at chemical equilibrium in a cell?

- A) an exergonic reaction in which the free energy at equilibrium is higher than the energy content of the reaction at any point away from equilibrium
- B) an exergonic reaction in which the entropy change in the cell is precisely balanced by an opposite entropy change in the cell's surroundings
- C) a chemical reaction in which neither the reactants nor the products are being produced or consumed in any metabolic pathway at that time in the cell
- D) an endergonic reaction in an active metabolic pathway where the energy for that reaction is supplied only by heat from the environment

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 8.2

19) The relationship between catabolism and anabolism is most similar to the relationship between which of the following pairs of terms?

- A) exergonic; spontaneous
- B) exergonic; endergonic
- C) free energy; entropy
- D) work; free energy

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.2

20) Why do hydrolysis reactions occur more readily in solution than dehydration reactions?

- A) Hydrolysis reactions increase G, or Gibbs free energy of the system.
- B) Hydrolysis reactions are endergonic and increase entropy of the system.
- C) Hydrolysis reactions are exergonic and decrease entropy of the system.
- D) Hydrolysis reactions are exergonic and increase entropy of the system.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 8.2

- 21) Which of the following statements describes a central role that ATP plays in cellular metabolism?
- A) Hydrolysis of ATP provides an input of free energy for exergonic reactions.
 - B) ATP provides energy coupling between exergonic and endergonic reactions.
 - C) Hydrolysis of the terminal phosphate group stores free energy that is used for cellular work.
 - D) Its terminal phosphate bond is stronger than most covalent bonds in other biological macromolecules.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.3

- 22) Why is the ΔG of ATP hydrolysis in the cell about twice as great as the ΔG of ATP hydrolysis in a test tube under standard conditions?
- A) A cell is an open system, whereas a test tube is a closed system.
 - B) ATP hydrolysis in a test tube releases more heat than ATP hydrolysis associated with cellular metabolism.
 - C) Reactant and product concentrations in the test tube are different from those in the cell.
 - D) ATP hydrolysis in cells is catalyzed by enzymes, whereas the reaction in a test tube occurs spontaneously.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.3

- 23) Which of the following molecules is most similar in structure to ATP?
- A) a pentose sugar
 - B) a DNA nucleotide
 - C) an RNA nucleotide
 - D) an amino acid with three phosphate groups attached
- Answer: C
- Bloom's Taxonomy: Knowledge/Comprehension
- Section: 8.3
- 24) Which of the following statements describes a common characteristic of catabolic pathways?
- A) They combine small molecules into larger, more energy-rich molecules.
 - B) They require energy from ATP hydrolysis to break down polymers into monomers.
 - C) They are endergonic and release energy that can be used for cellular work.
 - D) They are exergonic and provide energy that can be used to produce ATP from ADP and P_i .

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.3

25) When chemical, transport, or mechanical work is done by an organism, what happens to the heat generated?

- A) It is used to power yet more cellular work.
- B) It is captured to store energy as more ATP.
- C) It is used to generate ADP from nucleotide precursors.
- D) It is lost to the environment.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.3

26) When ATP releases some energy, it also releases inorganic phosphate. What happens to the inorganic phosphate in the cell?

- A) It is secreted as waste.
- B) It is used only to regenerate more ATP.
- C) It may be used to form a phosphorylated intermediate.
- D) It enters the nucleus to be incorporated in a nucleotide.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.3

27) A number of systems for pumping ions across membranes are powered by ATP. Such ATP-powered pumps are often called ATPases, although they do not often hydrolyze ATP unless they are simultaneously transporting ions. Because small increases in calcium ions in the cytosol can trigger a number of different intracellular reactions, cells keep the cytosolic calcium concentration quite low under normal conditions, using ATP-powered calcium pumps. For example, muscle cells transport calcium from the cytosol into the membranous system called the sarcoplasmic reticulum (SR). If a resting muscle cell's cytosol has a free calcium ion concentration of 10^{-7} while the concentration in the SR is 10^{-2} , then how is the ATPase acting?

A) ATPase activity must be powering an inflow of calcium from the outside of the cell into the SR.

B) ATPase activity must be transferring \textcircled{P}_i to the SR to enable this to occur.

C) ATPase activity must be pumping calcium from the cytosol to the SR against the concentration gradient.

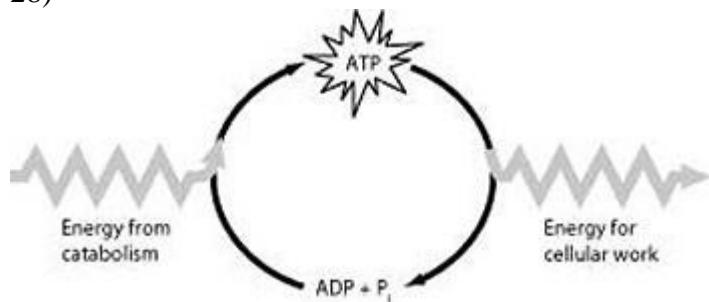
D) ATPase activity must be opening a channel for the calcium ions to diffuse back into the SR along the concentration gradient.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 8.3

28)



Which of the following is the most correct interpretation of the figure?

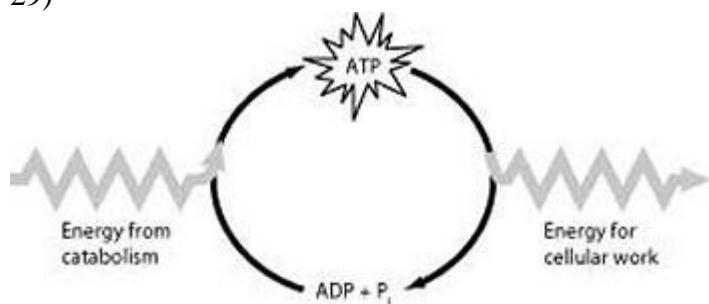
- A) Energy from catabolism can be used directly for performing cellular work.
- B) ADP + \textcircled{P}_i are a set of molecules that store energy for catabolism.
- C) ATP is a molecule that acts as an intermediary to store energy for cellular work.
- D) \textcircled{P}_i acts as a shuttle molecule to move energy from ATP to ADP.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.3

29)



How do cells use the ATP cycle illustrated in the figure?

- A) Cells use the cycle to recycle ADP and phosphate.
- B) Cells use the cycle to recycle energy released by ATP hydrolysis.
- C) Cells use the cycle to recycle ADP, phosphate, and the energy released by ATP hydrolysis.
- D) Cells use the cycle primarily to generate heat.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 8.3

30) Which of the following statements about enzyme function is true?

- A) Enzyme function is generally increased if the three-dimensional structure or conformation of an enzyme is altered.
- B) Enzyme function is independent of physical and chemical environmental factors such as pH and temperature.
- C) Enzymes increase the rate of chemical reactions by lowering activation energy barriers.
- D) Enzymes increase the rate of chemical reactions by providing activation energy to the substrate.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.4

31) Which of the following is true when comparing an uncatalyzed reaction to the same reaction with a catalyst?

- A) The catalyzed reaction will be slower.
- B) The catalyzed reaction will have the same ΔG .
- C) The catalyzed reaction will have higher activation energy.
- D) The catalyzed reaction will consume all of the catalyst.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.4

32) Which of the following aspects of enzyme structure is best described by a clasping handshake analogy?

- A) the specific manner in which an enzyme folds to form secondary and tertiary structures
- B) the specific manner in which an enzyme interacts with water
- C) the specific manner in which an enzyme binds substrate
- D) the specific manner in which an enzyme is denatured by low pH

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.4

33) Which of the following characteristics is most likely to be associated with an enzyme that catalyzes two different chemical reactions?

- A) The enzyme contains α -helices and β -pleated sheets.
- B) The enzyme is subject to competitive inhibition and allosteric regulation.
- C) The enzyme is composed of at least two subunits.
- D) Either the enzyme has two distinct active sites or the substrates involved in the two reactions have very similar structures.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 8.4

34) What is the name of the thermodynamic barrier that must be overcome before products are formed in a spontaneous reaction?

- A) entropy
- B) activation energy
- C) the equilibrium point
- D) free energy

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.4

35) During a laboratory experiment, you discover that an enzyme-catalyzed reaction has a ΔG of -20 kcal/mol. If you double the amount of enzyme in the reaction, what will be the ΔG for the new reaction?

- A) -40 kcal/mol
- B) -20 kcal/mol
- C) -10 kcal/mol
- D) +20 kcal/mol

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 8.4

36) Which of the following is a primary function of the active site of an enzyme?

- A) It binds allosteric regulators of the enzyme.
- B) It binds noncompetitive inhibitors of the enzyme.
- C) It catalyzes the reaction associated with the enzyme.
- D) It is activated by the presence of the end product of the metabolic pathway in which the enzyme is involved.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.4

37) Which of the following statements describes a key component of the induced fit hypothesis of enzyme catalysis?

- A) Substrate binds to an allosteric site rather than to the active site of an enzyme.
- B) Binding of an activator molecule changes the shape of the active site of an enzyme.
- C) The conformation of the active site is determined by the tertiary or quaternary structure of the enzyme.
- D) Binding of substrate to the active site changes the shape of the active site of an enzyme.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.4

38) Which of the following conditions may be overcome by increasing the substrate concentration in an enzymatic reaction with a fixed amount of enzyme?

- A) the need for a coenzyme
- B) allosteric inhibition
- C) noncompetitive inhibition
- D) competitive inhibition

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.4

39) Zinc, an essential trace element for most organisms, is present in the active site of the enzyme carboxypeptidase. The zinc most likely functions as _____.

- A) a noncompetitive inhibitor of the enzyme
- B) an allosteric activator of the enzyme
- C) a cofactor necessary for enzyme activity
- D) a coenzyme derived from a vitamin

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 8.4

40) How does a noncompetitive inhibitor decrease the rate of an enzyme-catalyzed reaction?

- A) by binding to the active site of the enzyme, thus preventing binding of the normal substrate
- B) by binding to an allosteric site, thus changing the shape of the active site of the enzyme
- C) by decreasing the free-energy change of the reaction catalyzed by the enzyme
- D) by binding to the substrate, thus changing its shape so that it no longer binds to the active site of the enzyme

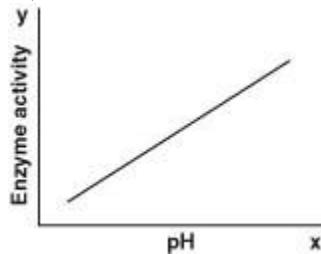
Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

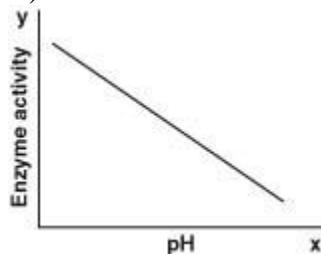
Section: 8.4

41) Which of the following graphs most likely describes the effect of pH on the function of the enzyme catalase in human cells? Note: The x -axis is pH and the y -axis is enzyme activity.

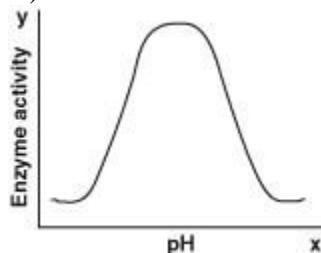
A)



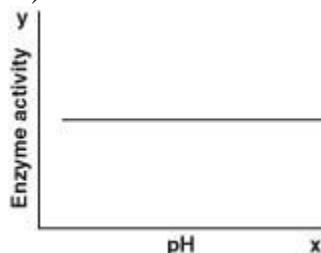
B)



C)



D)



Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.4

42) How might a change of one amino acid at a site, distant from the active site of an enzyme, alter the substrate specificity of an enzyme?

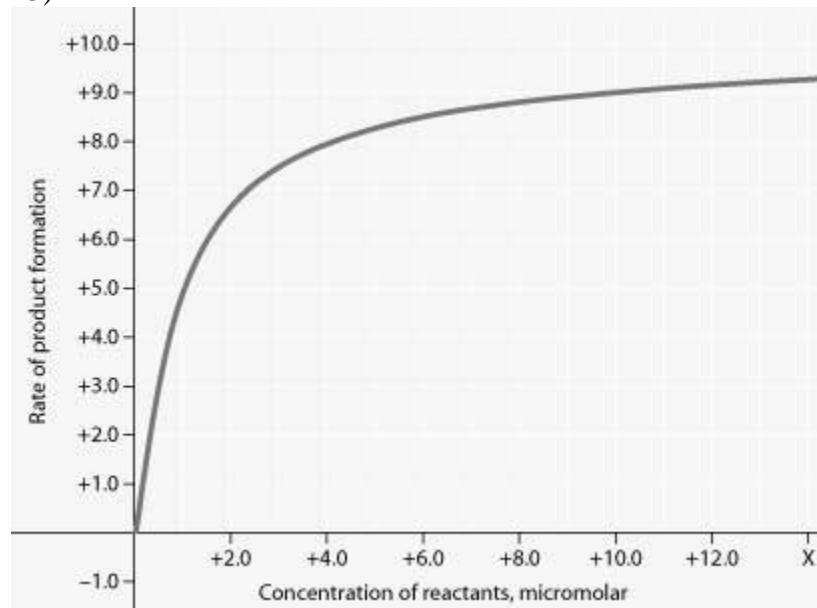
- A) by changing the stability of the enzyme
- B) by changing the three-dimensional conformation of the enzyme
- C) by changing the optimum pH for the enzyme
- D) by changing the binding site for a noncompetitive inhibitor

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 8.4

43)



Rate of an enzyme-catalyzed reaction as a function of varying reactant concentration, with the concentration of enzyme constant.

For the enzyme-catalyzed reaction shown in the figure, if the initial reactant concentration is 1.0 micromolar, which of these treatments will cause the greatest increase in the rate of the reaction?

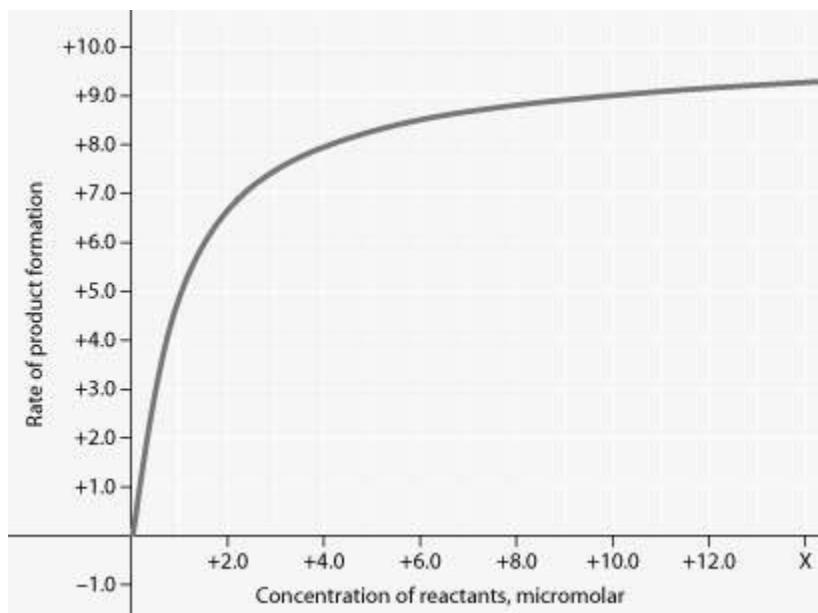
- A) doubling the activation energy needed
- B) cooling the reaction by 10°C
- C) doubling the enzyme concentration
- D) increasing the concentration of reactants to 10.0 micromolar, while reducing the concentration of enzyme by 1/2

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 8.4

44) Use the following information to answer the question below.



Rate of an enzyme-catalyzed reaction as a function of varying reactant concentration, with the concentration of enzyme constant

In the figure, why does the reaction rate plateau at higher reactant concentrations?

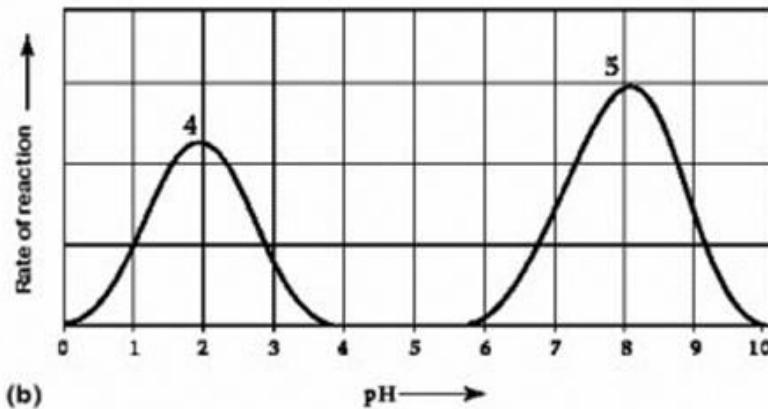
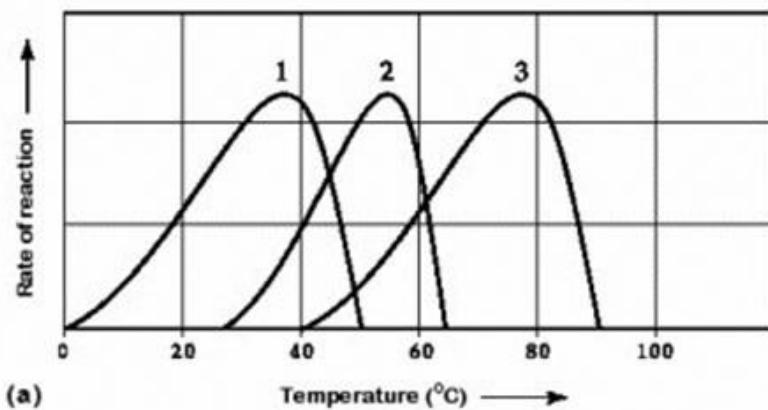
- A) Feedback inhibition by product occurs at high reactant concentrations.
- B) Most enzyme molecules are occupied by substrate at high reactant concentrations.
- C) The reaction nears equilibrium at high reactant concentrations.
- D) The rate of the reverse reaction increases at high reactant concentrations.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 8.4

45) Use the following information to answer the question below.



Activity of various enzymes at various temperatures (a) and at various pH (b)

Which curves on the graphs may represent the temperature and pH profiles of an enzyme taken from a bacterium that lives in a mildly alkaline hot springs at temperatures of 70 $^{\circ}\text{C}$ or higher?

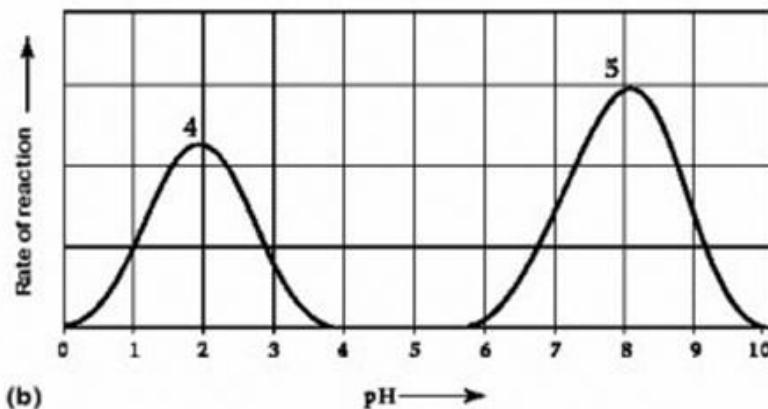
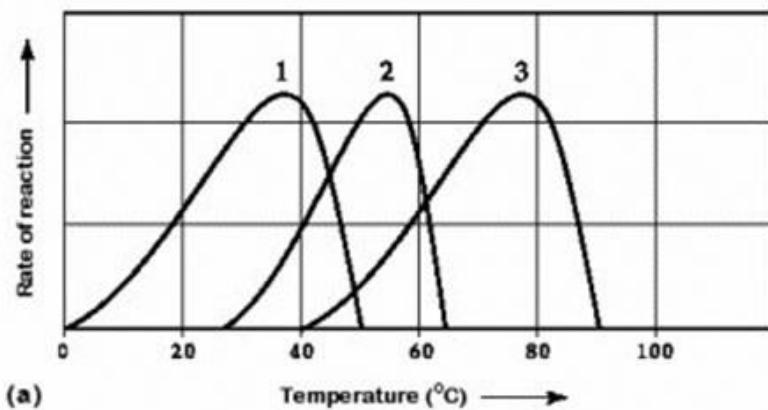
- A) curves 1 and 5
- B) curves 2 and 5
- C) curves 3 and 4
- D) curves 3 and 5

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 8.4

46) Use the following information to answer the question below.



Activity of various enzymes at various temperatures (a) and at various pH (b)

Which temperature and pH profile curves on the graphs are most likely associated with an enzyme isolated from a human stomach where conditions are strongly acid?

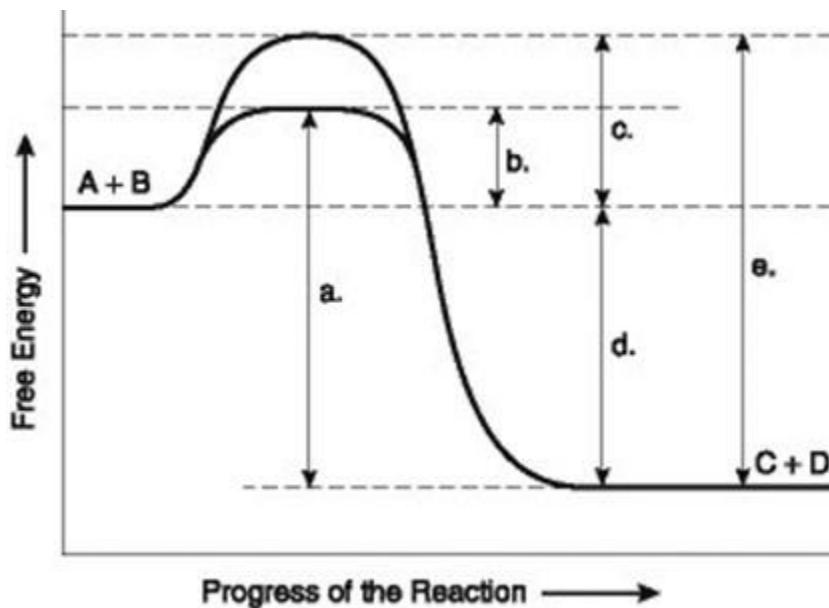
- A) curves 1 and 4
- B) curves 1 and 5
- C) curves 2 and 4
- D) curves 3 and 4

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 8.4

47) Use the following information to answer the question below.



The figure illustrates the energy states associated with the reaction $A + B \leftrightarrow C + D$. Which of the following terms best describes the forward reaction in the figure?

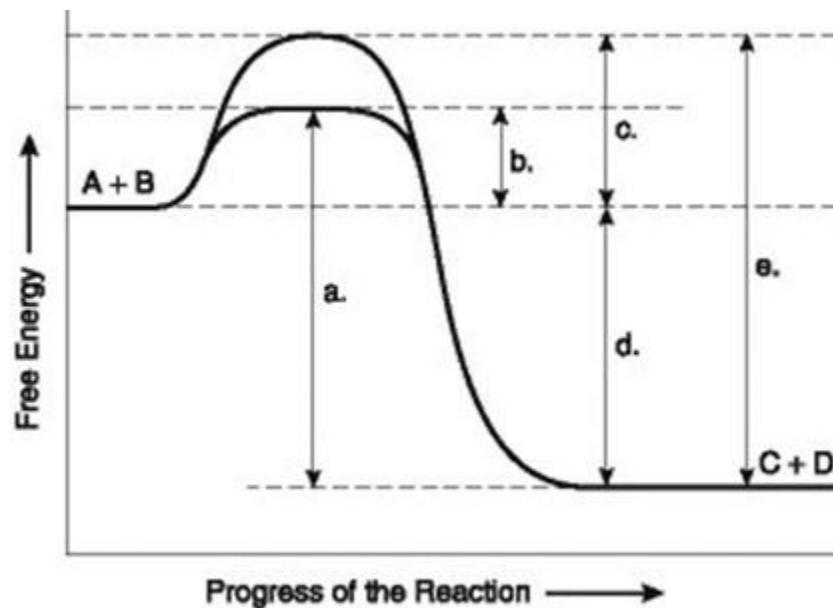
- A) endergonic, $\Delta G > 0$
- B) exergonic, $\Delta G < 0$
- C) endergonic, $\Delta G < 0$
- D) exergonic, $\Delta G > 0$

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 8.4

48) Use the following information to answer the question below.



The figure illustrates the energy states associated with the reaction $A + B \leftrightarrow C + D$. Which of the following in the figure would be the same in either an enzyme-catalyzed or a noncatalyzed reaction?

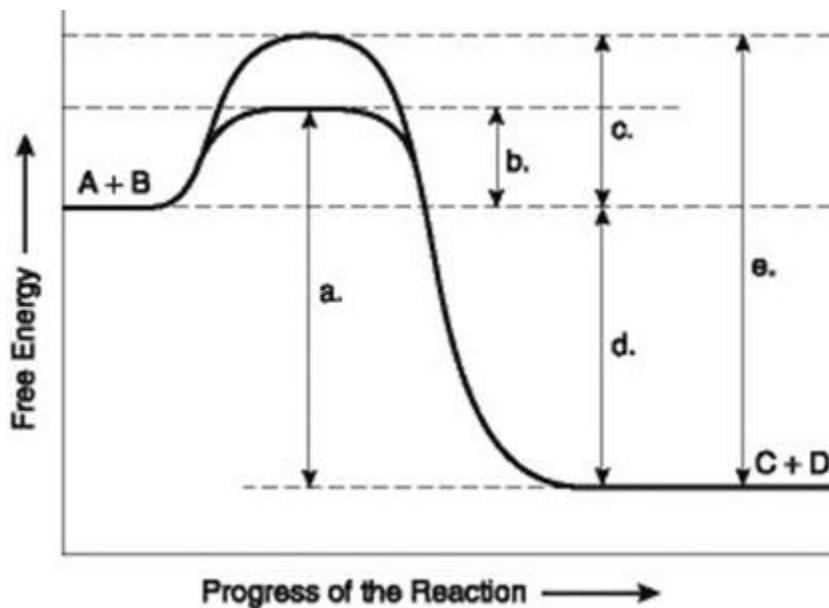
- A) a
- B) b
- C) c
- D) d

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 8.4

49) Use the following information to answer the question below.



The figure illustrates the energy states associated with the reaction $A + B \leftrightarrow C + D$. Which of the following represents the activation energy required for the enzyme-catalyzed reaction in the figure?

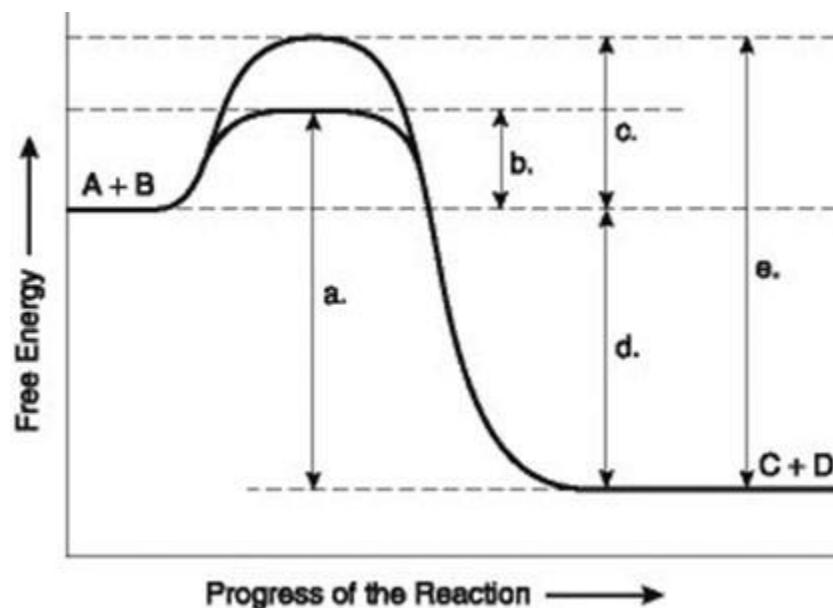
- A) a
- B) b
- C) c
- D) d

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 8.4

50) Use the following information to answer the question below.



The figure illustrates the energy states associated with the reaction $A + B \leftrightarrow C + D$. Which of the following represents the activation energy required for the non-enzyme-catalyzed reaction in the figure?

- A) a
- B) b
- C) c
- D) d

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 8.4

51) In a metabolic pathway, succinate dehydrogenase catalyzes the conversion of succinate to fumarate. The reaction is inhibited by malonic acid, a substance that resembles succinate but cannot be acted upon by succinate dehydrogenase. Increasing the amount of succinate molecules to those of malonic acid reduces the inhibitory effect of malonic acid. Which of the following statements correctly describes the role played by molecules described in the reaction?

- A) Succinate dehydrogenase is the enzyme, and fumarate is the substrate in the reaction.
- B) Succinate dehydrogenase is the enzyme, and malonic acid is the substrate in the reaction.
- C) Succinate is the substrate, and fumarate is the product in the reaction.
- D) Fumarate is the product, and malonic acid is a noncompetitive inhibitor in the reaction.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 8.4

52) In a metabolic pathway, succinate dehydrogenase catalyzes the conversion of succinate to fumarate. The reaction is inhibited by malonic acid, a substance that resembles succinate but cannot be acted upon by succinate dehydrogenase. Increasing the amount of succinate molecules to those of malonic acid reduces the inhibitory effect of malonic acid. What role does malonic acid play with respect to succinate dehydrogenase?

- A) Malonic acid is a competitive inhibitor.
- B) Malonic acid blocks the binding of fumarate.
- C) Malonic acid is a noncompetitive inhibitor.
- D) Malonic acid is an allosteric regulator.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 8.4

53) HIV is the virus that causes AIDS. In the mid-1990s, researchers discovered an enzyme in HIV called *protease*. Once the enzyme's structure was known, researchers began looking for drugs that would fit into the active site and block it. If this strategy for stopping HIV infections were successful, it would be an example of what phenomenon?

- A) noncompetitive inhibition
- B) denaturation
- C) allosteric regulation
- D) competitive inhibition

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 8.4

54) A series of enzymes catalyze the reactions in the metabolic pathway $X \rightarrow Y \rightarrow Z \rightarrow A$. Product A binds to the enzyme that converts X to Y at a position remote from its active site. This binding decreases the activity of the enzyme. What is substance X?

- A) an allosteric inhibitor
- B) a substrate
- C) an intermediate
- D) the product

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 8.5

55) A series of enzymes catalyze the reactions in the metabolic pathway $X \rightarrow Y \rightarrow Z \rightarrow A$. Product A binds to the enzyme that converts X to Y at a position remote from its active site. This binding decreases the activity of the enzyme. With respect to the enzyme that converts X to Y, substance A functions as _____.

- A) an allosteric inhibitor
- B) the substrate
- C) an intermediate
- D) a competitive inhibitor

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 8.5

56) _____ is a regulatory mechanism in which the end product of a metabolic pathway inhibits an enzyme that catalyzes an early step in the pathway.

- A) Allosteric inhibition
- B) Cooperative inhibition
- C) Feedback inhibition
- D) Metabolic inhibition

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.5

57) Characterization of the complete three-dimensional structure of a newly purified protein suggests that it catalyzes the breakdown of a large substrate. The protein consists of a single polypeptide chain. It has a large pocket that appears to be the binding site for the substrate and a smaller indentation that appears to be the binding site for a regulatory molecule. What do these structural observations suggest about the mechanism by which the activity of this protein is likely regulated?

- A) It is probably an enzyme that is regulated by noncompetitive inhibition.
- B) It is probably a multi-subunit enzyme that is regulated by allosteric regulation.
- C) It is probably an enzyme that is regulated by competitive inhibition.
- D) It is probably an enzyme that is regulated by cooperativity.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 8.5

58) Which of the following statements describes an example of cooperativity associated with enzyme regulation?

- A) binding of the end product of a metabolic pathway to the first enzyme in the pathway to inhibit the enzyme
- B) one enzyme in a metabolic pathway passing its product to act as a substrate for the next enzyme in the pathway
- C) binding a substrate to one subunit of a tetramer stimulates faster binding of substrate to each of the other three subunits
- D) binding of an ATP molecule along with another substrate molecule in the active site of the enzyme

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 8.5

59) In addition to activating or inhibiting enzymes through allosteric regulation, what other means does a cell use to control enzymatic activity?

- A) localization of enzymes into specific organelles or membranes
- B) secretion of enzymes out of the cell
- C) assembly of enzymes into large aggregates
- D) altering internal pH

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 8.5

60) Protein kinases are enzymes that transfer the terminal phosphate from ATP to an amino acid residue on the target protein. Many are located on the plasma membrane as integral membrane proteins or peripheral membrane proteins. What purpose may be served by their plasma membrane localization?

- A) ATP is more abundant near the plasma membrane.
- B) They can more readily encounter and phosphorylate other membrane proteins.
- C) Membrane localization lowers the activation energy of the phosphorylation reaction.
- D) They flip back and forth across the membrane to access target proteins on either side.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 8.5

61) Biological systems use free energy based on empirical data that all organisms require a constant energy input. The first law of thermodynamics states that energy can be neither created nor destroyed. For living organisms, which of the following statements is an important consequence of this first law?

- A) The energy content of an organism is constant except for when its cells are dividing.
- B) The organism must ultimately obtain all the necessary energy for life from its environment.
- C) The entropy of an organism decreases with time as the organism grows in complexity.
- D) Organisms are unable to transform energy from the different states in which it can exist.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 8.1

8.2 Student Edition End-of-Chapter Questions

1) Choose the pair of terms that correctly completes this sentence: Catabolism is to anabolism as _____ is to _____.

- A) exergonic; spontaneous
- B) exergonic; endergonic
- C) free energy; entropy
- D) work; energy

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

2) Most cells cannot harness heat to perform work because

- A) heat does not involve a transfer of energy.
- B) cells do not have much thermal energy; they are relatively cool.
- C) temperature is usually uniform throughout a cell.
- D) heat can never be used to do work.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

3) Which of the following metabolic processes can occur without a net influx of energy from some other process?

- A) ADP + \textcircled{P} \rightarrow ATP + H₂O
- B) C₆H₁₂O₆ + 6O₂ \rightarrow 6CO₂ + 6H₂O
- C) 6CO₂ + 6H₂O \rightarrow C₆H₁₂O₆ + 6O₂
- D) Amino acids \rightarrow Protein

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

4) If an enzyme in solution is saturated with substrate, the most effective way to obtain a faster yield of products is to

- A) add more of the enzyme.
- B) heat the solution to 90°C.
- C) add more substrate.
- D) add a noncompetitive inhibitor.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

5) Some bacteria are metabolically active in hot springs because

- A) they are able to maintain a lower internal temperature.
- B) high temperatures make catalysis unnecessary.
- C) their enzymes have high optimal temperatures.
- D) their enzymes are completely insensitive to temperature.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

6) If an enzyme is added to a solution where its substrate and product are in equilibrium, what will occur?

- A) Additional substrate will be formed.
- B) The reaction will change from endergonic to exergonic.
- C) The free energy of the system will change.
- D) Nothing; the reaction will stay at equilibrium.

Answer: D

Bloom's Taxonomy: Application/Analysis

9.1 Multiple-Choice Questions

1) In which reactions of cellular respiration and fermentation does substrate-level phosphorylation occur?

- A) only in glycolysis
- B) only in the citric acid cycle
- C) only in the electron transport chain
- D) in both glycolysis and the citric acid cycle

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.1

2) Which of the following statements describes what happens to a molecule that functions as the reducing agent (electron donor) in a redox or oxidation-reduction reaction?

- A) It gains electrons and gains potential energy.
- B) It loses electrons and loses potential energy.
- C) It gains electrons and loses potential energy.
- D) It loses electrons and gains potential energy.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.1

3) What happens when electrons are passed from one atom to a more electronegative atom?

- A) The more electronegative atom is reduced, and energy is released.
- B) The more electronegative atom is reduced, and energy is consumed.
- C) The more electronegative atom is oxidized, and energy is consumed.
- D) The more electronegative atom is oxidized, and energy is released.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.1

4) Which of the summary statements below describes the results of the following reaction?



- A) $\text{C}_6\text{H}_{12}\text{O}_6$ is oxidized and O_2 is reduced.
- B) O_2 is oxidized and H_2O is reduced.
- C) CO_2 is reduced and O_2 is oxidized.
- D) O_2 is reduced and CO_2 is oxidized.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 9.1

5) What happens to a glucose molecule when it loses a hydrogen atom as the result of an oxidation-reduction reaction?

- A) The glucose molecule is hydrolyzed.
- B) The glucose molecule is an oxidizing agent.
- C) The glucose molecule is oxidized.
- D) The glucose molecule is reduced.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.1

6) When a molecule of NAD⁺ (nicotinamide adenine dinucleotide) gains a hydrogen atom (not a proton), the molecule becomes _____.

- A) dehydrogenated
- B) oxidized
- C) reduced
- D) redoxed

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.1

7) Which of the following statements about NAD⁺ is true?

- A) NAD⁺ is reduced to NADH during glycolysis, pyruvate oxidation, and the citric acid cycle.
- B) NAD⁺ has more chemical energy than NADH.
- C) NAD⁺ can donate electrons for use in oxidative phosphorylation.
- D) In the absence of NAD⁺, glycolysis can still function.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.1

8) The oxygen consumed during cellular respiration is directly involved in which of the following processes or events?

- A) glycolysis
- B) accepting electrons at the end of the electron transport chain
- C) the citric acid cycle
- D) the oxidation of pyruvate to acetyl CoA

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.1

9) Why are carbohydrates and fats frequently considered high-energy foods?

- A) They contain many oxygen atoms.
- B) They contain no nitrogen atoms.
- C) They contain many electrons associated with hydrogen atoms.
- D) They are strong oxidizing molecules.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.1

10) A cell has enough available ATP to meet its needs for about 30 seconds. What is likely to happen when an athlete exhausts his or her ATP supply?

- A) He or she has to sit down and rest.
- B) Catabolic processes are activated that generate more ATP.
- C) ATP is transported into the cell from the circulatory system.
- D) Other cells take over, and the muscle cells that have used up their ATP cease to function.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 9.1

11) Substrate-level phosphorylation accounts for approximately what percentage of the ATP formed by the reactions of glycolysis?

- A) 0%
- B) 2%
- C) 38%
- D) 100%

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.2

12) The free energy for the oxidation of glucose to CO₂ and water is -686 kcal/mol, and the free energy for the reduction of NAD⁺ to NADH is +53 kcal/mol. Why are only two molecules of NADH formed during glycolysis when it appears that as many as a dozen could be formed?

- A) Most of the free energy available from the oxidation of glucose is used in the production of ATP in glycolysis.
- B) Glycolysis is a very inefficient reaction, with much of the energy of glucose released as heat.
- C) Most of the free energy available from the oxidation of glucose remains in pyruvate, one of the products of glycolysis.
- D) There is no CO₂ or water produced as products of glycolysis.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 9.2

13) Starting with one molecule of glucose, glycolysis results in the net production of which of the following sets of energy-containing products?

- A) 2 NAD⁺, 2 pyruvate, and 2 ATP
- B) 2 NADH, 2 pyruvate, and 2 ATP
- C) 4 NADH, 2 pyruvate, and 4 ATP
- D) 6 CO₂, 2 pyruvate, and 2 ATP

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.2

14) In glycolysis, for each molecule of glucose oxidized to pyruvate, _____.

- A) two molecules of ATP are used, and two molecules of ATP are produced
- B) two molecules of ATP are used, and four molecules of ATP are produced
- C) four molecules of ATP are used, and two molecules of ATP are produced
- D) two molecules of ATP are used, and six molecules of ATP are produced

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.2

15) Which kind of metabolic poison would most directly interfere with glycolysis?

- A) an agent that reacts with oxygen and depletes its concentration in the cell
- B) an agent that binds to pyruvate and inactivates it
- C) an agent that closely mimics the structure of glucose but is not metabolized
- D) an agent that reacts with NADH and oxidizes it to NAD⁺

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 9.2

16) During which of the following metabolic processes is most of the CO₂ from the catabolism of glucose is released?

- A) glycolysis
- B) electron transport
- C) oxidation of pyruvate to acetyl-CoA
- D) the citric acid cycle

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.3

17) Following glycolysis and the citric acid cycle, but before the electron transport chain and oxidative phosphorylation, the carbon skeleton of glucose has been broken down to CO₂ with some net gain of ATP. Most of the energy from the original glucose molecule at that point in the process, however, is stored in the form of which of the following molecules?

A) acetyl-CoA

B) NAD⁺

C) pyruvate

D) NADH

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.3

18) Which electron carrier(s) function in the citric acid cycle?

A) NAD⁺ only

B) NADH and FADH₂

C) the electron transport chain

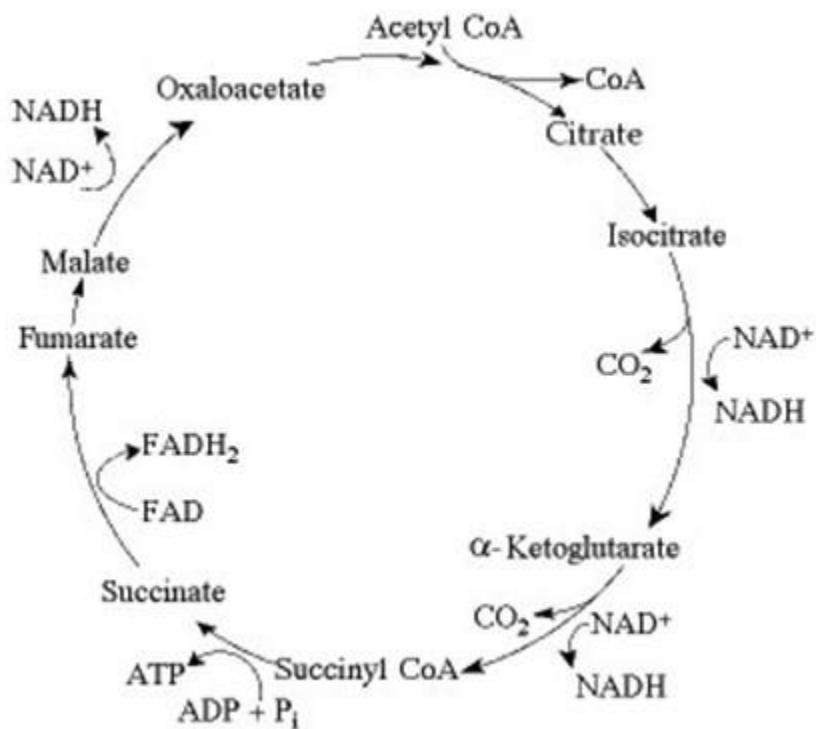
D) ADP and ATP

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.3

19) Use the following information to answer the question below.



The citric acid cycle.

If you were to add one of the eight citric acid cycle intermediates to the culture medium of yeast growing in the laboratory, what do you think would happen to the rates of ATP and carbon dioxide production?

- A) There would be no change in ATP production, but the rate of carbon dioxide production would increase.
- B) The rates of ATP production and carbon dioxide production would both increase.
- C) The rate of ATP production would increase, but the rate of carbon dioxide production would decrease.
- D) The rates of ATP and carbon dioxide production would both decrease.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 9.3

20) Carbon dioxide (CO₂) is released during which of the following stages of cellular respiration?

- A) glycolysis and the oxidation of pyruvate to acetyl CoA
- B) oxidation of pyruvate to acetyl CoA and the citric acid cycle
- C) oxidative phosphorylation and fermentation
- D) fermentation and glycolysis

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.3

21) If glucose is the sole energy source, what fraction of the carbon dioxide exhaled by animals is generated only by the reactions involved in oxidation of pyruvate to acetyl CoA?

A) 1/6

B) 1/3

C) 2/3

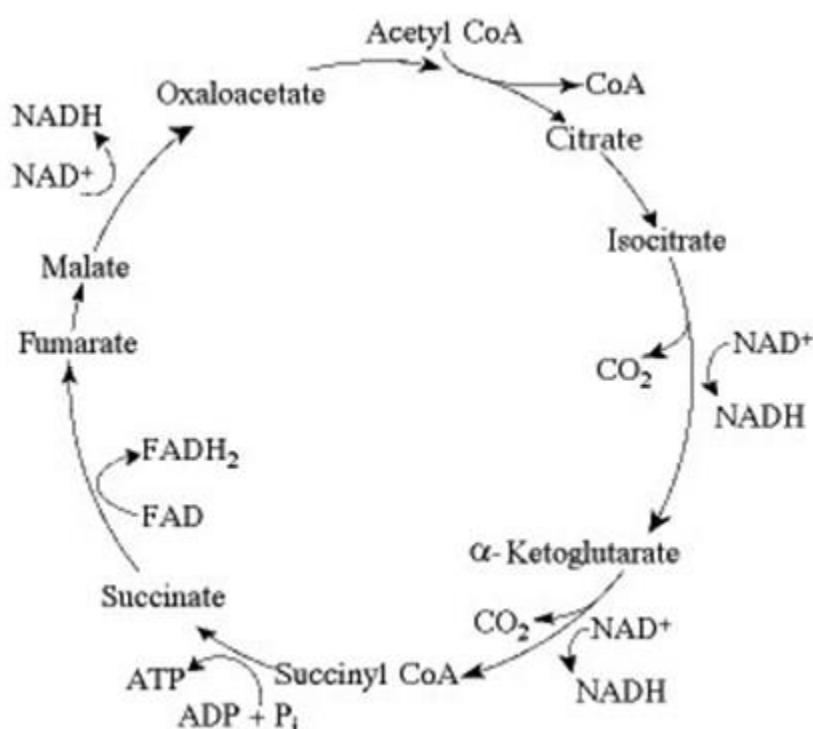
D) all of it

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 9.3

22) Use the following information to answer the question below.



The citric acid cycle.

For each mole of glucose ($C_6H_{12}O_6$) oxidized by cellular respiration, how many moles of CO_2 are released in the citric acid cycle (see the accompanying figure)?

A) 2

B) 4

C) 6

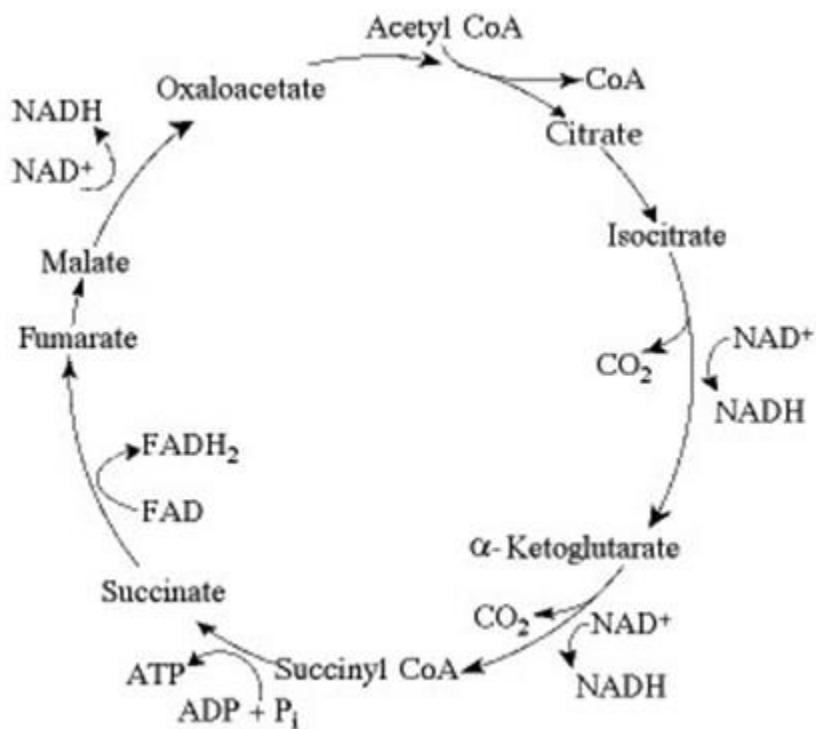
D) 32

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 9.3

23) Use the following information to answer the question below.



The citric acid cycle.

If pyruvate oxidation is blocked, what will happen to the levels of oxaloacetate and citric acid in the citric acid cycle shown in the accompanying figure?

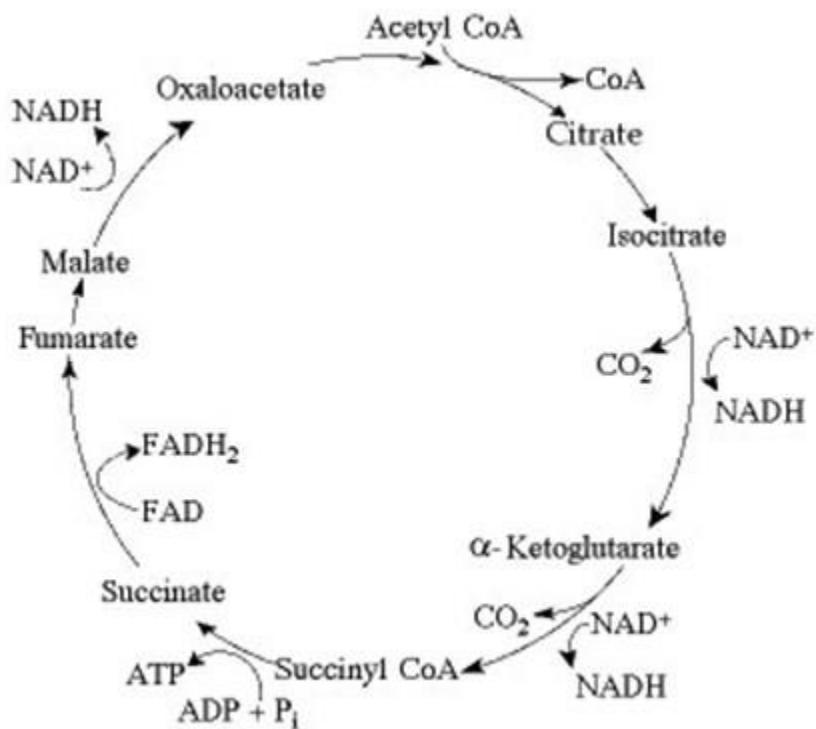
- A) Oxaloacetate will decrease and citric acid will accumulate.
- B) Oxaloacetate will accumulate and citric acid will decrease.
- C) Both oxaloacetate and citric acid will decrease.
- D) Both oxaloacetate and citric acid will accumulate.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 9.3

24) Use the following information to answer the question below.



The citric acid cycle.

Starting with citrate, which of the following combinations of products would result from three acetyl CoA molecules entering the citric acid cycle?

- A) 1 ATP, 2 CO₂, 3 NADH, and 1 FADH₂
- B) 3 ATP, 3 CO₂, 3 NADH, and 3 FADH₂
- C) 3 ATP, 6 CO₂, 9 NADH, and 3 FADH₂
- D) 6 ATP, 6 CO₂, 3 NADH, and 12 FADH₂

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 9.3

25) In the presence of oxygen, the three-carbon compound pyruvate can be catabolized in the citric acid cycle. First, however, the pyruvate (1) loses a carbon, which is given off as a molecule of CO₂, (2) is oxidized to form a two-carbon compound called acetate, and (3) is bonded to coenzyme A. Which of the following sets of products result from these reactions?

- A) acetyl CoA, O₂, and ATP
- B) acetyl CoA, FADH₂, and CO₂
- C) acetyl CoA, NADH, and CO₂
- D) acetyl CoA, NAD⁺, ATP, and CO₂

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.3

26) Which one of the following is formed by the removal of a carbon (as CO₂) from a molecule of pyruvate?

- A) ATP
- B) acetyl CoA
- C) citrate
- D) water

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.3

27) Which of the following events takes place in the electron transport chain?

- A) the breakdown of glucose into six carbon dioxide molecules
- B) the breakdown of an acetyl group to carbon dioxide
- C) the harnessing of energy from high-energy electrons derived from glycolysis and the citric acid cycle
- D) substrate-level phosphorylation

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.4

28) Which of the following statements about the electron transport chain is true?

- A) It is driven by ATP hydrolysis.
- B) It includes a series of hydrolysis reactions associated with mitochondrial membranes.
- C) It consists of a series of redox reactions
- D) It occurs in the cytoplasm of both prokaryotic and eukaryotic cells.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.4

29) Which of the following processes is driven by chemiosmosis?

- A) substrate-level phosphorylation
- B) oxidative phosphorylation
- C) ATP hydrolysis
- D) reduction of NAD⁺ to NADH

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 9.4

30) Which of the following sequences describes the path by which electrons travel downhill energetically in aerobic respiration?

- A) glucose → NADH → electron transport chain → oxygen
- B) glucose → pyruvate → ATP → oxygen
- C) glucose → pyruvate → electron transport chain → NADH → ATP
- D) food → glycolysis → citric acid cycle → NADH → ATP

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 9.4

31) Where are the proteins of the electron transport chain located?

- A) mitochondrial outer membrane
- B) mitochondrial inner membrane
- C) mitochondrial intermembrane space
- D) mitochondrial matrix

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.4

32) During aerobic respiration, which of the following molecules directly donates electrons to the electron transport chain at the lowest energy level?

- A) NADH
- B) ATP
- C) water
- D) FADH₂

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.4

33) Which of the following statements best describes the primary role played by oxygen in cellular respiration?

- A) It yields energy in the form of ATP as it is passed down the electron transport chain.
- B) It oxidizes glucose to form two molecules of pyruvate.
- C) It serves as an acceptor for carbon, forming CO₂ in the citric acid cycle.
- D) It serves as the final acceptor for electrons from the electron transport chain.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.4

34) Water is one of the end products of aerobic respiration. What is the source of the oxygen atom used in formation of the water?

- A) carbon dioxide (CO₂)
- B) glucose (C₆H₁₂O₆)
- C) molecular oxygen (O₂)
- D) pyruvate (C₃H₃O₃⁻)

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.4

35) In chemiosmosis, what is the most direct source of energy that is used to convert ADP + \textcircled{P}_i to ATP?

- A) energy released as electrons flow through the electron transport chain
- B) energy released from substrate-level phosphorylation
- C) energy released from movement of protons through ATP synthase, down their electrochemical gradient
- D) energy released as electrons are transported across the inner mitochondrial membrane

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.4

36) Energy released by the electron transport chain is used to pump H⁺ ions into which location in eukaryotic cells?

- A) cytoplasm adjacent to the mitochondrial outer membrane
- B) mitochondrial inner membrane
- C) mitochondrial intermembrane space
- D) mitochondrial matrix

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.4

37) Which of the following processes generates a proton-motive force in mitochondria?

- A) the flow of protons through ATP synthase down their concentration gradient
- B) the reduction of NAD⁺ by the first electron carrier in the electron transport chain
- C) lowering of pH in the mitochondrial matrix
- D) pumping of hydrogen ions from the mitochondrial matrix across the inner membrane and into the intermembrane space

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.4

38) Approximately how many molecules of ATP are produced from the complete oxidation of one molecule of glucose (C₆H₁₂O₆) in aerobic cellular respiration?

- A) 2
- B) 4
- C) 18-24
- D) 30-32

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.4

39) The synthesis of ATP by oxidative phosphorylation, using the energy released by movement of protons across the membrane down their electrochemical gradient, is an example of which of the following processes?

- A) active transport
- B) allosteric regulation
- C) a reaction with a positive ΔG
- D) coupling of an endergonic reaction to an exergonic reaction

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 9.4

40) If a cell is able to synthesize 30 ATP molecules for each molecule of glucose completely oxidized to carbon dioxide and water, approximately how many ATP molecules can the cell synthesize for each molecule of pyruvate oxidized to carbon dioxide and water?

- A) 8
- B) 12.5
- C) 16
- D) 25

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 9.4

41) In liver cells, the inner mitochondrial membranes are about five times the area of the outer mitochondrial membranes. What purpose must this serve?

- A) It allows for an increased rate of glycolysis.
- B) It allows for an increased rate of the citric acid cycle.
- C) It increases the surface for oxidative phosphorylation.
- D) It increases the surface for substrate-level phosphorylation.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 9.4

42) A person on a strict diet and exercise regimen lost 7 kg (about 15 pounds) of body fat in just two weeks. What is the most likely way that the lost fat left the body?

- A) It was released as CO_2 and H_2O .
- B) It was converted to heat and then released.
- C) It was converted to ATP, which weighs much less than fat.
- D) It was eliminated from the body as feces.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 9.4

43) Exposing inner mitochondrial membranes to ultrasonic vibrations will disrupt the membranes. However, the fragments will reseal "inside out." The little vesicles that result can still transfer electrons from NADH to oxygen and synthesize ATP. After the disruption, which components involved in oxidative phosphorylation must be present for electron transfer and ATP synthesis to still occur?

- A) only the electron transport system
- B) only the ATP synthase system
- C) all of the electron transport system and the proteins that add CoA to acetyl groups
- D) all of the electron transport system and ATP synthase

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 9.4

44) Exposing inner mitochondrial membranes to ultrasonic vibrations will disrupt the membranes. However, the fragments will reseal "inside out." The little vesicles that result can still transfer electrons from NADH to oxygen and synthesize ATP. Which of the following statements about these inside-out membrane vesicles is true?

- A) The inside of the vesicles will become acidic when NADH is added.
- B) The inside of the vesicles will become alkaline when NADH is added.
- C) ATP will be produced from ADP and P_i in the interior of the vesicle.
- D) The vesicles will pump protons out of the interior of the vesicle to the exterior using energy from ATP hydrolysis.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 9.4

45) What kinds of cells carry out ATP synthesis by chemiosmosis?

- A) all cells, both prokaryotic and eukaryotic, exclusively using oxygen as the electron acceptor
- B) only animal cells in mitochondria, exclusively using oxygen as the electron acceptor
- C) only eukaryotic cells, both plant and animal, using either oxygen or other electron acceptors
- D) all respiring cells, both prokaryotic and eukaryotic, using either oxygen or other electron acceptors

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.4

46) Which of the following metabolic processes normally occurs regardless of whether or not oxygen (O_2) is present?

- A) citric acid cycle
- B) glycolysis
- C) lactate fermentation
- D) oxidative phosphorylation

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.5

- 47) Which of the following metabolic processes take place in the cytosol of a eukaryotic cell?
- A) glycolysis and fermentation
 - B) fermentation and chemiosmosis
 - C) oxidation of pyruvate to acetyl CoA
 - D) citric acid cycle

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.5

- 48) In the absence of oxygen, yeast cells can obtain energy by fermentation, which results in the production of which of the following sets of molecules?
- A) ATP, CO₂, and ethanol (ethyl alcohol)
 - B) ATP, CO₂, and lactate
 - C) ATP, NADH, and ethanol
 - D) ATP, CO₂, and acetyl CoA

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.5

- 49) Which of the following statements describes a primary function of both alcohol fermentation and lactic acid fermentation?
- A) reduction of NAD⁺ to NADH
 - B) reduction of FAD to FADH₂
 - C) oxidation of NADH to NAD⁺
 - D) hydrolysis of ATP to ADP + \textcircled{P}_i

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 9.5

- 50) An organism is discovered that thrives in both the presence and absence of oxygen. Interestingly, as oxygen is removed from the organism's environment, the rate of sugar consumption increases while the growth rate decreases. What do these observations suggest about the likely identity of this organism?
- A) It is an unremarkable eukaryotic organism.
 - B) It is a photosynthetic organism.
 - C) It is an obligate anaerobic organism.
 - D) It is a facultative anaerobic organism.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 9.5

- 51) Why is glycolysis considered to be one of the first metabolic pathways to have evolved?
- A) It produces much less ATP than does oxidative phosphorylation.
 - B) It does not involve organelles or specialized structures, does not require oxygen, and is present in most organisms.
 - C) It is present in prokaryotic cells but not in eukaryotic cells.
 - D) It requires the presence of membrane-enclosed cell organelles found only in eukaryotic cells.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 9.5

- 52) Yeast cells that have defective mitochondria incapable of respiration will be able to grow by catabolizing which of the following carbon sources for energy?

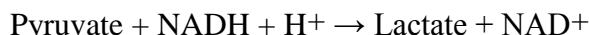
- A) glucose
- B) cholesterol
- C) fatty acids
- D) amino acids

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 9.5

- 53) What is the oxidizing agent in the following reaction?



- A) NADH
- B) NAD⁺
- C) lactate
- D) pyruvate

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 9.6

- 54) High levels of citric acid inhibit the enzyme phosphofructokinase, a key enzyme in glycolysis. Citric acid binds to the enzyme at a different location from the active site. This is an example of _____.

- A) competitive inhibition
- B) allosteric regulation
- C) the specificity of enzymes for their substrates
- D) positive feedback regulation

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 9.6

55) The enzyme phosphofructokinase (PFK) catalyzes a key step in glycolysis. PFK is inhibited by high levels of which of the following molecules?

- A) glucose and NAD⁺
- B) AMP and ATP
- C) ATP and citrate
- D) citrate and CO₂

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.6

56) The enzyme phosphofructokinase (PFK) catalyzes a key step in glycolysis. About 10% of Springer spaniels suffer from canine PFK deficiency. Given its critical role in glycolysis, which of the following conditions would be a likely consequence for dogs afflicted with this disorder?

- A) They would die as embryos.
- B) They would have elevated blood-glucose levels, which may result in a high incidence of diabetes.
- C) They would be lethargic and readily tire from exercise.
- D) They would carry out elevated levels of oxidative phosphorylation.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 9.6

57) A young dog has never had much energy. He is brought to a veterinarian for help, and she decides to conduct several diagnostic tests. She discovers that the dog's mitochondria can use only fatty acids and amino acids for respiration, and his cells produce more lactate than normal. Of the following, which is the best explanation of the dog's condition?

- A) His mitochondria lack the transport protein that moves pyruvate across the outer mitochondrial membrane.
- B) His cells cannot move NADH from glycolysis into the mitochondria.
- C) His cells lack the enzyme in glycolysis that forms pyruvate.
- D) His cells have a defective electron transport chain, so glucose is metabolized to lactate instead of to acetyl CoA.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 9.6

58) Even though plants cells carry out photosynthesis, they still use their mitochondria for oxidation of pyruvate. Under what conditions will plant cell mitochondria be active in this process?

- A) only in photosynthetic cells in the light, while photosynthesis occurs concurrently
- B) only in cells that store glucose in the form of starch and only in the dark
- C) in all cells, with or without light
- D) in photosynthesizing cells in the light, and in other cells in the dark

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 9.6

59) Beta oxidation generates substrates for cellular respiration through which of the following processes?

- A) catabolism of glucose
- B) catabolism of glycogen
- C) catabolism of proteins
- D) catabolism of fatty acids

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.6

60) Fatty acids usually have an even number of carbons in their structures. Catabolism of fatty acids produces two-carbon fragments that are converted to acetyl CoA molecules. What is the most likely way in which these acetyl CoA molecules would be metabolized in aerobic cellular respiration?

- A) They would directly enter the electron transport chain.
- B) They would directly enter the energy-yielding phase of glycolysis.
- C) They would be converted to pyruvate and then undergo pyruvate oxidation upon transport into mitochondria.
- D) They would directly enter the citric acid cycle.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 9.6

61) New biosensors, applied like a temporary tattoo to the skin, can alert serious athletes that they are about to "hit the wall" and will find it difficult to continue exercising. These biosensors monitor lactate, a form of lactic acid, released in sweat during strenuous exercise. Which of the statements below is the best explanation of why athletes would need to monitor lactate levels?

- A) During aerobic respiration, muscle cells cannot produce enough lactate to fuel muscle cell contractions, and muscles begin to cramp, thus athletic performance suffers.
- B) During anaerobic respiration, lactate levels increase when muscles cells need more energy; however, muscles cells eventually fatigue, thus athletes should modify their activities to increase aerobic respiration.
- C) During aerobic respiration, muscles cells produce too much lactate, which causes a rise in the pH of the muscle cells, thus athletes must consume increased amounts of sports drinks, high in electrolytes, to buffer the pH.
- D) During anaerobic respiration, muscle cells receive too little oxygen and begin to convert lactate to pyruvate (pyruvic acid), thus athletes experience cramping and fatigue.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 9.5

9.2 Student Edition End-of-Chapter Questions

1) The *immediate* energy source that drives ATP synthesis by ATP synthase during oxidative phosphorylation is the

- A) oxidation of glucose and other organic compounds.
- B) flow of electrons down the electron transport chain.
- C) H⁺ concentration gradient across the membrane holding ATP synthase.
- D) transfer of phosphate to ADP.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

2) Which metabolic pathway is common to both fermentation and cellular respiration of a glucose molecule?

- A) the citric acid cycle
- B) the electron transport chain
- C) glycolysis
- D) reduction of pyruvate to lactate

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

3) The final electron acceptor of the electron transport chain that functions in aerobic oxidative phosphorylation is

- A) oxygen.
- B) water.
- C) NAD⁺.
- D) pyruvate.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

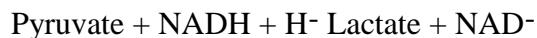
4) In mitochondria, exergonic redox reactions

- A) are the source of energy driving prokaryotic ATP synthesis.
- B) provide the energy that establishes the proton gradient.
- C) reduce carbon atoms to carbon dioxide.
- D) are coupled via phosphorylated intermediates to endergonic processes.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

5) What is the oxidizing agent in the following reaction?



- A) oxygen
- B) NADH
- C) lactate
- D) pyruvate

Answer: D

Bloom's Taxonomy: Application/Analysis

6) When electrons flow along the electron transport chains of mitochondria, which of the following changes occurs?

- A) The pH of the matrix increases.
- B) ATP synthase pumps protons by active transport.
- C) The electrons gain free energy.
- D) NAD^+ is oxidized.

Answer: A

Bloom's Taxonomy: Application/Analysis

7) Most CO_2 from catabolism is released during

- A) glycolysis.
- B) the citric acid cycle.
- C) lactate fermentation.
- D) electron transport.

Answer: B

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 10 Photosynthesis

10.1 Multiple Choice Questions

- 1) In which of the following organisms did the process of photosynthesis most likely originate?
- A) in plants
 - B) in prokaryotes
 - C) in fungi
 - D) three separate times during evolution

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension
Section: 10.1

- 2) In autotrophic bacteria, where is chlorophyll located?
- A) in chloroplast membranes
 - B) in the cell wall
 - C) in the nucleoid
 - D) in infolded regions of the plasma membrane

Answer: D

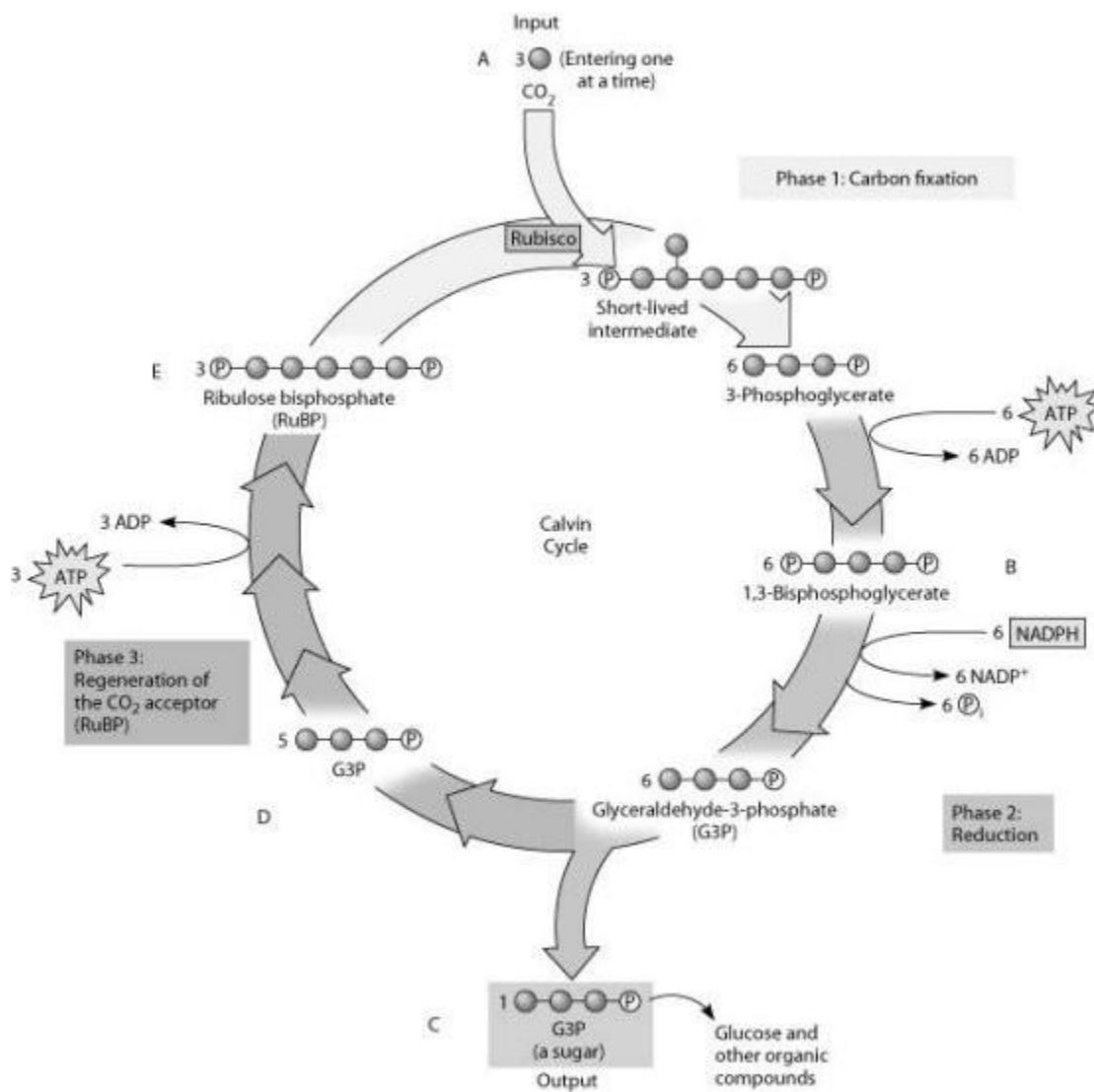
Bloom's Taxonomy: Knowledge/Comprehension
Section: 10.1

- 3) Under what conditions do photosynthesis and cellular respiration occur in plants?
- A) Photosynthesis and cellular respiration occur only in the light.
 - B) Photosynthesis occurs only in the light, and cellular respiration occurs only in the dark.
 - C) Photosynthesis occurs only in the light, and cellular respiration occurs in both the dark and the light.
 - D) Photosynthesis and cellular respiration occur in both the dark and the light.

Answer: C

Bloom's Taxonomy: Application/Analysis
Section: 10.1

4) Use the following figure to answer the question.



If photosynthesizing green algae are provided with CO_2 containing heavy oxygen (^{18}O), which of the following molecules produced by the algae (refer to the accompanying figure) will fail to contain ^{18}O in later biochemical analyses?

- A) glyceraldehyde 3-phosphate (G3P)
- B) 3-phosphoglycerate
- C) ribulose bisphosphate (RuBP)
- D) ADP

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 10.1

- 5) The oxygen released by photosynthesis is produced by which of the following processes?
- A) splitting water molecules
 - B) chemiosmosis
 - C) the electron transfer system of photosystem I
 - D) the electron transfer system of photosystem II

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.1

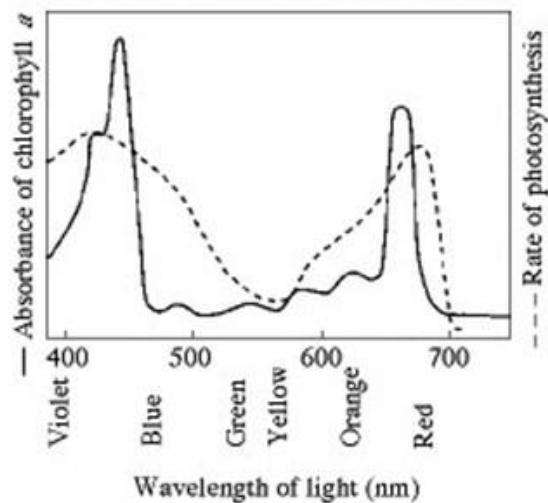
- 6) Which of the following statements correctly describes a distinction between autotrophs and heterotrophs?
- A) Cellular respiration is unique to heterotrophs.
 - B) Only heterotrophs have mitochondria.
 - C) Autotrophs, but not heterotrophs, can nourish themselves beginning with CO₂ and other nutrients that are inorganic.
 - D) Only heterotrophs require oxygen.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.1

- 7) Use the following figure to answer the question.



The figure shows the absorption spectrum for chlorophyll *a* and the action spectrum for photosynthesis. Why are they different?

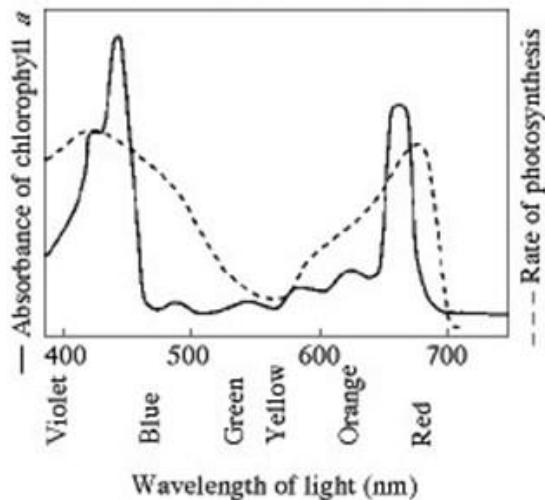
- A) Green and yellow wavelengths inhibit the absorption of red and blue wavelengths.
- B) Oxygen given off during photosynthesis interferes with the absorption of light.
- C) Other pigments absorb light in addition to chlorophyll *a*.
- D) Aerobic bacteria take up oxygen, which changes the measurement of the rate of photosynthesis.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

8) Use the following figure to answer the question.



What wavelength of light in the figure is most effective in driving photosynthesis?

- A) 420 nm
- B) 575 nm
- C) 625 nm
- D) 730 nm

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 10.2

9) Theodor W. Engelmann illuminated a filament of algae with light that passed through a prism, thus exposing different segments of algae to different wavelengths of light. He added aerobic bacteria and then noted in which areas the bacteria congregated. He noted that the largest groups were found in the areas illuminated by the red and blue light. What did Engelmann conclude about the congregation of bacteria in the red and blue areas?

- A) Bacteria congregated in these areas due to an increase in the temperature of the red and blue light.
- B) Bacteria congregated in these areas because these areas had the most oxygen being released.
- C) Bacteria are attracted to red and blue light and thus these wavelengths are more reactive than other wavelengths.
- D) Bacteria congregated in these areas due to an increase in the temperature caused by an increase in photosynthesis.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 10.2

10) Theodor W. Engelmann illuminated a filament of algae with light that passed through a prism, thus exposing different segments of algae to different wavelengths of light. He added aerobic bacteria and then noted in which areas the bacteria congregated. He noted that the largest groups were found in the areas illuminated by the red and blue light. Which of the following statements describes a relationship that Engelmann's experiment helped to determine?

- A) the relationship between wavelength of light and the rate of aerobic respiration
- B) the relationship between wavelength of light and the amount of heat released
- C) the relationship between wavelength of light and the rate of photosynthesis
- D) the relationship between carbon dioxide concentration and the rate of photosynthesis

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 10.2

11) A spaceship is designed to support animal life for a multiyear voyage to the outer planets of the solar system. Plants will be grown to provide oxygen and to recycle carbon dioxide. Since the spaceship will be too far from the sun for photosynthesis, an artificial light source will be needed. What wavelengths of light should be used to maximize plant growth with a minimum of energy expenditure?

- A) full-spectrum white light
- B) green light
- C) a mixture of blue and red light
- D) UV light

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 10.2

12) A spaceship is designed to support animal life for a multiyear voyage to the outer planets of the solar system. Plants will be grown to provide oxygen and to recycle carbon dioxide. Since the spaceship will be too far from the sun for photosynthesis, an artificial light source will be needed. Suppose a plant has a unique photosynthetic pigment and the leaves of this plant appear to be reddish yellow. What wavelengths of visible light are absorbed by this pigment?

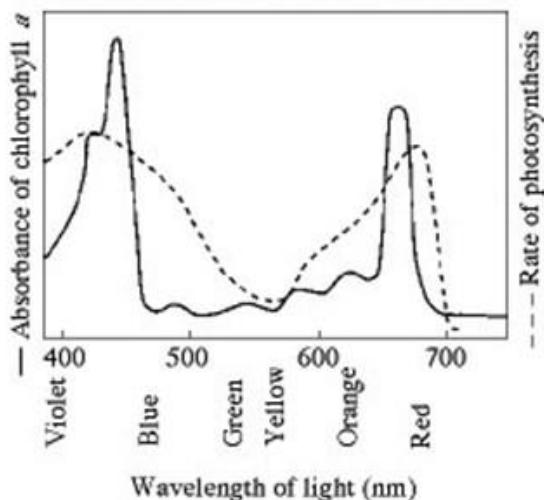
- A) red and yellow
- B) blue and violet
- C) green and yellow
- D) green and red

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 10.2

13) Use the following figure to answer the question.



Halobacterium has a photosynthetic membrane that appears purple. Its photosynthetic action spectrum is the inverse of the action spectrum for green plants (see figure). That is, the *Halobacterium* action spectrum has a peak where the green plant action spectrum has a trough. What wavelengths of light do the *Halobacterium* photosynthetic pigments absorb?

- A) red and yellow
- B) violet and blue
- C) green and yellow
- D) blue and red

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 10.2

14) Why are the reaction centers of photosystems composed of several structurally different pigments?

- A) Excited electrons must pass through several pigments before they can be transferred to electron acceptors of the electron transport chain.
- B) This arrangement enables the plant to absorb light energy of a variety of wavelengths.
- C) This arrangement enables the plant to absorb more photons from light energy, all of which are at the same wavelength.
- D) This arrangement enables the reaction center to excite electrons to a higher energy level.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

15) Paper chromatography is a technique used to separate molecules based upon their size and solubility in a particular solvent. If pigments from a particular species of plant are extracted and subjected to paper chromatography, which of the following results is most likely?

- A) Paper chromatography would produce a single band of pigment that is characteristic of that particular plant.
- B) Paper chromatography would separate the pigments into two bands that appear green.
- C) Paper chromatography would separate the pigments into several bands that appear green or yellow/orange.
- D) Paper chromatography would separate the pigments into two bands, one that appears blue and one that appears red.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 10.2

16) In autumn, chlorophyll is degraded in the leaves of deciduous trees. Why do the leaves change color to shades of yellow, orange, or red?

- A) Sugars from sap fill the leaves prior to winter.
- B) Degraded chlorophyll changes into many other colors.
- C) In the absence of photosynthesis, the leaves produce energy exclusively by aerobic cellular respiration.
- D) Other pigments such as carotenoids are still present in the leaves.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 10.2

17) Which of the following events accompanies absorption of energy by chlorophyll molecules of the reaction-center complex?

- A) ATP is synthesized from the energy absorbed.
- B) An electron is excited.
- C) NADP⁺ is reduced to NADPH.
- D) A molecule of water is split.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

18) What happens to the free energy released as electrons are passed from photosystem II to photosystem I through a series of electron carriers?

- A) It excites electrons of the reaction center in photosystem I.
- B) It is used to establish and maintain a proton gradient.
- C) It is used to synthesize ATP through substrate-level phosphorylation.
- D) It is used to phosphorylate NAD⁺ to NADPH.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

19) Which molecule is the final electron acceptor for electrons from photosystem I?

- A) oxygen
- B) chlorophyll in photosystem II
- C) carbon dioxide
- D) NADP⁺

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

20) What is the function of the pigment molecules in a light-harvesting complex in the thylakoid membranes?

- A) They split water and release oxygen from the reaction-center chlorophyll.
- B) They absorb and transfer light energy to the reaction-center chlorophyll.
- C) They synthesize ATP from ADP and P_i .
- D) They transfer electrons to NADP⁺.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

21) Which of the following processes is directly associated with photosystem I?

- A) receiving electrons from the thylakoid membrane electron transport chain
- B) generation of molecular oxygen
- C) extraction of hydrogen electrons from the splitting of water
- D) passing electrons to NADP⁺

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

22) Some photosynthetic organisms contain chloroplasts that lack photosystem II, yet are able to survive. Which of the following approaches would be the best way to detect the lack of photosystem II in these organisms?

- A) Determine whether they have thylakoid membranes.
- B) Determine whether they consume CO₂ in the dark.
- C) Determine whether they produce O₂ in the light.
- D) Determine the action spectrum for photosynthesis in these organisms.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 10.2

- 23) What are the products of linear electron flow during the light reactions of photosynthesis?
- A) heat and fluorescence
 - B) ATP and P700
 - C) ATP and NADPH
 - D) ADP and NADP⁺

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

- 24) What are the products of cyclic electron flow during the light reactions of photosynthesis?
- A) heat and fluorescence
 - B) ATP
 - C) ATP and NADPH
 - D) ADP and NADP⁺

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

- 25) As a research scientist, you measure the amount of ATP and NADPH consumed by the Calvin cycle in one hour. You find that 30,000 molecules of ATP were consumed, but only 20,000 molecules of NADPH were consumed. What is the source of the extra ATP molecules?
- A) photosystem II
 - B) photosystem I
 - C) cyclic electron flow
 - D) linear electron flow

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 10.2

- 26) Which of the following processes would be most directly affected if a thylakoid membrane is punctured so that the interior of the thylakoid is no longer separated from the stroma?
- A) splitting of water
 - B) flow of electrons from photosystem II to photosystem I
 - C) synthesis of ATP
 - D) reduction of NADP⁺

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 10.2

- 27) Where are ATP synthase complexes located in plant cells?
- A) thylakoid membrane only
 - B) inner mitochondrial membrane only
 - C) thylakoid membrane and inner mitochondrial membrane
 - D) thylakoid membrane and plasma membrane

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

28) In mitochondria, an electron transport chain pumps protons from the matrix into the intermembrane space, whereas in chloroplasts, an electron transport chain pumps protons from the _____.

- A) matrix to the stroma
- B) stroma to the thylakoid space
- C) thylakoid space to the matrix
- D) thylakoid space to the stroma

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

29) Which of the following events are associated with chemiosmosis in chloroplasts?

- A) The pH of the stroma increases and ATP is synthesized.
- B) The pH of the thylakoid space increases and ATP is synthesized.
- C) The pH of the cytoplasm outside the chloroplast decreases and ATP is synthesized.
- D) The pH of the stroma decreases and ATP is hydrolyzed.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 10.2

30) Which of the following statements best describes the relationship between photosynthesis and cellular respiration?

- A) Cellular respiration runs the biochemical pathways of photosynthesis in reverse.
- B) Photosynthesis stores energy in complex organic molecules; cellular respiration releases energy from complex organic molecules.
- C) Photosynthesis occurs only in plants; cellular respiration occurs only in animals.
- D) Photosynthesis is catabolic; cellular respiration is anabolic.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 10.1

31) In photosynthetic cells, synthesis of ATP by chemiosmosis occurs during _____.

- A) photosynthesis only
- B) respiration only
- C) photosynthesis and respiration
- D) photosynthesis, respiration, and fermentation

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 10.2

32) Carbon dioxide is split to form oxygen gas and carbon compounds in which of the following metabolic pathways?

- A) only photosynthesis
- B) only respiration
- C) photosynthesis and respiration
- D) neither photosynthesis nor respiration

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

33) What is the relationship between the wavelength of light and the quantity of energy per photon?

- A) They have a direct, linear relationship.
- B) They are inversely related.
- C) They are logarithmically related.
- D) They are separate phenomena.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

34) P680⁺ is said to be the strongest biological oxidizing agent. Given its function, why is this necessary?

- A) It is the receptor for the most excited electron in either photosystem of photosynthesis.
- B) It is the molecule that transfers electrons to plastoquinone (Pq) of the electron transfer system.
- C) It transfers its electrons to reduce NADP⁺ to NADPH.
- D) It obtains electrons from the oxygen atom in a water molecule, so it must have a stronger attraction for electrons than oxygen has.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 10.2

35) Carotenoids are often found in foods that are considered to have antioxidant properties in human nutrition. What related function do they have in plants?

- A) They serve as accessory pigments to increase light absorption.
- B) They protect against oxidative damage from excessive light energy.
- C) They shield the sensitive chromosomes of the plant from harmful ultraviolet radiation.
- D) They reflect orange light and enhance red light absorption by chlorophyll.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

36) In a plant, which of the following reactions produce molecular oxygen (O_2)?

- A) the light reactions alone
- B) the Calvin cycle alone
- C) the light reactions and the Calvin cycle
- D) neither the light reactions nor the Calvin cycle

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.2

37) The mechanism of photophosphorylation is most similar to which of the following processes?

- A) substrate-level phosphorylation in glycolysis
- B) oxidative phosphorylation in cellular respiration
- C) the Calvin cycle
- D) reduction of $NADP^+$

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 10.2

38) Which of the following processes is most directly driven by light energy?

- A) creation of a pH gradient by pumping protons across the thylakoid membrane
- B) carbon fixation in the stroma
- C) reduction of $NADP^+$ molecules
- D) removal of electrons from chlorophyll molecules

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 10.2

39) A gardener is concerned that her greenhouse is getting too hot from too much light and seeks to shade her plants with colored translucent plastic sheets, the color of which allows passage of only that wavelength. What color should she use to reduce overall light energy but still maximize plant growth?

- A) green
- B) blue
- C) orange
- D) Any color will work equally well.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 10.2

40) A flask containing photosynthetic green algae and a control flask containing water with no algae are both placed under a bank of lights that is set to cycle between 12 hours of light and 12 hours of dark. The dissolved oxygen concentrations in both flasks are monitored. Predict what the relative dissolved oxygen concentrations will be in the flask with algae compared to the control flask. The dissolved oxygen in the flask with algae will _____.

- A) always be higher
- B) always be lower
- C) be higher in the light, but the same in the dark
- D) be higher in the light, but lower in the dark

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 10.2

41) Which of the following molecules are products of the light reactions of photosynthesis that are utilized in the Calvin cycle?

- A) CO₂ and glucose
- B) H₂O and O₂
- C) ADP, \textcircled{P}_i , and NADP⁺
- D) ATP and NADPH

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.3

42) Where in a plant cell does the Calvin cycle take place?

- A) stroma of the chloroplast
- B) thylakoid membrane
- C) interior of the thylakoid (thylakoid space)
- D) outer membrane of the chloroplast

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.3

43) In the initial step in carbon fixation, a molecule of CO₂ is attached to RuBP to produce a six-carbon molecule, which is immediately split to produce two molecules of 3-phosphoglycerate. After phosphorylation and reduction produces glyceraldehyde 3-phosphate (G3P), what more needs to occur to complete the Calvin cycle?

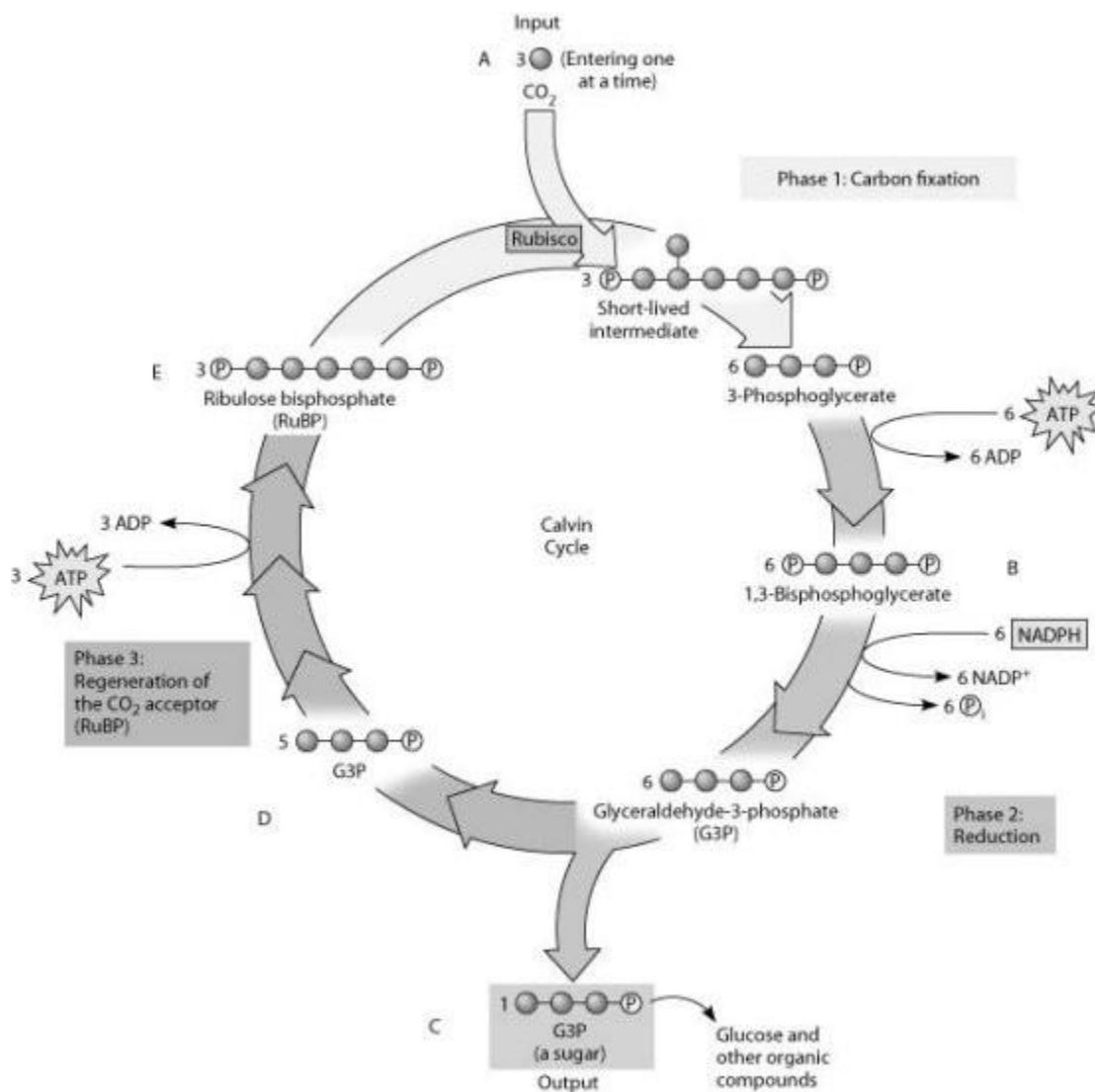
- A) addition of a pair of electrons from NADPH
- B) regeneration of ATP from ADP
- C) regeneration of RuBP
- D) regeneration of NADP⁺

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.3

44) Use the following figure to answer the question.



Refer to the accompanying figure and the molecules labeled A, B, C, D, and E. If the carbon atom of each of the incoming CO_2 molecules is labeled with a radioactive isotope of carbon, which organic molecules will be radioactively labeled after one cycle?

- A) C only
- B) B, C, D, and E
- C) C, D, and E only
- D) B and C only

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 10.3

45) To identify the molecule that accepts CO₂, Calvin and Benson manipulated the carbon-fixation cycle by either cutting off CO₂ or cutting off light from cultures of photosynthetic algae. They then measured the concentrations of various metabolites immediately following the manipulation. How would these experiments help identify the CO₂ acceptor?

- A) The CO₂ acceptor concentration would decrease when either the CO₂ or light are cut off.
- B) The CO₂ acceptor concentration would increase when either the CO₂ or light are cut off.
- C) The CO₂ acceptor concentration would decrease when the CO₂ is cut off, but increase when the light is cut off.
- D) The CO₂ acceptor concentration would increase when the CO₂ is cut off, but decrease when the light is cut off.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 10.3

46) Which of the following sequences correctly represents the flow of electrons during photosynthesis?

- A) NADPH → O₂ → CO₂
- B) H₂O → NADPH → Calvin cycle
- C) NADPH → chlorophyll → Calvin cycle
- D) NADPH → electron transport chain → O₂

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.3

47) Which of the following processes occurs during the Calvin cycle?

- A) reduction of NADPH
- B) release of oxygen
- C) regeneration of the CO₂ acceptor
- D) production of ATP

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.3

48) The reducing power for Calvin cycle reactions is provided by which of the following molecules?

- A) ATP
- B) NADH
- C) NADP⁺
- D) NADPH

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.3

49) What would be the expected effect on plants if the atmospheric CO₂ concentration was doubled?

- A) All plants would have faster growth rates.
- B) C₃ plants would have faster growth rates; C₄ plants would be minimally affected.
- C) C₄ plants would have faster growth rates; C₃ plants would be minimally affected.
- D) C₃ plants would have faster growth rates; C₄ plants would have slower growth rates.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 10.4

50) Why are C₄ plants able to photosynthesize with no apparent photorespiration?

- A) They do not participate in the Calvin cycle.
- B) They use PEP carboxylase to initially fix CO₂.
- C) They conserve water more efficiently.
- D) They exclude oxygen from their tissues.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.4

51) CAM plants keep stomata closed in the daytime, thus reducing loss of water. They can do this because they _____.

- A) fix CO₂ into organic acids during the night
- B) fix CO₂ into sugars in the bundle-sheath cells
- C) fix CO₂ into pyruvate in the mesophyll cells
- D) use photosystem I and photosystem II at night

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.4

52) Why might the alternative pathways of photosynthesis using C₄ or CAM systems be described as metabolic compromises?

- A) Both pathways increase the rate of photosynthesis but also increase the rate of water loss.
- B) The CAM pathway allows more CO₂ into the plant but also increases the rate of water loss.
- C) The C₄ pathway decreases water loss but also increases the rate of photorespiration.
- D) Both pathways minimize photorespiration but also expend more ATP during carbon fixation.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 10.4

53) What would be a likely consequence of a mutation in plants that results in a photorespiration deficiency?

- A) Photosynthetic efficiency would be reduced at low light intensities.
- B) Cells would carry on the Calvin cycle at a much slower rate.
- C) There would be more cellular damage from harmful products of the light reactions of photosynthesis.
- D) Less oxygen would be produced by photosynthesis.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 10.4

54) Compared to C₃ plants, C₄ plants _____.

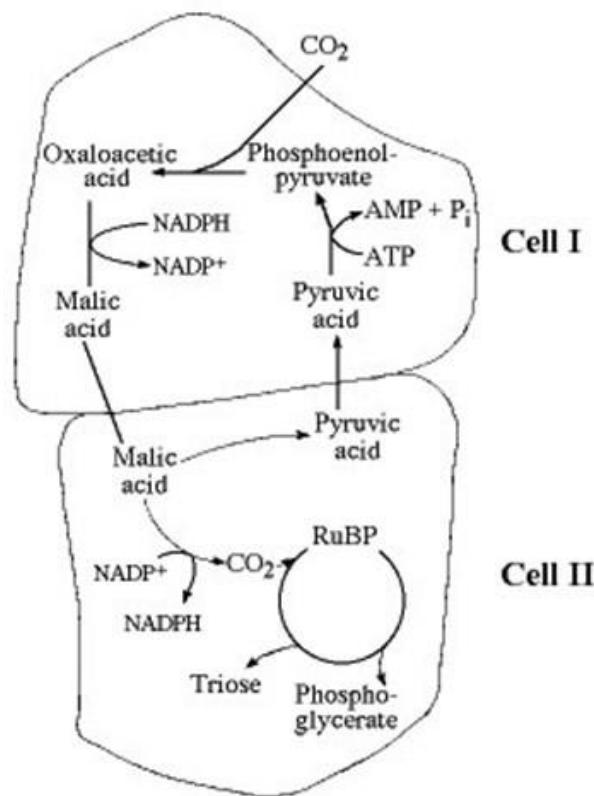
- A) can continue to fix CO₂ even at lower CO₂ concentrations and higher oxygen concentrations
- B) have higher rates of photorespiration
- C) do not use rubisco for carbon fixation
- D) make a four-carbon compound, oxaloacetate, which is then delivered to the citric acid cycle in mitochondria

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 10.4

55) Use the following figure to answer the question.



Which of the following statements is true concerning the accompanying figure?

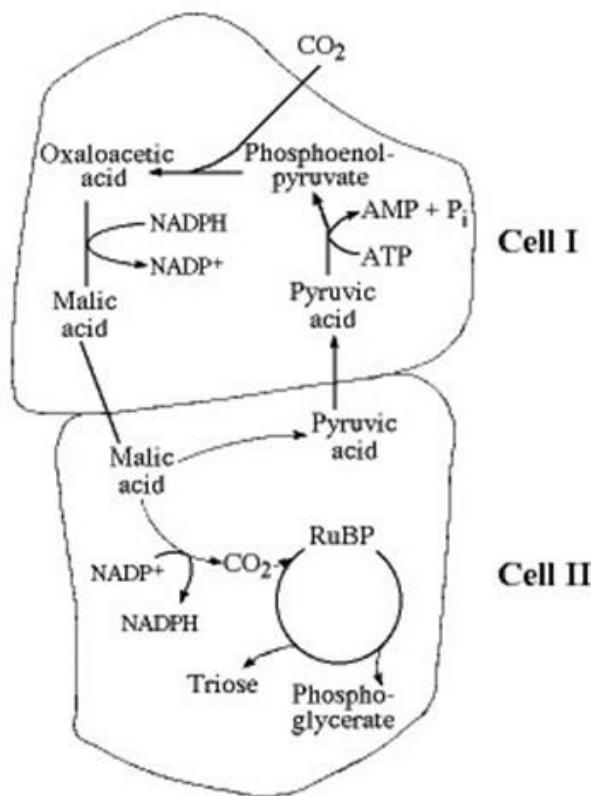
- A) It represents a C₄ photosynthetic system.
- B) It represents an adaptation that maximizes photorespiration.
- C) It represents a C₃ photosynthetic system.
- D) It represents a CAM photosynthetic system.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.4

56) Use the following figure to answer the question.



Referring to the accompanying figure, where would elevated concentrations of oxygen inhibit carbon fixation reactions?

- A) cell I only
- B) cell II only
- C) neither cell I nor cell II
- D) both cell I and cell II

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 10.4

57) Which of the following statements summarizes the metabolic results of photorespiration?

- A) It produces ATP and consumes oxygen and carbon dioxide.
- B) It produces carbon dioxide and consumes ATP and oxygen.
- C) It produces oxygen and consumes ATP and carbon dioxide.
- D) It produces oxygen and ATP and consumes carbon dioxide.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 10.4

58) Students conducted an experiment to determine the effect of light intensity on the rate of photosynthesis. They punched 40 leaf disks from spinach leaves and used a syringe partially filled with water to pull the gases from the leaf disks so that all leaf disks sunk to the bottom of the syringe. Ten leaf disks from the syringe were placed in each of four cups and covered with 50 ml of the solutions as indicated below. All leaf disks were resting on the bottom of the cups when the experiment began. The volume of liquid in each cup and the temperature of the solutions were held constant. All cups were placed 0.5 meters from the designated light source. A large beaker of water was placed between the light and the cups to act as a heat sink to prevent a change in temperature. At the end of 10 minutes, the number of disks floating in each cup was recorded.

Trial	Grams of baking soda (CO ₂ source)	Wattage of light bulb	Disks floating at 10 minutes
1	0.5	25	3
2	0.5	50	5
3	0.5	75	9
4	0	75	0

Use your knowledge of the mechanism of photosynthesis and the data presented in the chart to determine which of the statements is a correct explanation for the students' data.

- A) Cup 1 had a low rate of photosynthesis because 0.5 grams of baking soda did not provide a sufficient amount of CO₂.
- B) Cup 2 had the highest rate of photosynthesis because it had the highest ratio of disks floating to wattage of light.
- C) Cup 3 had the same rate of photosynthesis as Cup 1 because they had the same ratio of disks floating to wattage of light.
- D) Cup 4 had the lowest rate of photosynthesis because it had the least CO₂.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 10.1

10.2 Student Edition End-of-Chapter Questions

- 1) The light reactions of photosynthesis supply the Calvin cycle with
- A) light energy.
 - B) CO₂ and ATP.
 - C) H₂O and NADPH.
 - D) ATP and NADPH.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 2) Which of the following sequences correctly represents the flow of electrons during photosynthesis?
- A) NADPH → O₂ → CO₂
 - B) H₂O → NADPH → Calvin cycle
 - C) H₂O → photosystem I → photosystem II
 - D) NADP → Helectron transport chain → O₂

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 3) How is photosynthesis similar in C₄ plants and CAM plants?
- A) In both cases, only photosystem I is used.
 - B) Both types of plants make sugar without the Calvin cycle.
 - C) In both cases, rubisco is not used to fix carbon initially.
 - D) Both types of plants make most of their sugar in the dark.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Which of the following statements is a correct distinction between autotrophs and heterotrophs?
- A) Autotrophs, but not heterotrophs, can nourish themselves beginning with CO₂ and other nutrients that are inorganic.
 - B) Only heterotrophs require chemical compounds from the environment.
 - C) Cellular respiration is unique to heterotrophs.
 - D) Only heterotrophs have mitochondria.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 5) Which of the following does *not* occur during the Calvin cycle?
- A) carbon fixation
 - B) oxidation of NADPH
 - C) release of oxygen
 - D) regeneration of the CO₂ acceptor

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 6) In mechanism, photophosphorylation is most similar to
- A) substrate-level phosphorylation in glycolysis.
 - B) oxidative phosphorylation in cellular respiration.
 - C) carbon fixation.
 - D) reduction of NADP⁺.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 7) Which process is most directly driven by light energy?
- A) creation of a pH gradient by pumping protons across the thylakoid membrane
 - B) reduction of NADP⁺ molecules
 - C) transfer of energy from pigment molecule to pigment molecule
 - D) ATP synthesis

Answer: C

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 11 Cell Communication

11.1 Multiple-Choice Questions

- 1) In yeast signal transduction, a yeast cell releases a mating factor, which _____.
A) acts back on the same cell that secreted the mating factor, changing its development
B) passes through the membranes of neighboring cells, binds to DNA, and initiates transcription
C) binds to receptors on the membranes of other types of yeast cells
D) diffuses through the membranes of distant cells, causing them to produce factors that initiate long-distance migrations

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.1

- 2) Yeast cells of mating type **a** are genetically engineered to produce only mating factor **a** instead of the normal mating factor **A**. The gene for the mating factor receptor was unaltered. How will these engineered cells behave in terms of mating?
A) They will only mate with normal mating type **a** cells.
B) They will only mate with normal mating type **A** cells.
C) They will mate with each other or with normal mating type **a** cells, but not with normal mating type **A** cells.
D) They will only mate each other and not with normal mating type **a** or **A** cells.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 11.1

- 3) In the formation of biofilms, such as those forming on unbrushed teeth, cell signaling serves which function?
A) formation of mating complexes
B) aggregation of bacteria that can cause cavities
C) secretion of substances that inhibit foreign bacteria
D) digestion of unwanted parasite populations

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.1

- 4) Which of the following is a type of local signaling in which a cell secretes a signal molecule that affects neighboring cells?
A) hormonal signaling
B) autocrine signaling
C) paracrine signaling
D) synaptic signaling

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.1

- 5) Hormones are chemical substances produced in one organ that are released into the bloodstream and affect the function of a target organ. Which of the following conditions is required for the target organ to respond to a particular hormone?
- A) Cells in the target organ must modify their plasma membranes to allow the hormone to enter the cytoplasm.
 - B) The target organ must be the same as the organ that produced the hormone.
 - C) The target organ must have the opposite mating type of the organ that produced the hormone.
 - D) The target organ must have receptors that recognize and bind the hormone molecule.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.1

- 6) In which of the following ways do plant hormones differ from hormones in animals?
- A) Plant hormones frequently travel through the air as a gas.
 - B) Animal hormones are only local regulators.
 - C) Plant hormones commonly travel through the soil from one plant to another.
 - D) Animal hormones typically travel from the hormone producing cell to an adjacent responding cell through gap junctions.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.1

- 7) When a neuron responds to a particular neurotransmitter by opening gated ion channels, the neurotransmitter is serving as which part of the signal pathway?

- A) relay molecule
- B) transducer
- C) signal molecule
- D) response molecule

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.2

8) Use the following figure to answer the question.



Which of the following types of signaling is represented in the figure?

- A) autocrine
- B) paracrine
- C) hormonal
- D) synaptic

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.1

9) Use the following figure to answer the question.



In the figure, the dots in the space between the two structures represent which of the following?

- A) receptor molecules
- B) signal transducers
- C) neurotransmitters
- D) hormones

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.1

- 10) Which observation suggested to Sutherland the involvement of a second messenger in epinephrine's effect on liver cells?
- A) Receptor studies indicated that epinephrine was a ligand.
 - B) Glycogen breakdown was observed only when epinephrine was administered to intact cells.
 - C) Glycogen breakdown was observed when epinephrine and glycogen phosphorylase were combined in a cell-free system.
 - D) Epinephrine was known to have different effects on many types of cells.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 11.1

- 11) Which of the following statements about a G protein signaling pathway is true?
- A) A G protein-coupled receptor bound to GTP is in its active state.
 - B) A G protein bound to GTP is in its active state.
 - C) A G protein bound to GDP is in its active state.
 - D) Hydrolysis of bound GTP by a G protein activates the G protein.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.2

- 12) What is the most likely mechanism by which testosterone functions inside a cell?
- A) It acts as a signal receptor that activates tyrosine kinases.
 - B) It binds with a receptor protein that enters the nucleus and activates expression of specific genes.
 - C) It acts as a steroid signal receptor that activates ion channel proteins in the plasma membrane.
 - D) It coordinates a phosphorylation cascade that reduces spermatogenesis.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 11.2

- 13) Scientists have found that extracellular matrix components may induce specific gene expression in embryonic tissues such as the liver and testes. For this to happen, there must be direct communication between the extracellular matrix and the developing cells. Which kind of transmembrane protein would most likely be involved in this kind of induction?
- A) integrins
 - B) fibronectins
 - C) actin microfilaments
 - D) receptor tyrosine kinases

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 11.2

14) One of the major categories of receptors in the plasma membrane functions by forming dimers, adding phosphate groups, and then activating relay proteins. Which type does this?

- A) G protein-coupled receptors
- B) ligand-gated ion channels
- C) steroid receptors
- D) receptor tyrosine kinases

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.2

15) Which of the following statements describes a likely effect of a drug designed that inhibits the cellular response to testosterone?

- A) The cytoplasmic levels of cAMP would decrease.
- B) The transcription of certain genes would decrease.
- C) The cytosolic calcium concentration would increase.
- D) The activity of G proteins would decrease.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 11.2

16) Many G protein-coupled receptors contain seven transmembrane α -helical domains. The amino end of the protein lies at the exterior of the plasma membrane. Loops of amino acids connect the helices either at the exterior surface or on the cytosolic surface of the membrane. The loop on the cytosolic side between helices 5 and 6 is usually substantially longer than the others. Where would you expect to find the carboxyl end of the protein?

- A) at the exterior surface
- B) at the cytosolic surface
- C) connected with the loop at H5 and H6
- D) embedded in the phospholipid bilayer of the membrane

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 11.2

17) Many G protein-coupled receptors contain seven transmembrane α -helical domains. The amino end of the protein lies at the exterior of the plasma membrane. Loops of amino acids connect the helices either at the exterior surface or on the cytosolic surface of the membrane. The loop on the cytosolic side between helices 5 and 6 is usually substantially longer than the others. Where would a coupled G protein most likely interact with this receptor?

- A) at the amino end
- B) at the carboxyl end
- C) along the exterior margin
- D) at the loop between H5 and H6

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 11.2

18) Binding of a signaling molecule to which type of receptor leads directly to a change in the distribution of ions on opposite sides of the membrane?

- A) receptor tyrosine kinase
- B) G protein-coupled receptor
- C) ligand-gated ion channel
- D) steroid receptor

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.2

19) Why does testosterone, a lipid-soluble signaling molecule that crosses the membranes of all cells, affect only target cells?

- A) Only target cells retain the appropriate genes regulated by testosterone.
- B) Intracellular receptors for testosterone are present only in target cells.
- C) Only target cells possess the cytosolic enzymes that transduce the signal from testosterone to adenylyl cyclase.
- D) Only in target cells is testosterone able to initiate the phosphorylation cascade leading to activated transcription factor.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 11.2

20) If an animal cell suddenly lost the ability to produce GTP, what might happen to its signaling system?

- A) It would not be able to activate G proteins on the cytoplasmic side of the plasma membrane.
- B) It would be able to carry out reception and transduction but would not be able to respond to a signal.
- C) It would use ATP instead of GTP to activate G proteins on the cytoplasmic side of the plasma membrane.
- D) It would not be able to activate receptor tyrosine kinases.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 11.2

21) Which of the following statements is true of steroid receptors?

- A) The receptor molecules are themselves lipids or glycolipids.
- B) The receptor may be inside the nucleus of a target cell.
- C) The unbound steroid receptors are quickly recycled by lysosomes.
- D) Steroid receptors are typically bound to the external surface of the nuclear membrane.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.2

22) Particular receptor tyrosine kinases (RTKs) that promote excessive cell division are found at high levels in various cancer cells. HER2 is an RTK that is present at excessively high levels in some breast cancer cells. Herceptin is a protein that binds to HER2 and inhibits cell division. Herceptin may be an effective treatment for breast cancer treatment under which of the following conditions?

- A) If injection of HER2 in the patient's cancer cells stimulates cell division.
- B) If the patient's cancer cells have excessive levels of HER2.
- C) If the patient's genome codes for the HER2.
- D) If the patient has excessive levels of other RTKs in cancer cells.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 11.2

23) Which of the following activities would be inhibited by a drug that specifically blocks the addition of phosphate groups to proteins?

- A) binding of G proteins to G protein-coupled receptors
- B) ligand-gated ion channel signaling pathways
- C) adenylyl cyclase activity
- D) receptor tyrosine kinase activity

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 11.2

24) The receptors for steroid hormones are located inside the cell instead of the membrane surface like most other signal receptors. How do steroids gain access to their receptors?

- A) Steroid hormone receptors undergo conformational changes that relocate them on the membrane surface.
- B) Both steroid hormones and their receptors are produced by the same cells.
- C) Steroid hormones are lipid soluble, so they can readily diffuse through the lipid bilayer of the cell membrane.
- D) Steroid hormones first bind to a steroid activator and this complex is transported across the cell membrane by a steroid transport protein.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.2

25) Not all intercellular signals require transduction. Which one of the following signals would be processed without transduction?

- A) a lipid-soluble signal
- B) a signal that is weakly bound to a nucleotide
- C) a signal that binds to a receptor in the cell membrane
- D) a signal that binds to the extracellular matrix

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 11.2

- 26) What does it mean to say that a signal is transduced?
- A) The signal enters the cell directly and binds to a receptor inside.
 - B) The physical form of the signal changes as it passes from the cell membrane to the ultimate intracellular target.
 - C) The signal is amplified, such that even one signal molecule evokes a large response.
 - D) The signal triggers a sequence of phosphorylation events inside the cell.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.3

- 27) Which of the following processes generally requires protein phosphorylation?
- A) activation of receptor tyrosine kinases
 - B) activation of steroid hormone receptors
 - C) activation of G protein-coupled receptors
 - D) activation ligand-gated ion channels

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 11.3

- 28) A signal transmitted via phosphorylation of a series of proteins is generally associated with which of the following events?
- A) conformational changes to each protein in the series
 - B) binding of a hormone to an intracellular receptor
 - C) activation of a ligand-gated ion channel
 - D) production of ATP in the process of signal transduction

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.3

- 29) Which of the following is the most plausible explanation for why an animal cell would be unable to reduce the Ca^{2+} concentration in its cytosol compared with the extracellular fluid?
- A) inactivation of calcium-gated ion channels in the cell membrane
 - B) excessive transport of calcium from the cytosol into the endoplasmic reticulum
 - C) insufficient ATP levels in the cytosol
 - D) insufficient levels of protein kinase in the cell

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 11.3

- 30) How does the toxin of *Vibrio cholerae* cause profuse diarrhea?
- A) It modifies a G protein involved in regulating salt and water secretion.
 - B) It modifies adenylyl cyclase and triggers excess formation of cAMP.
 - C) It signals IP₃ to act as a second messenger for the release of calcium.
 - D) It modifies a ligand-gated ion channel.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.3

31) Which of the following results would most likely be an immediate result of a growth factor binding to its receptor?

- A) protein kinase activity
- B) adenylyl cyclase activity
- C) cAMP activity
- D) phosphorylase activity

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 11.3

32) The activity of adenylyl cyclase is essentially the opposite of which of the following enzymes?

- A) protein kinase
- B) protein phosphatase
- C) phosphodiesterase
- D) phosphorylase

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.3

33) Caffeine is an inhibitor of phosphodiesterase. Therefore, the cells of a person who has recently consumed coffee would have increased levels of which of the following molecules?

- A) phosphorylated proteins
- B) cAMP
- C) adenylyl cyclase
- D) activated G proteins

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 11.3

34) An inhibitor of which of the following enzymes could be used to block the release of calcium from the endoplasmic reticulum?

- A) serine/threonine kinases
- B) phosphodiesterase
- C) phospholipase C
- D) adenylyl cyclase

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 11.3

35) Which of the following statements is true of signal molecules?

- A) When signal molecules first bind to receptor tyrosine kinases, the receptors phosphorylate a number of nearby molecules.
- B) In response to some G protein-mediated signals, a special type of lipid molecule associated with the plasma membrane is cleaved to form IP₃ and calcium.
- C) In most cases, signal molecules interact with the cell at the plasma membrane, enter the cell, and eventually enter the nucleus.
- D) Protein kinase A activation is one possible result of signal molecules binding to G protein-coupled receptors.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 11.3

36) Which of the following is a correct association?

- A) kinase activity and the addition of a tyrosine
- B) phosphodiesterase activity and the removal of phosphate groups
- C) GTPase activity and hydrolysis of GTP to GDP
- D) adenylyl cyclase activity and the conversion of cAMP to AMP

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 11.3

37) Protein kinase is an enzyme that functions in which of the following ways?

- A) as a second messenger molecule
- B) as a receptor for various signal molecules
- C) activates or inactivates other proteins by adding a phosphate group to them
- D) activates a G protein

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.3

38) Viagra causes dilation of blood vessels and increased blood flow to the penis, facilitating erection. Viagra acts by inhibiting which of the following events?

- A) hydrolysis of cGMP to GMP
- B) hydrolysis of GTP to GDP
- C) dephosphorylation of cGMP
- D) formation of cGMP from GTP

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.3

39) Which of the following amino acids are most frequently phosphorylated by protein kinases in the cytoplasm during signal transduction?

- A) tyrosines
- B) glycine and histidine
- C) serine and threonine
- D) glycine and glutamic acid

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.3

40) What role do phosphatases play in signal transduction pathways?

- A) They transfer a phosphate group from one protein in the pathway to the next molecule in the series.
- B) They activate protein kinases by phosphorylation.
- C) They amplify the second messenger cAMP.
- D) They inactivate protein kinases to turn off signal transduction.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.3

41) If a pharmaceutical company wished to design a drug to maintain low blood sugar levels, one approach might be to design a compound that does which of the following?

- A) activates epinephrine receptors in liver cells
- B) increases cAMP production in liver cells
- C) blocks G protein activity in liver cells
- D) increases glycogen phosphorylase activity in liver cells

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 11.3

42) If a pharmaceutical company wished to design a drug to maintain low blood sugar levels, one approach might be to design a compound that does which of the following?

- A) increases glycogen phosphorylase activity in liver cells
- B) activates adenylyl cyclase in liver cells
- C) stimulates G protein activity in liver cells
- D) increases phosphodiesterase activity in liver cells

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 11.3

43) Consider this pathway:

epinephrine → G protein-coupled receptor → G protein → adenylyl cyclase → cAMP

The second messenger in this pathway is _____.

- A) cAMP
- B) G protein
- C) adenylyl cyclase
- D) G protein-coupled receptor

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.3

44) Sutherland discovered that the signaling molecule epinephrine is responsible for which of the following events?

- A) Stimulating glycogen synthesis.
- B) Decreasing blood glucose levels.
- C) Interacting directly with glycogen phosphorylase.
- D) Elevating cytosolic concentrations of cyclic AMP.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.3

45) Which of the following is true during a typical cAMP-mediated signal transduction event?

- A) The second messenger is the last part of the system to be activated.
- B) A hormone activates the second messenger by directly binding to it.
- C) The second messenger amplifies the hormonal response by attracting more hormones to the cell being affected.
- D) Adenylyl cyclase is activated after the hormone binds to the cell and before phosphorylation of proteins occurs.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.3

46) Put the steps of the process of signal transduction in the order they occur.

1. A conformational change in the signal-receptor complex activates an enzyme.
2. Protein kinases are activated.
3. A signal molecule binds to a receptor.
4. Target proteins are phosphorylated.
5. Second messenger molecules are released.

A) 1, 2, 3, 4, 5

B) 3, 1, 2, 4, 5

C) 3, 1, 5, 2, 4

D) 1, 2, 5, 3, 4

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 11.3

47) What is a primary function of transcription factors?

- A) They regulate the synthesis of DNA in response to a signal.
- B) They convert ATP into cAMP.
- C) They control gene expression.
- D) They regulate the release of calcium from the endoplasmic reticulum.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.4

48) At puberty, an adolescent female body changes in both structure and function of several organ systems, primarily under the influence of changing concentrations of estrogen and other steroid hormones. How can one hormone, such as estrogen, mediate so many effects?

- A) Estrogen is produced in very large concentration by nearly every tissue of the body.
- B) Each cell responds in the same way when steroids bind to the cell surface.
- C) Estrogen is kept away from the surface of any cells, not able to bind it at the surface.
- D) Estrogen binds to specific receptors inside many kinds of cells, each with different responses.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 11.4

49) What are scaffolding proteins?

- A) microtubule arrays that allow lipid-soluble hormones to get from the cell membrane to the nuclear pores
- B) large molecules to which several relay proteins attach to facilitate cascade effects
- C) relay proteins that orient receptors and their ligands in appropriate directions to facilitate complex formation
- D) proteins that enter the nucleus of a cell to regulate transcription

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.4

50) Phosphorylation cascades involving a series of protein kinases are useful for cellular signal transduction because they _____.

- A) are species specific
- B) always lead to the same cellular response
- C) amplify the original signal many times
- D) counter the harmful effects of phosphatases

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.4

51) A mutation that knocks out the GTPase activity of a G protein would have what effect on a cell?

- A) The concentration of available GTP would decrease.
- B) The number of G proteins in the cell would increase.
- C) The G protein would be inactivated by a G protein-coupled receptor/signal molecule complex.
- D) The G protein would always be active.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 11.4

52) Why has *C. elegans* proven to be a useful model for understanding apoptosis?

- A) *C. elegans* does not naturally use apoptosis, but can be induced to do so in the laboratory.
- B) *C. elegans* undergoes a fixed and easy-to-visualize number of apoptotic events during its normal development.
- C) *C. elegans* has large cells wherein apoptosis is easily observed without the aid of a microscope.
- D) As *C. elegans* ages, its cells die progressively until the whole organism is dead.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 11.5

53) Which of the following statements describes the events of apoptosis?

- A) The cell dies, it is lysed, its organelles are phagocytized, and its contents are recycled.
- B) The cell's DNA and organelles become fragmented, the cell dies, and it is phagocytized.
- C) The cell's DNA and organelles become fragmented, the cell shrinks and forms blebs, and the cell's parts are packaged in vesicles that are digested by specialized cells.
- D) The cell's nucleus and organelles are lysed, and then the cell enlarges and bursts.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.5

54) If an adult person has a faulty version of the human analog to *ced-4* of the nematode, which of the following is most likely to result?

- A) activation of a developmental pathway found in the worm but not in humans
- B) a form of cancer in which there is insufficient apoptosis
- C) formation of molecular pores in the mitochondrial outer membrane
- D) excess skin loss

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 11.5

55) In the nematode *C. elegans*, *ced-9* prevents apoptosis in a normal cell in which of the following ways?

- A) It prevents the caspase activity of *ced-3* and *ced-4*.
- B) *Ced-9* remains inactive until it is signaled by *ced-3* and other caspases.
- C) *Ced-9* cleaves to produce *ced-3* and *ced-4*.
- D) *Ced-9* prevents blebbing by its action on the cell membrane.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.5

56) In research on aging (both cellular aging and organismal aging), it has been found that aged cells do not progress through the cell cycle as they had previously. Which of the following, if found in cells or organisms as they age, would provide evidence that this is related to cell signaling?

- A) Growth factor ligands do not bind as efficiently to receptors.
- B) Hormone concentrations decrease.
- C) cAMP levels change very frequently.
- D) Enzymatic activity declines.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 11.5

57) Which of the following provides the best evidence that cell-signaling pathways evolved early in the history of life?

- A) Cell-signaling pathways are seen in "primitive" cells such as bacteria and yeast.
- B) Bacteria and yeast cells signal each other in a process called quorum sensing.
- C) Signal transduction molecules identified in distantly related organisms are similar.
- D) Most signals in all types of cells are received by cell surface receptors.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 11.1

58) Cells that are infected, damaged, or have reached the end of their functional life span often undergo "programmed cell death." This controlled cell suicide is called apoptosis. Select the appropriate description of this event on a cell's life cycle.

- A) Apoptosis is regulated by cell surface receptors that signal when a cell has reached its density-dependent limits.
- B) During apoptosis, dying cells leak out their contents, including digestive enzymes that also destroy healthy cells.
- C) During apoptosis, cellular agents chop up the DNA and fragment the organelles and other cytoplasmic components of a cell.
- D) Each cell organelle has protein signals that initiate the breakdown of the organelle's components, which leads to cell death.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 11.5

11.2 Student Edition End-of-Chapter Questions

1) Binding of a signaling molecule to which type of receptor leads directly to a change in the distribution of substances on opposite sides of the membrane?

- A) intracellular receptor
- B) G protein-coupled receptor
- C) phosphorylated receptor tyrosine kinase dimer
- D) ligand-gated ion channel

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

2) The activation of receptor tyrosine kinases is characterized by

- A) dimerization and phosphorylation.
- B) dimerization and IP₃ binding.
- C) a phosphorylation cascade.
- D) GTP hydrolysis.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

3) Lipid-soluble signaling molecules, such as aldosterone, cross the membranes of all cells but affect only target cells because

- A) only target cells retain the appropriate DNA segments.
- B) intracellular receptors are present only in target cells.
- C) only target cells have enzymes that break down aldosterone.
- D) only in target cells is aldosterone able to initiate the phosphorylation cascade that turns genes on.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

4) Consider this pathway: epinephrine → G protein-coupled receptor → G protein → adenylyl cyclase → AMP. Identify the second messenger.

- A) cAMP
- B) G protein
- C) GTP
- D) adenylyl cyclase

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

5) Apoptosis involves all but which of the following?

- A) fragmentation of the DNA
- B) cell-signaling pathways
- C) lysis of the cell
- D) digestion of cellular contents by scavenger cells

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

6) Which observation suggested to Sutherland the involvement of a second messenger in epinephrine's effect on liver cells?

- A) Enzymatic activity was proportional to the amount of calcium added to a cell-free extract.
- B) Receptor studies indicated that epinephrine was a ligand.
- C) Glycogen breakdown was observed only when epinephrine was administered to intact cells.
- D) Glycogen breakdown was observed only when epinephrine and glycogen phosphorylase were mixed.

Answer: C

Bloom's Taxonomy: Application/Analysis

7) Protein phosphorylation is commonly involved with all of the following *except*

- A) activation of receptor tyrosine kinases.
- B) activation of protein kinase molecules.
- C) activation of G protein-coupled receptors.
- D) regulation of transcription by signaling molecules.

Answer: C

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 12 The Cell Cycle

12.1 Multiple-Choice Questions

1) Eukaryotic chromosomes are composed of which of the following macromolecules?

- A) DNA and RNA
- B) DNA only
- C) DNA and proteins
- D) DNA and phospholipids

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.1

2) Starting with a fertilized egg (zygote), a series of six cell divisions would produce an early embryo with how many cells?

- A) 12
- B) 16
- C) 32
- D) 64

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 12.1

3) In a diploid cell with 5 chromosome pairs ($2n = 10$), how many centromeres will be found in a nucleus at G2 of the cell division cycle?

- A) 5
- B) 10
- C) 20
- D) 40

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 12.2

4) Scientists isolate cells in various phases of the cell cycle. They isolate a group of cells that have 1 1/2 times more DNA than G1 phase cells. What is the most likely part of the cell cycle from which these cells were isolated?

- A) between the G1 and S phases in the cell cycle
- B) in the G2 phase of the cell cycle
- C) in the M phase of the cell cycle
- D) in the S phase of the cell cycle

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 12.2

5) G₁ is associated with which of the following cellular events?

- A) normal growth and cell function
- B) DNA replication
- C) the beginning of mitosis
- D) break down of the nuclear membrane

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

6) What is the name of the microtubule-organizing center found in animal cells as an identifiable structure present during all phases of the cell cycle?

- A) centriole
- B) centrosome
- C) centromere
- D) kinetochore

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

7) In the cells of many eukaryotic species, the nuclear envelope has to disappear to permit which of the following events in the cell cycle?

- A) DNA synthesis
- B) attachment of microtubules to kinetochores
- C) separation of the centrosomes
- D) condensation of the chromosomes

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

8) The mitotic spindle plays a critical role in which of the following processes?

- A) splitting of the cell (cytokinesis) following mitosis
- B) triggering the compaction and condensation of chromosomes
- C) dissolving the nuclear membrane
- D) separation of sister chromatids

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

9) Metaphase is characterized by _____.

- A) alignment of chromosomes on the equator of the cell
- B) separation of the centromeres
- C) cytokinesis
- D) separation of sister chromatids

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

- 10) In what way do kinetochore microtubules facilitate the process of splitting the centromeres?
- A) They use motor proteins to hydrolyze the centromere at specific arginine residues.
 - B) They create tension by pulling toward opposite poles.
 - C) They slide past each other like actin microfilaments.
 - D) They phosphorylate the centromere, thereby changing its conformation.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 12.2

- 11) Certain cell types normally have several nuclei per cell. How could such multinucleated cells be explained?
- A) The cell underwent repeated cytokinesis but no mitosis.
 - B) The cell underwent repeated mitosis with simultaneous cytokinesis.
 - C) The cell underwent repeated mitosis, but cytokinesis did not occur.
 - D) The cell had multiple S phases before it entered mitosis.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 12.2

- 12) How is plant cell cytokinesis different from animal cell cytokinesis?
- A) The contractile filaments found in plant cells are structures composed of carbohydrates; the cleavage furrow in animal cells is composed of contractile proteins.
 - B) Plant cells deposit vesicles containing cell wall building blocks on the metaphase plate; animal cells form a cleavage furrow.
 - C) The structural proteins of plant cells separate the two cells; in animal cells, a cell membrane separates the two daughter cells.
 - D) Plant cells divide after metaphase but before anaphase; animal cells divide after anaphase.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

- 13) FtsZ is a bacterial cytoskeletal protein that forms a contractile ring involved in binary fission. Its function is analogous to _____.
- A) the cleavage furrow of eukaryotic animal cells
 - B) the cell plate of eukaryotic plant cells
 - C) the mitotic spindle of eukaryotic cells
 - D) the microtubule-organizing center of eukaryotic cells

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 12.2

14) At which phase of the cell cycle do centrioles begin to move apart in animal cells?

- A) anaphase
- B) telophase
- C) metaphase
- D) prophase

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

15) In a diploid cell with 5 chromosome pairs ($2n = 10$), how many sister chromatids will be found in a nucleus at prophase of mitosis?

- A) 5
- B) 10
- C) 20
- D) 40

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 12.2

16) If there are 40 centromeres in a cell at anaphase of mitosis, how many chromosomes will be found in each daughter cell following cytokinesis?

- A) 10
- B) 20
- C) 40
- D) 80

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 12.2

17) If a cell at metaphase of mitosis contains 20 sister chromatids, how many chromosomes will be present in a G₁ cell?

- A) 5
- B) 10
- C) 20
- D) 40

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 12.2

18) Taxol is an anticancer drug extracted from the Pacific yew tree. In animal cells, Taxol prevents microtubule depolymerization. Thus, Taxol stops mitosis by interfering with which of the following structures or processes?

- A) the mitotic spindle
- B) cytokinesis
- C) centriole duplication
- D) chromosome condensation

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.3

19) Movement of the chromosomes during anaphase would be most affected by a drug that prevents which of the following events in mitosis and cell division?

- A) nuclear envelope breakdown
- B) elongation of microtubules
- C) shortening of microtubules
- D) formation of a cleavage furrow

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 12.2

20) Measurements of the amount of DNA per nucleus were taken on a large number of cells from a growing fungus. The measured DNA levels ranged from 3 to 6 picograms per nucleus. In which stage of the cell cycle did the nucleus contain 6 picograms of DNA?

- A) G₁
- B) S
- C) G₂
- D) G₀

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 12.2

21) A group of cells is assayed for DNA content immediately following mitosis and is found to have an average of 8 picograms of DNA per nucleus. How many picograms of DNA would be found in a nucleus at prophase of mitosis?

- A) 4
- B) 8
- C) 16
- D) 24

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 12.2

22) The beginning of anaphase is indicated by which of the following processes?

- A) Loss of kinetochores from the chromatids.
- B) Attachment of sister chromatids to each other by cohesin.
- C) Enzymatic cleavage of cohesin.
- D) Disappearance of the nuclear membrane.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

23) During which phase of mitosis do the chromatids become chromosomes?

- A) telophase
- B) anaphase
- C) prophase
- D) metaphase

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

24) A cleavage furrow is _____.

- A) a ring of vesicles forming a cell plate
- B) the separation of divided prokaryotes
- C) a groove in the plasma membrane between daughter nuclei
- D) the space that is created between two chromatids during anaphase

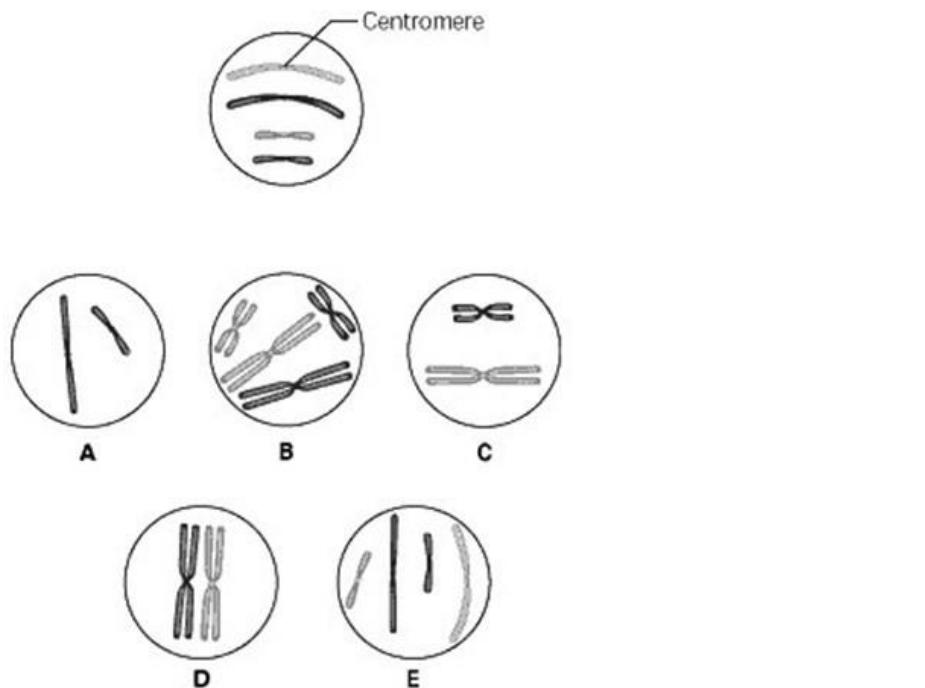
Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

25) Use the figure to answer the question below.

The unlettered circle at the top of the figure shows a diploid nucleus with four chromosomes that have not yet replicated. There are two pairs of homologous chromosomes, one long and the other short. One haploid set is black, and the other is gray. The circles labeled A to E show various combinations of these chromosomes.



What is the correct chromosomal condition at prometaphase of mitosis?

- A) B
- B) C
- C) D
- D) E

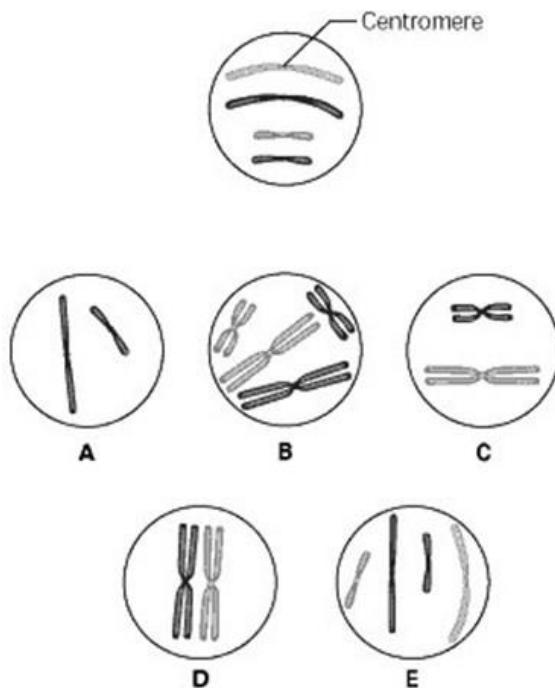
Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

26) Use the figure to answer the question below.

The unlettered circle at the top of the figure shows a diploid nucleus with four chromosomes that have not yet replicated. There are two pairs of homologous chromosomes, one long and the other short. One haploid set is black, and the other is gray. The circles labeled A to E show various combinations of these chromosomes.



What is the correct chromosomal condition for one daughter nucleus at telophase of mitosis?

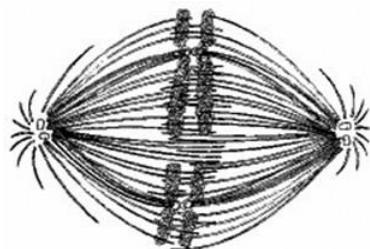
- A) B
- B) C
- C) D
- D) E

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

27) Use the figure to answer the question below.



If the cell whose nuclear material is shown in the figure continues toward completion of mitosis, which of the following events would occur next?

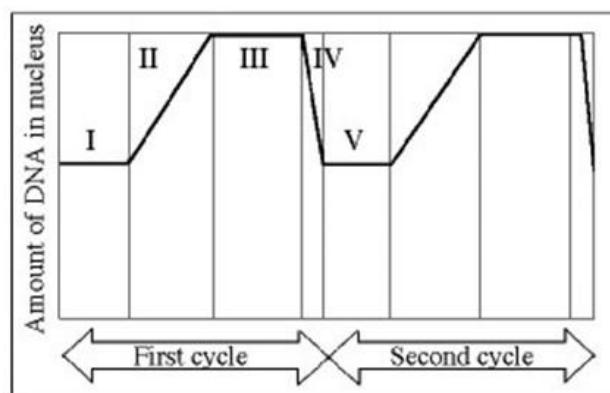
- A) spindle fiber formation
- B) nuclear envelope breakdown
- C) formation of telophase nuclei
- D) synthesis of chromatids

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

28) Use the figure to answer the question below.



In the figure, G₁ is represented by which numbered part(s) of the cycle?

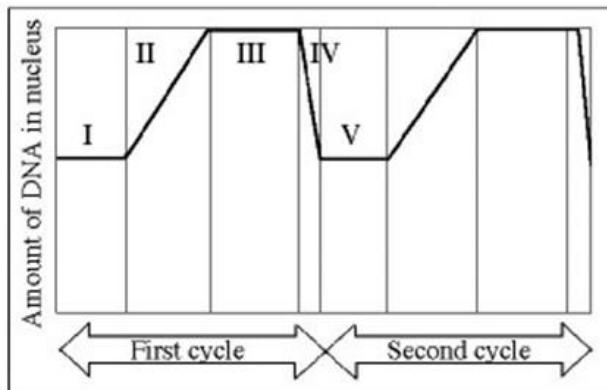
- A) I and V
- B) II
- C) III
- D) IV

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 12.2

29) Use the figure to answer the question below.



In the figure, which number represents DNA synthesis?

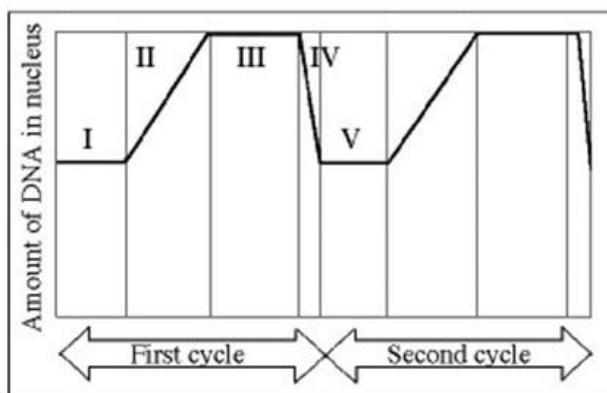
- A) I
- B) II
- C) III
- D) IV

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 12.2

30) Use the figure to answer the question below.



In the figure, at which of the numbered regions would you expect to find cells at metaphase?

- A) II and IV
- B) II only
- C) III only
- D) IV only

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 12.2

31) Use the data in the accompanying table to answer the question.

Minutes Spent in Cell Cycle Phases

Cell Type	G ₁	S	G ₂	M
Beta	18	24	12	16
Delta	100	1	0	0
Gamma	18	48	14	20

The data in the table were obtained from a study of the length of time spent in each phase of the cell cycle by cells of three eukaryotic organisms designated beta, delta, and gamma.

Which of the statements is the best explanation for the difference between time spent in S phase by beta and gamma?

- A) Gamma contains more DNA than beta.
- B) Beta and gamma contain the same amount of DNA.
- C) Beta cells reproduce by binary fission and gamma cells reproduce by mitosis and cytokinesis.
- D) Beta is a plant cell and gamma is an animal cell.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 12.2

32) Certain unicellular eukaryotes, including diatoms and some yeasts, have mechanisms of nuclear division that may resemble intermediate steps in the evolution of mitosis. Which of the following is a characteristic feature of nuclear division in these organisms?

- A) They reproduce by binary fission in their early stages of development and by mitosis when they are mature.
- B) They have circular chromosomes that are segregated by a mitotic spindle.
- C) Chromosomes are segregated by a mitotic spindle, but the nuclear envelope remains intact during division.
- D) Chromosomes are segregated by attachment to the plasma membrane.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

33) Several organisms, primarily protists, have what are called intermediate mitotic organization. What is the most probable hypothesis about these intermediate forms of cell division?

- A) They represent a form of cell reproduction that must have evolved completely separately from those of other organisms.
- B) They rely on totally different proteins for the processes they undergo.
- C) They may be more closely related to plant forms that also have unusual mitosis.
- D) They show some but not all of the evolutionary steps toward complete mitosis.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 12.2

34) Nucleotides can be radiolabeled before they are incorporated into newly synthesized DNA and, therefore, can be assayed to track their incorporation. In a set of experiments, a student-faculty research team used labeled T nucleotides and introduced these into a culture of dividing human cells at specific times. Which of the following questions might be answered by using the method described?

- A) How many cells are produced by the culture per hour?
- B) What is the length of the S phase of the cell cycle?
- C) How many picograms of DNA are made per cell cycle?
- D) When do spindle fibers attach to chromosomes?

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 12.2

35) Nucleotides can be radiolabeled before they are incorporated into newly forming DNA and, therefore, can be assayed to track their incorporation. In a set of experiments, a student-faculty research team used labeled T nucleotides to study the incorporation of labeled nucleotides into a culture of lymphocytes. They found that the lymphocytes incorporated the labeled nucleotide at a significantly higher level after a pathogen was introduced into the culture. What might they conclude from this observation?

- A) The pathogen consumed radiolabeled nucleotides.
- B) Infection causes lymphocytes to divide more rapidly.
- C) Infection causes lymphocytes to increase in size.
- D) Infection causes lymphocyte cultures to skip some parts of the cell cycle.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 12.2

36) Through a microscope, you can see a cell plate beginning to develop across the middle of a cell and nuclei forming on either side of the cell plate. This cell is most likely _____.

- A) an animal cell in the process of cytokinesis
- B) an animal cell in anaphase of mitosis
- C) a plant cell in the process of cytokinesis
- D) a plant cell in metaphase of mitosis

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

37) Which of the following events occurs during interphase of the cell cycle?

- A) condensation of the chromosomes
- B) separation of the spindle poles
- C) spindle formation
- D) replication of the DNA

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

38) The drug cytochalasin B blocks the function of actin. Which of the following aspects of the animal cell cycle would be most disrupted by cytochalasin B?

- A) spindle formation
- B) spindle attachment to kinetochores
- C) movement of chromosomes to the poles during anaphase
- D) cleavage furrow formation and cytokinesis

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 12.2

39) Motor proteins require which of the following structures or molecules to function in the movement of chromosomes toward the poles of the mitotic spindle?

- A) intact centromeres
- B) a microtubule-organizing center
- C) ATP as an energy source
- D) intact cohesin

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.2

40) Use the data in the accompanying table to answer the question.

Minutes Spent in Cell Cycle Phases

Cell Type	G ₁	S	G ₂	M
Beta	18	24	12	16
Delta	100	1	0	0
Gamma	18	48	14	20

The data in the table were obtained from a study of the length of time spent in each phase of the cell cycle by cells of three eukaryotic organisms designated beta, delta, and gamma. What is the best explanation for the data associated with delta cells?

- A) Delta cells contain no DNA.
- B) Delta cells contain no RNA.
- C) Delta cells are in the G₀ phase.
- D) Delta cells divide in the G₁ phase.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 12.3

41) Why do neurons and some other specialized cells divide infrequently?

- A) They no longer have active nuclei.
- B) They have entered into G₀.
- C) They can no longer degrade cyclins.
- D) They no longer produce MPF.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.3

42) What two components constitute an active MPF?

- A) a growth factor and mitotic factor
- B) ATP synthetase and a protease
- C) cyclin and tubulin
- D) cyclin and a cyclin-dependent kinase

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.3

43) Which of the following properties is associated with a cyclin-dependent kinase (Cdk)?

- A) A Cdk is inactive, or "turned off," in the presence of a cyclin.
- B) The number of Cdk molecules increases during the S and G₂ phases and decrease during M.
- C) A Cdk is an enzyme that catalyzes the attachment of kinetochores to microtubules.
- D) A Cdk is an enzyme that attaches phosphate groups to other proteins.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.3

44) What would you expect to happen if MPF (maturation-promoting factor) is introduced into immature frog oocytes that are arrested in G₂?

- A) The cells would remain arrested in G₂.
- B) The cells would enter G₀.
- C) The cells would enter mitosis.
- D) The cells would begin DNA synthesis.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 12.3

45) Once a cell enters mitosis, the molecules that activate division must be turned off. What happens to MPF during mitosis?

- A) It is completely degraded.
- B) It is phosphorylated by a Cdk, which inactivates it.
- C) The cyclin component of MPF is degraded.
- D) The Cdk component of MPF is degraded.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.3

46) The M phase checkpoint ensures that all chromosomes are attached to the mitotic spindle. If this does not happen, cells would most likely be arrested in _____.

- A) telophase
- B) prophase
- C) G₂
- D) metaphase

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 12.3

47) Which of the following molecules is released by platelets in the vicinity of an injury?

- A) PDGF
- B) MPF
- C) cyclin
- D) Cdk

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.3

48) Which of the following molecules is a protein synthesized at specific times during the cell cycle that associates with a kinase to form a catalytically active complex?

- A) PDGF
- B) MPF
- C) cyclin
- D) Cdk

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.3

49) Which of the following molecules is a protein maintained at steady levels throughout the cell cycle that requires cyclin to become catalytically active?

- A) PDGF
- B) MPF
- C) cyclin
- D) Cdk

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.3

50) Which of the following molecules triggers the cell's passage past the G₂ checkpoint into mitosis?

- A) PDGF
- B) MPF
- C) cyclin
- D) Cdk

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.3

51) At what stage of the cell cycle is the cyclin component of MPF destroyed?

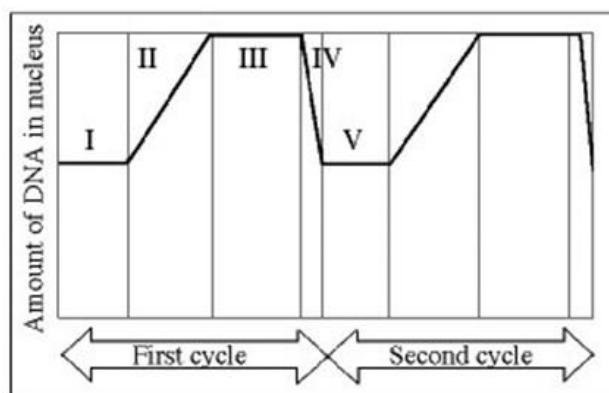
- A) in late G₁
- B) at mid-S phase
- C) in early G₂
- D) in late M

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.3

52) Use the figure to answer the question below.



In the figure, MPF reaches its highest concentration during this stage.

- A) I
- B) II
- C) III
- D) IV

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 12.3

53) Density-dependent inhibition is explained by which of the following processes?

- A) As cells become more numerous, they begin to squeeze against each other, restricting their size.
- B) As cells become more numerous, the cell surface proteins of one cell contact the adjoining cells, and they signal each other to stop dividing.
- C) As cells become more numerous, the protein kinases they produce begin to compete with each other, such that the proteins produced by one cell essentially cancel those produced by its neighbor.
- D) As cells become more numerous, the level of waste products increases, which slows metabolism and inhibits growth.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.3

54) Besides the ability of some cancer cells to over proliferate, which of the following situations might logically result in a tumor?

- A) changes in the order of cell cycle stages
- B) lack of appropriate cell death
- C) inability to form spindles
- D) failure of cells to enter S phase

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 12.3

55) Early observations of a cultured cell line indicated that the cells did not exhibit either density-dependent inhibition or anchorage dependence. What do these observations suggest about this cell line?

- A) The cells are unable to form spindle microtubules.
- B) The cells follow an altered series of cell cycle phases.
- C) The cells show characteristics of tumors.
- D) The cells have nonfunctional MPF.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 12.3

56) For a chemotherapeutic drug to be useful for treating cancer cells, which of the following characteristics is most desirable?

- A) It is safe enough to prevent all apoptosis.
- B) It does not interfere with metabolically active cells.
- C) It specifically inhibits cells entering G₀.
- D) It specifically inhibits rapidly dividing cells.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 12.3

57) Cells from advanced malignant tumors often have very abnormal chromosomes and an abnormal number of chromosomes. What might explain the association between malignant tumors and chromosomal abnormalities?

- A) Cancer cells are no longer density-dependent.
- B) Cancer cells are no longer anchorage-dependent.
- C) Cell cycle checkpoints are not in place to stop cells with chromosome abnormalities.
- D) Transformation introduces new chromosomes into cells.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 12.3

58) Exposure of zebrafish nuclei to cytosol isolated from eggs at metaphase of mitosis resulted in phosphorylation of NEP55 and L68 proteins by cyclin-dependent kinase 2. NEP55 is a protein of the inner nuclear membrane, and L68 is a protein of the nuclear lamina. What is the most likely role of phosphorylation of these proteins in the process of mitosis?

- A) They enable the attachment of the spindle microtubules to kinetochore regions of the centromere.
- B) They are involved in chromosome condensation.
- C) They are involved in the disassembly of the nuclear envelope.
- D) They assist in the migration of centrosomes to opposite sides of the nucleus.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 12.3

12.2 Student Edition End-of-Chapter Questions

1) Through a microscope, you can see a cell plate beginning to develop across the middle of a cell and nuclei forming on either side of the cell plate. This cell is most likely

- A) an animal cell in the process of cytokinesis.
- B) a plant cell in the process of cytokinesis.
- C) a bacterial cell dividing.
- D) a plant cell in metaphase.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

2) Vinblastine is a standard chemotherapeutic drug used to treat cancer. Because it interferes with the assembly of microtubules, its effectiveness must be related to

- A) disruption of mitotic spindle formation.
- B) suppression of cyclin production.
- C) myosin denaturation and inhibition of cleavage furrow formation.
- D) inhibition of DNA synthesis.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 3) One difference between cancer cells and normal cells is that cancer cells
- A) are unable to synthesize DNA.
 - B) are arrested at the S phase of the cell cycle.
 - C) continue to divide even when they are tightly packed together.
 - D) cannot function properly because they are affected by density-dependent inhibition.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 4) The decline of MPF activity at the end of mitosis is due to
- A) the destruction of the protein kinase Cdk.
 - B) decreased synthesis of Cdk.
 - C) the degradation of cyclin.
 - D) the accumulation of cyclin.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 5) In the cells of some organisms, mitosis occurs without cytokinesis. This will result in
- A) cells with more than one nucleus.
 - B) cells that are unusually small.
 - C) cells lacking nuclei.
 - D) cell cycles lacking an S phase.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 6) Which of the following does *not* occur during mitosis?
- A) condensation of the chromosomes
 - B) replication of the DNA
 - C) separation of sister chromatids
 - D) spindle formation

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 7) Cell A has half as much DNA as cells B, C, and D in a mitotically active tissue. Cell A is most likely in
- A) G₁.
 - B) G₂.
 - C) prophase.
 - D) metaphase.

Answer: A

Bloom's Taxonomy: Application/Analysis

8) The drug cytochalasin B blocks the function of actin. Which of the following aspects of the animal cell cycle would be most disrupted by cytochalasin B?

- A) spindle formation
- B) spindle attachment to kinetochores
- C) cell elongation during anaphase
- D) cleavage furrow formation and cytokinesis

Answer: D

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 13 Meiosis and Sexual Life Cycles

13.1 Multiple-Choice Questions

1) If a horticulturist breeding gardenias succeeds in having a single plant with a particularly desirable set of traits, which of the following would be her most probable and efficient route to establishing a line of such plants?

- A) Backtrack through her previous experiments to obtain another plant with the same traits.
- B) Breed this plant with another plant with much weaker traits.
- C) Clone the plant.
- D) Force the plant to self-pollinate to obtain an identical one.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 13.1

2) Which of the following statements defines a *genome*?

- A) the complete set of an organism's polypeptides
- B) the complete set of a species' polypeptides
- C) a karyotype
- D) the complete set of an organism's genes and other DNA sequences

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.1

3) Asexual reproduction occurs during which of the following processes?

- A) meiosis
- B) mitosis
- C) fertilization
- D) the exchange of chromosomes between organisms of different species

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.1

4) Quaking aspen trees can send out underground stems for asexual reproduction. Sexual reproduction is not as common, but when it does happen, the haploid gametes have 19 chromosomes. How many chromosomes are in the cells of the underground stems?

- A) 9
- B) 10
- C) 19
- D) 38

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 13.2

- 5) Which of the following statements is correct in comparing sexual and asexual reproduction?
- A) Asexual reproduction, but not sexual reproduction, is characteristic of only plants and fungi.
 - B) In sexual reproduction, individuals transmit half of their nuclear genes to each of their offspring.
 - C) In asexual reproduction, offspring are produced by fertilization without meiosis.
 - D) Asexual reproduction produces only haploid offspring.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.2

- 6) At which stage of mitosis are chromosomes usually photographed in the preparation of a karyotype?
- A) prophase
 - B) metaphase
 - C) anaphase
 - D) interphase

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.2

- 7) Which of the following statements is true of a species that has a chromosome number of $2n = 16$?
- A) The species is diploid with 32 chromosomes per cell.
 - B) The species has 16 sets of chromosomes per cell.
 - C) Each diploid cell has eight homologous pairs of chromosomes.
 - D) A gamete from this species has four chromosomes.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 13.2

- 8) Eukaryotic sexual life cycles show tremendous variation. Which of the following characteristics do all sexual life cycles have in common?

I. Alternation of generations

II. Meiosis

III. Fertilization

IV. Gametes

V. Spores

- A) I, II, and IV
- B) II, III, and IV
- C) II, IV, and V
- D) I, II, III, IV, and V

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.2

9) Which of the following processes occurs in a plant's sexual life cycle?

- A) sporophytes produce gametes by meiosis
- B) gametophytes produce gametes by mitosis
- C) gametophytes produce gametes by meiosis
- D) sporophytes produce gametes by mitosis

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.2

10) Which of the following statements describes an example of alternation of generations?

- A) A grandparent and grandchild each have dark hair, but the parent has blond hair.
- B) A diploid plant (sporophyte) produces a spore by meiosis that gives rise to a multicellular, haploid pollen grain (gametophyte).
- C) A diploid animal produces gametes by meiosis, and the gametes undergo fertilization to produce a diploid zygote.
- D) A haploid mushroom produces gametes by mitosis, and the gametes undergo fertilization, which is immediately followed by meiosis.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 13.2

11) A particular organism has 46 chromosomes in its karyotype. Which of the following statements is correct regarding this organism?

- A) It must be human.
- B) It must be an animal.
- C) It reproduces sexually.
- D) It produces gametes with 23 chromosomes.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 13.2

12) A triploid cell contains three sets of homologous chromosomes. If a cell of a diploid species that normally has 42 chromosomes per cell is triploid, this cell would be expected to have which of the following sets of chromosomes?

- A) 63 chromosomes in 31 1/2 pairs
- B) 63 chromosomes in 21 sets of 3
- C) 63 chromosomes, each with 3 sister chromatids
- D) 21 chromosome pairs and 21 unique chromosomes

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 13.2

- 13) Which of the following processes might produce a human zygote with 45 chromosomes?
- an error in meiotic anaphase occurring in either an egg or sperm
 - failure of the egg nucleus to be fertilized by the sperm
 - failure of an egg to complete meiosis II
 - incomplete cytokinesis during spermatogenesis after meiosis I

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 13.3

- 14) In a human karyotype, chromosomes are arranged in 23 pairs. If we choose one of these pairs, such as pair 14, which of the following do the two chromosomes of the pair have in common?

- length and position of the centromere only
- length, centromere position, and staining pattern only
- length, centromere position, staining pattern, and traits coded for by their genes
- They have nothing in common except that they are X-shaped.

Answer: C

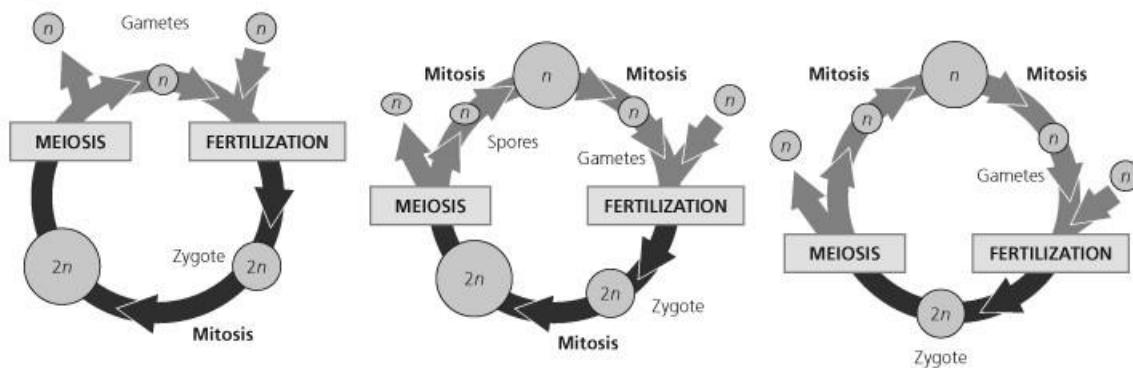
Bloom's Taxonomy: Application/Analysis

Section: 13.2

Refer to the life cycles illustrated in the figure below to answer the following questions.

Key

- Haploid (n)
→ Diploid ($2n$)



- 15) Which of the life cycles is typical for animals?

- I only
- II only
- III only
- I and III

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.2

16) Which of the life cycles is typical for plants and some algae?

- A) I only
- B) II only
- C) III only
- D) I and III

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.2

17) Which of the life cycles is typical for most fungi and some protists?

- A) I only
- B) II only
- C) III only
- D) I and II

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.2

18) In a life cycle such as that shown in part III of the figure above, if the zygote's chromosome number is ten, which of the following statements will be true?

- A) The sporophyte's chromosome number per cell is ten and the gametophyte's is five.
- B) The sporophyte's chromosome number per cell is five and the gametophyte's is ten.
- C) The sporophyte and gametophyte each have ten chromosomes per cell.
- D) The sporophyte and gametophyte each have five chromosomes per cell.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 13.2

19) Which of the following characteristics do homologous chromosomes exhibit?

- A) They carry information for different traits.
- B) They carry information for the same traits.
- C) They carry the same alleles.
- D) They align on the metaphase plate in meiosis II.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.2

20) Many organisms spend most of their life cycle in the diploid state. If meiosis produces haploid cells, how is the diploid number restored for these types of organisms?

- A) by DNA replication
- B) through the transcription of DNA to RNA
- C) by synapsis of the homologous pairs of chromosomes during prophase of meiosis I
- D) by fertilization

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 13.2

- 21) Which of the following statements is correct regarding the human X chromosomes?
- A) It is present in every somatic cell of males and females.
 - B) It is the same size as other chromosomes and has the same number of genes.
 - C) It carries genes that determine an individual's biological sex.
 - D) It is referred to as an autosome.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.2

- 22) Which of the following statements correctly describes a karyotype?
- A) It is a display of all of the cell types in an organism.
 - B) It is an organized image of a cell's chromosomes.
 - C) It reveals the appearance of an organism.
 - D) It is a display of a cell's mitotic stages.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.2

- 23) If a cell has completed meiosis I and the first cytokinesis, and is just beginning meiosis II, which of the following is an appropriate description of its genetic contents?
- A) It has half the amount of DNA as the cell that began meiosis.
 - B) It has half the chromosomes but twice the DNA of the parent cell.
 - C) It has one-fourth the DNA and one-half the chromosomes as the parent cell.
 - D) It is genetically identical to another cell formed from the same meiosis I event.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 13.3

- 24) The somatic cells of a privet shrub each contain a total of 46 chromosomes. How do the chromosomes of this plant differ from the chromosomes of humans, who also have a total of 46?
- A) Privet shrub cells cannot reproduce sexually.
 - B) Privet shrub sex cells have chromosomes that can synapse with human chromosomes in the laboratory.
 - C) Genes of privet shrub chromosomes are significantly different than those in humans.
 - D) Privet shrubs must be metabolically more like animals than like other shrubs.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 13.3

25) Which of the following statements describes the chromosomal makeup of each daughter cell after telophase of meiosis I?

- A) The cells are diploid, and the chromosomes are each composed of a single chromatid.
- B) The cells are diploid, and the chromosomes are each composed of two chromatids.
- C) The cells are haploid, and the chromosomes are each composed of a single chromatid.
- D) The cells are haploid, and the chromosomes are each composed of two chromatids.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.3

26) How do cells at the completion of meiosis compare with cells that are in prophase of meiosis I?

- A) The cells have half the number of chromosomes and half the amount of DNA.
- B) The cells have the same number of chromosomes and half the amount of DNA.
- C) The cells have half the number of chromosomes and one-fourth the amount of DNA.
- D) The cells have half the amount of cytoplasm and twice the amount of DNA.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 13.3

27) Which of the following events happens at the conclusion of meiosis I?

- A) Homologous chromosomes of a pair are separated from each other.
- B) The chromosome number per cell remains the same.
- C) Sister chromatids are separated.
- D) Four daughter cells are formed.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.3

28) During which of the following processes do sister chromatids separate from each other?

- A) during meiosis I only
- B) during meiosis II only
- C) during both mitosis and meiosis I
- D) during both mitosis and meiosis II

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.3

29) Which of the following processes occurs in meiosis but not in mitosis?

- A) chromosome replication
- B) synapsis of chromosomes
- C) alignment of chromosomes at the equator
- D) condensation of chromosomes

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.3

30) When chiasmata can first be seen in cells using a microscope, which of the following processes has most likely occurred?

- A) meiosis II
- B) anaphase II
- C) prophase I
- D) the separation of homologs

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.3

For the following questions, match the key event of meiosis with the stages listed below.

- | | |
|-----------------|--------------------|
| I. Prophase I | V. Prophase II |
| II. Metaphase I | VI. Metaphase II |
| III. Anaphase I | VII. Anaphase II |
| IV. Telophase I | VIII. Telophase II |

31) Homologous chromosomes are aligned at the equator of the spindle.

- A) I
- B) II
- C) IV
- D) VI

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.3

32) Centromeres of sister chromatids disjoin and chromatids separate.

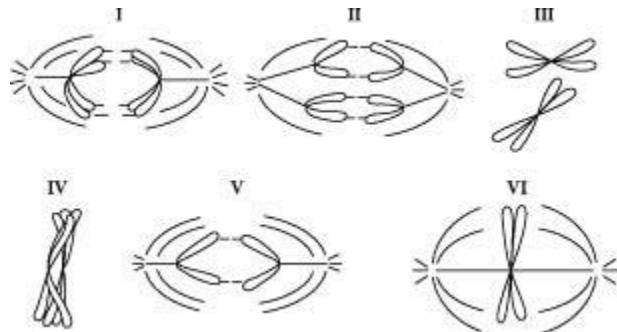
- A) III
- B) IV
- C) V
- D) VII

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.3

Refer to the drawings in the figure below of a single pair of homologous chromosomes as they might appear during various stages of either mitosis or meiosis, and answer the following question(s).



33) Which diagram represents anaphase I of meiosis?

- A) I
- B) II
- C) IV
- D) V

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 13.3

34) Which diagram represents anaphase II of meiosis?

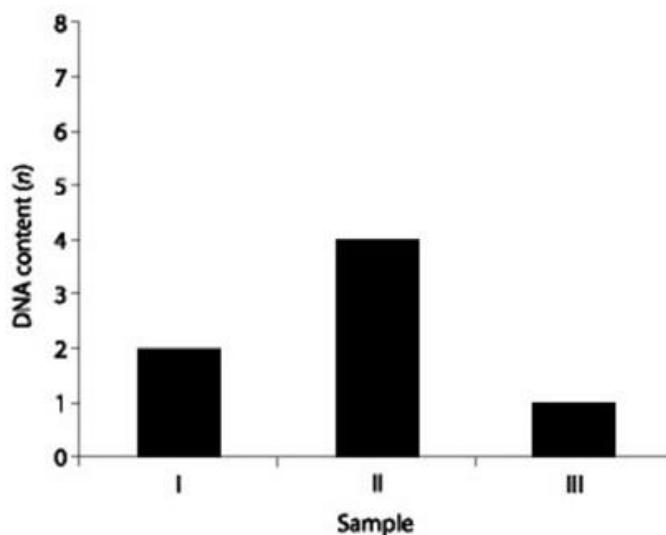
- A) I
- B) III
- C) IV
- D) V

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 13.3

DNA was isolated from three different cell types of the same organism, the relative DNA content for each type was determined, and the results were plotted on the graph shown in the figure below. Refer to the graph to answer the following questions.



35) Which sample of DNA might be from a cell that stopped the process of cell division in G₀ phase of the cell cycle prior to meiosis?

- A) I
- B) II
- C) III
- D) either I or II

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 13.3

36) Which sample of DNA might represent an animal cell in the G₂ phase of the cell cycle prior to meiosis?

- A) I
- B) II
- C) III
- D) both I and II

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 13.3

37) Which sample of DNA might represent a zygote?

- A) I
- B) II
- C) III
- D) either I or II

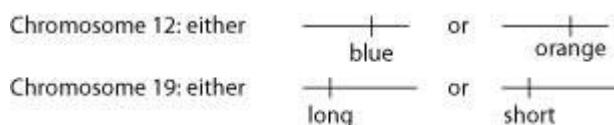
Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 13.3

Refer to the information and figure below to answer the following questions.

A certain (hypothetical) organism is diploid, has either blue or orange wings as the consequence of one of its genes on chromosome 12, and has either long or short antennae as the result of a second gene on chromosome 19, as shown in the figure.



38) A certain female's number 12 chromosomes both have the blue gene and number 19 chromosomes both have the long gene. As cells in her ovaries undergo meiosis, which of the following combinations of genes and chromosomes will her eggs have?

- A) either two number 12 chromosomes with blue genes or two with orange genes
- B) either two number 19 chromosomes with long genes or two with short genes
- C) either one blue or one orange gene in addition to either one long or one short gene
- D) one chromosome 12 with one blue gene and one chromosome 19 with one long gene

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 13.3

39) If a female of this species has one chromosome 12 with a blue gene and another chromosome 12 with an orange gene, and has both number 19 chromosomes with short genes, which of the following combinations of genes will her eggs have?

- A) only blue short gene eggs
- B) only orange short gene eggs
- C) one half blue short and one half orange short gene eggs
- D) three fourths blue short and one fourth orange short gene eggs

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 13.3

40) A female with a paternal set of one orange and one long gene chromosome and a maternal set comprised of one blue and one short gene chromosome would be expected to produce which of the following types of eggs after meiosis?

- A) All eggs will have maternal types of gene combinations.
- B) All eggs will have paternal types of gene combinations.
- C) Half the eggs will have maternal and half will have paternal combinations.
- D) Each egg has a one-fourth chance of having either blue long, blue short, orange long, or orange short combinations.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 13.3

41) Somatic cells of roundworms have four individual chromosomes per cell. How many chromosomes would you expect to find in an ovum from a roundworm?

- A) four
- B) two
- C) eight
- D) a diploid number

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 13.3

42) Which of the following processes occur during meiosis but not mitosis?

- A) Haploid cells fuse to form diploid cells.
- B) Haploid cells multiply into more haploid cells.
- C) Diploid cells form haploid cells.
- D) A diploid cell combines with a haploid cell.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.3

43) During which of the following phases of meiosis do homologous chromosomes separate?

- A) anaphase II
- B) prophase I
- C) mitosis
- D) anaphase I

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.3

44) Which of the following statements describes a major difference between meiosis II and mitosis in a diploid animal?

- A) Homologous chromosomes align on the metaphase plate in meiosis II.
- B) Sister chromatids separate in mitosis, and homologous chromosomes separate in meiosis II.
- C) Meiosis II occurs in a haploid cell, while mitosis occurs in diploid cells.
- D) Crossing over of chromosomes takes place in meiosis II.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 13.3

45) Which of the following statements describes a major difference between mitosis and meiosis I in a diploid organism?

- A) Sister chromatids separate in mitosis, while homologous pairs of chromosomes separate in meiosis I.
- B) Sister chromatids separate in mitosis, while homologous pairs of chromosomes separate in meiosis II.
- C) DNA replication takes place prior to mitosis, but not before meiosis I.
- D) Only meiosis I results in daughter cells that contain identical genetic information.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 13.3

46) Crossing over of chromosomes normally takes place during which of the following processes?

- A) meiosis II
- B) meiosis I
- C) mitosis
- D) mitosis and meiosis II

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.3

47) Which of the following statements describes one characteristic of each chromosome in a cell during the entire process of meiosis I?

- A) Each chromosome is paired with a homologous chromosome.
- B) Each chromosome consists of two sister chromatids joined by a centromere.
- C) Each chromosome consists of a single strand of DNA.
- D) Each chromosome is joined with its homologous pair to form a synaptonemal complex.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 13.3

48) During which of the following processes do homologous pairs of chromosomes align adjacent to one another at the metaphase plate of a cell?

- A) metaphase of mitosis
- B) metaphase I of meiosis
- C) telophase II of meiosis
- D) metaphase II of meiosis

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.3

49) During which of the following phases of meiosis do centromeres split and sister chromatids migrate to opposite poles of the cell?

- A) anaphase I
- B) telophase I
- C) anaphase II
- D) telophase II

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.3

50) During which of the following processes does independent assortment of chromosomes occur?

- A) in meiosis I only
- B) in meiosis II only
- C) in mitosis and meiosis I
- D) in mitosis and meiosis II

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.4

51) For a species with a haploid number of 23 chromosomes, how many different combinations of maternal and paternal chromosomes are possible for the gametes based on the independent assortment of chromosomes during meiosis?

- A) 23
- B) 46
- C) about 1,000
- D) about 8 million

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.4

- 52) Independent assortment of chromosomes is a result of which of the following processes?
- A) the random way each pair of homologous chromosomes lines up at the metaphase plate during meiosis I
 - B) the random combinations of eggs and sperm during fertilization
 - C) the random distribution of the sister chromatids to the two daughter cells during anaphase II
 - D) the diverse combination of alleles that may be found within any given chromosome

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.4

- 53) Which of the following processes occurs when homologous chromosomes cross over in meiosis I?

- A) Two sister chromatids get tangled, resulting in one re-sequencing its DNA.
- B) Two sister chromatids exchange identical pieces of DNA.
- C) Corresponding segments of non-sister chromatids are exchanged.
- D) Maternal alleles are "corrected" to be like paternal alleles and vice versa.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.4

- 54) How does natural selection apply to sexual reproduction as opposed to asexual reproduction?

- A) Sexual reproduction results in many new gene combinations, some of which will lead to differential reproduction.
- B) Sexual reproduction results in the greatest number of new mutations.
- C) Sexual reproduction allows the greatest number of offspring to be produced.
- D) Sexual reproduction utilizes far less energy than asexual reproduction.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 13.4

- 55) The bulldog ant has a diploid number of two chromosomes. Therefore, following meiosis, each daughter cell will have a single chromosome. In addition to mutations, how might genetic diversity be generated in this species?

- A) crossing over only
- B) independent assortment only
- C) crossing over and random fertilization
- D) nothing else

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 13.4

56) Which of the following processes facilitates the fastest way for organisms to adapt to a changing environment?

- A) mutation
- B) asexual reproduction
- C) sexual reproduction
- D) mitosis

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 13.4

57) Imagine that there are 25 different species of protists living in a tide pool. Some of these species reproduce both sexually and asexually, and some of them can reproduce only asexually. The pool gradually becomes infested with disease-causing viruses and bacteria. Which species are more likely to thrive in the changing environment?

- A) The sexually reproducing species is likely to thrive.
- B) The asexually reproducing species is likely to thrive.
- C) Sexually and asexually reproducing species are equally likely to thrive.
- D) Neither species will be able to thrive.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 13.4

58) In eukaryotes, genetic information is passed to the next generation by processes that include mitosis or meiosis. Which of the following explanations correctly identifies the process and supports the claim that heritable information is passed from one generation to another?

- A) During mitosis, DNA replication occurs twice within the cell cycle to insure a full set of chromosomes within each of the daughter cells produced.
- B) Mitosis, followed by cytokinesis, produces daughter cells that are genetically different from the parent cell, thus insuring variation within the population.
- C) In asexual reproduction, a single individual is the sole parent and passes copies of its genes to its offspring without the fusion of gametes.
- D) Single-celled organisms can fuse their cells, reproducing asexually through mitosis to form new cells that are not identical to the parent cell.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 13.3

59) Genetic variation leads to genetic diversity in populations and is the raw material for evolution. Biological systems have multiple processes, such as reproduction, that affect genetic variation. They are evolutionarily conserved and shared by various organisms. Which of the following statements best represents the connection between reproduction and evolution?

- A) Plants that use sexual reproduction are rare since this type of reproduction in plants does not contribute to genetic diversity.
- B) In order to increase genetic diversity for evolution in sexually reproducing organisms, mutations must occur in the zygote after fertilization.
- C) Since prokaryotic organisms reproduce asexually, there is no mechanism for them to add genetic diversity for evolution.
- D) Sexual reproduction increases genetic variation because random mutations can be shuffled between organisms.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 13.4

13.2 Student Edition End-of-Chapter Questions

1) A human cell containing 22 autosomes and a Y chromosome is

- A) a sperm.
- B) an egg.
- C) a zygote.
- D) a somatic cell of a male.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

2) The two homologs of a pair move toward opposite poles of dividing cell during

- A) mitosis.
- B) meiosis I.
- C) meiosis II.
- D) fertilization.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

3) Meiosis II is similar to mitosis in that

- A) sister chromatids separate during anaphase.
- B) DNA replicates before the division.
- C) the daughter cells are diploid.
- D) homologous chromosomes synapse.

Answer: A

Bloom's Taxonomy: Application/Analysis

4) If the DNA content of a diploid cell in the G₁ phase of the cell cycle is x , then the DNA content of the same cell at metaphase of meiosis I will be

- A) $0.25x$.
- B) $0.5x$.
- C) x .
- D) $2x$.

Answer: D

Bloom's Taxonomy: Application/Analysis

5) If we continue to follow the cell lineage from question 4, then the DNA content of a single cell at metaphase of meiosis II will be

- A) $0.25x$.
- B) $0.5x$.
- C) x .
- D) $2x$.

Answer: C

Bloom's Taxonomy: Application/Analysis

14.1 Multiple-Choice Questions

- 1) Which of the following statements is correct in describing the terms *monohybrid cross* and *dihybrid cross*?
- A) A monohybrid cross involves a single parent, whereas a dihybrid cross involves two parents.
 - B) A dihybrid cross involves organisms that are heterozygous for two characters that are being studied, and a monohybrid cross involves organisms that are heterozygous for only one character being studied.
 - C) A monohybrid cross is performed for one generation, whereas a dihybrid cross is performed for two generations.
 - D) A monohybrid cross results in a 9:3:3:1 ratio, whereas a dihybrid cross gives a 3:1 ratio.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.1

- 2) What was the most significant conclusion that Gregor Mendel drew from his experiments with pea plants?
- A) There is considerable genetic variation in garden peas.
 - B) Traits are inherited in discrete units and are not the result of "blending."
 - C) Recessive genes occur more frequently in the F₁ generation than do dominant ones.
 - D) Genes are composed of DNA.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.1

- 3) How many unique gametes could be produced through independent assortment by an individual with the genotype *AaBbCCDdEE*?

- A) 4
- B) 8
- C) 16
- D) 64

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 14.1

- 4) The individual with genotype *AaBbCCDdEE* can make many kinds of gametes. Which of the following correctly describes why this situation is possible?

- A) recurrent mutations form new alleles
- B) crossing over during prophase I leads to genetic variety
- C) different possible assortment of chromosomes into gametes occurs
- D) there is a tendency for dominant alleles to segregate together

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.1

5) Mendel continued some of his experiments into the F₂ or F₃ generation in order to _____.

- A) obtain a larger number of offspring on which to base statistics
- B) observe whether or not a recessive trait would reappear
- C) observe whether or not the dominant trait would reappear
- D) distinguish which alleles were segregating

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.1

6) Which of the following statements about independent assortment or segregation is correct?

- A) The law of independent assortment describes the behavior of two or more genes relative to one another.
- B) The law of segregation describes the behavior of two or more genes relative to one another.
- C) The law of independent assortment is accounted for by observations of prophase I of meiosis.
- D) The law of segregation is accounted for by anaphase of mitosis.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.1

7) A sexually reproducing animal has two unlinked genes, one for head shape (*H*) and one for tail length (*T*). Its genotype is *HhTt*. Which of the following genotypes is possible in a gamete from this organism?

- A) *Hh*
- B) *HhTt*
- C) *T*
- D) *HT*

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 14.1

8) Which of the following statements correctly describes how Mendel accounted for the observation that traits had disappeared in the F₁ generation and then reappeared in the F₂ generation?

- A) New mutations were frequently generated in the F₂ progeny, causing traits that had been lost in the F₁ to reappear in the F₂.
- B) The mechanism controlling the appearance of traits was different between the F₁ and the F₂ plants.
- C) Traits can be dominant or recessive, and the recessive traits were "hidden" by the dominant ones in the F₁.
- D) Members of the F₁ generation had only one allele for each trait, but members of the F₂ had two alleles for each trait.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.1

9) Which of the following statements correctly explains the fact that all seven of the pea plant traits studied by Mendel obeyed the principle of independent assortment?

- A) None of the traits obeyed the law of segregation.
- B) The diploid number of chromosomes in the pea plants was seven.
- C) All of the genes controlling the traits were located on the same chromosome.
- D) All of the genes controlling the traits behaved as if they were on different chromosomes.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 14.1

10) Mendel's observation of the segregation of alleles in gamete formation has its basis in which of the following phases of cell division?

- A) prophase I of meiosis
- B) anaphase II of meiosis
- C) metaphase II of meiosis
- D) anaphase I of meiosis

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 14.1

11) Mendel's law of independent assortment has its basis in which of the following events of meiosis I?

- A) synapsis of homologous chromosomes
- B) crossing over of homologous pairs of chromosomes
- C) alignment of pairs of homologous chromosomes along the middle of the cell
- D) the division of cells at telophase

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 14.1

12) Use the figure and the following description to answer the question.

In a particular plant, leaf color is controlled by gene locus D . Plants with at least one allele D have dark green leaves, and plants with the homozygous recessive dd genotype have light green leaves. A true-breeding, dark-leaved plant is crossed with a light-leaved one, and the F₁ offspring is allowed to self-pollinate. The predicted outcome of the F₂ is diagrammed in the Punnett square shown in the figure, where 1, 2, 3, and 4 represent the genotypes corresponding to each box within the square.

	D	d
D	1	2
d	3	4

Which of the boxes marked 1-4 correspond to plants with dark leaves?

- A) 1 only
- B) 2 and 3
- C) 4 only
- D) 1, 2, and 3

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 14.1

13) Use the figure and the following description to answer the question.

In a particular plant, leaf color is controlled by gene locus D . Plants with at least one allele D have dark green leaves, and plants with the homozygous recessive dd genotype have light green leaves. A true-breeding, dark-leaved plant is crossed with a light-leaved one, and the F₁ offspring is allowed to self-pollinate. The predicted outcome of the F₂ is diagrammed in the Punnett square shown in the figure, where 1, 2, 3, and 4 represent the genotypes corresponding to each box within the square.

	D	d
D	1	2
d	3	4

Which of the boxes marked 1-4 correspond to plants with a heterozygous genotype?

- A) 1
- B) 1, 2, and 3
- C) 2 and 3
- D) 2, 3, and 4

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 14.1

14) Use the figure and the following description to answer the question.

In a particular plant, leaf color is controlled by gene locus D . Plants with at least one allele D have dark green leaves, and plants with the homozygous recessive dd genotype have light green leaves. A true-breeding, dark-leaved plant is crossed with a light-leaved one, and the F₁ offspring is allowed to self-pollinate. The predicted outcome of the F₂ is diagrammed in the Punnett square shown in the figure, where 1, 2, 3, and 4 represent the genotypes corresponding to each box within the square.

	D	d
D	1	2
d	3	4

Which of the boxes marked 1-4 correspond to plants that will be true-breeding?

- A) 1 and 4 only
- B) 2 and 3 only
- C) 1, 2, 3, and 4
- D) 1 only

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 14.1

15) Skin color in a certain species of fish is inherited by a single gene with four different alleles. How many different types of gametes would be possible in this organism?

- A) 2
- B) 4
- C) 8
- D) 16

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.1

16) Why did all of the F₁ offspring of Mendel's classic pea cross always look like one of the two parental varieties?

- A) No genes interacted to produce the parental phenotype.
- B) Each allele affected phenotypic expression.
- C) The traits blended together during fertilization.
- D) One allele was dominant.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.1

17) Mendel crossed yellow-seeded and green-seeded pea plants and then allowed the offspring to self-pollinate to produce an F₂ generation. The results were as follows: 6,022 yellow and 2,001 green (8,023 total). Which of the following statements correctly describes the relationship of the allele for green seeds to the allele for yellow seeds?

- A) The green allele is dominant to the yellow allele.
- B) The two alleles exhibit incomplete dominance.
- C) The green allele is recessive to the yellow allele.
- D) The two alleles are codominant.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 14.1

18) Albinism is a recessive trait. A man and woman both show normal pigmentation, but both have one parent who has albinism (without melanin pigmentation). What is the probability that their first child will have albinism?

- A) 0
- B) 1/2
- C) 1/4
- D) 1

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 14.1

19) Albinism is a recessive trait. A man and woman who both have normal pigmentation have one child out of three who has albinism (without melanin pigmentation). What are the genotypes of this child's parents?

- A) One parent must be homozygous for the recessive allele; the other parent can be homozygous dominant, homozygous recessive, or heterozygous.
- B) One parent must be heterozygous; the other parent can be homozygous dominant, homozygous recessive, or heterozygous.
- C) Both parents must be heterozygous.
- D) One parent must be homozygous dominant; the other parent must be heterozygous.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 14.1

20) A black guinea pig crossed with a guinea pig with albinism produced 12 black offspring. When the albino was crossed with a second black animal, six blacks and six albinos were obtained. What is the best explanation for this genetic situation?

- A) Albinism is a recessive trait; black is a dominant trait.
- B) Albinism is a dominant trait; black is incompletely dominant.
- C) Albinism and black are codominant.
- D) Albinism is a recessive trait; black is codominant.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 14.1

21) Gray seed color in peas is dominant to white. Assume that Mendel conducted a series of experiments where plants with gray seeds were crossed among themselves, and the following progeny were produced: 302 gray and 98 white. What is the most probable genotype of each parent?

- A) $GG \times gg$
- B) $Gg \times Gg$
- C) $GG \times Gg$
- D) $gg \times Gg$

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 14.1

22) When Mendel crossed yellow-seeded and green-seeded pea plants, all the offspring were yellow-seeded. When he took these F₁ yellow-seeded plants and crossed them to green-seeded plants, what genotypic ratio was expected?

- A) 1:2:1
- B) 3:1
- C) 1:1
- D) 1:1:1:1

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 14.1

23) Black fur in mice (*B*) is dominant to brown fur (*b*). Short tails (*T*) are dominant to long tails (*t*). What fraction of the progeny of crosses $BbTt \times BBtt$ will be expected to have black fur and long tails?

- A) 1/16
- B) 3/8
- C) 1/2
- D) 9/16

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 14.2

24) In pea plants, the tall phenotype is dominant to the dwarf phenotype. If a heterozygous pea plant is crossed with a homozygous tall pea plant, what is the probability that the offspring will be dwarf in size?

- A) 1
- B) 1/2
- C) 1/4
- D) 0

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 14.2

25) What is the probability of producing the genotype $AABBCC$ in a cross of individuals who both possess this genotype: $AaBbCc$?

- A) 1/4
- B) 1/8
- C) 1/16
- D) 1/64

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 14.2

26) Given the following genotypes for two parents, $AABBCc \times AabbCc$, assume that all traits exhibit simple dominance and independent assortment. What proportion of the progeny of this cross will be expected to phenotypically resemble the first parent with the genotype $AABBCc$?

- A) 1/4
- B) 3/4
- C) 3/8
- D) 1

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 14.2

27) Which of the following statements best describes the addition rule of probability?

- A) the probability that two or more independent events will occur simultaneously
- B) the probability that either one of two independent events will occur
- C) the probability of producing two or more heterozygous offspring
- D) the likelihood that a trait is due to two or more meiotic events

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.2

28) Which of the following calculations require the use of the addition rule of probability?

- A) Calculate the probability of black offspring from the cross $AaBb \times AaBb$, where B is the symbol for black.
- B) Calculate the probability of children with both cystic fibrosis and polydactyly when parents are each heterozygous for both genes.
- C) Calculate the probability of each of four children having cystic fibrosis if the parents are both heterozygous.
- D) Calculate the probability of a child having either sickle-cell anemia or cystic fibrosis if parents are each heterozygous for both.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 14.2

29) Two true-breeding stocks of pea plants are crossed. One parent has red, axial flowers, and the other has white, terminal flowers; all F₁ individuals have red, axial flowers. The genes for flower color and location assort independently. Among the F₂ offspring, what is the probability of producing plants with white axial flowers?

- A) 9/16
- B) 1/16
- C) 3/16
- D) 1/4

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 14.2

30) A man has extra digits (six fingers on each hand and six toes on each foot). His wife and their daughter have the normal number of digits (five fingers on each hand and five toes on each foot.) Having extra digits is a dominant trait. The couple's second child has extra digits. What is the probability that their next (third) child will have extra digits?

- A) 1/2
- B) 1/16
- C) 1/8
- D) 3/4

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 14.2

31) Phenylketonuria is an inherited disease caused by a recessive autosomal allele. If a woman and her husband are both carriers, what is the probability that their first child will be a phenotypically normal girl?

- A) 1/4
- B) 1/16
- C) 3/16
- D) 3/8

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 14.2

32) Assuming independent assortment for all gene pairs, what is the probability that a cross between the following parents, $AABbCc \times AaBbCc$, will produce an $AaBbCc$ offspring?

- A) 1/2
- B) 1/16
- C) 1/8
- D) 3/4

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 14.2

33) Suppose two individuals with the genotype $AaBbCc$ are mated. Assuming that the genes are not linked, what fraction of the offspring are expected to be homozygous recessive for the three traits?

- A) 1/4
- B) 1/8
- C) 1/16
- D) 1/64

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 14.2

34) In cattle, roan coat color (mixed red and white hairs) occurs in the heterozygous ($CRCW$) offspring of red ($CRCR$) and white ($CWCW$) homozygotes. Which of the following crosses would produce offspring in the ratio of 1 red:2 roan:1 white?

- A) red \times white
- B) roan \times roan
- C) white \times roan
- D) red \times roan

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 14.3

35) Which of the following inheritance patterns describes the ability of a single allele to have multiple phenotypic effects?

- A) incomplete dominance
- B) multiple alleles
- C) pleiotropy
- D) epistasis

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.3

36) Which of the following phenotypes is an example of polygenic inheritance?

- A) pink flowers in snapdragons
- B) the ABO blood group in humans
- C) white and purple flower color in peas
- D) skin pigmentation in humans

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.3

37) Hydrangea plants of the same genotype are planted in a large flower garden. Some of the plants produce blue flowers and others pink flowers. This can be best explained by which of the following?

- A) the knowledge that multiple alleles are involved
- B) the allele for blue hydrangea is completely dominant over the allele for pink hydrangea
- C) the alleles are codominant
- D) environmental factors such as soil pH affect the phenotype

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.3

38) Which of the following scenarios describes an example of epistasis?

- A) Recessive genotypes for each of two genes ($aabb$) results in an albino corn snake.
- B) In rabbits and many other mammals, one genotype (ee) prevents any fur color from developing.
- C) In *Drosophila* (fruit flies), white eyes can be due to an X-linked gene or to a combination of other genes.
- D) In cacti, there are several genes for the type of spines.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 14.3

39) Radish flowers may be red, purple, or white. A cross between a red-flowered plant and a white-flowered plant yields all-purple offspring. The part of the radish we eat may be oval or long, with long being the dominant trait. If true-breeding red long radishes are crossed with true-breeding white oval radishes, the F₁ will be expected to exhibit which of the following phenotypes?

- A) red and long
- B) white and long
- C) purple and long
- D) purple and oval

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 14.3

40) Radish flowers may be red, purple, or white. A cross between a red-flowered plant and a white-flowered plant yields all-purple offspring. The flower color trait in radishes is an example of which of the following inheritance patterns?

- A) a multiple allelic system
- B) sex linkage
- C) codominance
- D) incomplete dominance

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.3

41) Skin color in a certain species of fish is inherited via a single gene with four different alleles. One fish of this type has alleles 1 and 3 (S_1S_3), and its mate has alleles 2 and 4 (S_2S_4). If each allele confers a unit of color darkness such that S_1 has one unit, S_2 has two units, and so on, then what proportion of their offspring would be expected to have five units of color?

- A) 1/4
- B) 1/8
- C) 1/2
- D) 0

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 14.3

42) Gene S controls the sharpness of spines in a type of cactus. Cacti with the dominant allele, S , have sharp spines, whereas homozygous recessive ss cacti have dull spines. At the same time, a second gene, N , determines whether or not cacti have spines. Homozygous recessive nn cacti have no spines at all. The relationship between genes S and N is an example of which of the following inheritance patterns?

- A) incomplete dominance
- B) epistasis
- C) pleiotropy
- D) codominance

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.3

43) Gene S controls the sharpness of spines in a type of cactus. Cacti with the dominant allele, S , have sharp spines, whereas homozygous recessive ss cacti have dull spines. At the same time, a second gene, N , determines whether or not cactuses have spines. Homozygous recessive nn cactuses have no spines at all. A cross between a true-breeding sharp-spined cactus and a spineless cactus would produce _____.

- A) all sharp-spined progeny
- B) 50% sharp-spined, 50% dull-spined progeny
- C) 25% sharp-spined, 50% dull-spined, 25% spineless progeny
- D) It is impossible to determine the phenotypes of the progeny.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 14.3

44) Gene *S* controls the sharpness of spines in a type of cactus. Cacti with the dominant allele, *S*, have sharp spines, whereas homozygous recessive *ss* cacti have dull spines. At the same time, a second gene, *N*, determines whether or not cacti have spines. Homozygous recessive *nn* cacti have no spines at all. If cacti heterozygous for both traits, *SsNn*, were allowed to self-pollinate, the offspring would segregate into which of the following phenotype ratios?

- A) 3 sharp-spined:1 spineless
- B) 1 sharp-spined:2 dull-spined:1 spineless
- C) 1 sharp-spined:1 dull-spined:1 spineless
- D) 9 sharp-spined:3 dull-spined:4 spineless

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 14.3

45) Feather color in budgies is determined by two different genes: *Y* for pigment on the outside of the feather, and *B* for pigment on the inside of the feather. *YYBB*, *YyBB*, or *YYBb* is green; *yyBB* or *yyBb* is blue; *YYbb* or *Yybb* is yellow; and *yybb* is white. A blue budgie is crossed with a white budgie. Which of the following results in the offspring is most possible?

- A) green offspring only
- B) white offspring only
- C) blue offspring only
- D) blue and white offspring

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 14.3

46) Feather color in budgies is determined by two different genes, *Y* for pigment on the outside of the feather, and *B* for pigment on the inside of the feather. *YYBB*, *YyBB*, or *YYBb* is green; *yyBB* or *yyBb* is blue; *YYbb* or *Yybb* is yellow; and *yybb* is white. Two blue budgies were crossed. Over the years, they produced 22 offspring, five of which were white. What are the most likely genotypes for the two blue budgies?

- A) *yyBB* and *yyBB*
- B) *yyBB* and *yyBb*
- C) *yyBb* and *yyBb*
- D) *yyBb* and *yybb*

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 14.3

47) In human blood types, Rh positive is a trait that shows simple dominance over Rh negative. A woman who has blood type A positive has a daughter who is type O positive and a son who is type B negative. Which of the following phenotypes is possible for the father?

- A) A negative
- B) O negative
- C) B positive
- D) AB negative

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 14.3

48) A gene for the MN blood group has codominant alleles *M* and *N*. If both children in a family are of blood type M, which of the following situations is possible?

- A) Each parent is either M or MN.
- B) Each parent must be type M.
- C) Both children are heterozygous for this gene.
- D) Neither parent can have the *N* allele.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 14.3

49) Marfan syndrome in humans is caused by an abnormality of the connective tissue protein fibrillin. Patients are usually very tall and thin, with long spindly fingers, curvature of the spine, sometimes weakened arterial walls, and sometimes eye problems, such as lens dislocation.

Which of the following would you conclude about Marfan syndrome from this information?

- A) It is recessive.
- B) It is dominant.
- C) It is pleiotropic.
- D) It is epistatic.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.3

50) In rabbits, the homozygous genotype *LCLC* has normal legs, *LCLc* results in deformed legs, and *LcLc* results in very short legs. The genotype *FBFB* produces black fur, *FBFb* brown fur, and *FbFb* white fur. If a cross is made between brown rabbits with deformed legs and white rabbits with deformed legs, what percentage of the offspring would be expected to have deformed legs and white fur?

- A) 25%
- B) 33%
- C) 100%
- D) 50%

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 14.3

51) In humans, ABO blood types refer to glycoproteins in the membranes of red blood cells. There are three alleles for this autosomal gene: I^A , I^B , and i . The I^A allele codes for the A glycoprotein, The I^B allele codes for the B glycoprotein, and the i allele doesn't code for any membrane glycoprotein. I^A and I^B are codominant, and i is recessive to both I^A and I^B . People with type A blood have the genotypes I^AI^A or I^Ai , people with type B blood are I^BI^B or I^Bi , people with type AB blood are I^AI^B , and people with type O blood are ii . If a woman with type AB blood marries a man with type O blood, which of the following blood types could their children possibly have?

- A) A and B
- B) AB and O
- C) A, B, and O
- D) A, B, AB, and O

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 14.3

52) An obstetrician knows that one of her patients is a pregnant woman whose fetus is at risk for a serious disorder that is detectable biochemically in fetal cells. The obstetrician would most reasonably offer which of the following procedures to her patient?

- A) karyotyping of the woman's somatic cells
- B) X-ray
- C) amniocentesis or CVS
- D) blood transfusion

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.4

53) In some parts of Africa, the frequency of heterozygosity for the sickle-cell anemia allele is unusually high, presumably because this reduces the frequency of malaria. Such a relationship is related to which of the following?

- A) Mendel's law of independent assortment
- B) Mendel's law of segregation
- C) Darwin's explanation of natural selection
- D) the malarial parasite changing the allele

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.4

54) Phenylketonuria (PKU) is a recessive human disorder in which an individual cannot appropriately metabolize the amino acid phenylalanine. This amino acid is not naturally produced by humans. Which of the following treatments would be most effective for people with PKU?

- A) Feed them the substrate that can be metabolized into phenylalanine.
- B) Regulate the diet of the affected persons to severely limit the uptake of phenylalanine.
- C) Feed the patients the missing enzymes in a regular cycle, such as twice per week.
- D) Feed the patients an excess of the missing product.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.4

55) Hutchinson-Gilford progeria is an exceedingly rare human genetic disorder in which there is very early senility and death, usually from coronary artery disease, at an average age of 13 years. Patients, who look very old even as children, do not live to reproduce. Which of the following statements represents the most likely assumption regarding this disorder?

- A) The disease is autosomal dominant.
- B) The disorder will increase in frequency in successive generations within a family.
- C) The disorder may be due to mutation in a single protein-coding gene.
- D) Each patient will have had at least one affected grandparent or parent.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 14.4

56) One of two major forms of a human condition called neurofibromatosis (NF1) is inherited as a dominant gene, although it may range from mildly to very severely expressed. Which of the following is the best explanation for why a young, affected child is the first in her family to be diagnosed?

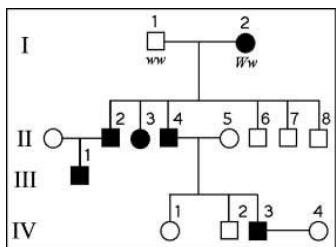
- A) The mother carries the gene but does not express it.
- B) One of the parents has a mild expression of the gene.
- C) The condition skipped a generation in the family.
- D) The child has one more chromosome than either of the parents.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 14.4

57) The following question refers to the pedigree chart in the figure for a family, some of whose members exhibit the dominant trait, W . Affected individuals are indicated by a dark square or circle.



What is the genotype of individual II-5?

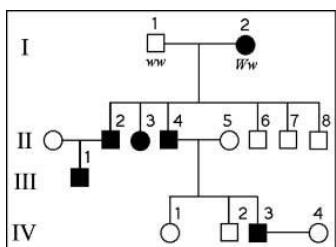
- A) WW
- B) Ww
- C) ww
- D) ww or Ww

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 14.4

58) The following question refers to the pedigree chart in the figure for a family, some of whose members exhibit the dominant trait, W . Affected individuals are indicated by a dark square or circle.



What is the likelihood that the offspring of IV-3 and IV-4 will have the trait?

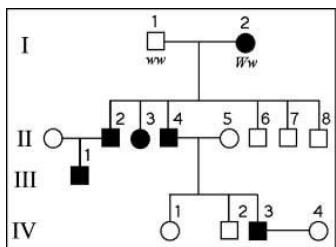
- A) 0%
- B) 50%
- C) 75%
- D) 100%

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 14.4

59) The following question refers to the pedigree chart in the figure for a family, some of whose members exhibit the dominant trait, W. Affected individuals are indicated by a dark square or circle.



What is the probability that individual III-1 is Ww?

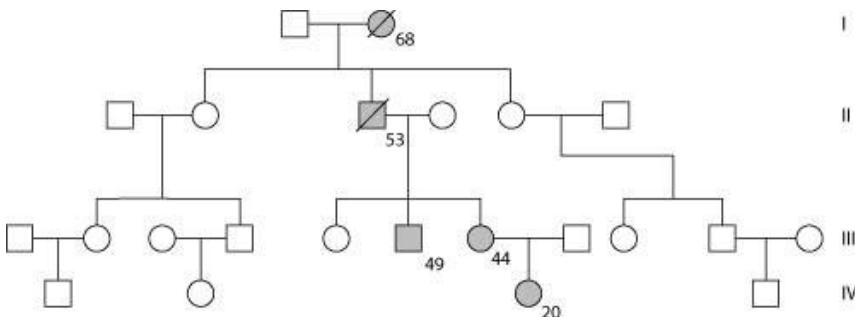
- A) 3/4
- B) 1/4
- C) 2/4
- D) 1

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 14.4

60) The figure shows the pedigree for a family. Dark-shaded symbols represent individuals with one of the two major types of colon cancer. Numbers under the symbols are the individual's age at the time of diagnosis. Males are represented by squares, females by circles.



From this pedigree, this trait seems to be inherited _____.

- A) from mothers
- B) as an autosomal recessive
- C) as a result of epistasis
- D) as an autosomal dominant

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 14.4

61) Which of the following statements is a correct explanation for the observation that all offspring exhibit a phenotype for a particular trait that appears to be a blend of the two parental varieties?

- A) Neither of the parental genes is dominant over the other.
- B) The genes for the trait are dominant in both of the parents.
- C) The genes are linked and do not separate during meiosis.
- D) The genes for the trait are recessive in both of the parents.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 14.3

62) The pattern of inheritance can be predicted from data if one is given the parent or offspring genotypes or phenotypes. Two organisms, with genotypes BbDD and BBdd, are mated.

Assuming independent assortment of the B/b and D/d genes, determine the genotypic ratios in offspring that would occur.

- A) 1/2 BBDD, 1/2 bbdd
- B) 1/4 BBDD, 1/4 BbDD, 1/4 BBDd, 1/4 BbDd
- C) 9/16 BBDD, 3/16 BbDD, 3/16 BBDd, 1/16 bbdd
- D) 1/4 BBDD, 1/2 BbDd, 1/4 bbdd

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 14.2

15.1 Multiple-Choice Questions

1) When Thomas Hunt Morgan crossed his red-eyed F₁ generation flies to each other, the F₂ generation included both red- and white-eyed flies. Remarkably, all the white-eyed flies were male. What was the explanation for this result?

- A) The gene involved is located on the Y chromosome.
- B) The gene involved is located on the X chromosome.
- C) The gene involved is located on an autosome, but only in males.
- D) Other male-specific factors influence eye color in flies.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.1

2) Which of the following statements correctly describes the meaning of the chromosome theory of inheritance as expressed in the early 20th century?

- A) Individuals inherit particular chromosomes attached to genes.
- B) Mendelian genes are at specific loci on the chromosome and, in turn, segregate during meiosis.
- C) No more than a single pair of chromosomes can be found in a healthy normal cell.
- D) Natural selection acts on certain chromosome combinations rather than on genes.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.1

3) Why are males more often affected by sex-linked traits than females?

- A) Male hormones such as testosterone often alter the effects of mutations on the X chromosome.
- B) Female hormones such as estrogen often compensate for the effects of mutations on the X chromosome.
- C) X chromosomes in males generally have more mutations than X chromosomes in females.
- D) Males are hemizygous for the X chromosome.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.2

4) The *SRY* gene is best described as _____.

- A) a gene present on the X chromosome that triggers female development
- B) an autosomal gene that is required for the expression of genes on the Y chromosome
- C) a gene present on the Y chromosome that triggers male development
- D) an autosomal gene that is required for the expression of genes on the X chromosome

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.2

5) In cats, black fur color is determined by an X-linked allele; the other allele at this locus determines orange color. The heterozygote is tortoiseshell. What kinds of offspring would you expect from the cross of a black female and an orange male?

- A) tortoiseshell females; tortoiseshell males
- B) black females; orange males
- C) tortoiseshell females; black males
- D) orange females; black males

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 15.2

6) Red-green color blindness is a sex-linked recessive trait in humans. Two people with normal color vision have a color-blind son. What are the genotypes of the parents?

- A) X^nX^n and X^nY
- B) X^NXX^N and X^nY
- C) X^NXX^N and X^NY
- D) X^NXX^n and X^NY

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 15.2

7) Cinnabar eye color is a sex-linked, recessive characteristic in fruit flies. If a female having cinnabar eyes is crossed with a wild-type male, what percentage of the F₁ males will have cinnabar eyes?

- A) 0%
- B) 25%
- C) 50%
- D) 100%

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 15.2

8) Generally, only female cats have the tortoiseshell phenotype for fur color. Which of the following statements explains this phenomenon?

- A) A male inherits only one allele of the X-linked gene controlling hair color.
- B) The Y chromosome has a gene blocking orange coloration.
- C) Only males can have Barr bodies.
- D) Multiple crossovers on the Y chromosome prevent orange pigment production.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.2

9) In birds, sex is determined by a ZW chromosome scheme. Males are ZZ and females are ZW. A recessive lethal allele that causes death of the embryo is sometimes present on the Z chromosome in pigeons. What would be the sex ratio in the offspring of a cross between a male that is heterozygous for the lethal allele and a normal female?

- A) 2:1 male to female
- B) 1:2 male to female
- C) 1:1 male to female
- D) 3:1 male to female

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 15.2

10) Sex determination in mammals is due to the *SRY* gene found on the Y chromosome. Which of the following situations could allow a person with an XX karyotype to develop a male phenotype?

- A) the loss of the *SRY* gene from an autosome
- B) translocation of *SRY* to an X chromosome
- C) the presence of an extra autosomal chromosome
- D) the presence of one normal and one shortened (deleted) X

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 15.2

11) In humans, clear gender differentiation occurs not at fertilization, but after the second month of gestation. Which of the following statements describes the first event of this differentiation?

- A) formation of testosterone in male embryos
- B) formation of estrogens in female embryos
- C) activation of *SRY* in male embryos and masculinization of the gonads
- D) activation of *SRY* in females and feminization of the gonads

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.2

12) Duchenne muscular dystrophy is a serious condition caused by a recessive allele of a gene on the human X chromosome. The patients have muscles that weaken over time because they have absent or decreased dystrophin, a muscle protein. They rarely live past their 20s. How likely is it for a woman to have this condition?

- A) Women can never have this condition.
- B) One-fourth of the daughters of an affected man would have this condition.
- C) One-half of the daughters of an affected father and a carrier mother could have this condition.
- D) Only if a woman is XXX could she have this condition.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 15.2

13) All female mammals have one active X chromosome per cell instead of two. What causes this to happen?

- A) activation of the *XIST* gene on the X chromosome that will become the Barr body
- B) activation of the *BARR* gene on one X chromosome, which then becomes inactive
- C) inactivation of the *XIST* gene on the X chromosome derived from the male parent
- D) attachment of methyl (-CH₃) groups to the X chromosome that will remain active

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.2

14) A man who is a dwarf with achondroplasia and normal vision marries a color-blind woman of normal height. The man's father was six feet tall, and both the woman's parents were of average height. Dwarfism caused by achondroplasia is autosomal dominant, and red-green color blindness is X-linked recessive. How many of their daughters might be expected to be color-blind with achondroplasia?

- A) none
- B) half
- C) one out of four
- D) three out of four

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 15.2

15) A man who is a dwarf with achondroplasia and normal vision marries a color-blind woman of normal height. The man's father was six feet tall, and both the woman's parents were of average height. Dwarfism caused by achondroplasia is autosomal dominant, and red-green color blindness is X-linked recessive. What proportion of their sons would be color blind and of normal height?

- A) none
- B) half
- C) one out of four
- D) all

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 15.2

16) Pseudohypertrophic muscular dystrophy is a human disorder that causes gradual deterioration of the muscles. Only boys are affected, and they are always born to phenotypically normal parents. Due to the severity of the disease, the boys die in their teens. Is this disorder likely to be caused by a dominant or recessive allele? Is the inheritance of this trait sex-linked or autosomal?

- A) dominant, sex-linked
- B) recessive, autosomal
- C) recessive, sex-linked
- D) incomplete dominant, sex-linked

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 15.2

17) A recessive allele on the X chromosome is responsible for red-green color blindness in humans. A woman with normal vision whose father is color blind marries a color-blind male. What is the probability that this couple's first son will be color blind?

- A) 1/4
- B) 1/2
- C) 2/3
- D) 3/4

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 15.2

18) Which of the following individuals will inherit an X-linked allele from a man who carries it?

- A) all of his daughters
- B) half of his daughters
- C) all of his sons
- D) all of his children

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.2

19) Glucose-6-phosphate dehydrogenase deficiency (G6PD) is inherited as an X-linked recessive allele in humans. A woman whose father suffered from G6PD marries a normal man. What proportion of their sons is expected to be G6PD?

- A) 100%
- B) 1/4
- C) 1/2
- D) zero

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 15.2

20) Glucose-6-phosphate dehydrogenase deficiency (G6PD) is inherited as an X-linked recessive allele in humans. A woman whose father suffered from G6PD marries a man who has the disease. What proportion of their sons would have the disease?

- A) 100%
- B) 1/2
- C) 1/4
- D) zero

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 15.2

21) Use the following information to answer the question.

Sex	Phenotype	Number
male	wild	123
male	yellow	116
female	wild	240

In a *Drosophila* experiment, a cross was made between homozygous wild-type females and yellow-bodied males. All of the resulting F1s were phenotypically wild type. However, adult flies of the F2 generation (resulting from matings of the F1s) had the characteristics shown in the figure. How is the mutant allele for yellow body inherited?

- A) It is recessive.
- B) It is codominant.
- C) It is dominant.
- D) It is incompletely dominant.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 15.2

22) Use the following information to answer the question.

Sex	Phenotype	Number
male	wild	123
male	yellow	116
female	wild	240

In a *Drosophila* experiment, a cross was made between homozygous wild-type females and yellow-bodied males. All of the resulting F1s were phenotypically wild type. However, adult flies of the F2 generation (resulting from matings of the F1s) had the characteristics shown in the figure. How is the mutant allele for yellow body inherited?

- A) It is not X-linked.
- B) It is X-linked.
- C) It is inherited by X inactivation.
- D) It is Y-linked.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 15.2

23) Which of the following statements regarding gene linkage is correct?

- A) The closer two genes are on a chromosome, the lower the probability that a crossover will occur between them.
- B) The observed frequency of recombination of two genes that are far apart from each other has a maximum value of 100%.
- C) All of the traits that Mendel studied—seed color, pod shape, flower color, and others—are due to genes linked on the same chromosome.
- D) Linked genes are found on different chromosomes.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.3

24) Which of the following statements would explain a testcross involving F1 dihybrid flies in which more parental-type offspring than recombinant-type offspring are produced?

- A) The two genes are closely linked on the same chromosome.
- B) The two genes are linked but on different chromosomes.
- C) Recombination did not occur in the cell during meiosis.
- D) Both of the characters are controlled by more than one gene.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.3

- 25) What does a recombination frequency of 50% indicate?
- A) The two genes are likely to be located on different chromosomes.
 - B) All of the offspring have combinations of traits that match one of the two parents.
 - C) The genes are located on sex chromosomes.
 - D) Abnormal meiosis has occurred.
- Answer: A
- Bloom's Taxonomy: Knowledge/Comprehension
- Section: 15.3
- 26) Which of the following phrases correctly defines what one map unit is?
- A) the physical distance between two linked genes
 - B) a 1% frequency of recombination between two genes
 - C) 1 nanometer of distance between two genes
 - D) the recombination frequency between two genes assorting independently
- Answer: B
- Bloom's Taxonomy: Knowledge/Comprehension
- Section: 15.3
- 27) Which of the following occurrences describes how recombination between linked genes comes about?
- A) Nonrecombinant chromosomes break and then rejoin with one another.
 - B) Independent assortment sometimes fails.
 - C) Linked genes travel together at anaphase.
 - D) Crossovers between these genes result in chromosomal exchange.
- Answer: D
- Bloom's Taxonomy: Knowledge/Comprehension
- Section: 15.3
- 28) What is an adaptive advantage of recombination between linked genes?
- A) Recombination is required for independent assortment.
 - B) Recombination must occur or genes will not assort independently.
 - C) New allele combinations are acted upon by natural selection.
 - D) The forces on the cell during meiosis II result in recombination.
- Answer: C
- Bloom's Taxonomy: Knowledge/Comprehension
- Section: 15.3
- 29) Map units on a linkage map cannot be relied upon to calculate physical distances on a chromosome for which of the following reasons?
- A) The frequency of crossing over varies along the length of the chromosome.
 - B) The relationship between recombination frequency and map units is different in every individual.
 - C) Physical distances between genes change during the course of the cell cycle.
 - D) The gene order on the chromosomes is slightly different in every individual.
- Answer: A
- Bloom's Taxonomy: Knowledge/Comprehension
- Section: 15.3

30) Use the following map of four genes on a chromosome to answer the question.



Between which two genes would you expect the highest frequency of recombination?

- A) *A* and *W*
- B) *E* and *G*
- C) *A* and *E*
- D) *A* and *G*

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 15.3

31) Use the following information to answer the question.

		<i>b</i> = black body <i>cn</i> = cinnabar eyes <i>rb</i> = reduced bristles <i>vg</i> = vestigial wings		
		<i>b</i>	<i>cn</i>	<i>rb</i>
Gene	<i>b</i>	0	9	3.5
	<i>cn</i>	9	0	6.5
	<i>rb</i>	3.5	6.5	0
	<i>vg</i>	19	9.0	16
		<i>b</i>	<i>cn</i>	<i>rb</i>

The numbers in the boxes are the recombination frequencies in between the genes (in percent).

In a series of mapping experiments, the recombination frequencies for four different linked genes of *Drosophila* were determined as shown in the figure. Based on this information, what is the order of these genes on a chromosome map?

- A) *rb-cn-vg-b*
- B) *cn-rb-b-vg*
- C) *b-rb-cn-vg*
- D) *vg-cn-b-rb*

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 15.3

32) Use the following information to answer the question.

A plantlike organism on the planet Pandora can have three recessive genetic traits: bluish leaves, due to an allele (*a*) of gene *A*; a feathered stem, due to an allele (*b*) of gene *B*; and hollow roots due to an allele (*c*) of gene *C*. The three genes are linked and recombine.

A geneticist performed a testcross with an organism that had been found to be heterozygous for the three recessive traits, and she was able to identify progeny of the following phenotypic distribution (+ = wild type):

Phenotypes	Leaves	Stems	Roots	Number
1	<i>a</i>	+	+	14
2	<i>a</i>	+	<i>c</i>	0
3	<i>a</i>	<i>b</i>	+	32
4	<i>a</i>	<i>b</i>	<i>c</i>	440
5	+	<i>b</i>	+	0
6	+	<i>b</i>	<i>c</i>	16
7	+	+	<i>c</i>	28
8	+	+	+	470
			Total	1000

Which of the following are the phenotypes of the parents in this cross?

- A) 2 and 5
- B) 1 and 6
- C) 4 and 8
- D) 3 and 7

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 15.3

33) Use the following information to answer the question.

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7	+	+	<i>c</i>	28
8	+	+	+	470
			Total	1000

Which of the progeny phenotypes will require recombination between genes *A* and *B*?

- A) 1, 2, 5, and 6
- B) 1, 3, 6, and 7
- C) 2, 4, 5, and 8
- D) 2, 3, 5, and 7

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 15.3

34) Use the following information to answer the question.

A plantlike organism on the planet Pandora can have three recessive genetic traits: bluish leaves, due to an allele (*a*) of gene *A*; a feathered stem, due to an allele (*b*) of gene *B*; and hollow roots due to an allele (*c*) of gene *C*. The three genes are linked and recombine.

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6	+	<i>b</i>	<i>c</i>	16
7	+	+	<i>c</i>	28
8	+	+	+	470
			Total	1000

If recombination frequency is equal to distance in map units, what is the approximate distance between genes *A* and *B*?

- A) 3 map units
- B) 6 map units
- C) 15 map units
- D) 30 map units

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 15.3

35) Use the following information to answer the question.

A plantlike organism on the planet Pandora can have three recessive genetic traits: bluish leaves, due to an allele (*a*) of gene *A*; a feathered stem, due to an allele (*b*) of gene *B*; and hollow roots due to an allele (*c*) of gene *C*. The three genes are linked and recombine.

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5	+	<i>b</i>	+	0
6	+	<i>b</i>	<i>c</i>	16
7	+	+	<i>c</i>	28
8	+	+	+	470
			Total	1000

What is the greatest benefit of having used a testcross for this experiment?

- A) The homozygous recessive parents are obvious to the naked eye.
- B) The homozygous parents are the only ones whose crossovers make a difference.
- C) The phenotypes of the progeny reveal the allelic content of the gamete from the heterozygous parent.
- D) All of the progeny will be heterozygous.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 15.3

36) Use the following information to answer the question.

A plantlike organism on the planet Pandora can have three recessive genetic traits: bluish leaves, due to an allele (*a*) of gene *A*; a feathered stem, due to an allele (*b*) of gene *B*; and hollow roots due to an allele (*c*) of gene *C*. The three genes are linked and recombine.

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5	+	<i>b</i>	+	0
6	+	<i>b</i>	<i>c</i>	16
7	+	+	<i>c</i>	28
8	+	+	+	470
			Total	1000

The greatest distance among the three genes is between *a* and *c*. What does this mean?

- A) Gene *c* is between *a* and *b*.
- B) Genes are in the order: *a-b-c*.
- C) Gene *a* is not recombining with *c*.
- D) Gene *a* is between *b* and *c*.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 15.3

37) Which of the following statements correctly describes the reason that closely linked genes are typically inherited together?

- A) They are located close together on the same chromosome.
- B) The number of genes in a cell is greater than the number of chromosomes.
- C) Alleles are paired together during meiosis.
- D) Genes align that way during metaphase I of meiosis.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.3

38) A homozygous tomato plant with red fruit and yellow flowers was crossed with a homozygous tomato plant with golden fruit and white flowers. The F₁ all had red fruit and yellow flowers. The F₁ were testcrossed by crossing them to homozygous recessive individuals, and the following offspring were obtained:

Red fruit and yellow flowers—41

Red fruit and white flowers—7

Golden fruit and yellow flowers—8

Golden fruit and white flowers—44

How many map units separate these genes?

- A) 17.6
- B) 15
- C) 17.1
- D) 18.1

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 15.3

39) In *Drosophila melanogaster*, vestigial wings are determined by a recessive allele of a gene that is linked to a gene with a recessive allele that determines black body color. T. H. Morgan crossed black-bodied, normal-winged females and gray-bodied, vestigial-winged males. The F₁ were all gray bodied, normal winged. The F₁ females were crossed to homozygous recessive males to produce testcross progeny. Morgan calculated the map distance to be 17 map units. Which of the following information is correct about the testcross progeny?

- A) black-bodied, normal-winged flies = 17% of the total
- B) black-bodied, normal-winged flies *plus* gray-bodied, vestigial-winged flies = 17% of the total
- C) gray-bodied, normal-winged flies *plus* black-bodied, vestigial-winged flies = 17% of the total
- D) black-bodied, vestigial-winged flies = 17% of the total

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 15.3

40) If cell X enters meiosis, and nondisjunction of one chromosome occurs in one of its daughter cells during meiosis II, how will this affect the gametes at the completion of meiosis?

- A) All the gametes descended from cell X will be diploid.
- B) Half of the gametes descended from cell X will be $n + 1$, and half will be $n - 1$.
- C) One-quarter of the gametes descended from cell X will be $n + 1$, one-quarter will be $n - 1$, and half will be n .
- D) Two of the four gametes descended from cell X will be haploid, and two will be diploid.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.4

41) One possible result of chromosomal breakage is for a fragment to join a nonhomologous chromosome. What is this type of chromosomal alteration called?

- A) deletion
- B) inversion
- C) translocation
- D) duplication

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.4

42) Which of the following statements correctly describes what happens to a chromosome after a nonreciprocal translocation occurs?

- A) A deletion of part of the chromosome occurs.
- B) A duplication of part of the chromosome occurs.
- C) Nondisjunction of pairs of homologous occurs.
- D) A chromosome transfers a fragment but receives none in return.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.4

43) Of the following human aneuploidies, which is the one that generally has the most severe impact on the health of the individual?

- A) 47, trisomy 21
- B) 47, XXY
- C) 47, XXX
- D) 45, X

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.4

44) A phenotypically normal prospective couple seeks genetic counseling because the man knows that he has a translocation of a portion of his chromosome 4, which has been exchanged with a portion of his chromosome 12. Although his translocation is balanced, he and his wife want to know the probability that his sperm will be abnormal. What is your prognosis regarding his sperm?

- A) One-quarter will carry the two normal chromosomes, 4 and 12, one-quarter will have only the two translocation chromosomes and no normal chromosomes 4 and 12, and half will have one normal and one translocated chromosome.
- B) All will carry the same translocation as the father.
- C) None will carry the translocation.
- D) Half will be normal, and the rest will have the father's translocation.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 15.4

45) Abnormal chromosomes are frequently found in malignant tumors. Errors such as translocations may place a gene in close proximity to different control regions. Which of the following events might then occur to make the cancer worse?

- A) an increase in nondisjunction
- B) expression of inappropriate gene products
- C) a decrease in mitotic frequency
- D) failure of the cancer cells to multiply

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 15.4

46) A couple has a child with Down syndrome. The mother is 39 years old at the time of delivery. Which of the following is the most probable cause of the child's condition?

- A) The woman inherited this tendency from her parents.
- B) The mother had a chromosomal duplication.
- C) One member of the couple underwent nondisjunction in somatic cell production.
- D) One of the gametes in the mother most likely underwent nondisjunction during meiosis.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 15.4

47) What is a syndrome?

- A) a characteristic facial appearance
- B) a trait that leads to cancer at some stage in life
- C) a group of traits typically found in conjunction with a particular chromosomal aberration or gene mutation
- D) a specific characteristic that appears in conjunction with one specific aneuploidy

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.4

48) Which of the following correctly describes a Philadelphia chromosome?

- A) a human chromosome 22 that has had a specific translocation
- B) a human chromosome 9 that is found only in one type of cancer
- C) an animal chromosome found primarily in the mid-Atlantic area of the United States
- D) a chromosome found only in mitochondria

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.4

49) Which of the following statements is generally true of aneuploidies in newborns?

- A) A monosomy is more frequent than a trisomy.
- B) Monosomy X is the only viable monosomy known to occur in humans.
- C) Human aneuploidy usually conveys an adaptive advantage in humans.
- D) An aneuploidy resulting in the deletion of a chromosome segment is less serious than a duplication.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.4

50) A woman is found to have 47 chromosomes, including three X chromosomes. Which of the following statements describes her expected phenotype?

- A) a female with masculine characteristics such as facial hair
- B) an apparent male who is sterile
- C) healthy female of slightly above-average height
- D) a sterile female

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.4

51) Which of the following is an example of monosomy in humans?

- A) Turner syndrome
- B) Klinefelter syndrome
- C) Down syndrome
- D) trisomy X

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.4

52) Genomic imprinting is generally due to the addition of methyl (-CH₃) groups to C nucleotides and chemical histone changes to silence a given gene. If this depends on the sex of the parent who transmits the gene, which of the following statements must be true?

- A) Genes required for early development stages must not be imprinted.
- B) Methylation of this kind must occur more in males than in females.
- C) Methylation must be reversible in ovarian and testicular cells.
- D) The imprints are transmitted only to gamete-producing cells.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 15.5

53) German scientist Carl Correns found that the inheritance of variegated color on the leaves of certain plants was determined only by the maternal parent. What phenomenon explains this pattern of inheritance?

- A) ribosome structure
- B) inheritance of plastid genes
- C) genomic imprinting
- D) sex linkage

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 15.5

54) Mitochondrial DNA is primarily involved in coding for proteins needed for protein complexes of the electron transport chain and ATP synthase. Therefore, mutations in mitochondrial genes would most affect which of the following processes?

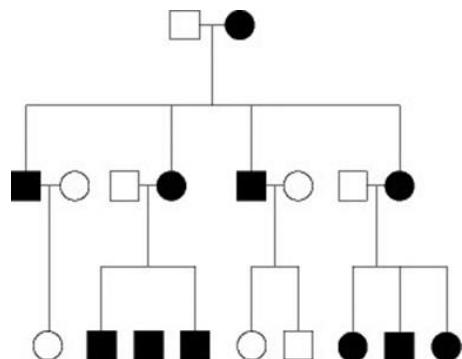
- A) DNA synthesis in cells of the immune system
- B) the movement of oxygen into erythrocytes
- C) generation of ATP in muscle cells
- D) the storage of urine in the urinary bladder

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 15.5

55) Use the following figure to answer the question.



The pedigree in the figure shows the transmission of a trait in a particular family. Based on this pattern of transmission, the trait is most likely _____.

- A) mitochondrial
- B) sex-linked dominant
- C) sex-linked recessive
- D) autosomal dominant

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 15.5

56) A certain kind of snail can have a right-handed direction of shell coiling (*DD* or *Dd*) or left-handed coiling (*dd*). However, if direction of coiling is due to a protein deposited by the mother in the egg cytoplasm, then a *Dd* egg-producing snail and a *dd* sperm-producing snail will have offspring of which genotype(s) and phenotype(s)?

- A) 1/2 *Dd*:1/2 *dd*; all right-coiling
- B) all *Dd*; all right-coiling
- C) 1/2 *Dd*: 1/2 *dd*; half right-coiling and half left-coiling
- D) all *Dd*; half right-coiling and half left-coiling

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 15.5

57) During meiosis, a defect occurs in a cell that results in the failure of spindle microtubules binding at the kinetochores. Which of the following statements describes the most likely result of such a defect?

- A) New microtubules with more effective binding capabilities to kinetochores will be synthesized to compensate for the defect.
- B) Excessive cell divisions will occur resulting in cancerous tumors and an increase in the chromosome numbers known as polyploidy.
- C) The defect will be bypassed in order to ensure normal chromosome distribution in the new cells.
- D) The resulting cells will not receive the correct number of chromosomes in the gametes, a condition known as aneuploidy.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 15.4

58) Inheritance patterns cannot always be explained by Mendel's models of inheritance. If a pair of homologous chromosomes fails to separate during meiosis I, select the choice that shows the chromosome number of the four resulting gametes with respect to the normal haploid number (n)?

- A) $n + 1$; $n + 1$; $n - 1$; $n - 1$
- B) $n + 1$; $n - 1$; n ; n
- C) $n + 1$; $n - 1$; $n - 1$; $n - 1$
- D) $n + 1$; $n + 1$; n ; n

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 15.4

16.1 Multiple-Choice Questions

- 1) In his transformation experiments, what phenomenon did Griffith observe?
- A) Mixing a heat-killed pathogenic strain of bacteria with a living nonpathogenic strain can convert some of the living cells into the pathogenic form.
 - B) Mixing a heat-killed nonpathogenic strain of bacteria with a living pathogenic strain makes the pathogenic strain nonpathogenic.
 - C) Infecting mice with nonpathogenic strains of bacteria makes them resistant to pathogenic strains.
 - D) Mice infected with a pathogenic strain of bacteria can spread the infection to other mice.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.1

- 2) Which of the following statements describes the process of transformation in bacteria?
- A) A strand of DNA is created from an RNA molecule.
 - B) A strand of RNA is created from a DNA molecule.
 - C) Bacterial cells are infected by a phage DNA molecule.
 - D) External DNA is taken into a cell, becoming part of the cell's genome.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.1

- 3) A heat-killed, phosphorescent (light-emitting) strain of bacteria is mixed with a living, non-phosphorescent strain. Further observations of the mixture show that some of the living cells are now phosphorescent. Which of the following observations would provide the best evidence that the ability to phosphoresce is a heritable trait?

- A) evidence that DNA was passed from the heat-killed strain to the living strain
- B) evidence that protein passed from the heat-killed strain to the living strain
- C) especially bright phosphorescence in the living strain
- D) phosphorescence in descendants of the living cells

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 16.1

- 4) Which of the following facts did Hershey and Chase make use of in trying to determine whether DNA or protein is the genetic material?
- A) DNA contains sulfur, whereas protein does not.
 - B) DNA contains phosphorus, whereas protein does not.
 - C) DNA contains nitrogen, whereas protein does not.
 - D) DNA contains purines, whereas protein includes pyrimidines.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.1

5) Which of the following investigators was (were) responsible for the discovery that in DNA from any species, the amount of adenine equals the amount of thymine, and the amount of guanine equals the amount of cytosine?

- A) Alfred Hershey and Martha Chase
- B) Oswald Avery, Maclyn McCarty, and Colin MacLeod
- C) Erwin Chargaff
- D) Matthew Meselson and Franklin Stahl

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.1

6) Cytosine makes up 42% of the nucleotides in a sample of DNA from an organism.

Approximately what percentage of the nucleotides in this sample will be thymine?

- A) 8%
- B) 16%
- C) 42%
- D) 58%

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 16.1

7) Thymine makes up 28% of the nucleotides in a sample of DNA from an organism.

Approximately what percentage of the nucleotides in this sample will be guanine?

- A) 8%
- B) 16%
- C) 22%
- D) 72%

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 16.1

8) It became apparent to Watson and Crick after completion of their model that the DNA molecule could carry a vast amount of hereditary information. Which of the following characteristics of DNA is responsible for this?

- A) sequence of bases
- B) phosphate-sugar backbones
- C) complementary pairing of bases
- D) side groups of nitrogenous bases

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.1

9) In an analysis of the nucleotide composition of a molecule of DNA, which of the following combinations of base pairs will be found?

- A) A = C
- B) A = G and C = T
- C) A + C = G + T
- D) G + C = T + A

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 16.1

10) For a science fair project, two students decided to repeat the Hershey and Chase experiment, with modifications. They decided to radioactively label the nitrogen of the DNA, rather than the phosphate. They reasoned that each nucleotide has only one phosphate and two to five nitrogen atoms. Thus, labeling the nitrogen atoms would provide a stronger signal than labeling the phosphates. Why won't this experiment work?

- A) There is no radioactive isotope of nitrogen.
- B) Radioactive nitrogen has a half-life of 100,000 years, and the material would be too dangerous for too long.
- C) Although there are more nitrogens in a nucleotide, labeled phosphates actually have 16 extra neutrons; therefore, they are more radioactive.
- D) Amino acids (and thus proteins) also have nitrogen atoms; thus, the radioactivity would not distinguish between DNA and proteins.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 16.1

11) Hershey and Chase set out to determine what molecule served as the unit of inheritance. They completed a series of experiments in which *E. coli* was infected by a T2 virus. Which molecular component of the T2 virus actually ended up inside the cell?

- A) protein
- B) RNA
- C) ribosome
- D) DNA

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 16.1

12) In the polymerization of DNA, a phosphodiester bond is formed between a phosphate group of the nucleotide being added and which of the following atoms or molecules of the last nucleotide in the polymer?

- A) the 5' phosphate
- B) C₆
- C) the 3' OH
- D) a nitrogen from the nitrogen-containing base

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.1

- 13) Which of the following statements accurately describes the differences between DNA replication in prokaryotes and DNA replication in eukaryotes?
- A) Prokaryotic chromosomes have histones, whereas eukaryotic chromosomes do not.
 - B) Prokaryotic chromosomes have a single origin of replication, whereas eukaryotic chromosomes have many.
 - C) The rate of elongation during DNA replication is slower in prokaryotes than in eukaryotes.
 - D) Prokaryotes produce Okazaki fragments during DNA replication, but eukaryotes do not.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

- 14) What is meant by the description "antiparallel" regarding the two strands that make up the DNA double helix?
- A) The double helix structure of DNA creates nonparallel strands.
 - B) The 5' to 3' direction of one strand runs counter to the 5' to 3' direction of the other strand.
 - C) Base pairings create unequal spacing between the two DNA strands.
 - D) One strand contains only purines and the other contains only pyrimidines.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

- 15) Suppose you are provided with an actively dividing culture of *E. coli* bacteria to which radioactive thymine has been added. What would happen if a cell replicates once in the presence of this radioactive base?

- A) One of the daughter cells, but not the other, would have radioactive DNA.
- B) Neither of the two daughter cells would be radioactive.
- C) All four bases of the DNA would be radioactive.
- D) DNA in both daughter cells would be radioactive.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 16.2

- 16) In *E. coli*, there is a mutation in a gene called *dnaB* that alters the helicase that normally acts at the origin of replication. Which of the following events would you expect to occur as a result of this mutation?

- A) Additional proofreading will occur.
- B) No replication fork will be formed.
- C) Replication will occur via RNA polymerase alone.
- D) Replication will require a DNA template from another source.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 16.2

17) In *E. coli*, which enzyme catalyzes the elongation of a new DNA strand in the 5' → 3' direction?

- A) primase
- B) DNA ligase
- C) DNA polymerase III
- D) helicase

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

18) Which of the following characteristics of eukaryotic telomeres cause them to replicate differently than the rest of the chromosome?

- A) the activity of telomerase enzyme
- B) DNA polymerase that cannot replicate the leading strand template to its 5' end
- C) gaps left at the 5' end of the lagging strand template
- D) gaps left at the 3' end of the lagging strand because of the need for a primer

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 16.2

19) How does the enzyme telomerase meet the challenge of replicating the ends of linear chromosomes?

- A) It adds a single 5' cap structure that resists degradation by nucleases.
- B) It causes specific double-strand DNA breaks that result in blunt ends on both strands.
- C) It catalyzes the lengthening of telomeres, compensating for the shortening that could occur during replication without telomerase activity.
- D) It adds numerous GC pairs, which resist hydrolysis and maintain chromosome integrity.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

20) At a specific area of a chromosome, the sequence of nucleotides below is present where the chain opens to form a replication fork:

3' C C T A G G C T G C A A T C C 5'

An RNA primer is formed starting at the underlined T (T) of the template. Which of the following represents the primer sequence?

- A) 5' G C C T A G G 3'
- B) 5' A C G T T A G G 3'
- C) 5' A C G U U A G G 3'
- D) 5' G C C U A G G 3'

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 16.2

21) In *E. coli*, to repair a thymine dimer by nucleotide excision repair, in which order do the necessary enzymes act?

- A) nuclease, DNA polymerase, RNA primase
- B) helicase, DNA polymerase, DNA ligase
- C) DNA ligase, nuclease, helicase
- D) nuclease, DNA polymerase, DNA ligase

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

22) In *E. coli*, what is the function of DNA polymerase III?

- A) to unwind the DNA helix during replication
- B) to seal together the broken ends of DNA strands
- C) to add nucleotides to the 3' end of a growing DNA strand
- D) to degrade damaged DNA molecules

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

23) Which of the following statements correctly describes the difference between ATP and the nucleotides used during DNA synthesis?

- A) The nucleotides have the sugar deoxyribose; ATP has the sugar ribose.
- B) The nucleotides have two phosphate groups; ATP has three phosphate groups.
- C) ATP contains three high-energy bonds; the nucleotides have two.
- D) ATP is found only in human cells; the nucleotides are found in all animal and plant cells.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

24) Which of the following statements correctly describes the difference between the leading and the lagging strands of DNA during DNA replication?

- A) The leading strand is synthesized in the same direction as the movement of the replication fork, and the lagging strand is synthesized in the opposite direction.
- B) The leading strand is synthesized by adding nucleotides to the 3' end of the growing strand, and the lagging strand is synthesized by adding nucleotides to the 5' end.
- C) The lagging strand is synthesized continuously, whereas the leading strand is synthesized in short fragments that are ultimately stitched together.
- D) The leading strand is synthesized at twice the rate of the lagging strand.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

- 25) Why does a new DNA strand elongate only in the 5' to 3' direction during DNA replication?
- A) DNA polymerase begins adding nucleotides at the 5' end of the template.
 - B) The polarity of the DNA molecule prevents addition of nucleotides at the 3' end.
 - C) Replication must progress toward the replication fork.
 - D) DNA polymerase can add nucleotides only to the free 3' end.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

- 26) What is the function of the enzyme topoisomerase in DNA replication?
- A) relieving strain in the DNA ahead of the replication fork caused by the untwisting of the double helix
 - B) elongating new DNA at a replication fork by adding nucleotides to the existing chain
 - C) reattaching the hydrogen bonds between the base pairs in the double helix
 - D) building RNA primers using the parental DNA strand as a template

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

- 27) What is the role of DNA ligase in the elongation of the lagging strand during DNA replication?
- A) It synthesizes RNA nucleotides to make a primer.
 - B) It joins Okazaki fragments together.
 - C) It unwinds the parental double helix.
 - D) It stabilizes the unwound parental DNA.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

- 28) Which of the following types of molecules help to hold the DNA strands apart while they are being replicated?
- A) primase
 - B) ligase
 - C) DNA polymerase
 - D) single-strand DNA binding proteins

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

29) Individuals with the disorder xeroderma pigmentosum are hypersensitive to sunlight, and mutations to the DNA in their skin cells are left uncorrected. Why are the mutations not corrected in individuals with this disorder?

- A) The disorder makes cells unable to replicate DNA.
- B) The disorder causes mitosis to stop during metaphase.
- C) The disorder makes cells unable to form chromosomes.
- D) The disorder causes cells to be unable to repair thymine dimers.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

30) Which of the following characteristics would you expect of a eukaryotic organism that lacks the enzyme telomerase?

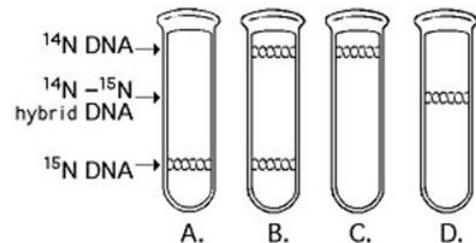
- A) a high probability of somatic cells becoming cancerous
- B) an inability to produce Okazaki fragments
- C) an inability to repair thymine dimers
- D) a reduction in chromosome length in gametes

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 16.2

31) Use the figure to answer the following question.



In the late 1950s, Meselson and Stahl grew bacteria in a medium containing "heavy" (radioactive) nitrogen (¹⁵N) and then transferred them to a medium containing ¹⁴N (non-radioactive). Which of the results in the figure would be expected after one round of DNA replication in the presence of ¹⁴N?

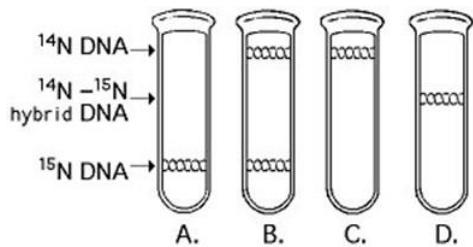
- A) A
- B) B
- C) C
- D) D

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 16.2

32) Use the figure to answer the following question.



A space probe returns with a culture of a microorganism found on a distant planet. Analysis shows that it is a carbon-based life-form that has DNA. You grow the cells in ^{15}N medium for several generations and then transfer them to ^{14}N medium. Which pattern in the figure would you expect if the DNA was replicated in a *conservative* manner?

- A) A
- B) B
- C) C
- D) D

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 16.2

33) After the first replication was observed in their experiments testing the nature of DNA replication, Meselson and Stahl could be confident of which of the following conclusions?

- A) Replication is semi-conservative.
- B) Replication is not dispersive.
- C) Replication is not conservative.
- D) Replication is neither dispersive nor conservative.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

34) You briefly expose bacteria undergoing DNA replication to radioactively labeled nucleotides. When you centrifuge the DNA isolated from the bacteria, the DNA separates into two classes. One class of labeled DNA includes very large molecules (thousands or even millions of nucleotides long), and the other includes short stretches of DNA (several hundred to a few thousand nucleotides in length). Which two classes of DNA do these different samples represent?

- A) leading strands and Okazaki fragments
- B) lagging strands and Okazaki fragments
- C) Okazaki fragments and RNA primers
- D) leading strands and RNA primers

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 16.2

35) Within a double-stranded DNA molecule, adenine forms hydrogen bonds with thymine, and cytosine forms hydrogen bonds with guanine. What is the significance of the structural arrangement?

- A) It allows variable width of the double helix.
- B) It permits complementary base pairing.
- C) It determines the tertiary structure of a DNA molecule.
- D) It determines the type of protein produced.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

36) Semiconservative replication involves a template. What is the template?

- A) single-stranded binding proteins
- B) DNA polymerase
- C) one strand of the DNA molecule
- D) an RNA molecule

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

37) In DNA replication, the resulting daughter molecules contain one strand of the original parental DNA and one new strand. What is the explanation for this phenomenon?

- A) DNA replication is semiconservative.
- B) DNA replication is conservative.
- C) DNA replication is not conservative.
- D) RNA synthesis is conservative.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

38) Who performed classic experiments that supported the semiconservative model of DNA replication?

- A) Watson and Crick
- B) Meselson and Stahl
- C) Hershey and Chase
- D) Franklin and Wilkins

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

39) DNA contains the template needed to copy itself, but it has no catalytic activity in cells. What catalyzes the formation of phosphodiester bonds between adjacent nucleotides in the DNA polymer being formed during DNA replication?

- A) ribozymes
- B) DNA polymerase
- C) ATP
- D) RNA primers

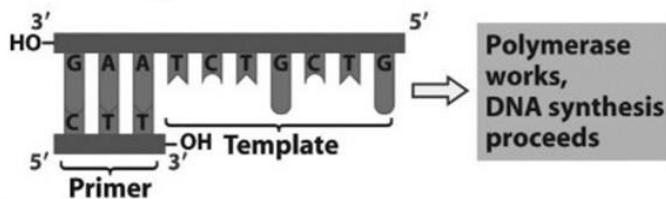
Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

40) Use the figure to answer the following question.

Single strand as a template plus 3' end to start DNA synthesis



Referring to the figure, what bases will be added to the primer as DNA replication proceeds?

- A) 5' C, A, G, C, A, G, A 3'
- B) 3' T, C, T, G, C, T, G 5'
- C) 5' A, G, A, C, G, A, C 3'
- D) 3' G, T, C, G, T, C, T 5'

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 16.2

41) Which of the following statements correctly describes the difference between the leading strand and the lagging strand in DNA replication?

- A) The leading strand is synthesized in the 3' → 5' direction in a discontinuous fashion, while the lagging strand is synthesized in the 5' → 3' direction in a continuous fashion.
- B) The leading strand is synthesized continuously in the 5' → 3' direction, while the lagging strand is synthesized discontinuously in the 5' → 3' direction.
- C) The leading strand requires an RNA primer, whereas the lagging strand does not.
- D) There are different DNA polymerases involved in elongation of the leading strand and the lagging strand.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 16.2

42) What are telomeres?

- A) the structures that hold two sister chromatids together
- B) enzymes that elongate the DNA strand during replication
- C) the sites of origin of DNA replication
- D) the ends of linear chromosomes

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

43) Telomere shortening puts a limit on the number of times a cell can divide. Research has shown that telomerase can extend the life span of cultured human cells. How might adding telomerase affect cellular aging?

- A) Telomerase will speed up the rate of cell proliferation.
- B) Telomerase eliminates telomere shortening and retards aging.
- C) Telomerase shortens telomeres, which delays cellular aging.
- D) Telomerase would have no effect on cellular aging.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 16.2

44) Which of the following types of cells are affected most by telomere shortening?

- A) only prokaryotic cells
- B) only eukaryotic cells
- C) cells in prokaryotes and eukaryotes
- D) only animal cells

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.2

45) Which of the following effects might be caused by reduced or very little active telomerase activity?

- A) Cells may become cancerous.
- B) Telomere lengthens in germ cells.
- C) Cells age and begin to lose function.
- D) Cells maintain normal functioning.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 16.2

46) Researchers found a strain of *E. coli* bacteria that had mutation rates one hundred times higher than normal. Which of the following statements correctly describes the most likely cause of these results?

- A) The single-strand binding proteins were malfunctioning during DNA replication.
- B) There were one or more base pair mismatches in the RNA primer.
- C) The proofreading mechanism of DNA polymerase was not working properly.
- D) The DNA polymerase was unable to add bases to the 3' end of the growing nucleic acid chain.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 16.2

47) In a healthy eukaryotic cell, the rate of DNA repair is typically equal to the rate of DNA mutation. When the rate of repair lags behind the rate of mutation, what is a possible fate of the cell?

- A) The cell can be transformed into a cancerous cell.
- B) RNA may be used instead of DNA as inheritance material.
- C) DNA replication will proceed more quickly.
- D) DNA replication will continue by a new mechanism.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 16.2

48) Which of the following statements accurately describes the structure of a eukaryotic chromosome?

- A) It is composed of a single strand of DNA.
- B) It is constructed as a series of nucleosomes wrapped around two DNA molecules.
- C) It has different numbers of genes in different cell types of an organism.
- D) It is a single linear molecule of double-stranded DNA plus proteins.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.3

49) If a cell were unable to produce histone proteins, which of the following results would be a likely effect on the cell?

- A) There would be an increase in the amount of DNA produced during replication.
- B) The cell's DNA could not be packed into its nucleus.
- C) Spindle fibers would not form during prophase.
- D) Amplification of other genes would compensate for the lack of histones.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 16.3

- 50) Which of the following statements accurately describes one characteristic of histones?
- A) Each nucleosome consists of two molecules of histone H1.
 - B) Histone H1 is not present in the nucleosome bead; instead, it draws the nucleosomes together.
 - C) The carboxyl end of each histone extends outward from the nucleosome and is called a "histone tail."
 - D) Histones are found in mammals, but not in other animals or in plants or fungi.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.3

- 51) Which of the following molecular characteristics cause histones to bind tightly to DNA?
- A) Histones are positively charged, and DNA is negatively charged.
 - B) Histones are negatively charged, and DNA is positively charged.
 - C) Both histones and DNA are strongly hydrophobic.
 - D) Histones are covalently linked to the DNA.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.3

- 52) Which of the following lists represents the order of increasingly higher levels of organization of chromatin?
- A) nucleosome, 30-nm chromatin fiber, looped domain
 - B) looped domain, 30-nm chromatin fiber, nucleosome
 - C) nucleosome, looped domain, 30-nm chromatin fiber
 - D) 30-nm chromatin fiber, nucleosome, looped domain

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.3

- 53) Which of the following statements correctly describes the structure of chromatin?
- A) Heterochromatin is composed of DNA, whereas euchromatin is made of DNA and RNA.
 - B) Both heterochromatin and euchromatin are found in the cytoplasm.
 - C) Heterochromatin is highly condensed, whereas euchromatin is less compact.
 - D) Euchromatin is not transcribed, whereas heterochromatin is transcribed.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.3

- 54) Which of the following structural characteristics is most critical for the association between histones and DNA?
- A) Histones are small proteins.
 - B) Histones are highly conserved (that is, histones are very similar in every eukaryote).
 - C) There are at least five different histone proteins in every eukaryote.
 - D) Histones are positively charged.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 16.3

55) In DNA replication in *E. coli*, the enzyme primase is used to attach a 5 to 10 base ribonucleotide strand complementary to the parental DNA strand. The RNA strand serves as a starting point for the DNA polymerase that replicates the DNA. If a mutation occurred in the primase gene, which of the following results would you expect?

- A) Replication would only occur on the leading strand.
- B) Replication would only occur on the lagging strand.
- C) Replication would not occur on either the leading or lagging strand.
- D) Replication would not be affected as the enzyme primase is involved with RNA synthesis.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 16.2

56) Hershey and Chase used a DNA-based virus for their work. How might the results have been different if they had used an RNA virus?

- A) With an RNA virus, radioactive protein would have been in the final pellet.
- B) With an RNA virus, radioactive RNA would have been in the final pellet.
- C) With an RNA virus, neither sample would have had a radioactive pellet.
- D) With an RNA virus, the protein shell would have been radioactive in both samples.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 16.1

57) The lagging strand is characterized by a series of short segments of DNA (Okazaki fragments) that will be joined together to form a finished lagging strand. The experiments that led to the discovery of Okazaki fragments gave evidence for which of the following ideas?

- A) DNA polymerase is an enzyme that synthesizes leading and lagging strands during replication only in one direction.
- B) DNA is a polymer consisting of four monomers: adenine, thymine, guanine, and cytosine.
- C) DNA is the genetic material.
- D) Bacterial replication is fundamentally different from eukaryotic replication. The key should not be way longer than the distractors.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 16.2

16.2 Student Edition End-of-Chapter Questions

- 1) In his work with pneumonia-causing bacteria and mice, Griffith found that
- A) the protein coat from pathogenic cells was able to transform nonpathogenic cells.
 - B) heat-killed pathogenic cells caused pneumonia.
 - C) some substance from pathogenic cells was transferred to nonpathogenic cells, making them pathogenic.
 - D) the polysaccharide coat of bacteria caused pneumonia.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 2) What is the basis for the difference in how the leading and lagging strands of DNA molecules are synthesized?
- A) The origins of replication occur only at the 5' end.
 - B) Helicases and single-strand binding proteins work at the 5' end.
 - C) DNA polymerase can join new nucleotides only to the 3' end of a pre-existing strand, and the strands are antiparallel.
 - D) DNA ligase works only in the 3' → 5' direction.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 3) In analyzing the number of different bases in a DNA sample, which result would be consistent with the base-pairing rules?
- A) A = G
 - B) A + G = C + T
 - C) A + T = G + C
 - D) A = C

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 4) The elongation of the leading strand during DNA synthesis
- A) progresses away from the replication fork.
 - B) occurs in the 3' → 5' direction.
 - C) produces Okazaki fragments.
 - D) depends on the action of DNA polymerase.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 5) In a nucleosome, the DNA is wrapped around
- A) histones.
 - B) ribosomes.
 - C) polymerase molecules.
 - D) a thymine dimer.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

6) *E. coli* cells grown on ^{15}N medium are transferred to ^{14}N medium and allowed to grow for two more generations (two rounds of DNA replication). DNA extracted from these cells is centrifuged. What density distribution of DNA would you expect in this experiment?

- A) one high-density and one low-density band
- B) one intermediate-density band
- C) one high-density and one intermediate-density band
- D) one low-density and one intermediate-density band

Answer: D

Bloom's Taxonomy: Application/Analysis

7) A biochemist isolates, purifies, and combines in a test tube a variety of molecules needed for DNA replication. When she adds some DNA to the mixture, replication occurs, but each DNA molecule consists of a normal strand paired with numerous segments of DNA a few hundred nucleotides long. What has she probably left out of the mixture?

- A) DNA polymerase
- B) DNA ligase
- C) Okazaki fragments
- D) primase

Answer: B

Bloom's Taxonomy: Application/Analysis

8) The spontaneous loss of amino groups from adenine in DNA results in hypoxanthine, an uncommon base, opposite thymine. What combination of proteins could repair such damage?

- A) nuclease, DNA polymerase, DNA ligase
- B) telomerase, primase, DNA polymerase
- C) telomerase, helicase, single-strand binding protein
- D) DNA ligase, replication fork proteins, adenylyl cyclase

Answer: A

Bloom's Taxonomy: Application/Analysis

17.1 Multiple-Choice Questions

- 1) Which of the following statements correctly describes Archibald Garrod's hypothesis for how "inborn errors of metabolism" such as alkaptonuria occur?
- A) Metabolic enzymes require vitamin cofactors, and affected individuals have significant nutritional deficiencies.
 - B) Enzymes are made of DNA, and affected individuals lack DNA polymerase.
 - C) Certain metabolic reactions are carried out by ribozymes, and affected individuals lack key splicing factors.
 - D) Genes dictate the production of specific enzymes, and affected individuals have genetic defects that cause them to lack certain enzymes.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.1

- 2) A particular triplet of bases in the template strand of DNA is 5'-AGT-3'. What would be the corresponding codon for the mRNA that is transcribed?
- A) 3'-UCA-5'
 - B) 3'-UGA-5'
 - C) 5'-TCA-3'
 - D) 3'-ACU-5'

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 17.1

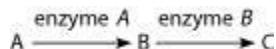
- 3) The genetic code is essentially the same for all organisms. From this, one can logically assume which of the following statements to be true?
- A) A gene from an organism can theoretically be expressed by any other organism.
 - B) DNA was the first genetic material.
 - C) The same codons in different organisms translate into different amino acids.
 - D) Different organisms have different types of amino acids.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 17.1

4) Use the figure to answer the question.



The figure shows a simple metabolic pathway. According to Beadle and Tatum's hypothesis, how many genes are necessary for this pathway?

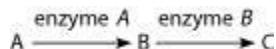
- A) 1
- B) 2
- C) 3
- D) It cannot be determined from the pathway.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 17.1

5) Use the figure to answer the question.



Refer to the metabolic pathway illustrated. If A, B, and C are all required for growth, a strain that is mutant for the gene-encoding enzyme A would be able to grow on medium supplemented with which of the following nutrient(s)?

- A) nutrient A only
- B) either nutrient B or C
- C) nutrient C only
- D) nutrients A and C

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 17.1

6) Use the figure to answer the question.



Refer to the metabolic pathway illustrated. If A, B, and C are all required for growth, a strain mutant for the gene encoding enzyme B would be able to grow on medium supplemented with which of the following nutrient(s)?

- A) nutrient A only
- B) nutrient B only
- C) nutrient C only
- D) nutrients A and C

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 17.1

7) The following question refers to this table of codons.

		Second Base					
		U	C	A	G		
First Base	U	UUU Phe UUC UUA UUG	UCU Ser UCC UCA UCG	UAU Tyr UAC UAA Stop UAG Stop	UGU Cys UGC UGA Stop UGG Trp	U C A G	
	C	CUU Leu CUC CUA CUG	CCU Pro CCC CCA CCG	CAU His CAC CAA Gin CAG	CGU Arg CGC CGA CGG	U C A G	
	A	AUU Ile AUC AUA AUG Met or Start	ACU Thr ACC ACA ACG	AAU Asn AAC AAA Lys AAG	AGU Ser AGC AGA Arg AGG	U C A G	
	G	GUU Val GUC GUA GUG	GCU Ala GCC GCA GCG	GAU Asp GAC GAA Glu GAG	GGU Gly GGC GGA GGG	U C A G	

Which of the following sequences of nucleotides are possible in the template strand of DNA that would code for the polypeptide sequence Phe-Leu-Ile-Val?

- A) 5'-TTG-CTA-CAG-TAG-3'
- B) 5'-AUG-CTG-CAG-TAT-3'
- C) 3'-AAA-AAT-ATA-ACA-5'
- D) 3'-AAA-GAA-TAA-CAA-5'

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 17.1

8) The following question refers to this table of codons.

		Second Base					
		U	C	A	G		
First Base	U	UUU Phe UUC UUA UUG	UCU Ser UCC UCA UCG	UAU Tyr UAC UAA Stop UAG Stop	UGU Cys UGC UGA Stop UGG Trp	U C A G	
	C	CUU Leu CUC CUA CUG	CCU Pro CCC CCA CCG	CAU His CAC CAA Gin CAG	CGU Arg CGC CGA CGG	U C A G	
	A	AUU Ile AUC AUA AUG Met or Start	ACU Thr ACC ACA ACG	AAU Asn AAC AAA Lys AAG	AGU Ser AGC AGA Arg AGG	U C A G	
	G	GUU Val GUC GUA GUG	GCU Ala GCC GCA GCG	GAU Asp GAC GAA Glu GAG	GGU Gly GGC GGA GGG	U C A G	

What amino acid sequence will be generated, based on the following mRNA codon sequence?
 5'-AUG-UCU-UCG-UUA-UCC-UUG-3'

- A) Met-Arg-Glu-Arg-Glu-Arg
- B) Met-Glu-Arg-Arg-Glu-Leu
- C) Met-Ser-Leu-Ser-Leu-Ser
- D) Met-Ser-Ser-Leu-Ser-Leu

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 17.1

9) The following question refers to this table of codons.

		Second Base					
		U	C	A	G		
First Base	U	UUU Phe UUC UUA UUG	UCU Ser UCC UCA UCG	UAU Tyr UAC UAA Stop UAG Stop	UGU Cys UGC UGA Stop UGG Trp	U C A G	
	C	CUU Leu CUC CUA CUG	CCU Pro CCC CCA CCG	CAU His CAC CAA Gin CAG	CGU Arg CGC CGA CGG	U C A G	
	A	AUU Ile AUC AUA AUG Met or Start	ACU Thr ACC ACA ACG	AAU Asn AAC AAA Lys AAG	AGU Ser AGC AGA Arg AGG	U C A G	
	G	GUU Val GUC GUA GUG	GCU Ala GCC GCA GCG	GAU Asp GAC GAA Glu GAG	GGU Gly GGC GGA GGG	U C A G	

Refer to the figure. Which of the triplets below is a possible anticodon for a tRNA that transports proline to a ribosome?

- A) 3'-UUC-5'
- B) 3'-CCG-5'
- C) 3'-GGC-5'
- D) 3'-CCC-5'

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 17.1

10) Which of the following statements supports the one gene-one enzyme hypothesis?

- A) A mutation in a single gene can result in a defective protein.
- B) Alkaptonuria results when individuals lack multiple enzymes involved in the catalysis of homogentisic acid.
- C) Sickle-cell anemia results in normal hemoglobin.
- D) Multiple antibody genes can code for different related proteins, depending on the splicing that takes place post-transcriptionally.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 17.1

11) Which of the following characteristics is directly related to the coding of a single amino acid during the process of translation?

- A) the base sequence of the tRNA
- B) the amino acetyl tRNA synthase
- C) the three-base sequence of mRNA
- D) the complementarity of DNA and RNA

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.1

12) Which of the following processes occurs during transcription?

- A) DNA is replicated
- B) RNA is synthesized
- C) proteins are synthesized
- D) mRNA attaches to ribosomes

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.1

13) Which of the following molecular structures contain codons?

- A) a protein
- B) mRNA
- C) tRNA
- D) rRNA

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.1

14) The genetic code is redundant. What is meant by this statement?

- A) A single codon can specify the addition of more than one amino acid.
- B) The genetic code is different for different domains of organisms.
- C) The genetic code is universal (the same for all organisms).
- D) More than one codon can specify the addition of the same amino acid.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.1

15) Once researchers identified DNA as the molecule responsible for transmitting heritable traits, they asked how information was transferred from the DNA in the nucleus to the site of protein synthesis in the cytoplasm. Which of the following statements correctly describes the mechanism of information transfer in eukaryotes that accomplishes this task?

- A) DNA from a single gene is replicated and transferred to the cytoplasm, where it serves as a template for protein synthesis.
- B) Messenger RNA is transcribed from a single gene and transfers information from the DNA in the nucleus to the cytoplasm, where protein synthesis takes place.
- C) Histone proteins in the chromosomes transfer information from the nucleus to the ribosome, where protein synthesis takes place.
- D) Transfer RNA takes information from DNA directly to a ribosome, where protein synthesis takes place.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.1

16) According to the central dogma, what is the intermediate molecule involved in the flow of information in a cell that should go in the blank?

DNA → _____ → Proteins

- A) mtDNA
- B) rRNA
- C) mRNA
- D) tRNA

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.1

17) Codons are three-base sequences in mRNA that specify the addition of a single amino acid to the growing protein chain during translation. How do eukaryotic codons and prokaryotic codons compare?

- A) Prokaryotic codons usually contain different bases than those of eukaryotes.
- B) Prokaryotic codons usually specify different amino acids than those of eukaryotes.
- C) The translation of codons is mediated by tRNAs in eukaryotes, but translation requires no intermediate molecules such as tRNAs in prokaryotes.
- D) Codons are a nearly universal language among all organisms.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.1

18) Which of the following processes occurs in prokaryotes but not in eukaryotes?

- A) post-transcriptional splicing
- B) transcription and translation occur simultaneously
- C) translation in the absence of a ribosome
- D) gene splicing

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.1

- 19) Which of the following statements best describes the termination of transcription in prokaryotes?
- A) RNA polymerase transcribes through the polyadenylation signal, causing proteins to associate with the transcript and cut it free from the polymerase.
 - B) RNA polymerase transcribes through the terminator sequence, causing the polymerase to separate from the DNA and release the transcript.
 - C) Once transcription has initiated, RNA polymerase transcribes until it reaches the end of the chromosome.
 - D) RNA polymerase transcribes through a stop codon, causing the polymerase to stop advancing through the gene and release the mRNA.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.2

- 20) In eukaryotes, there are several different types of RNA polymerase. Which type is involved in transcription of mRNA for a globin protein?

- A) RNA polymerase I
- B) RNA polymerase II
- C) RNA polymerase III
- D) primase

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.2

- 21) Transcription in eukaryotes requires which of the following molecules in addition to RNA polymerase?

- A) anticodons
- B) ribosomes and tRNA
- C) several transcription factors
- D) aminoacyl-tRNA synthetase

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.2

- 22) Which of the following statements best describes the significance of the TATA box in the promoters of eukaryotes?

- A) It is the recognition site for the binding of a specific transcription factor.
- B) It sets the reading frame of the mRNA during translation.
- C) It is the recognition site for ribosomal binding during translation.
- D) It is the recognition site for ribosomal binding during transcription.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.2

23) Which of the following processes occurs in eukaryotic gene expression?

- A) mRNA, tRNA, and rRNA are translated.
- B) RNA polymerase binds to the terminator sequence.
- C) A cap is added to the 5' end of the mRNA.
- D) RNA polymerase requires tRNA to elongate the molecule.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.3

24) Which of the following statements correctly describes a ribozyme?

- A) It is a catalyst that uses RNA as a substrate.
- B) It is an RNA with catalytic activity.
- C) It is an enzyme that catalyzes the association between the large and small ribosomal subunits.
- D) It is an enzyme that synthesizes RNA as part of the transcription process.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.3

25) Which of the following processes correctly describes alternative RNA splicing?

- A) It is a mechanism for increasing the rate of translation.
- B) It can allow the production of proteins of different sizes and functions from a single mRNA.
- C) It can allow the production of similar proteins from different RNAs.
- D) It increases the rate of transcription.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.3

26) In the structural organization of many eukaryotic genes, individual exons may be related to which of the following?

- A) the sequence of the intron that immediately precedes each exon
- B) the number of polypeptides making up the functional protein
- C) the various domains of the polypeptide product
- D) the number of start sites for transcription

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.3

27) In an experimental situation, a student researcher inserts an mRNA molecule into a eukaryotic cell after she has removed its 5' cap and poly-A tail. Which of the following processes would you expect her to find to have occurred?

- A) The mRNA is quickly converted into a ribosomal subunit.
- B) The cell adds a new poly-A tail to the mRNA.
- C) The mRNA attaches to a ribosome and is translated, but more slowly.
- D) The molecule is digested by enzymes because it is not protected at the 5' end.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 17.3

28) Use this model of a eukaryotic transcript to answer the following question.

E = exon and I = intron

5'-UTR E₁ I₁ E₂ I₂ E₃ I₃ E₄ UTR-3'

Which components of the previous molecule will also be found in mRNA in the cytosol?

- A) 5'-UTR I₁ I₂ I₃ UTR-3'
- B) 5'-E₁ E₂ E₃ E₄-3'
- C) 5'-UTR E₁ E₂ E₃ E₄ UTR-3'
- D) 5'-E₁ I₁ E₂ I₂ E₃ I₃ E₄-3'

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 17.3

29) Which one of the following statements about RNA processing is correct?

- A) Exons are cut out before mRNA leaves the nucleus.
- B) Ribozymes may function in RNA splicing.
- C) RNA splicing can be catalyzed by tRNA.
- D) A primary transcript is often much shorter than the final RNA molecule that leaves the nucleus.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.3

30) How does the primary transcript in the nucleus of a eukaryotic cell compare to the functional mRNA?

- A) the primary transcript is the same size as the mRNA
- B) the primary transcript is larger than the mRNA
- C) the primary transcript is smaller than the mRNA
- D) both the primary transcript and mRNA contain introns

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 17.3

31) How does the primary transcript in the nucleus of a prokaryotic cell compare to the functional mRNA?

- A) the primary transcript is larger than the mRNA
- B) the primary transcript is smaller than the mRNA
- C) the primary transcript and the mRNA both contain introns
- D) the primary transcript is the same size as the mRNA

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 17.3

32) A particular triplet of bases in the coding sequence of DNA is AAA. The anticodon on the tRNA that binds the mRNA codon is _____.

- A) TTT
- B) UUA
- C) UUU
- D) AAA

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 17.4

33) Accuracy in the translation of mRNA into the primary structure of a polypeptide depends on specificity in the _____.

- A) binding of ribosomes to mRNA
- B) binding of the anticodon to small subunit of the ribosome
- C) attachment of amino acids to rRNAs
- D) binding of the anticodon to the codon and the attachment of amino acids to tRNAs

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

34) What would be the consequence of a mutation in a bacterial cell that produces a defective aminoacyl-tRNA synthetase that attaches a lysine instead of the normal phenylalanine to tRNAs with the anticodon AAA?

- A) None of the proteins in the cell will contain phenylalanine.
- B) Proteins in the cell will include lysine instead of phenylalanine at amino acid positions specified by the codon UUU.
- C) The cell will compensate for the defect by attaching phenylalanine to tRNAs with lysine-specifying anticodons.
- D) The ribosome will skip a codon every time a UUU is encountered.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 17.4

35) In bacteria, there are 61 mRNA codons that specify an amino acid, but only 45 tRNAs. Which of the following statements explains this fact?

- A) Some tRNAs have anticodons that recognize four or more different codons.
- B) The rules for base pairing between the third base of a codon and tRNA are flexible.
- C) Many codons are never used, so the tRNAs that recognize them are dispensable.
- D) The DNA codes for all 61 tRNAs, but some are then destroyed.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

- 36) Which of the following processes is the first event to take place in translation in eukaryotes?
- A) base pairing of activated methionine-tRNA to AUG of the messenger RNA
 - B) binding of the larger ribosomal subunit to smaller ribosomal subunits
 - C) the ribosome reaches a stop codon
 - D) the small subunit of the ribosome recognizes and attaches to the 5' cap of mRNA

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

- 37) Which of the following statements correctly describes the function of a signal peptide?
- A) It directs an mRNA molecule into the cisternal space of the ER.
 - B) It terminates translation of messenger RNA.
 - C) It helps target a protein to the ER.
 - D) It signals the initiation of transcription.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

- 38) What is the function of the release factor during translation in eukaryotes?
- A) It binds to the stop codon in the A site in place of a tRNA.
 - B) It releases the amino acid from its tRNA to allow the amino acid to form a peptide bond.
 - C) It supplies a source of energy for termination of translation.
 - D) It releases the ribosome from the ER to allow polypeptides into the cytosol.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

39) Use the following information to answer the question.

A part of an mRNA molecule with the following sequence is being read by a ribosome: 5'-CCG-ACG-3' (mRNA). The following charged transfer RNA molecules (with their anticodons shown in the 3' to 5' direction) are available. Two of them can correctly match the mRNA so that a dipeptide can form.

tRNA Anticodon	Amino Acid
GGC	Proline
CGU	Alanine
UGC	Threonine
CCG	Glycine
ACG	Cysteine
CGG	Alanine

Which of the following dipeptides will form from this mRNA?

- A) cysteine-alanine
- B) proline-threonine
- C) glycine-cysteine
- D) alanine-alanine

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 17.4

40) Use the following information to answer the question.

A part of an mRNA molecule with the following sequence is being read by a ribosome: 5'-CCG-ACG-3' (mRNA). The following charged transfer RNA molecules (with their anticodons shown in the 3' to 5' direction) are available. Two of them can correctly match the mRNA so that a dipeptide can form.

tRNA Anticodon	Amino Acid
GGC	Proline
CGU	Alanine
UGC	Threonine
CCG	Glycine
ACG	Cysteine
CGG	Alanine

Which of the following anticodons in the first tRNA to bind will complement this mRNA?

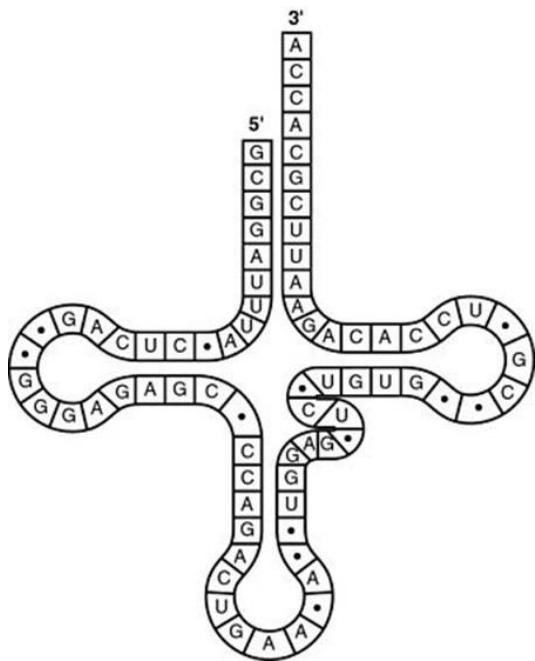
- A) 3'-GGC-5'
- B) 5'-GGC-3'
- C) 5'-UGC-3'
- D) 3'-UGC-5'

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 17.4

41) Use the figure to answer the question.



What type of bonding is responsible for maintaining the shape of the tRNA molecule shown in the figure?

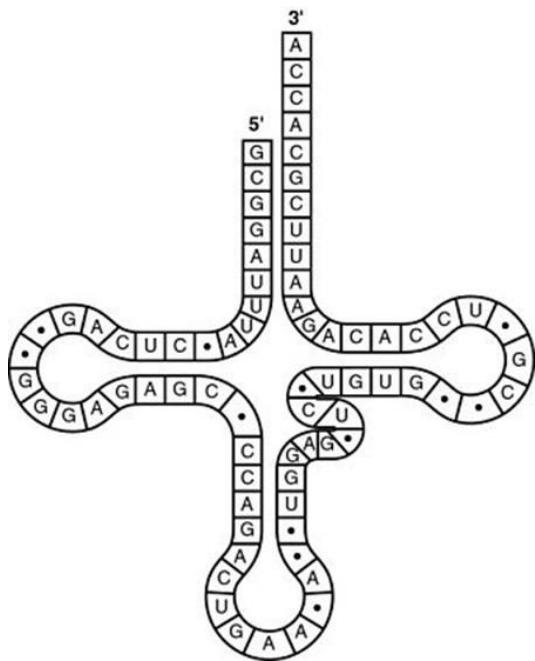
- A) ionic bonding between phosphates
- B) hydrogen bonding between base pairs
- C) van der Waals interactions between hydrogen atoms
- D) peptide bonding between amino acids

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

42) Use the figure to answer the question.



The figure represents tRNA that recognizes and binds a particular amino acid (in this instance, phenylalanine). Which codon on the mRNA strand codes for this amino acid?

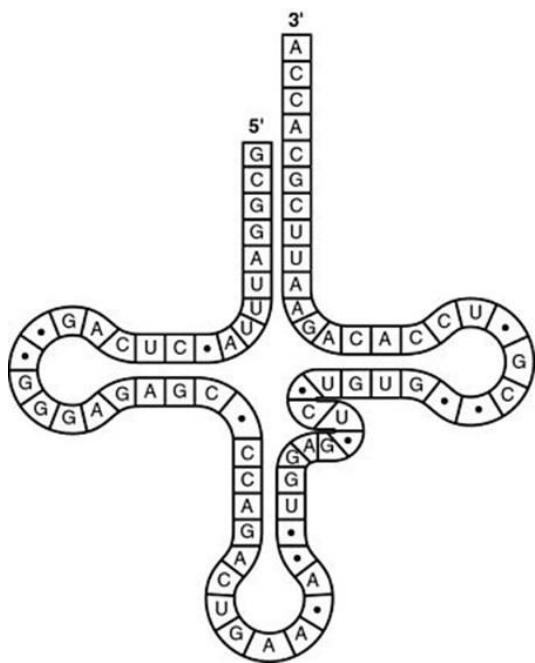
- A) 5'-UGG-3'
- B) 3'-GUG-5'
- C) 5'-GUA-3'
- D) 5'-UUC-3'

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 17.4

43) Use the figure to answer the question.



The tRNA shown in the figure has its 3' end projecting beyond its 5' end. Which of the following processes will occur at this 3' end?

- A) The amino acid binds covalently.
- B) The excess nucleotides (ACCA) will be cleaved off at the ribosome.
- C) The small and large subunits of the ribosome will attach to it.
- D) The 5' cap of the mRNA will become covalently bound.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

44) Which of the following properties is associated with a protein that will be secreted from a eukaryotic cell?

- A) It must be translated by a ribosome that remains free within the cytosol.
- B) Its signal sequence must target it to the ER, after which it goes to the Golgi.
- C) Its signal sequence must be cleaved off before the polypeptide can enter the ER.
- D) Its signal sequence must target it to the plasma membrane, where it causes exocytosis.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

45) Which of the following molecules are required for the process of translation?

- A) mRNA, tRNA, DNA, and rRNA
- B) mRNA, DNA, and rRNA
- C) mRNA, tRNA, and rRNA
- D) mRNA, tRNA, and DNA

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

46) During the elongation phase of translation, which site in the ribosome represents the location where a codon is being read?

- A) E site
- B) P site
- C) A site
- D) the large ribosomal subunit

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

47) Once a peptide bond has been formed between the amino acid attached to the tRNA in the P site and the amino acid associated with the tRNA in the A site, what process occurs next?

- A) translocation
- B) reading of the next codon of mRNA
- C) initiation
- D) The codon-anticodon hydrogen bonds holding the tRNA in the A site are broken.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

48) Which one of the following structures, if missing, would usually prevent translation from starting?

- A) exon
- B) 5' cap
- C) AUG codon
- D) poly-A tail

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

49) Which of the following processes occurs when termination of translation takes place?

- A) The end of the mRNA molecule is reached.
- B) A stop codon is reached.
- C) The 5' cap is reached.
- D) The poly-A tail is reached.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

50) Post-translational modifications of proteins may include which of the following processes?

- A) removal of introns
- B) addition of a 5' cap
- C) addition of a poly-A tail
- D) addition of carbohydrates to form a glycoprotein

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 17.4

51) Which of the following statements is true about protein synthesis in prokaryotes?

- A) Extensive RNA processing is required before prokaryotic transcripts can be translated.
- B) Translation can begin while transcription is still in progress.
- C) Prokaryotic cells have complicated mechanisms for targeting proteins to the appropriate cellular organelles.
- D) Unlike eukaryotes, prokaryotes require no initiation or elongation factors.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.4

52) Which of the following types of mutation, resulting in an error in the mRNA just after the AUG start of translation, is likely to have the most serious effect on the polypeptide product?

- A) a deletion of a codon
- B) a deletion of two nucleotides
- C) a substitution of the third nucleotide in an ACC codon
- D) a substitution of the first nucleotide of a GGG codon

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 17.5

53) Which of the following statements correctly describes the effect a nonsense mutation would have on a gene?

- A) It changes an amino acid in the encoded protein.
- B) It has no effect on the amino acid sequence of the encoded protein.
- C) It introduces a premature stop codon into the mRNA.
- D) It alters the reading frame of the mRNA.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.5

54) Which of the following DNA mutations is most likely to damage the protein it specifies?

- A) a base-pair deletion
- B) an addition of three nucleotides
- C) a substitution in the last base of a codon
- D) a codon deletion

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 17.5

55) The most commonly occurring mutation in people with cystic fibrosis is a deletion of a single codon. What is the result of this type of mutation?

- A) a base-pair substitution
- B) a frameshift mutation
- C) a polypeptide missing an amino acid
- D) a nonsense mutation

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 17.5

56) Which of the following statements is the most current description of a gene?

- A) a unit of heredity that causes formation of a phenotypic characteristic
- B) a DNA subunit that codes for a single complete protein
- C) a DNA sequence that is expressed to form a functional product: either RNA or polypeptide
- D) a discrete unit of hereditary information that consists of a sequence of amino acids

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 17.5

57) How might a single base substitution in the sequence of a gene affect the amino acid sequence of a protein encoded by the gene?

- A) Only a single amino acid could change, because the reading frame would be unaffected.
- B) The amino acid sequence would be substantially altered, because the reading frame would change with a single base substitution.
- C) All amino acids following the substitution would be affected, because the reading frame would be shifted.
- D) It is not possible for a single base substitution to affect protein structure, because each codon is three bases long.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 17.5

58) An original section of DNA has the base sequence AGCGTTACCGT. A mutation in this DNA strand results in the base sequence AGGCAGTTACCGT. What type of mutation does this change represent?

- A) a missense mutation
- B) a point mutation
- C) a silent mutation
- D) frameshift mutation

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 17.5

59) A single base substitution mutation is likely to have a less deleterious effect when the base change exhibits which of the following results?

- A) a stop codon
- B) a codon that specifies the same amino acid as the original codon
- C) an amino acid substitution that alters the tertiary structure of the protein
- D) an amino acid substitution at the active site of an enzyme

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 17.5

60) Rank the following one-base point mutations with respect to their likelihood of affecting the structure of the corresponding polypeptide (from most likely to least likely).

1. insertion mutation deep within an intron
2. substitution mutation at the third position of a codon in an exon
3. substitution mutation at the second position of a codon in an exon
4. deletion mutation within the first exon of the gene

- A) 1, 2, 3, 4
- B) 4, 3, 2, 1
- C) 2, 1, 4, 3
- D) 3, 1, 4, 2

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 17.5

17.2 Student Edition End-of-Chapter Questions

- 1) In eukaryotic cells, transcription cannot begin until
- A) the two DNA strands have completely separated and exposed the promoter.
 - B) several transcription factors have bound to the promoter.
 - C) the 5 caps are removed from the mRNA.
 - D) the DNA introns are removed from the template.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 2) Which of the following is *not* true of a codon?
- A) It may code for the same amino acid as another codon.
 - B) It never codes for more than one amino acid.
 - C) It extends from one end of a tRNA molecule.
 - D) It is the basic unit of the genetic code.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 3) The anticodon of a particular tRNA molecule is
- A) complementary to the corresponding mRNA codon.
 - B) complementary to the corresponding triplet in rRNA.
 - C) the part of tRNA that bonds to a specific amino acid.
 - D) catalytic, making the tRNA a ribozyme.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Which of the following is *not* true of RNA processing?
- A) Exons are cut out before mRNA leaves the nucleus.
 - B) Nucleotides may be added at both ends of the RNA.
 - C) Ribozymes may function in RNA splicing.
 - D) RNA splicing can be catalyzed by spliceosomes.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 5) Which component is *not* directly involved in translation?
- A) GTP
 - B) DNA
 - C) tRNA
 - D) ribosomes

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

6)

		Second mRNA base					
		U	C	A	G		
First mRNA base (5' end of codon)	U	UUU Phe UUC (F) UUA Leu UUG (L)	UCU Ser UCC (S) UCA	UAU Tyr UAC (Y) UAA Stop UAG Stop	UGU Cys UGC (C) UGA Stop UGG Trp (W)	U	C
	C	CUU Leu CUC (L) CUA CUG	CCU Pro (P) CCC CCA	CAU His (H) CAC CAA Gln (Q)	CGU Arg (R) CGC CGA CGG	U	C
	A	AUU Ile AUC (I) AUA AUG Met (M) or start	ACU Thr (T) ACC ACA	AAU Asn (N) AAC AAA Lys (K)	AGU Ser (S) AGC AGA Arg (R) AGG	U	C
	G	GUU GUC Val (V) GUA GUG	GCU Ala (A) GCC GCA	GAU Asp (D) GAC GAA Glu (E) GAG	GGU Gly (G) GGC GGA GGG	U	C
						A	G
Third mRNA base (3' end of codon)							

Using Figure 17.6, identify a 5' → 3' sequence of nucleotides in the DNA template strand for an mRNA coding for the polypeptide sequence Phe-Pro-Lys.

- A) 5-UUUCCAAA-3
- B) 5-GAACCCCTT-3
- C) 5-CTTCGGGAA-3
- D) 5-AAACCCUUU-3

Answer: C

Bloom's Taxonomy: Application/Analysis

7) Which of the following mutations would be *most* likely to have a harmful effect on an organism?

- A) a deletion of three nucleotides near the middle of a gene
- B) a single nucleotide deletion in the middle of an intron
- C) a single nucleotide deletion near the end of the coding sequence
- D) a single nucleotide insertion downstream of, and close to, the start of the coding sequence

Answer: D

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 18 Regulation of Gene Expression

18.1 Multiple-Choice Questions

1) Which of the following molecules is a protein produced by a regulatory gene?

- A) operon
- B) inducer
- C) promoter
- D) repressor

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.1

2) Which of the following molecules helps to "turn off" genes in a cell?

- A) operon
- B) inducer
- C) promoter
- D) corepressor

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.1

3) When taken up by a cell, which of the following molecules binds to a repressor so that the repressor no longer binds to the operator?

- A) inducer
- B) promoter
- C) repressor
- D) corepressor

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.1

4) Most repressor proteins are allosteric. Which of the following molecules binds with the repressor to alter its conformation and therefore affect its function?

- A) inducer
- B) promoter
- C) transcription factor
- D) cAMP

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.1

5) Which of the following processes would result from a mutation that deactivates a regulatory gene of a repressible operon in an *E. coli* cell?

- A) continuous transcription of the structural gene controlled by that regulator
- B) complete inhibition of transcription of the structural gene controlled by that regulator
- C) irreversible binding of the repressor to the operator
- D) continuous translation of the mRNA because of alteration of its structure

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 18.1

6) Which of the following conditions is most likely to cause the lactose operon to be transcribed?

- A) There is more glucose in the cell than lactose.
- B) There is glucose but no lactose in the cell.
- C) The cyclic AMP and lactose levels are both high within the cell.
- D) The cAMP level is high and the lactose level is low.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.1

7) How does the transcription of structural genes in an inducible operon occur?

- A) It occurs continuously in the cell.
- B) It starts when the pathway's substrate is present.
- C) It starts when the pathway's product is present.
- D) It stops when the pathway's product is present.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.1

8) For a repressible operon to be transcribed, which of the following conditions must occur?

- A) A corepressor must be present.
- B) RNA polymerase and the active repressor must be present.
- C) RNA polymerase must bind to the promoter, and the repressor must be inactive.
- D) RNA polymerase must not occupy the promoter, and the repressor must be inactive.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.1

9) Altering patterns of gene expression in prokaryotes would most likely serve an organism's survival by _____.

- A) organizing gene expression, so that genes are expressed in a given order
- B) allowing each gene to be expressed an equal number of times
- C) allowing an organism to adjust to changes in environmental conditions
- D) allowing environmental changes to alter a prokaryote's genome

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 18.2

10) In positive control of several sugar metabolism-related operons, the cAMP receptor protein (CRP) binds to DNA to stimulate transcription. Which of the following environmental conditions causes an increase in CRP activity in stimulating transcription?

- A) an increase in glucose and an increase in cAMP
- B) a decrease in glucose and an increase in cAMP
- C) an increase in glucose and a decrease in cAMP
- D) a decrease in glucose and a decrease in the repressor

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.1

11) There is a mutation that is found in *E. coli* in the repressor that results in a molecule known as a super-repressor because it represses the *lac* operon permanently. Which of the following characteristics would you expect to observe in such a mutant?

- A) It cannot bind to the operator.
- B) It cannot make a functional repressor.
- C) It cannot bind to the inducer.
- D) It makes a repressor that binds CAP.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 18.1

12) Suppose an experimenter becomes proficient with a technique that allows her to move DNA sequences within a prokaryotic genome. If a researcher moves the promoter for the *lac* operon to the region between the beta galactosidase (*lacZ*) gene and the permease (*lacY*) gene, which of the following results would be most likely?

- A) The three genes of the *lac* operon will be expressed normally.
- B) RNA polymerase will no longer transcribe permease.
- C) The operon will still transcribe the *lacZ* and *lacY* genes, but the mRNA will not be translated.
- D) Beta galactosidase will not be produced.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 18.1

13) Suppose an experimenter becomes proficient with a technique that allows her to move DNA sequences within a prokaryotic genome. If a researcher moves the operator to the far end of the operon, past the transacetylase (*lacA*) gene, which of the following processes would likely occur when the cell is exposed to lactose?

- A) The inducer will no longer bind to the repressor.
- B) The repressor will no longer bind to the operator.
- C) The operon will never be transcribed.
- D) The genes of the *lac* operon will be transcribed continuously.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 18.1

14) Suppose an experimenter becomes proficient with a technique that allows her to move DNA sequences within a prokaryotic genome. If a researcher moves the repressor gene (*lacI*), along with its promoter, to a position at some several thousand base pairs away from its normal position, which of the following results would be expected?

- A) The repressor will no longer bind to the operator.
- B) The repressor will no longer bind to the inducer.
- C) The *lac* operon will be expressed continuously.
- D) The *lac* operon will function normally.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 18.1

15) Which of the following results would occur if the repressor of an inducible operon were mutated so that it could not bind the operator?

- A) the irreversible binding of the repressor to the promoter
- B) the reduced transcription of the operon's genes
- C) the continuous transcription of the operon's genes
- D) the overproduction of cAMP receptor protein (CRP)

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 18.1

16) According to the *lac* operon model proposed by Jacob and Monod, what is predicted to occur if the operator is removed from the operon?

- A) The *lac* operon would be transcribed continuously.
- B) Only *lacZ* would be transcribed.
- C) Only *lacY* would be transcribed.
- D) Galactosidase permease would be produced, but would be incapable of transporting lactose.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 18.1

17) Under what conditions does the *trp* repressor block transcription of the *trp* operon?

- A) when the repressor binds to the inducer
- B) when the repressor binds to tryptophan
- C) when the repressor is not bound to tryptophan
- D) when the repressor is not bound to the operator

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.1

- 18) How does extracellular glucose inhibit transcription of the *lac* operon?
- A) by strengthening the binding of the repressor to the operator
 - B) by weakening the binding of the repressor to the operator
 - C) by inhibiting RNA polymerase from opening the strands of DNA to initiate transcription
 - D) by reducing the levels of intracellular cAMP

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.1

- 19) The cAMP receptor protein (CRP) is said to be responsible for positive regulation of the *lac* operon because _____.
A) CRP binds cAMP
B) CRP binds to the CAP-binding site
C) CRP prevents binding of the repressor to the operator
D) CRP bound to the CRP-binding site stimulates the transcription of the *lac* operon

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 18.1

- 20) Imagine that you've isolated a yeast mutant that contains histones resistant to acetylation.
What phenotype would you predict for this mutant?
A) The mutant will grow rapidly.
B) The mutant will require galactose for growth.
C) The mutant will show decreased levels of gene expression.
D) The mutant will show increased levels of gene expression.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 18.2

- 21) Which of the following statements correctly describes the primary difference between enhancers and proximal control elements?
A) Enhancers are transcription factors; proximal control elements are DNA sequences.
B) Enhancers improve transcription; proximal control elements inhibit transcription.
C) Enhancers are located considerable distances from the promoter; proximal control elements are close to the promoter.
D) Enhancers are DNA sequences; proximal control elements are proteins.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 18.2

22) The reason for differences in the sets of proteins expressed in a nerve and a pancreatic cell of the same individual is that nerve and pancreatic cells contain different _____.

- A) genes
- B) regulatory sequences
- C) sets of regulatory proteins
- D) promoters

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 18.2

23) Gene expression is often assayed by measuring the level of mRNA produced from a gene.

What level of the control of gene expression can be analyzed by this type of assay?

- A) replication control
- B) transcriptional control
- C) alternative splicing
- D) translational control

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 18.2

24) Which of the following processes would allow the detection of alternative splicing of transcripts from a given gene?

- A) Compare the DNA sequence of the given gene to that of a similar gene in a related organism.
- B) Measure the relative rates of transcription of the given gene compared to that of a gene known to be constitutively spliced.
- C) Compare the sequences of different primary transcripts made from the given gene.
- D) Compare the sequences of different mRNAs made from the given gene.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 18.2

25) Which of the following mechanisms is used to coordinate the expression of multiple, related genes in eukaryotic cells?

- A) Environmental signals enter the cell and bind directly to promoters.
- B) A given gene may have multiple enhancers, but each enhancer is generally associated with only that gene and no other.
- C) The genes are organized into a large operon, allowing them to be coordinately controlled as a single unit.
- D) A single repressor is able to turn off several related genes.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.2

26) DNA methylation and histone acetylation are examples of which of the following processes?

- A) genetic mutation
- B) chromosomal rearrangements
- C) epigenetic phenomena
- D) translocation

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.2

27) Which of the following functions are characteristic of general transcription factors in eukaryotes?

- A) They bind to other proteins or to the TATA box.
- B) They inhibit RNA polymerase binding to the promoter and begin transcribing.
- C) They usually lead to a high level of transcription even without additional specific transcription factors.
- D) They bind to sequences just after the start site of transcription.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.2

28) How do steroid hormones produce their effects in cells?

- A) by binding to the regulatory gene in an operon
- B) by activating translation of certain mRNAs
- C) by promoting the degradation of specific mRNAs
- D) by binding to intracellular receptors and promoting transcription of specific genes

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.2

29) How are bacteria able to change their patterns of protein synthesis so quickly in response to environmental changes?

- A) mRNAs that are produced are short-lived and degraded within a few minutes of being synthesized.
- B) mRNA have long lifespans, allowing the bacteria to use them many times for translation.
- C) mRNA is stored for later use.
- D) Operons are activated in the presence of transcription factors.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.2

30) A researcher found a method she could use to manipulate and quantify phosphorylation and methylation in embryonic cells in culture. In one set of experiments, she succeeded in increasing acetylation of histone tails in the chromatin of the cells. Which of the following results would she most likely see in these cells?

- A) increased chromatin condensation
- B) decreased chromatin condensation
- C) decreased binding of transcription factors
- D) inactivation of the selected genes

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 18.2

31) A researcher found a method she could use to manipulate and quantify phosphorylation and methylation in embryonic cells in culture. One of her colleagues suggested she try increased methylation of cytosine (C) nucleotides in the DNA of promoters of a mammalian system. Which of the following results would she most likely see?

- A) decreased chromatin condensation
- B) activation of histone tails for enzymatic function
- C) higher levels of transcription of certain genes
- D) inactivation of the selected genes

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 18.2

32) Which of the following methods is utilized by eukaryotes to control their gene expression that is different from the type of control found in bacteria?

- A) control of chromatin remodeling
- B) control of RNA splicing
- C) transcriptional control
- D) control of both RNA splicing and chromatin remodeling

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 18.3

33) Which of the following processes destroys RNA molecules in a cell if they have a sequence complementary to an introduced double-stranded RNA?

- A) RNA interference
- B) RNA obstruction
- C) RNA blocking
- D) RNA disposal

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.3

34) At the beginning of this century, there was a general announcement regarding the sequencing of the human genome and the genomes of many other multicellular eukaryotes. Many people were surprised that the number of protein-coding sequences was much smaller than they had expected. Which of the following types of DNA make up the rest of the human genome?

- A) DNA that consists of histone coding sequences
- B) DNA that is translated directly without being transcribed
- C) non-protein-coding DNA that is transcribed into several kinds of small RNAs with biological function
- D) non-protein-coding DNA that serves as binding sites for reverse transcriptase

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 18.3

35) Among the newly discovered small noncoding RNAs, one type helps to reestablish ethylation patterns during gamete formation and blocks expression of some transposons. Which of the following types of RNA is responsible for this function?

- A) miRNA
- B) piRNA
- C) lncRNA
- D) siRNA

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.3

36) Which of the following statements best describes the characteristics of siRNA?

- A) a double-stranded RNA, one of whose strands can complement and inactivate a sequence of mRNA
- B) a single-stranded RNA that can, where it has internal complementary base pairs, fold into cloverleaf patterns
- C) a double-stranded RNA that is formed by cleavage of hairpin loops in a larger precursor
- D) a portion of rRNA that allows it to bind to several ribosomal proteins in forming large or small subunits

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 18.3

37) A researcher introduces double-stranded RNA into a culture of mammalian cells and can identify its location or that of its smaller subsections experimentally, using a fluorescent probe. Some time later, she finds that the introduced strand separates into single-stranded RNAs, one of which is degraded. What does this enable the remaining strand to do?

- A) attach to histones in the chromatin
- B) bind to complementary regions of target mRNAs
- C) activate other siRNAs in the cell
- D) bind to noncomplementary RNA sequences

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 18.3

38) A researcher introduces double-stranded RNA into a culture of mammalian cells and can identify its location or that of its smaller subsections experimentally, using a fluorescent probe. When she finds that the introduced strand separates into single-stranded RNAs, what other evidence of this single-stranded RNA piece's activity would she find?

- A) She can measure the degradation rate of the remaining single strand.
- B) The rate of accumulation of the polypeptide encoded by the target mRNA is reduced.
- C) The amount of miRNA is multiplied by its replication.
- D) The cell's translation ability is entirely shut down.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 18.3

39) The fact that plants can be cloned from somatic cells demonstrates that _____.

- A) differentiated cells retain all the genes of the zygote
- B) genes are lost during differentiation
- C) the differentiated state is normally very unstable
- D) differentiation does not occur in plants

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 18.4

40) Which of the following molecules are involved in pattern formation during development?

- A) cytoplasmic determinants
- B) miRNAs
- C) cAMP
- D) transcription factors

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.4

41) What essential information does the product of the *bicoid* gene in *Drosophila* provide during development?

- A) orientation of the dorsal-ventral axis
- B) orientation of the left-right axis
- C) segmentation
- D) orientation of the anterior-posterior axis

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.4

- 42) What would be the result of a mutation in a maternal effect gene in a female *Drosophila*?
- A) She will not develop past the early embryonic stage.
 - B) All of her offspring will show the mutant phenotype, regardless of their genotype.
 - C) Only her male offspring will show the mutant phenotype.
 - D) Only her female offspring will show the mutant phenotype.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 18.4

- 43) Mutations in which of the following genes lead to transformations in the identity of entire body parts?

- A) segmentation genes
- B) egg-polarity genes
- C) homeotic genes
- D) inducers

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.4

- 44) Which of the following are maternal effect genes that control the orientation of the egg and thus the *Drosophila* embryo?

- A) homeotic genes
- B) segmentation genes
- C) egg-polarity genes
- D) morphogens

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.4

- 45) The *bicoid* gene product is normally localized to the anterior end of the embryo. If large amounts of the product were injected into the posterior end as well, which of the following developmental events would occur?

- A) The embryo would grow extra wings and legs.
- B) The embryo would probably show no anterior development and die.
- C) Anterior structures would form in both ends of the embryo.
- D) The embryo would develop normally.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 18.4

46) In colorectal cancer, several genes must be mutated for a cell to develop into a cancer cell. Which of the following kinds of genes would you expect to be mutated?

- A) genes coding for enzymes that act in the colon
- B) genes involved in control of the cell cycle
- C) genes that are especially susceptible to mutation
- D) genes of the bacteria, which are abundant in the colon

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 18.5

47) Which of the following statements describes a cell that is considered to be differentiated?

- A) The cell replicates by the process of mitosis.
- B) The cell loses connections to the surrounding cells.
- C) The cell produces proteins specific to a particular cell type.
- D) The cell appears to be different from the surrounding cells.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 18.4

48) When the Bicoid protein is expressed in *Drosophila*, divisions between cells in the embryo are not yet fully developed. This information helps to explain which observation by Nüsslein-Volhard and Wieschaus?

- A) mRNA from the egg is translated into the Bicoid protein.
- B) Bicoid protein diffuses throughout the embryo in a concentration gradient.
- C) Bicoid protein serves as a transcription regulator.
- D) Bicoid protein determines the dorso-ventral axis of the embryo.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 18.4

49) Which axis in the embryo does the protein product of the *bicoid* gene in *Drosophila* determine?

- A) anterior-posterior axis
- B) anterior-lateral axis
- C) posterior-dorsal axis
- D) posterior-ventral axis

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.4

- 50) Which of the following types of mutation would convert a proto-oncogene into an oncogene?
- A) a mutation that blocks transcription of the proto-oncogene
 - B) a mutation that creates an unstable proto-oncogene mRNA
 - C) a mutation that greatly increases the amount of the proto-oncogene protein
 - D) a deletion of most of the proto-oncogene coding sequence

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.5

- 51) Which of the following processes do normal proto-oncogenes typically exhibit?
- A) They normally suppress tumor growth.
 - B) They enhance tumor growth.
 - C) They stimulate normal cell growth and division.
 - D) They are underexpressed in cancer cells.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.5

- 52) Which of the following functions does the product of the *p53* gene carry out?
- A) It inhibits the cell cycle.
 - B) It slows down the rate of DNA replication by interfering with the binding of DNA polymerase.
 - C) It causes cells to reduce expression of genes involved in DNA repair.
 - D) It allows cells to pass on mutations due to DNA damage.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.5

- 53) Which of the following statements correctly describes a characteristic of tumor-suppressor gene?
- A) They are frequently overexpressed in cancerous cells.
 - B) They are cancer-causing genes introduced into cells by viruses.
 - C) They encode proteins that help prevent uncontrolled cell growth.
 - D) They often encode proteins that stimulate the cell cycle.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.5

- 54) Why are *BRCA1* and *BRCA2* considered to be tumor-suppressor genes?
- A) Their normal products participate in repair of DNA damage.
 - B) The mutant forms of either one of these prevent breast cancer.
 - C) The normal genes make estrogen receptors.
 - D) They block penetration of breast cells by chemical carcinogens.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.5

55) Forms of the Ras protein found in tumors usually cause which of the following events to occur?

- A) DNA replication to stop
- B) cell-to-cell adhesion to be nonfunctional
- C) cell division to cease
- D) excessive cell division

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.5

56) A genetic test to detect predisposition to cancer would likely examine the *APC* gene for involvement in which type(s) of cancer?

- A) colorectal only
- B) lung and breast
- C) lung only
- D) lung and prostate

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 18.5

18.2 Student Edition End-of-Chapter Questions

1) If a particular operon encodes enzymes for making an essential amino acid and is regulated like the *trp* operon, then

- A) the amino acid inactivates the repressor.
- B) the repressor is active in the absence of the amino acid.
- C) the amino acid acts as a corepressor.
- D) the amino acid turns on transcription of the operon.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

2) Muscle cells differ from nerve cells mainly because they

- A) express different genes.
- B) contain different genes.
- C) use different genetic codes.
- D) have unique ribosomes.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

3) The functioning of enhancers is an example of

- A) a eukaryotic equivalent of prokaryotic promoter functioning.
- B) transcriptional control of gene expression.
- C) the stimulation of translation by initiation factors.
- D) post-translational control that activates certain proteins.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Cell differentiation always involves
- A) transcription of the *myoD* gene.
 - B) the movement of cells.
 - C) the production of tissue-specific proteins.
 - D) the selective loss of certain genes from the genome.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 5) Which of the following is an example of post-transcriptional control of gene expression?
- A) the addition of methyl groups to cytosine bases of DNA
 - B) the binding of transcription factors to a promoter
 - C) the removal of introns and alternative splicing of exons
 - D) gene amplification contributing to cancer

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 6) What would occur if the repressor of an inducible operon were mutated so it could not bind the operator?
- A) irreversible binding of the repressor to the promoter
 - B) reduced transcription of the operon's genes
 - C) buildup of a substrate for the pathway controlled by the operon
 - D) continuous transcription of the operon's genes

Answer: D

Bloom's Taxonomy: Application/Analysis

- 7) Absence of *bicoid* mRNA from a *Drosophila* egg leads to the absence of anterior larval body parts and mirror-image duplication of posterior parts. This is evidence that the product of the *bicoid* gene
- A) normally leads to formation of head structures.
 - B) normally leads to formation of tail structures.
 - C) is transcribed in the early embryo.
 - D) is a protein present in all head structures.

Answer: A

Bloom's Taxonomy: Application/Analysis

- 8) Which of the following statements about the DNA in one of your brain cells is true?
- A) Most of the DNA codes for protein.
 - B) The majority of genes are likely to be transcribed.
 - C) It is the same as the DNA in one of your liver cells.
 - D) Each gene lies immediately adjacent to an enhancer.

Answer: C

Bloom's Taxonomy: Application/Analysis

- 9) Within a cell, the amount of protein made using a given mRNA molecule depends partly on
- A) the degree of DNA methylation.
 - B) the rate at which the mRNA is degraded.
 - C) the number of introns present in the mRNA.
 - D) the types of ribosomes present in the cytoplasm.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 10) Proto-oncogenes can change into oncogenes that cause cancer. Which of the following best explains the presence of these potential time bombs in eukaryotic cells?
- A) Proto-oncogenes first arose from viral infections.
 - B) Proto-oncogenes are mutant versions of normal genes.
 - C) Proto-oncogenes are genetic "junk."
 - D) Proto-oncogenes normally help regulate cell division.

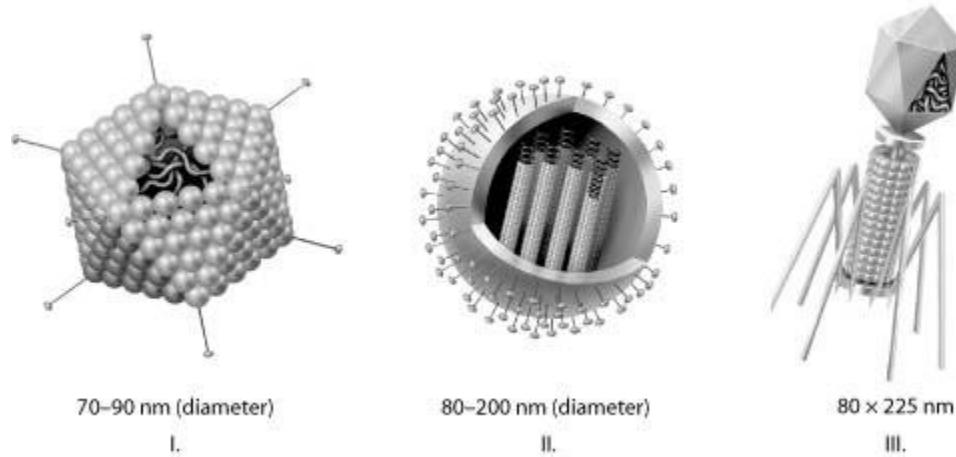
Answer: D

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 19 Viruses

19.1 Multiple-Choice Questions

1) Use the figures to answer the question.



Which of the three types of viruses shown would you expect to include glycoproteins?

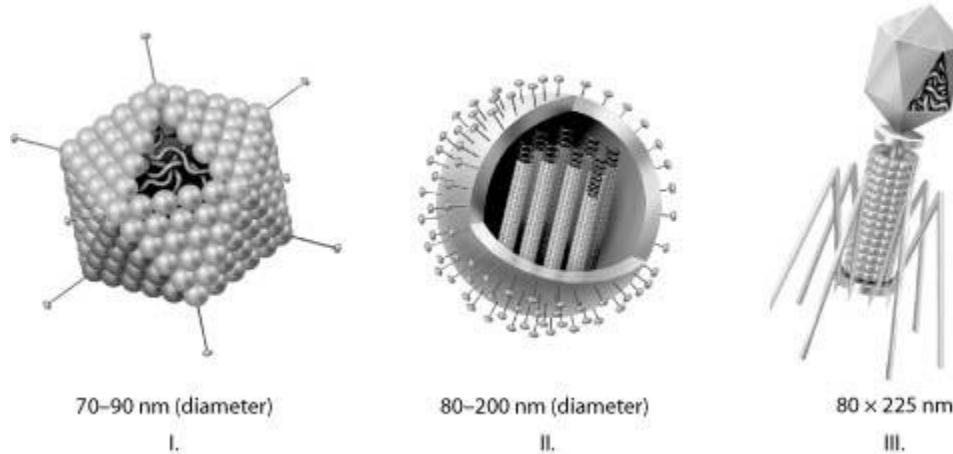
- A) I only
- B) II only
- C) III only
- D) I and II only

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.1

2) Use the figures to answer the question.



Which of the three types of viruses shown in the figure would you expect to include a capsid(s)?

- A) I only
- B) II only
- C) III only
- D) I, II, and III

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.1

3) Which of the following statements supports the argument that viruses are nonliving?

- A) They do not carry out metabolic processes.
- B) Their DNA does not encode proteins.
- C) They have RNA rather than DNA.
- D) They do not evolve.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.1

4) Which of the following processes can viruses carry out?

- A) They can manufacture their own ATP, proteins, and nucleic acids.
- B) They can use the host cell to copy themselves and make viral proteins.
- C) They can use the host cell to copy themselves and then synthesize their own proteins inside the viral capsid.
- D) They can metabolize food and produce their own ATP.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.2

- 5) Which of the following descriptions correctly identifies the main structural differences between viruses with envelopes and viruses without envelopes?
- A) Viruses with envelopes have their genetic material enclosed by a layer made only of protein.
 - B) Viruses without envelopes have only a phospholipid membrane, while viruses with envelopes have two membranes, the other one being a protein capsid.
 - C) Viruses with envelopes have a phospholipid membrane outside their capsid, whereas viruses without envelopes do not have a phospholipid membrane.
 - D) Both types of viruses have a capsid and phospholipid membrane; but in the viruses without envelopes, the genetic material is between these two membranes, while in the viruses with envelopes the genetic material is inside both membranes.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.1

- 6) The host range of a virus is determined by _____.
A) the enzymes carried by the virus
B) whether its nucleic acid is DNA or RNA
C) the proteins in the host's cytoplasm
D) the proteins on its surface and that of the host

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.2

- 7) Which of the following events or characteristics accounts for someone who has had regular herpesvirus-mediated cold sores or genital sore flare-ups?

- A) reinfection by a closely related herpesvirus of a different strain
- B) reinfection by the same herpesvirus strain
- C) copies of the herpesvirus genome permanently maintained in host nuclei
- D) copies of the herpesvirus genome permanently maintained in host cell cytoplasm

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 19.2

- 8) In many ways, the regulation of the genes of a particular group of viruses will be similar to the regulation of the host genes. Therefore, which of the following regulation mechanisms would you expect of the genes of a bacteriophage?

- A) regulation via acetylation of histones
- B) positive control mechanisms rather than negative
- C) control of more than one gene in an operon
- D) reliance on transcription activators

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 19.2

- 9) Which of the following characteristics is typical of the lytic cycle of a bacteriophage?
- A) Viral DNA is incorporated into the host genome.
 - B) The viral genome replicates without destroying the host.
 - C) A large number of phages are released at a time.
 - D) The virus-host relationship usually lasts for generations.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.2

- 10) Which of the following statements accurately describes the lysogenic cycle of lambda (λ) phage?

- A) After infection, the viral genes immediately turn the host cell into a lambda-producing factory, and the host cell then lyses.
- B) Most of the prophage genes are activated by the product of a particular prophage gene.
- C) The phage genome is integrated in the host chromosome where it is replicated along with the host genome.
- D) The phage DNA is copied and exits the cell as a phage.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.2

- 11) Which of the following characteristics correctly describes retroviruses?

- A) They are made up of only a single protein.
- B) They can only reproduce by infecting bacteria.
- C) They have a single-stranded DNA that acts as a template for DNA synthesis.
- D) They have a single-stranded RNA that acts as a template for DNA synthesis.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.2

- 12) What is the function of reverse transcriptase in retroviruses?

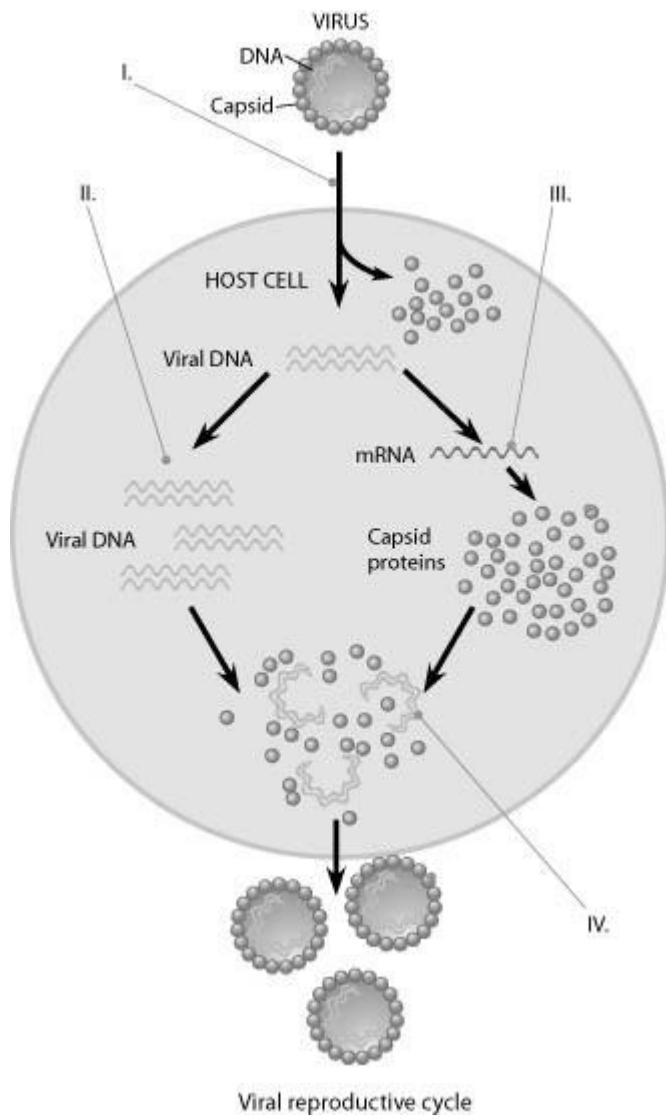
- A) It uses viral RNA as a template for DNA synthesis.
- B) It converts host cell RNA into viral DNA.
- C) It translates viral RNA into proteins.
- D) It uses viral RNA as a template for making complementary RNA strands.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.2

13) Use the figure to answer the question.



In the figure, at the arrow marked II, what enzyme is being utilized?

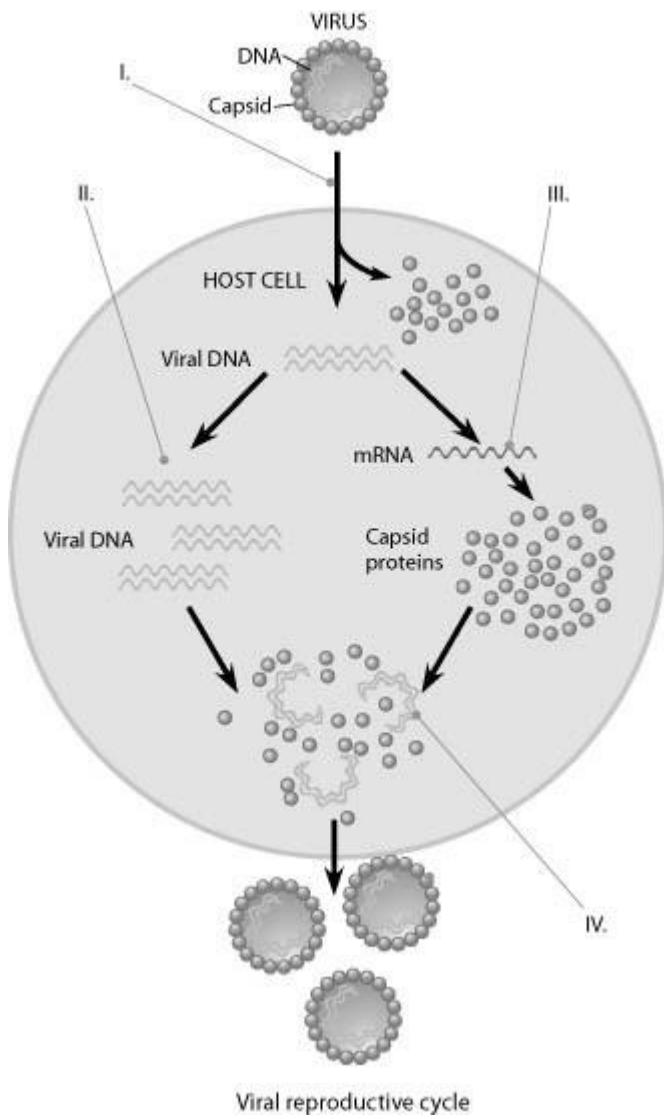
- A) reverse transcriptase
- B) viral DNA polymerase
- C) host cell DNA polymerase
- D) host cell RNA polymerase

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.2

14) Use the figure to answer the question.



In the figure, when new viruses are being assembled at the point marked IV, what mediates the assembly?

- A) host cell chaperones
- B) assembly proteins coded for by the host nucleus
- C) assembly proteins coded for by the viral genes
- D) no mediator is required; the new viruses self-assemble

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.2

15) Some viruses can be crystallized and their structures analyzed. One such virus is yellow mottle virus, which infects beans. This virus has a single-stranded RNA genome containing about 6,300 nucleotides. Its capsid is 25-30 nm in diameter and contains 180 identical capsomeres. If the yellow mottle virus begins its infection of a cell by using its genome as mRNA, which of the following would you expect to be able to measure when analyzing the reproduction of this virus?

- A) replication rate
- B) transcription rate
- C) translation rate
- D) formation of new transcription factors

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 19.2

16) Use the following information to answer the question.

The herpesviruses are important enveloped DNA viruses that cause disease in vertebrates and in some invertebrates such as oysters. Some of the human forms are herpes simplex virus (HSV) types I and II, causing facial and genital lesions, and the varicella zoster virus (VSV), causing chicken pox and shingles. Each of these three actively infects nervous tissue. Primary infections are fairly mild, but the virus is not then cleared from the host; rather, viral genomes are maintained in cells in a latent phase. The virus can later reactivate, replicate again, and infect others.

In electron micrographs of HSV infection, it can be seen that the intact virus initially reacts with cell-surface proteoglycans, then with specific receptors. This is later followed by viral capsids docking with nuclear pores. Afterward, the capsids go from being full to being "empty." Which of the following statements best fits these observations?

- A) Viral capsids are needed for the cell to become infected; only the capsids enter the nucleus.
- B) The viral envelope is not required for infectivity, since the envelope does not enter the nucleus.
- C) Only the genetic material of the virus is involved in the cell's infectivity, and is injected like the genome of a phage.
- D) The viral envelope mediates entry into the cell, the capsid mediates entry into the nuclear membrane, and the genome is all that enters the nucleus.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 19.2

17) Use the following information to answer the question.

Poliovirus is an RNA virus of the picornavirus group, which uses its RNA as mRNA. At its 5' end, the RNA genome has a viral protein (VPg) instead of a 5' cap. This is followed by a non-translated leader sequence, and then a single long protein-coding region (~7,000 nucleotides), followed by a poly-A tail. Observations were made that used radioactive amino acids similar in structure to those that are found in viruses and other organisms. Short-period use of the radioactive amino acids result in labeling of only very long proteins, while longer periods of labeling result in several different short polypeptides.

What conclusion is most consistent with the results of the radioactive labeling experiment?

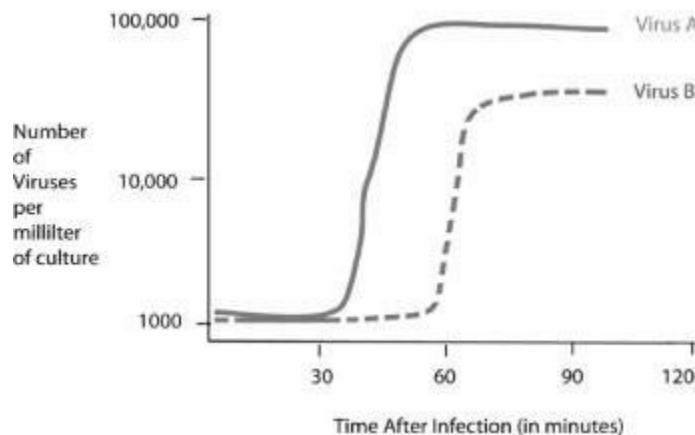
- A) Host cell ribosomes only translate the viral code into short polypeptides.
- B) The RNA is only translated into a single long polypeptide, which is then cleaved into shorter ones.
- C) The RNA is translated into short polypeptides, which are subsequently assembled into large ones.
- D) The large radioactive polypeptides are coded by the host, whereas the short ones are coded for by the virus.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 19.2

18) Use the following figure and information to answer the question(s) below.



Cells were infected with approximately 1,000 copies of either virus A or virus B at the 0 time point. At five-minute intervals, a sample of the virus and cell mixture was removed. The intact cells were removed from the sample, and the number of viruses per milliliter of culture was determined.

Using the data in the figure, how long does it take for virus A to go through one lytic cycle?

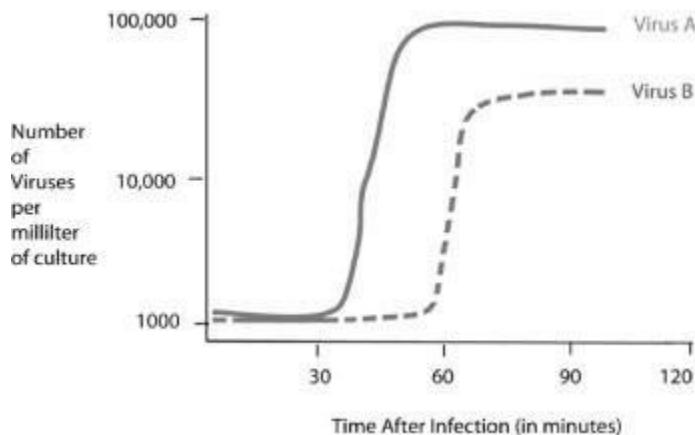
- A) 15 minutes
- B) 30 minutes
- C) 45 minutes
- D) 90 minutes

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 19.2

19) Use the following figure and information to answer the question.



Cells were infected with approximately 1,000 copies of either virus A or virus B at the 0 time point. At five-minute intervals, a sample of the virus and cell mixture was removed. The intact cells were removed from the sample, and the number of viruses per milliliter of culture was determined.

Using the data in the figure, how long does it take for virus B to go through one lytic cycle?

- A) 15 minutes
- B) 30 minutes
- C) 45 minutes
- D) 60 minutes

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 19.2

20) The virus genome and viral proteins are assembled into virus particles during which of the following parts of the reproductive cycle?

- A) the lytic cycle and the lysogenic cycle in all known host organisms
- B) the lysogenic cycle only
- C) the lytic cycle only
- D) the lytic cycle in all host organisms but the lysogenic cycle only in bacteria

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 19.2

21) Which of the following viruses would most likely have reverse transcriptase inside them?

- A) an RNA-based lytic virus
- B) an RNA-based lysogenic virus
- C) a DNA-based lytic virus
- D) a DNA-based lysogenic virus

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 19.2

22) If a viral host cell has a mutation that interferes with the addition of carbohydrates to proteins in the Golgi apparatus, which of the following processes could likely result?

- A) The viral envelope proteins would not have glycoproteins added to them and might not arrive at the host plasma membrane.
- B) The viral capsid proteins would not have glycoproteins added to them and might not arrive at the host plasma membrane.
- C) The viral core proteins would not have glycoproteins added to them and might not arrive at the host plasma membrane.
- D) The virus would be unable to reproduce within the host cell.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 19.2

23) HIV is inactivated in the laboratory after a few minutes of sitting at room temperature, but the flu virus is still active after sitting for several hours. What are the practical consequences of these findings?

- A) HIV can be transmitted more easily from person to person than the flu virus.
- B) The flu virus can be transmitted more easily from person to person than HIV.
- C) This property of HIV makes it more likely to be a pandemic than the flu virus.
- D) Disinfecting surfaces is more important to reduce the spread of HIV than the flu.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 19.2

24) Viruses use the host cell's machinery to make copies of themselves. However, some human viruses require a type of replication that humans do not normally have. For example, humans normally do not have the ability to convert RNA into DNA. How can these types of viruses infect humans, when human cells cannot perform a particular role that the virus requires?

- A) The virus causes mutations in the human cells, resulting in the formation of new enzymes that are capable of performing these roles.
- B) The viral genome codes for specialized enzymes not found in the host cells.
- C) The virus infects only those cells and species that can perform all the replication roles necessary.
- D) Viruses can stay in a quiescent state until the host cell evolves this ability.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 19.2

25) The first class of antiviral drugs developed to treat HIV infection, such as AZT, were known as reverse transcriptase inhibitors. How did these drugs carry out their functions?

A) The drugs targeted and destroyed the viral genome before it could be reverse transcribed into DNA.

B) The drug molecules bonded to the dsDNA genome of the virus in such a way that it could not separate for replication to occur.

C) The drug molecules bonded to the viral reverse transcriptase enzyme, thus preventing the virus from making a DNA copy of its RNA genome.

D) The drugs prevented host cells from producing the enzymes used by the virus to replicate its genome.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 19.2

26) A virus consisting of a single strand of RNA, which is reverse transcribed into complementary DNA, is referred to as a _____.

A) protease

B) retrovirus

C) bacteriophage

D) non-enveloped virus

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.2

27) Which of the following types of viral genomes could be transcribed using reverse transcriptase?

A) ssRNA

B) dsRNA

C) ssDNA

D) dsDNA

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.2

28) Which of the following statements correctly describes vaccines and how they help prevent viral infection?

A) Vaccines are active versions of a virus that stimulate an immune reaction in a person.

B) Vaccines are inactive versions of a virus that stimulate an immune reaction in a person.

C) Vaccines are infectious proteins that stimulate an immune reaction in a person.

D) Vaccines are infectious enzymes that stimulate an immune reaction in a person.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.3

29) Which of the following human diseases is caused by a virus that requires reverse transcriptase to transcribe its genome inside the host cell?

- A) herpes
- B) AIDS
- C) smallpox
- D) influenza

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.2

30) Why do RNA viruses appear to have higher rates of mutation?

- A) RNA nucleotides are more unstable than DNA nucleotides.
- B) Replication of their genomes does not involve proofreading.
- C) RNA viruses can incorporate a variety of nonstandard bases.
- D) RNA viruses are more sensitive to mutagens.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.3

31) A researcher lyses a cell that contains nucleic acid molecules and capsomeres of tobacco mosaic virus (TMV). The cell contents are left in a covered test tube overnight. The next day this mixture is sprayed on tobacco plants. What would you expect to happen to the plants that were sprayed with the mixture?

- A) The plants would develop some but not all of the symptoms of the TMV infection.
- B) The plants would develop the typical symptoms of TMV infection.
- C) The plants would not show any disease symptoms.
- D) The plants would become infected, but extracts from these plants would be unable to infect other plants.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 19.3

32) Which of the following processes can be effective in preventing the onset of viral infection in humans?

- A) taking vitamins before being exposed to various viruses
- B) getting vaccinated to certain viruses
- C) taking antibiotics to inhibit bacterial growth
- D) taking drugs that inhibit transcription

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.3

33) Which of the following statements is correct regarding viral infections in plants?

- A) They can be controlled with antibiotics.
- B) They can spread within a plant via plasmodesmata.
- C) They have little effect on plant growth.
- D) They are not spread by animals.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.3

34) Which of the following statements correctly describes a difference between viruses and prions?

- A) Viruses infect many types of cells, whereas prions infect only prokaryotic cells.
- B) Viruses have capsids composed of protein, whereas prions are made only of nucleic acid.
- C) Viruses have genomes composed of RNA, whereas prions have genomes composed of DNA.
- D) Viruses generally cause disease symptoms quickly, whereas prions generally take many years to cause disease symptoms.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.3

35) The difference between vertical and horizontal transmission of plant viruses is that vertical transmission is _____.

- A) transmission of a virus from a parent plant to its progeny, and horizontal transmission is one plant spreading the virus to another plant
- B) the spread of viruses from upper leaves to lower leaves of the plant, and horizontal transmission is the spread of a virus among leaves at the same general level
- C) the spread of viruses from trees and tall plants to bushes and other smaller plants, and horizontal transmission is the spread of viruses among plants of similar size
- D) the transfer of DNA from a plant of one species to a plant of a different species, and horizontal transmission is the spread of viruses among plants of the same species

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.3

36) What are prions?

- A) mobile segments of DNA
- B) tiny circular molecules of RNA that can infect plants
- C) viral DNA that attaches itself to the host genome and causes disease
- D) misfolded versions of normal proteins that can cause disease

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.3

37) A person is most likely to recover from a cold due to viral infection if the infected cells are able to perform which of the following processes?

- A) The cells can undergo normal cell division.
- B) The cells can carry on translation, at least for a few hours.
- C) The cells produce and release viral protein.
- D) The cells transcribe viral mRNA.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.3

38) Effective antiviral drugs are usually associated with which of the following properties?

- A) interference with viral replication
- B) prevention of the host from becoming infected
- C) removal of viral proteins
- D) removal of viral mRNAs

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.3

39) Which of the following statements best reflects what we know about how the flu virus moves between species?

- A) The flu virus in a pig is mutated and replicated in alternate arrangements so that humans who eat the pig products can be infected.
- B) A flu virus from a human epidemic or pandemic infects birds; the birds replicate the virus differently and then pass it back to humans.
- C) An influenza virus gains new sequences of DNA from another virus, such as a herpesvirus; this enables it to be transmitted to a human host.
- D) An animal such as a pig is infected with more than one virus, genetic recombination occurs, the new virus mutates, the virus is passed to a new species such as a bird, and the virus mutates again and can now be transmitted to humans.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 19.3

40) Refer to the treatments listed to answer the question.

You isolate an infectious substance capable of causing disease in plants, but you do not know whether the infectious agent is a bacterium, virus, or prion. You have four methods at your disposal to analyze the substance and determine the nature of the infectious agent.

- I. Treat the substance with enzymes that destroy all nucleic acids, and then determine whether the substance is still infectious.
- II. Filter the substance to remove all elements smaller than what can be easily seen under a light microscope.
- III. Culture the substance on nutritive medium, away from any plant cells.
- IV. Treat the sample with proteases that digest all proteins, and then determine whether the substance is still infectious.

If you already know that the infectious agent was either bacterial or viral, which method(s) listed above would allow you to distinguish between these two possibilities?

- A) I
- B) II
- C) II or III
- D) IV

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 19.3

41) Refer to the treatments listed to answer the question.

You isolate an infectious substance capable of causing disease in plants, but you do not know whether the infectious agent is a bacterium, virus, or prion. You have four methods at your disposal to analyze the substance and determine the nature of the infectious agent.

- I. Treat the substance with enzymes that destroy all nucleic acids, and then determine whether the substance is still infectious.
- II. Filter the substance to remove all elements smaller than what can be easily seen under a light microscope.
- III. Culture the substance on nutritive medium, away from any plant cells.
- IV. Treat the sample with proteases that digest all proteins, and then determine whether the substance is still infectious.

If you already know that the infectious agent was either a virus or a prion, which method(s) listed above would allow you to distinguish between these two possibilities?

- A) I only
- B) II only
- C) IV only
- D) either I or IV

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 19.3

42) Use the following information to answer the question.

The herpes viruses are important enveloped DNA viruses that cause disease in vertebrates and in some invertebrates such as oysters. Some of the human forms are herpes simplex virus (HSV) types I and II, causing facial and genital lesions, and the varicella zoster virus (VSV), causing chicken pox and shingles. Each of these three actively infects nervous tissue. Primary infections are fairly mild, but the virus is not then cleared from the host; rather, viral genomes are maintained in cells in a latent phase. The virus can later reactivate, replicate again, and infect others.

If scientists are trying to use what they know about the herpes simplex virus to devise a means of protecting other people from being infected, which of the following treatments would have the best chance of lowering the number of new cases of infection?

- A) Vaccinate all persons with preexisting cases of herpes simplex virus.
- B) Interfere with new viral replication in preexisting cases of herpes simplex virus.
- C) Treat herpes simplex virus lesions to shorten the breakout.
- D) Educate people about avoiding sources of infection.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 19.3

43) What is difference between an epidemic and a pandemic?

- A) An epidemic is a disease; a pandemic is a treatment.
- B) An epidemic is restricted to a local region; a pandemic is global.
- C) An epidemic has low mortality; a pandemic has higher mortality.
- D) An epidemic is caused by a bacterial infection; a pandemic is caused by a viral infection.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.3

44) Will treating a viral infection with antibiotics affect the course of the infection?

- A) No; antibiotics work by inhibiting enzymes specific to bacteria. Antibiotics have no effect on eukaryotic or virally encoded enzymes.
- B) No; antibiotics do not kill viruses because viruses do not have DNA or RNA.
- C) Yes; antibiotics activate the immune system, and this decreases the severity of the infection.
- D) Yes; antibiotics can prevent viral entry into the cell by binding to host-receptor proteins.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.3

- 45) Why do scientists consider HIV to be an emerging virus?
- A) HIV infected humans long before the 1980s, but it has now mutated to a deadlier form.
 - B) HIV mutates rapidly, making the virus very different from HIV in the early 1980s.
 - C) HIV suddenly became apparent and widespread in the 1980s.
 - D) HIV is now starting to cause diseases other than AIDS, such as rare types of cancers and pneumonias.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.3

- 46) A population of viruses with similar characteristics is called a _____.

- A) class
- B) species
- C) type
- D) genome

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.2

- 47) Evidence suggests that factors that contribute towards the virulence of *E. coli* strain O157:H7, a bacterial strain reported to cause several food poisoning deaths, are caused by genes from a virus that infects bacteria. Considering this evidence, which of the following statements most likely explains how the O157:H7 population acquired the genetic variation that distinguishes the strain from harmless *E. coli* strains, such as those that reside in our intestines?
- A) The virus entered the bacterial cell and incorporated its DNA into the bacterial genome, allowing the bacteria's cellular machinery to create new viruses.
 - B) Viral envelope proteins bind to receptors on the bacterial membrane, allowing the viral genetic material to enter the bacterium and become translated into proteins.
 - C) The virus entered the cell and acquired specific genes from the bacteria to increase the virulence of the virus.
 - D) The virus infected the bacterium, and allowed the bacterial population to replicate with a copy of the phage genome in each new bacterium.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 19.2

- 48) Which of the following processes within viral replication is the greatest source of genetic variation in RNA virus populations?

- A) High mutation rate due to lack of proofreading of RNA genome replication errors.
- B) Transcription from the host cell RNA polymerase introduces numerous mutations.
- C) Capsid proteins from the host cell can replace the viral capsid.
- D) Viral RNA is translated by host cell ribosomes.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 19.3

49) In 2009, a flu pandemic was believed to have originated when viral transmission occurred from pig to human, thereby earning the designation "swine flu." Although pigs are thought to have been the breeding ground for the 2009 virus, sequences from bird, pig, and human viruses were all found within this newly identified virus. What is the most likely explanation of why this virus contained sequences from bird, pig, and human viruses?

- A) The virus was descended from a common ancestor of bird, pig, and human flu viruses.
- B) The infected individuals happened to be infected with all three virus types.
- C) Related viruses can undergo genetic recombination if the RNA genomes mix and match during viral assembly.
- D) The human was likely infected with various bacterial strains that contained all three RNA viruses.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 19.3

19.2 Student Edition End-of-Chapter Questions

1) Which of the following characteristics, structures, or processes is common to both bacteria and viruses?

- A) metabolism
- B) ribosomes
- C) genetic material composed of nucleic acid
- D) cell division

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

2) Emerging viruses arise by

- A) mutation of existing viruses.
- B) the spread of existing viruses to new host species.
- C) the spread of existing viruses more widely within their host species.
- D) all of the above

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

3) To cause a human pandemic, the H5N1 avian flu virus would have to

- A) spread to primates such as chimpanzees.
- B) develop into a virus with a different host range.
- C) become capable of human-to-human transmission.
- D) become much more pathogenic.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

4) A bacterium is infected with an experimentally constructed bacteriophage composed of the T2 phage protein coat and T4 phage DNA. The new phages produced would have

- A) T2 protein and T4 DNA.
- B) T4 protein and T2 DNA.
- C) T2 protein and T2 DNA.
- D) T4 protein and T4 DNA.

Answer: D

Bloom's Taxonomy: Application/Analysis

5) RNA viruses require their own supply of certain enzymes because

- A) host cells rapidly destroy the viruses.
- B) host cells lack enzymes that can replicate the viral genome.
- C) these enzymes translate viral mRNA into proteins.
- D) these enzymes penetrate host cell membranes.

Answer: B

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 20 DNA Tools and Biotechnology

20.1 Multiple-Choice Questions

1) Which of the following processes helps bacterial cells protect their own DNA from restriction enzymes (endonucleases)?

- A) adding methyl groups to adenines and cytosines
- B) using DNA ligase to seal the bacterial DNA into a closed circle
- C) adding histones to protect the double-stranded DNA
- D) forming "sticky ends" of bacterial DNA to prevent the enzyme (endonuclease) from attaching

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.1

2) What is the most logical sequence of steps for splicing foreign DNA into a plasmid and inserting the plasmid into a bacterium?

- I. Transform bacteria with a recombinant DNA molecule.
- II. Cut the plasmid DNA using restriction enzymes (endonucleases).
- III. Extract plasmid DNA from bacterial cells.
- IV. Hydrogen-bond the plasmid DNA to non-plasmid DNA fragments.
- V. Use ligase to seal plasmid DNA to non-plasmid DNA.

- A) II, III, V, IV, I
- B) III, II, IV, V, I
- C) III, IV, V, I, II
- D) IV, V, I, II, III

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.1

3) A principal problem with inserting an unmodified mammalian gene into a plasmid and then getting that gene expressed in bacteria is that _____.

- A) prokaryotes use a different genetic code from that of eukaryotes
- B) bacteria translate only mRNAs that have multiple messages
- C) bacteria cannot remove eukaryotic introns
- D) bacterial RNA polymerase cannot make RNA complementary to mammalian DNA

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 20.1

4) Why are yeast cells frequently used as hosts for cloning?

- A) They easily form colonies.
- B) They can remove exons from mRNA.
- C) They do not have plasmids.
- D) They are eukaryotic cells.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.1

5) Why is sequencing an entire genome, such as that of *C. elegans*, a nematode, important for genetic research?

- A) It allows researchers to use the sequence to build a "better" nematode, which is resistant to disease.
- B) It allows research on a group of organisms we do not usually care much about.
- C) A sequence that is found to have a particular function in the nematode is likely to have a closely related function in vertebrates.
- D) A sequence that is found to have no introns in the nematode genome is likely to have acquired the introns from higher organisms.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 20.1

6) Which of the following methods would be most successful in attempting to introduce a particular piece of DNA into an animal cell?

- A) electroporation followed by recombination
- B) introducing a plasmid into the cell
- C) infecting the mouse cell with a Ti plasmid
- D) transcription and translation

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 20.1

7) Why is it so important to be able to amplify DNA fragments when studying genes?

- A) Before amplification, DNA fragments are likely to bind to RNA and would no longer be able to be analyzed.
- B) A gene may represent only a millionth of the cell's DNA.
- C) Restriction enzymes (endonucleases) cut DNA into fragments that are too small.
- D) A clone requires multiple copies of each gene per clone.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.1

8) *Pax-6* is a gene that is involved in eye formation in many invertebrates, such as *Drosophila*. *Pax-6* is also found in vertebrates. A *Pax-6* gene from a mouse can be expressed in a fly and the protein (PAX-6) leads to a compound fly eye. This information suggests which of the following characteristics of this gene?

- A) *Pax-6* genes are identical in nucleotide sequence.
- B) PAX-6 proteins have identical amino acid sequences.
- C) *Pax-6* is highly conserved and shows shared evolutionary ancestry.
- D) PAX-6 proteins are different for formation of different kinds of eyes.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 20.1

9) Which of the following characteristics of *Taq* polymerase make it useful in the PCR process?

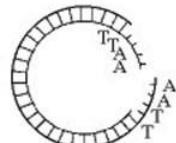
- A) It is heat stable and can withstand the heating step of PCR.
- B) Only minute amounts are needed for each cycle of PCR.
- C) It binds more readily than other polymerases to the primers.
- D) It has regions that are complementary to the primers.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.1

10) Use the figure to answer the following question.



Which of the following enzymes was used to produce the molecule of DNA in the figure?

- A) ligase
- B) a restriction enzyme (endonuclease)
- C) RNA polymerase
- D) DNA polymerase

Answer: B

Bloom's Taxonomy: Application/Analysis

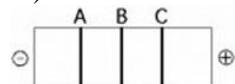
Section: 20.1

11) Use the figure to answer the following question.

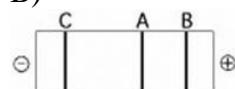


The segment of DNA shown in the figure has restriction sites I and II, which create restriction fragments A, B, and C. Which of the gels produced by electrophoresis best represents the separation and identity of these fragments?

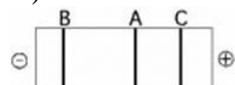
A)



B)



C)



D)



Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 20.1

12) For which of the following processes can dideoxyribonucleotides be used?

- A) to separate different sized DNA fragments
- B) to produce cDNA from mRNA
- C) to sequence a DNA fragment
- D) to visualize DNA expression

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.1

13) Many identical copies of genes cloned in bacteria are produced as a result of which of the following processes?

- A) plasmid replication
- B) bacterial cell reproduction
- C) transformation
- D) plasmid and bacterial cell reproduction

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 20.1

14) Which of the following sequences is most likely to be cut by a restriction enzyme?

- A) 5'-AATTCT 3'
- 3'-TTAAGA-5'
- B) 5'-AATATT-3'
- 3'-TTATAA-5'
- C) 5'-AAAATT-3'
- 3'-TTTCAA-5'
- D) 5'-ACTACT-3'
- 3'-TGATGA-5'

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 20.1

15) What information is critical to the success of polymerase chain reaction (PCR) itself?

- A) The DNA sequence of the ends of the DNA to be amplified must be known.
- B) The complete DNA sequence of the DNA to be amplified must be known.
- C) The sequence of restriction-enzyme recognition sites in the DNA to be amplified must be known.
- D) The sequence of restriction-enzyme recognition sites in the DNA to be amplified and in the plasmid where the amplified DNA fragment will be cloned must be known.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 20.1

16) Which of the following correctly lists the processes in order for one cycle of polymerase chain reaction (PCR)?

- A) denature DNA; add fresh enzyme; anneal primers; add dNTPs; extend primers
- B) anneal primers; denature DNA; extend primers
- C) extend primers; anneal primers; denature DNA
- D) denature DNA; anneal primers; extend primers

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 20.1

17) The final step in a Sanger DNA sequencing reaction is to run the DNA fragments on a gel. What purpose does this serve?

- A) It adds ddNTP to the end of each DNA fragment.
- B) It changes the length of the DNA fragments.
- C) It separates DNA fragments based on their charge.
- D) It separates DNA fragments generated during the sequencing reaction based on one-nucleotide differences in their size.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 20.1

18) How can a gene that contains introns be made shorter (but remain functional) for genetic engineering purposes?

- A) using a restriction enzyme (endonuclease) to cut the gene into shorter pieces
- B) using reverse transcriptase to reconstruct the gene from its mRNA
- C) using DNA polymerase to reconstruct the gene from its polypeptide product
- D) using DNA ligase to put together fragments of the DNA that code for a particular polypeptide

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 20.2

19) Which of the following enzymes is required to make complementary DNA (cDNA) from RNA?

- A) restriction enzymes (endonucleases)
- B) helicase
- C) DNA ligase
- D) reverse transcriptase

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.2

20) How have DNA microarrays made a huge impact on genomic studies?

- A) They can be used to eliminate the function of any gene in the genome.
- B) They can be used to introduce entire genomes into bacterial cells.
- C) They allow the expression of many or even all of the genes in the genome to be compared at once.
- D) They allow physical maps of the genome to be assembled in a very short time.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.2

21) RNAi methodology uses double-stranded pieces of RNA to trigger breakdown of a specific mRNA or inhibit its translation. For which of the following processes might this technique be useful?

- A) to decrease the production from a harmful mutated gene
- B) to destroy an unwanted allele in a homozygous individual
- C) to form a knockout organism that will not pass the deleted sequence to its progeny
- D) to raise the concentration of a desired protein

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 20.2

22) Which of the following statements correctly describes how RNA interference (RNAi) silences selected genes?

- A) Synthetic double-stranded RNA molecules stop transcription from occurring.
- B) Synthetic double-stranded RNA molecules stop DNA replication from occurring.
- C) Synthetic double-stranded RNA molecules trigger the breakdown of a gene's messenger RNA.
- D) Synthetic double-stranded RNA molecules stop mitosis from occurring.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.2

23) In large scale, genome-wide association studies in humans, what types of genetic markers do researchers look for?

- A) lengthy sequences that might be shared by most members of a population
- B) SNPs where one allele is found more often in persons with a particular disorder than in healthy controls
- C) SNPs where one allele is found in families with a particular introns sequence
- D) SNPs where one allele is found in two or more adjacent genes

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 20.2

24) For a particular microarray assay (DNA chip), cDNA has been made from the mRNAs of a dozen patients' breast tumor biopsies. Which of the following types of evidence will researchers be looking for in order to determine if the cells are cancerous?

- A) a particular gene that is amplified in all or most of the patient samples
- B) a pattern of fluorescence that indicates which cells are over proliferating
- C) a pattern shared among some or all of the samples that indicates gene expression differing from control samples
- D) a group of cDNAs that match those in non-breast cancer control samples from the same population

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 20.2

- 25) In a comparison of two DNA sequences found in the same location on homologous chromosomes, one of the homologs carries the sequence 5'-AACTACGA-3', and the other homolog carries the sequence 5'-AACTTCGA-3'. Within a population, you discover that each of these sequences is common. Which of the following statements correctly describes these sequences?
- A) They contain a SNP that may be useful for genetic mapping.
 - B) They can identify a protein-coding region of a gene.
 - C) They may cause disease.
 - D) They may carry out RNA interference.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 20.2

- 26) Which of the following processes uses labeled probes to visualize the expression of genes in whole tissues and organisms?

- A) RT-PCR
- B) *in situ* hybridization
- C) DNA microarrays
- D) RNA interference

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.2

- 27) Which of the following processes is most like the formation of identical twins?

- A) cell cloning
- B) therapeutic cloning
- C) use of adult stem cells
- D) organismal cloning

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.3

- 28) In 1997, Dolly the sheep was cloned. Which of the following processes was used?

- A) replication and dedifferentiation of adult stem cells from sheep bone marrow
- B) separation of an early stage sheep blastula into separate cells, one of which was incubated in a surrogate ewe
- C) transfer of an adult cell's nucleus into an enucleated sheep egg, followed by incubation in a surrogate
- D) isolation of stem cells from a lamb embryo and production of a zygote equivalent

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.3

29) Which of the following problems with animal cloning might result in premature death of the clones?

- A) use of pluripotent instead of totipotent stem cells
- B) use of nuclear DNA as well as mtDNA
- C) abnormal gene regulation due to variant methylation
- D) the indefinite replication of totipotent stem cells

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 20.3

30) Reproductive cloning of human embryos is generally considered unethical. However, on the subject of therapeutic cloning, there is a wider divergence of opinion. Which of the following statements provides a likely explanation?

- A) The use of adult stem cells is likely to produce more cell types than the use of embryonic stem cells.
- B) Cloning to produce embryonic stem cells may lead to great medical benefits for many.
- C) Cloning to produce stem cells relies on a different initial procedure than reproductive cloning.
- D) A clone that lives until the blastocyst stage does not yet have human DNA.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 20.3

31) Which of the following statements correctly describes one of the main differences between embryonic stem cells and adult stem cells?

- A) Embryonic stem cells only differentiate into only eggs and sperm, and adult stem cells differentiate into any type of cell.
- B) Embryonic stem cells can give rise to all cell types in the organism, and adult stem cells cannot.
- C) Embryonic stem cells can continue to reproduce for an indefinite period, and adult stem cells cannot.
- D) One aim of using embryonic stem cells is to provide cells for repair of diseased tissue.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 20.3

32) A researcher is using adult stem cells and comparing them to other adult cells from the same tissue. Which of the following findings is likely from this comparison?

- A) The cells from the two sources exhibit different patterns of DNA methylation.
- B) Adult stem cells have more DNA nucleotides than their counterparts.
- C) The two kinds of cells have virtually identical gene expression patterns in microarrays.
- D) The non-stem cells have fewer repressed genes.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 20.3

- 33) In animals, what is the difference between reproductive cloning and therapeutic cloning?
- A) Reproductive cloning uses totipotent cells, whereas therapeutic cloning does not.
 - B) Reproductive cloning uses embryonic stem cells, whereas therapeutic cloning does not.
 - C) Therapeutic cloning uses nuclei of adult cells transplanted into enucleated unfertilized eggs.
 - D) Therapeutic cloning supplies cells for repair of diseased or injured organs.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.3

- 34) The first cloned cat, called Carbon Copy, was a calico, but she looked significantly different from her female parent. Why was this the case with this clone?
- A) The cloning was done poorly and it was likely that some contaminating cat DNA became part of Carbon Copy's genome.
 - B) Fur color genes in cats is determined by differential acetylation patterns.
 - C) Cloned animals have been found to have a higher frequency of transposon activation.
 - D) X chromosome inactivation in the embryo is random and produces different patterns.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.3

- 35) In recent times, it has been shown that adult cells can be induced to become pluripotent stem cells (iPS). To make this conversion, what has been done to the adult cells?
- A) A retrovirus is used to introduce four specific master regulatory genes.
 - B) The adult stem cells must be fused with embryonic cells.
 - C) Cytoplasm from embryonic cells is injected into the adult cells.
 - D) The nucleus of an embryonic cell is used to replace the nucleus of an adult cell.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.3

- 36) Suppose that a researcher is successful at producing induced pluripotent stem cells (iPS) for replacement of pancreatic insulin-producing cells for people with type 1 diabetes. Which of the following could still pose problems for this individual?

- I. the possibility that, once introduced into the patient, the iPS cells produce non-pancreatic cells
- II. the failure of the iPS cells to take up residence in the pancreas
- III. the inability of the iPS cells to respond to appropriate regulatory signals

- A) I only
- B) II only
- C) III only
- D) I, II, and III

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 20.3

37) Which of the following statements correctly describes one characteristic of genetically engineered plants?

- A) They are more difficult to develop than genetically engineered animals.
- B) They include transgenic rice plants that can grow in water more salty than seawater.
- C) They are used in research but not yet in commercial agricultural production.
- D) They are banned throughout the world.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.4

38) Scientists developed a set of guidelines to address the safety of DNA technology. Which of the following safety measures is one that has been adopted by researchers?

- A) Microorganisms used in recombinant DNA experiments must be genetically crippled to ensure that they cannot survive outside of the laboratory.
- B) Genetically modified organisms are not allowed to be part of our food supply.
- C) Transgenic plants are engineered so that the plant genes cannot hybridize.
- D) Experiments involving HIV or other potentially dangerous viruses have been banned.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.4

39) Which of the following statements describes one of the technical reasons why gene therapy is problematic in humans?

- A) Most cells with an engineered gene do not produce gene product.
- B) Cells with transferred genes are unlikely to replicate.
- C) Transferred genes may not have appropriately controlled activity.
- D) mRNA from transferred genes cannot be translated.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 20.4

40) One possible use of transgenic plants is in the production of human proteins, such as vaccines. Which of the following issues is a possible hindrance that must be overcome in order for this process to work properly?

- A) prevention of transmission of plant allergens to the vaccine recipients
- B) prevention of vaccine-containing plants being consumed by insects
- C) use of plant cells to translate non-plant-derived mRNA
- D) inability of the human digestive system to accept plant-derived protein

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 20.4

41) Which of the following characteristics of short tandem repeats (STRs) DNA makes it useful for DNA fingerprinting?

- A) The number of repeats is highly variable from person to person or animal to animal.
- B) The sequence of DNA that is repeated varies significantly from individual to individual.
- C) The sequence variation is acted upon differently by natural selection in different environments.
- D) Every racial and ethnic group has inherited different short tandem repeats.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.4

42) Transgenic mice are useful to human researchers because they _____.

- A) can be valuable animal models of human disease
- B) are essential for mapping human genes
- C) are now used in place of bacteria for cloning human genes
- D) were instrumental in pinpointing the location of the *huntingtin* gene

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.4

43) Which of the following information or processes does gene therapy require?

- A) the knowledge and availability of the defective gene but not the normal allele
- B) the ability to introduce the normal allele into the patient
- C) the ability to express the introduced gene at any time in the tissue site within the patient
- D) the ability to introduce a defective allele into a patient

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 20.4

44) What is the most favorable characteristic of retroviruses that makes them useful in gene therapy applications?

- A) Retroviruses have an RNA genome.
- B) Retroviruses possess reverse transcriptase.
- C) DNA copies of retroviral genomes become integrated into the genome of the infected cell.
- D) Retroviruses mutate often.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 20.4

45) Why might using retroviral vectors for gene therapy increase the patient's risk of developing cancer?

- A) Retroviral vectors may introduce proteins from the virus.
- B) Retroviral vectors do not express the genes that were introduced into a patient's cells.
- C) Retroviral vectors do not integrate their recombinant DNA into the patient's genome.
- D) Retroviral vectors integrate recombinant DNA into the genome in ways that may misregulate the expression of genes at or near the site of integration.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.4

46) In the form of gene therapy used successfully for severe combined immunodeficiency syndrome, SCID-X1, how is the genetic engineering of human cells achieved?

- A) by injecting engineered viruses into the patient's bloodstream
- B) by injecting engineered viruses into the patient's bone marrow
- C) by treating a relative's cultured bone marrow cells with genetically engineered viruses and then injecting these cells into the patient's bone marrow
- D) by isolating the patient's bone marrow cells, infecting them with genetically engineered viruses, and injecting them back into the patient's bone marrow

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 20.4

47) One predicted aspect of climate change is that climates, including precipitation and temperature, over most of Earth will become more variable. Which of the following is a good strategy for genetically engineering crops if this is true?

- A) Use only plant crops that are genetically engineered.
- B) Genetically engineer most crops to withstand very long droughts.
- C) Genetically engineer several genotypes within single crop types.
- D) Genetically engineer the fastest growing crops possible.

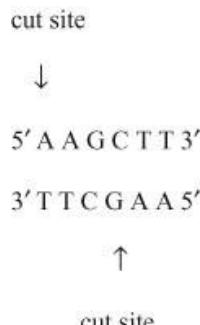
Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 20.4

48) Use the following information to answer the question.

In an experiment, DNA from the linear form of the bacteriophage Lambda was cut into fragments using the restriction enzyme Hind III. Hind III cuts the Lambda DNA between the adenine nucleotides on the complimentary strands in a specific sequence, as indicated in the diagram, producing eight different size fragments. These fragments are then separated with an electrical current based on size after the DNA fragments are placed in a porous gel, a process called gel electrophoresis.



Select an observation that best describes a correct aspect of the two processes of restriction digest and gel electrophoresis.

- A) When separated on a gel, the pattern of DNA bands will be characteristic of those cut with Hind III; different restriction enzymes will not produce these same fragments.
- B) The sequence 5'-AAGCTT-3' is found eight times in the Lambda genome, and the restriction enzyme Hind III finds each location.
- C) If an electrical current is not used, eight separate DNA bands would be visible, but they would not be separated as much as when an electrical current is used.
- D) Only the restriction enzyme Hind III can be used to cut Lambda DNA since restriction enzymes are specific to the type of DNA they can cut.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 20.2

49) Use the following information to answer the question.

Organisms share many conserved core processes and features, including transcription and translation, using a uniform genetic code. Scientists have used these shared processes and features in biotechnology. For example, for the process of some transformations, a plasmid is constructed when a eukaryotic gene of interest is added with an antibiotic resistant gene such as beta-lactamase, which is used for ampicillin resistance. This plasmid is then inserted into a prokaryotic bacterial cell, such as *E. coli*, through a transformation process that leads to the production of the product protein from the eukaryotic organism. To culture the bacteria and obtain the protein product, the bacteria must grow.

Select the appropriate condition to determine if the plasmid has entered the *E. coli* bacterial cell.

- A) nutrient broth to which no antibiotic has been added
- B) water to which ampicillin has been added
- C) nutrient broth to which ampicillin has been added
- D) nutrient broth to which other resistant bacteria have been added

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 20.1

20.2 Student Edition End-of-Chapter Questions

1) In DNA technology, the term *vector* can refer to

- A) the enzyme that cuts DNA into restriction fragments.
- B) the sticky end of a DNA fragment.
- C) a SNP marker.
- D) a plasmid used to transfer DNA into a living cell.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

2) Which of the following tools of DNA technology is incorrectly paired with its use?

- A) electrophoresis—separation of DNA fragments
- B) DNA ligase—cutting DNA, creating sticky ends of restriction fragments
- C) DNA polymerase—polymerase chain reaction to amplify sections of DNA
- D) reverse transcriptase—production of cDNA from mRNA

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

3) Plants are more readily manipulated by genetic engineering than are animals because

- A) plant genes do not contain introns.
- B) more vectors are available for transferring recombinant DNA into plant cells.
- C) a somatic plant cell can often give rise to a complete plant.
- D) plant cells have larger nuclei.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

4) A paleontologist has recovered a bit of tissue from the 400-year-old preserved skin of an extinct dodo (a bird). To compare a specific region of the DNA from a sample with DNA from living birds, which of the following would be most useful for increasing the amount of dodo DNA available for testing?

- A) SNP analysis
- B) polymerase chain reaction (PCR)
- C) electroporation
- D) gel electrophoresis

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

5) DNA technology has many medical applications. Which of the following is *not* done routinely at present?

- A) production of hormones for treating diabetes and dwarfism
- B) analysis of gene expression for more informed cancer treatments
- C) gene editing by the CRISPR-Cas9 system in viable human embryos to correct genetic diseases
- D) prenatal identification of genetic disease alleles

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

6) Which of the following is *not* true of cDNA produced using human brain tissue as the starting material?

- A) It can be amplified by the polymerase chain reaction.
- B) It was produced from pre-mRNA using reverse transcriptase.
- C) It can be labeled and used as a probe to detect genes expressed in the brain.
- D) It lacks the introns of the pre-mRNA.

Answer: B

Bloom's Taxonomy: Application/Analysis

7) Expression of a cloned eukaryotic gene in a bacterial cell involves many challenges. The use of mRNA and reverse transcriptase is part of a strategy to solve the problem of

- A) post-transcriptional processing.
- B) post-translational processing.
- C) nucleic acid hybridization.
- D) restriction fragment ligation.

Answer: A

Bloom's Taxonomy: Application/Analysis

8) Which of the following sequences in double-stranded DNA is most likely to be recognized as a cutting site for a restriction enzyme?

A) AAGG

TTCC

B) GGCC

CCGG

C) ACCA

TGGT

D) AAAA

TTTT

Answer: B

Bloom's Taxonomy: Application/Analysis

21.1 Multiple-Choice Questions

1) What is metagenomics?

- A) genomics as applied to a species that most typifies the average phenotype of its genus
- B) the sequencing of one or two representative genes from several species
- C) the sequencing of only the most highly conserved genes in a lineage
- D) sequencing DNA from a group of species from the same ecosystem

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.1

2) Which of the following processes is an early step in the whole-genome shotgun approach to sequencing?

- A) break genomic DNA at random sites
- B) map the position of cloned DNA fragments
- C) randomly select DNA primers and hybridize these to random positions of chromosomes in preparation for sequencing

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.1

3) Using modern techniques of sequencing by synthesis and the shotgun approach, sequences are assembled into chromosomes by _____.

- A) placing them on previously generated genetic maps
- B) cloning them into plasmid vectors
- C) computer analysis looking for sequence overlaps
- D) cloning them into plasmid vectors, placing them on previously generated genetic maps, followed by computer analysis looking for sequence overlaps

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.1

4) Which of the following statements defines *proteomics*?

- A) It is the linkage of each gene to a particular protein.
- B) It is the study of the full protein set and its properties.
- C) It is the totality of the functional possibilities of a single protein.
- D) It is the study of how amino acids are ordered in a protein.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.2

5) Bioinformatics can be used to scan for short sequences that specify known mRNAs, called _____.

- A) expressed sequence tags
- B) multigene families
- C) proteomes
- D) short tandem repeats

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.2

6) Which of the following processes correctly describes gene annotation in bioinformatics?

- A) finding transcriptional start and stop sites, RNA splice sites, and ESTs in DNA sequences
- B) assigning names to newly discovered genes
- C) describing the functions of noncoding regions of the genome
- D) matching the corresponding phenotypes of different species

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.2

7) Bioinformatics includes _____.

- I. using computer programs to align DNA sequences
- II. creating recombinant DNA from separate species
- III. developing computer-based tools for genome analysis
- IV. using mathematical tools to make sense of biological systems

- A) I and II
- B) II and III
- C) II and IV
- D) I, III, and IV

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 21.2

8) After finding a new medicinal plant, a pharmaceutical company decides to determine if the plant has genes similar to those of other known medicinal plants. What would annotation of the genome of this plant allow the company to determine?

- A) what proteins are produced by the plant
- B) what mRNA transcripts are produced by the plant
- C) identify genes and determine their functions
- D) identify the location of mRNA within the plant cells

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.2

9) If the sequence of a cDNA has matches with DNA sequences in the genome, then this genomic DNA could be described by which of the following statements?

- A) The sequence codes for a protein.
- B) The sequence codes for an rRNA.
- C) The sequence is part of an intron.
- D) The sequence is a regulatory sequence.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 21.2

10) Which of the following techniques would be most appropriate to test the hypothesis that humans and chimps differ in the expression of a large set of shared genes?

- A) DNA microarray analysis
- B) polymerase chain reaction (PCR)
- C) DNA sequencing
- D) protein-protein interaction assays

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 21.2

11) What can proteomics reveal that genomics cannot?

- A) the number of genes characteristic of a species
- B) the patterns of alternative splicing
- C) the set of proteins present within a cell or tissue type
- D) the movement of transposable elements within the genome

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 21.2

12) A sequence database such as GenBank could be used to carry out which of the following processes?

- A) Determine the expression pattern for specific human genes.
- B) Construct a tree to determine the evolutionary relationships between various bird species.
- C) Search for genes that have not yet been identified in eukaryotic genomes.
- D) Compare patterns of gene expression in cancerous and non-cancerous cells.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 21.2

13) Current analysis indicates that less than 2% of the human genome codes for proteins. Based on the systems approach employed by the ENCODE project, what percentage of the genome is estimated to be transcribed at some point in at least one cell type?

- A) less than 2%
- B) about 50%
- C) about 75%
- D) 100%

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.2

14) Which of the following statements is a correct representation of gene density?

- A) Humans have 1,000 Mb per genome.
- B) *C. elegans* has ~20,000 genes.
- C) Humans have ~20,000 protein-encoding genes in a 3,000 Mb.
- D) *Saccharomyces* has a genome 40 times the size of a human genome.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 21.3

15) Why might the cricket genome have eleven times as many base pairs as that of *Drosophila melanogaster*?

- A) Crickets have higher gene density.
- B) *Drosophila* are more complex organisms.
- C) Crickets must have more noncoding DNA.
- D) Crickets must make many more proteins.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 21.3

16) Which of the following conclusions has led to the comparison between the number of human genes and those of other animal species?

- A) The density of the human genome is far higher than in most other animals.
- B) The number of proteins expressed by the human genome is far greater than the number of its genes.
- C) Most human DNA consists of genes for protein, tRNA, rRNA, and miRNA.
- D) The genomes of most other organisms are significantly smaller than the human genome.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 21.3

17) Why is it more difficult to identify eukaryotic genes than prokaryotic genes using genomic techniques?

- A) The proteins are larger in eukaryotes than in prokaryotes.
- B) The coding portions of genes in eukaryotes are shorter than in prokaryotes.
- C) There are no start codons in eukaryotic genes.
- D) There are introns in eukaryotic genes.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.3

18) Which of the following statements correctly describes one of the characteristics of alternative splicing in vertebrate genomes?

- A) Vertebrate genomes can produce more than one polypeptide from a single gene.
- B) Vertebrate genomes can produce only one polypeptide from a single gene.
- C) Vertebrate genomes are always smaller than other organisms.
- D) Alternative splicing leaves introns in vertebrate genes after they are transcribed.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.3

19) Which of the following statements correctly describes one characteristic of a multigene family?

- A) A multigene family includes multiple genes whose products must be coordinately expressed.
- B) A multigene family includes genes whose sequences are very similar and that probably arose by duplication.
- C) A multigene family includes a gene whose exons can be spliced in a number of different ways.
- D) A multigene family includes a highly conserved gene found in a number of different species.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.4

20) Which of the following statements correctly describes one characteristic of retrotransposons?

- A) They use an RNA molecule as an intermediate in transposition.
- B) They are found only in animal cells.
- C) They generally move by a cut-and-paste mechanism.
- D) They contribute a significant portion of the genetic variability seen within a population of gametes.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.4

- 21) In humans, the embryonic and fetal forms of hemoglobin have a higher affinity for oxygen than that of adults. Why is this the case?
- A) Nonidentical genes produce different versions of globins during development.
 - B) Pseudogenes interfere with gene expression in adults.
 - C) The attachment of methyl groups to cytosine following birth changes the type of hemoglobin produced.
 - D) Histone proteins change shape during embryonic development.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.4

- 22) Why is sequencing of eukaryotic genomes more difficult than sequencing genomes of bacteria or archaea?
- A) It is due to the large size of eukaryotic proteins.
 - B) Eukaryotic genomes contain sequences for hard-to-find proteins.
 - C) There is a high proportion of G-C base pairs in eukaryotic DNA, which makes sequencing difficult to complete.
 - D) The large size of eukaryotic genomes and the large amount of eukaryotic repetitive DNA make sequencing difficult.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 21.4

- 23) How do transposons and retrotransposons differ in how they move around in a genome?
- A) Transposons move by viruses and retrotransposons move by plasmids.
 - B) Transposons move by means of a DNA intermediate and retrotransposons move by means of an RNA intermediate.
 - C) Transposons move by means of a RNA intermediate and retrotransposons move by means of an DNA intermediate.
 - D) Transposons move by viruses and retrotransposons move by bacteria.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.4

- 24) How do transposable elements and short tandem repeats (STRs) differ?
- A) STRs occur within exons; transposable elements occur within introns.
 - B) STRs occur within introns; transposable elements occur within exons.
 - C) STRs make up only a small percentage of a given genome while transposable elements often make up larger parts of a given genome.
 - D) The repeated unit in STRs is much larger than the repeated unit of transposable elements.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 21.4

25) Which of the following can be duplicated in a genome?

- A) only DNA sequences
- B) only entire sets of chromosomes
- C) only entire chromosomes
- D) DNA sequences, chromosomes, or sets of chromosomes

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 21.5

26) Unequal crossing over during prophase I can result in one sister chromosome with a deletion and another with a duplication. A mutated form of hemoglobin, so-called hemoglobin Lepore, exists in the human population. Hemoglobin Lepore has a deleted series of amino acids. If this mutated form was caused by unequal crossing over, what would be an expected consequence?
A) There should also be persons whose hemoglobin contains two copies of the series of amino acids that is deleted in hemoglobin Lepore.

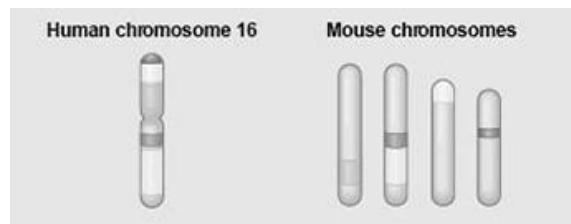
- B) Each of the genes in the hemoglobin gene family must show the same deletion.
- C) The deleted gene must have undergone exon shuffling.
- D) The deleted region must be located in a different area of the individual's genome.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 21.5

27) Use the following information to answer the question.



The figure shows a diagram of blocks of genes on human chromosome 16 and the locations of blocks of similar genes on four chromosomes of the mouse.

Which of the following statements describes the result of the movement of these blocks?

- A) During evolutionary time, these sequences have separated and have returned to their original positions.
- B) DNA sequences within these blocks have become increasingly divergent.
- C) Sequences represented have duplicated at least three times.
- D) Chromosomal translocations have moved blocks of sequences to other chromosomes.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 21.5

28) Humans have 23 pairs of chromosomes, and chimps have 24 pairs of chromosomes. What is the most likely explanation for these differences in human and chimp genomes?

- A) The common ancestor of humans and chimps had 24 pairs of chromosomes. During human evolution, two human chromosomes fused end to end.
- B) In the evolution of chimps, new adaptations resulted from additional chromosomal material.
- C) At some point in evolution, human and chimp ancestors reproduced with each other.
- D) Errors in mitosis resulted in an additional pair of chromosomes in chimps.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.5

29) During which of the following processes does exon shuffling occur?

- A) splicing of DNA
- B) DNA replication
- C) meiotic recombination
- D) translation

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.5

30) When gene duplication occurs to its ultimate extent by doubling all genes in a genome, which of the following results has occurred?

- A) pseudogene creation
- B) creation of a gene cluster
- C) creation of a polyploid
- D) creation of a diploid

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 21.5

31) Which of the following types of genes or gene families may be created by mutations that occur in one member of a gene pair that arose from gene duplication?

- A) only a pseudogene
- B) only a gene with a new function
- C) only a gene family with two distinct but related members
- D) a pseudogene, a gene with a new function, and a gene family with two distinct but related members

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.5

32) Based on the data in the Amino Acid Sequence Identity Table, which two members of the human globin gene family are the most divergent?

- A) α 1 and β
- B) $\text{A}\gamma$ and β
- C) α 1 and α 2
- D) α 1 and G?

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 21.5

33) Fragments of DNA have been extracted from the remnants of extinct woolly mammoths, amplified, and sequenced. How can these fragments of DNA now be used?

- A) to introduce certain mammoth traits into relatives, such as elephants
- B) to clone live woolly mammoths
- C) to understand the reasons why mammoths went extinct
- D) to better understand the evolutionary relationships among members of related taxa

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 21.6

34) Homeotic genes contain a homeobox sequence that is highly conserved among very diverse species. The homeobox is the code for the domain of a protein that binds to DNA in a regulatory developmental process. Which of the following statements is therefore correct regarding homeotic genes?

- A) Homeotic genes are selectively expressed as an organism develops.
- B) Homeoboxes cannot be expressed in nonhomeotic genes.
- C) Homeotic genes in apes and humans are very different.
- D) All organisms must have homeotic genes.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 21.6

35) A recent study compared the *Homo sapiens* genome with that of Neanderthals. The results of the study indicated that there was a mixing of the two genomes at some period in evolutionary history. Which of the following potential discoveries of additional data might be consistent with this hypothesis?

- A) some Neanderthal sequences not found in living humans
- B) a few modern *H. sapiens* with some Neanderthal sequences
- C) duplications of several Neanderthal genes on a Neanderthal chromosome
- D) some Neanderthal chromosomes that are shorter than their counterparts in living humans

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 21.6

36) Several of the different globin genes are expressed in humans, but at different times in development. Which of the listed mechanisms could allow for this?

- A) exon shuffling
- B) pseudogene activation
- C) differential translation of mRNAs
- D) differential gene regulation over time

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 21.6

37) Biologists now routinely test for homology between genes in different species. If genes are determined to be homologous, how are they related to each other?

- A) by descent from a common ancestor
- B) because of convergent evolution
- C) by chance mutations
- D) in function but not structure

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 21.6

38) A current view of how the human and chimpanzee can share most of their nucleotide sequences yet exhibit significant phenotypic differences is that many of the most important sequence differences alter _____.

- A) structural genes
- B) the number of repeated sequences
- C) regulatory sequences
- D) environmental factors

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.6

39) Studies in knockout mice have demonstrated an important role of the *FOXP2* transcription factor in the development of vocalizations. Recent sequence comparisons of the *FOXP2* gene in Neanderthals and modern humans show that while the DNA sequence may be different, the protein sequence it codes for is identical. Which of the following conclusions might logically be inferred from this information?

- A) There was a problem with the experiment because different DNA sequences cannot result in the same protein sequence.
- B) The differences in DNA sequence support the hypothesis that Neanderthals were primitive beings that could only grunt.
- C) Human and Neanderthal vocalizations may have been more similar than previously thought.
- D) The experiments in mice demonstrating the function of the *FOXP2* gene are not relevant to humans and Neanderthals because they are not primates.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 21.6

40) Comparisons of DNA sequences within the human species have revealed many variations. Which of the following variations involves duplication of relatively long stretches of DNA?

- A) CNVs
- B) SNPs
- C) STRs
- D) Transposable elements

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 21.6

41) A microarray is a tool used in genetic research to determine the mRNAs being produced in a particular tissue, and their relative level of expression. Known genes can therefore be assayed for their expression in different situations. One use of the technology is in cancer diagnosis and treatment. If a known gene functions as a tumor suppressor, predict which of the following pieces of evidence would be most useful in diagnosis of a cancer due to a mutation in this tumor-suppressor gene.

- A) The tissue sample shows a high level of gene expression relative to a control (noncancerous) sample.
- B) The tissue sample responds to treatment with a mitosis-promoting compound.
- C) The mRNAs for the targeted tumor suppressor sequence are not being produced.
- D) The mRNAs for cyclins and kinases show unusually high levels of expression.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 21.2

21.2 Student Edition End-of-Chapter Questions

1) Bioinformatics includes all of the following *except*

- A) using computer programs to align DNA sequences.
- B) using DNA technology to combine DNA from two different sources in a test tube.
- C) developing computer-based tools for genome analysis.
- D) using mathematical tools to make sense of biological systems.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

2) Homeotic genes

A) encode transcription factors that control the expression of genes responsible for specific anatomical structures.

B) are found only in *Drosophila* and other arthropods.

C) are the only genes that contain the homeobox domain.

D) encode proteins that form anatomical structures in the fly.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

3) Two eukaryotic proteins have one domain in common but are otherwise very different. Which of the following processes is most likely to have contributed to this similarity?

- A) gene duplication
- B) alternative splicing
- C) exon shuffling
- D) random point mutations

Answer: C

Bloom's Taxonomy: Application/Analysis

22.1 Multiple-Choice Questions

1) Darwin and Wallace's theory of evolution by natural selection was revolutionary because it _____.

- A) was the first theory to refute the ideas of special creation
- B) proved that individuals acclimated to their environment over time
- C) dismissed the idea that species are constant and emphasized the importance of variation and change in populations
- D) was the first time a biologist had proposed that species changed through time

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.1

2) The Linnaeus classification system grouped organisms by _____.

- A) linear hierarchy of the *scala naturae*
- B) increasingly more general categories
- C) increasingly more complex categories
- D) environmental location

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.1

3) Fossils found in strata reveal that _____.

- A) older strata carry fossils that differ greatly from living organisms
- B) geologic changes occur quickly on Earth
- C) unused body parts decrease in size
- D) innate drive to complexity of life

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.1

4) Prior to the work of Lyell and Darwin, the prevailing belief was that Earth is _____.

- A) a few thousand years old, and populations are unchanging
- B) a few thousand years old, and populations gradually change
- C) millions of years old, and populations rapidly change
- D) millions of years old, and populations are unchanging

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.1

- 5) Which of the following statements best explains why modification or change in an organ or tissue during the lifetime of an individual is not inherited?
- A) Characteristics acquired during an organism's life are generally not passed on through genes.
 - B) Spontaneous mutations can result in the appearance of new traits.
 - C) Only favorable adaptations have survival value.
 - D) Disuse of an organ may lead to its eventual disappearance.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 22.1

- 6) When Cuvier considered the fossils found in the vicinity of Paris, he concluded that the extinction of species _____.
A) does not occur, but evolution does occur
B) and the evolution of species both occur
C) and the evolution of species do not occur
D) occurs, but that there is no evolution

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.1

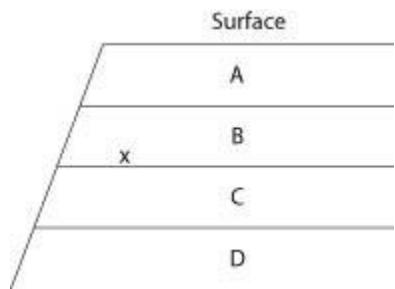
- 7) For which one of the following observations were both Lamarck's hypothesis and Darwin's hypothesis in complete agreement?
A) Use and disuse of organs determines their size in progeny.
B) Gradual evolutionary change explains why organisms are well-suited to their environments.
C) Acquired characteristics are inherited.
D) More complex species are descended from less complex species.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.1

8) The following questions refer to the figure below, which shows an outcrop of sedimentary rock whose strata are labeled A-D.



If x indicates the location of fossils of two closely related species, then fossils of their most-recent common ancestor are most likely to occur in which stratum?

- A) A
- B) B
- C) C
- D) D

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 22.1

9) If x indicates the fossils of two closely related species, neither of which is extinct, then their remains may be found in how many of these strata?

- A) one stratum
- B) two strata
- C) three strata
- D) four strata

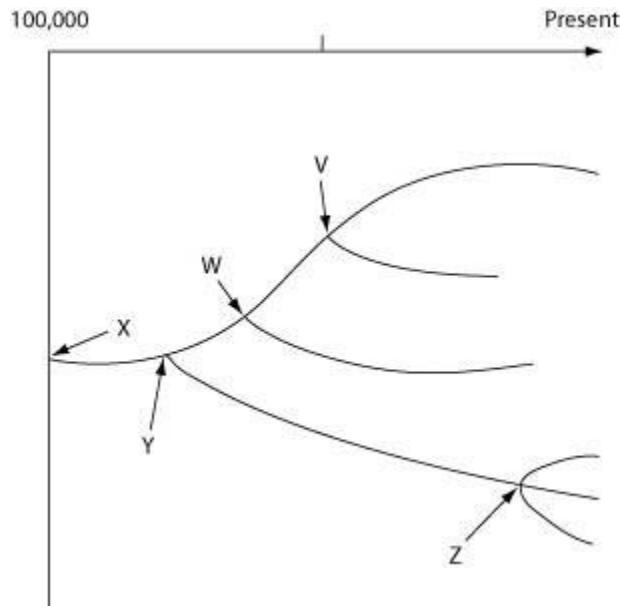
Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 22.1

10) The following questions refer to the evolutionary tree in the figure below.

The horizontal axis of the cladogram depicted below is a timeline that extends from 100,000 years ago to the present; the vertical axis represents nothing in particular. The labeled branch points on the tree (V-Z) represent various common ancestors. Let's say that only since 50,000 years ago has there been enough variation between the lineages depicted here to separate them into distinct species, and only the tips of the lineages on this tree represent distinct species.



In Darwin's tree of life, each fork in the tree represents _____.

- A) groups of living organisms
- B) groups of extinct organisms
- C) the most recent common ancestor of the subsequent branches
- D) morphologic gaps in the fossil record

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.2

11) Which pair of scientists below would probably have agreed with the process that is depicted by this tree?

- A) Cuvier and Lamarck
- B) Darwin and Wallace
- C) Aristotle and Lyell
- D) Wallace and Linnaeus

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.2

- 12) The cow *Bos primigenius* (which is bred for meat and milk) has a smaller brain and larger eyes than closely related wild species of ungulates. These traits most likely arose by _____.
A) natural selection, because these traits evolved in the population over time
B) natural selection, because these traits were not consciously selected by humans
C) artificial selection, because changes in these traits co-occurred with human selection for high milk output and high muscle content
D) artificial selection, because these animals differ from their close relatives and common ancestor

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 22.2

- 13) Starting from the wild mustard *Brassica oleracea*, breeders have created the strains known as Brussels sprouts, broccoli, kale, and cabbage. Therefore, which of the following statements is correct?
A) In this wild mustard, there is enough heritable variation to permit these different varieties.
B) Heritable variation is low in wild mustard—otherwise this wild strain would have different characteristics.
C) Natural selection is rare in wild populations of wild mustard.
D) In wild mustard, most of the variation is due to differences in soil or other aspects of the environment.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 22.2

- 14) What are adaptations?
A) geologic changes over time
B) rocks containing fossils
C) inherited characteristics of organisms that enhance their survival
D) descent with modification from a common ancestor

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.2

- 15) Which of these conditions are always true of populations evolving due to natural selection?

Condition 1: The population must vary in traits that are heritable.
Condition 2: Some heritable traits must increase reproductive success.
Condition 3: Individuals pass on most traits that they acquire during their lifetime.

- A) Condition 1 only
B) Condition 2 only
C) Conditions 1 and 2
D) Conditions 2 and 3

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 22.2

16) A farmer uses triazine herbicide to control pigweed in his field. For the first few years, the triazine works well and almost all the pigweed dies; but after several years, the farmer sees more and more pigweed. Which of these statements explains why the pigweed reappeared?

- A) The herbicide company lost its triazine formula and started selling poor-quality triazine.
- B) Natural selection caused the pigweed to mutate, creating a new triazine-resistant species.
- C) Triazine-resistant pigweed has less-efficient photosynthesis metabolism.
- D) Triazine-resistant weeds were more likely to survive and reproduce.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 22.2

17) Which one of the following statements best defines artificial selection?

- A) Process that occurs when individuals inherit traits that enable them to survive and reproduce
- B) Process where humans decide which plants and/or animals will not breed
- C) Process of human directed breeding aimed to produce selective traits in selected species
- D) Process that favors beneficial mutations

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.2

18) After the drought of 1977, researchers hypothesized that on the Galápagos Island Daphne Major, medium ground finches with large, deep beaks survived better than those with smaller beaks because they could more easily crack and eat the tough *Tribulus cistoides* fruits. A tourist company sets up reliable feeding stations with a variety of bird seeds (different types and sizes) so that tourists can get a better look at the finches. Which of these events is now most likely to occur to finch beaks on this island?

- A) evolution of yet larger, deeper beaks over time, until all birds have relatively large, deep beaks
- B) evolution of smaller, pointier beaks over time, until all birds have relatively small, pointy beaks
- C) increased variation in beak size and shape over time
- D) no change in beak size and shape over time

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 22.2

- 19) The following question is based on information from Frank M. Frey, "Opposing Natural Selection from Herbivores and Pathogens May Maintain Floral-Color Variation in *Claytonia virginica* (*Portulacaceae*)," *Evolution* 58(11), 2004: 2426-37.

Claytonia virginica is a woodland spring herb with flowers that vary from white, to pale pink, to bright pink. Slugs prefer to eat pink-flowering over white-flowering plants (due to chemical differences between the two), and plants experiencing severe herbivory are more likely to die. The bees that pollinate this plant also prefer pink to white flowers, so that *Claytonia* with pink flowers have greater relative fruit set than *Claytonia* with white flowers. A researcher observes that the percentage of different flower colors remains stable in the study population from year to year. Given no other information, if the researcher removes all slugs from the study population, what do you expect to happen to the distribution of flower colors in the population over time?

- A) The percentage of pink flowers should increase over time.
- B) The percentage of white flowers should increase over time.
- C) The distribution of flower colors should not change.
- D) The distribution of flower colors should randomly fluctuate over time.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 22.2

- 20) Which statement illustrates the connection between natural selection and overreproduction of a population?

- A) Populations vary in their inherited traits.
- B) Species produce more offspring than can survive in the environment.
- C) Individuals with inherited traits that promote survival tend to have more surviving offspring.
- D) Individuals with traits that do not enhance survival cannot reproduce.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 22.2

- 21) Darwin used the phrase "descent with modification" to explain _____.

- A) unity of life
- B) descent of all organisms from a single, ancient ancestor
- C) that habitat differences stimulate change in organisms
- D) evolution of the unity and diversity of life

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 22.2

- 22) Which of the following statements describe *evolution*?

- A) Individuals evolve in response to their environment.
- B) The match between organism and their environment decreases.
- C) Natural selection chooses the most popular trait.
- D) Quick changes occur in an individual's phenotype.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.2

23) Given a population that contains genetic variation, what is the correct sequence of the following events under the influence of natural selection?

1. Well-adapted individuals leave more offspring than do poorly adapted individuals.
2. A change occurs in the environment.
3. Genetic frequencies within the population change.
4. Poorly adapted individuals have decreased survivorship.

A) $2 \rightarrow 4 \rightarrow 1 \rightarrow 3$

B) $4 \rightarrow 2 \rightarrow 1 \rightarrow 3$

C) $4 \rightarrow 2 \rightarrow 3 \rightarrow 1$

D) $2 \rightarrow 4 \rightarrow 3 \rightarrow 1$

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 22.2

24) Which of the following factors could cause a surge in population size?

- A) a decrease in available food
- B) an increase in the number of predators
- C) better eyesight evolves in the population
- D) decreased camouflage evolves in the population

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 22.2

25) Which of the following statements describe the effect of evolution on a population?

- A) increasingly better match between a population and its environment
- B) increased genetic variation among individuals in a population
- C) increased variation among individuals in a population
- D) increased sexual reproduction in a population

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.2

26) Which of Darwin's ideas had the strongest connection to his reading of Malthus's essay on human population growth?

- A) descent with modification
- B) variation among individuals in a population
- C) struggle for existence
- D) that the ancestors of the Galápagos finches had come from the South American mainland

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.2

- 27) If Darwin had been aware of genes and their typical mode of transmission to subsequent generations, with which statement would he most likely have been in agreement?
- A) If natural selection can change gene frequency in a population over generations, given enough time and genetic diversity, then natural selection can cause sufficient genetic change to produce new species from old ones.
- B) If an organism's somatic cell genes change during its lifetime, making it more fit, then it will be able to pass these genes on to its offspring.
- C) If an organism acquires new genes by engulfing, or being infected by, another organism, then a new genetic species will result.
- D) A single mutation in a single gene in a single gamete, if inherited by future generations, will produce a new species.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 22.2

- 28) Which one of the following observations did Darwin first make during his discovery of evolution?
- A) The ability of individuals to survive and reproduce is not equal.
- B) There is variation in inherited traits.
- C) Individuals who reproduce more leave more offspring.
- D) The unequal ability to reproduce leads to the accumulation of favorable traits in a population.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 22.2

- 29) Currently, two extant elephant species (X and Y) are classified in the genus *Loxodonta*, and a third species (Z) is placed in the genus *Elephas*. Thus, which statement should be true?
- A) Species X and Y are not related to species Z.
- B) Species X and Y share a greater number of homologies with each other than either does with species Z.
- C) Species X and Y share a common ancestor that is alive today.
- D) Species X and Y are the result of artificial selection.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 22.2

- 30) In a hypothetical environment, fishes called pike-cichlids are visual predators of large, adult algae-eating fish (in other words, they locate their prey by sight). The population of algae-eaters experiences predatory pressure from pike-cichlids. Which of the following is *least* likely to result in the algae-eater population in future generations?
- A) selection for drab coloration of the algae-eaters
- B) selection for nocturnal algae-eaters (active only at night)
- C) selection for larger female algae-eaters, bearing broods composed of more, and larger, young
- D) selection for algae-eaters that become sexually mature at smaller overall body sizes

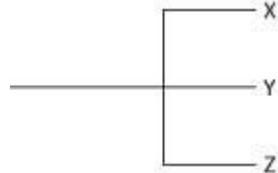
Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

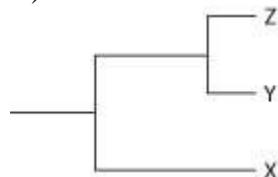
Section: 22.2

31) Currently, two of the living elephant species (X and Y) are placed in the genus *Loxodonta*, and a third surviving species (Z) is placed in the genus *Elephas*. Assuming this classification reflects evolutionary relatedness, which of the following is the most accurate phylogenetic tree?

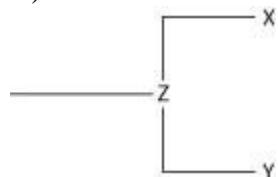
A)



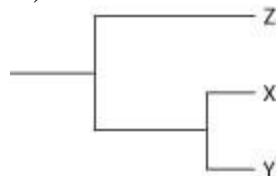
B)



C)



D)



Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 22.2

32) Cotton-topped tamarins are small primates with tufts of long white hair on their heads. While studying these creatures, you notice that males with longer hair get more opportunities to mate and father more offspring. To test the hypothesis that having longer hair is adaptive in these males, you should _____.

- A) test whether other traits in these males are also adaptive
- B) look for evidence of hair in ancestors of tamarins
- C) determine if hair length is heritable
- D) test whether males with shaved heads are still able to mate

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 22.2

33) Fossils of *Thrinaxodon*, a species that lived during the Triassic period, have been found in both South Africa and Antarctica. *Thrinaxodon* had a reptile-like skeleton and laid eggs, but small depressions on the front of its skull suggest it had whiskers and, therefore, fur.

Thrinaxodon may have been warm-blooded. The fossils of *Thrinaxodon* are consistent with the hypothesis that _____.

- A) fossils found in a given area look like the modern species in that same area
- B) the environment where it lived was very warm
- C) mammals evolved from a reptilian ancestor
- D) Antarctica and South Africa separated after *Thrinaxodon* went extinct

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 22.3

34) Many crustaceans (for example, lobsters, shrimp, and crayfish) use their tails to swim, but crabs have reduced tails that curl under their shells and are not used in swimming. This is an example of _____.

- A) convergent evolution
- B) a homologous structure
- C) natural selection
- D) a vestigial trait

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 22.3

35) Scientific theories _____.

- A) are nearly the same things as hypotheses
- B) are supported by, and make sense of, many observations
- C) cannot be tested because the described events occurred only once
- D) are predictions of future events

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.3

36) DDT was once considered a "silver bullet" that would permanently eradicate insect pests. Instead, DDT is largely useless against many insects. Which of these would have prevented this evolution of DDT resistance in insect pests?

- A) All habitats should have received applications of DDT at about the same time.
- B) The frequency of DDT application should have been higher.
- C) None of the insect pests would have genetic variations that resulted in DDT resistance.
- D) DDT application should have been continual.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 22.3

37) If the bacterium *Staphylococcus aureus* experiences a cost for maintaining one or more antibiotic-resistance genes, what would happen in environments that lack antibiotics?

- A) These genes would be maintained in case the antibiotics appear.
- B) These bacteria would be outcompeted and replaced by bacteria that have lost these genes.
- C) These bacteria would try to make the cost worthwhile by locating and migrating to microenvironments where traces of antibiotics are present.
- D) The number of genes conveying antibiotic resistance would increase in these bacteria.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 22.3

38) Of the following anatomical structures, which is homologous to the bones in the wing of a bird?

- A) bones in the hind limb of a kangaroo
- B) chitinous struts in the wing of a butterfly
- C) bony rays in the tail fin of a flying fish
- D) bones in the flipper of a whale

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 22.3

39) Structures as different as human arms, bat wings, and dolphin flippers contain many of the same bones, which develop from similar embryonic tissues. These structural similarities are an example of _____.

- A) homology
- B) convergent evolution
- C) the evolution of common structure as a result of common function
- D) the evolution of similar appearance as a result of common function

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 22.3

40) Over long periods of time, many cave-dwelling organisms have lost their eyes. Tapeworms have lost their digestive systems. Whales have lost their hind limbs. How can natural selection account for these losses?

- A) Natural selection cannot account for losses, but accounts only for new structures and functions.
- B) Natural selection accounts for these losses by the principle of use and disuse.
- C) Under particular circumstances that persisted for long periods, each of these structures presented greater costs than benefits.
- D) The ancestors of these organisms experienced harmful mutations that forced them to lose these structures.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 22.3

41) Which of the following evidence most strongly supports the common origin of all life on Earth? All organisms _____.
A) require energy
B) use essentially the same genetic code
C) reproduce
D) show heritable variation

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 22.3

42) Members of two different species possess a similar-looking structure that they use in a similar way to perform about the same function. Which of the following would suggest that the relationship more likely represents homology instead of convergent evolution?

- A) The two species live at great distance from each other.
- B) The two species share many proteins.
- C) The structures in adult members of both species are similar in size.
- D) Both species are well adapted to their particular environments.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 22.3

43) What must be true of any organ described as *vestigial*?

- A) It must be analogous to some feature in an ancestor.
- B) It must be homologous to some feature in an ancestor.
- C) It must be both homologous and analogous to some feature in an ancestor.
- D) It need be neither homologous nor analogous to some feature in an ancestor.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.3

44) Pseudogenes are _____.
A) composed of RNA, rather than DNA
B) the same things as introns
C) unrelated genes that code for the same gene product
D) nonfunctional vestigial genes

Answer: D
Bloom's Taxonomy: Knowledge/Comprehension
Section: 22.3

45) It has been observed that organisms on islands are different from, but closely related to, similar forms found on the nearest continent. This is taken as evidence that _____.

- A) island forms are descended from mainland forms
- B) common environments are inhabited by the same organisms
- C) island forms and mainland forms have identical gene pools
- D) the island forms and mainland forms are converging

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.3

46) Given what we know about evolutionary biology, we expect to find the largest number of endemic species in which of the following geological features, which have existed for at least a few million years?

- A) an isolated ocean island in the tropics
- B) an extensive mountain range
- C) a grassland in the center of a large continent, with extreme climatic conditions
- D) a shallow estuary on a warm-water coast

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 22.3

47) The greatest number of endemic species is expected in environments that are _____.

- A) easily reached and ecologically diverse
- B) isolated and show little ecological diversity
- C) isolated and ecologically diverse
- D) easily reached and show little ecological diversity

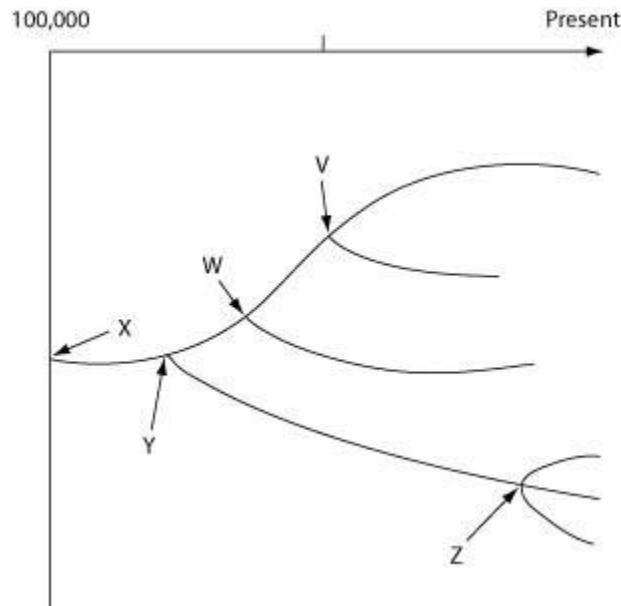
Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 22.3

The following questions refer to the evolutionary tree in the figure below.

The horizontal axis of the cladogram depicted below is a timeline that extends from 100,000 years ago to the present; the vertical axis represents nothing in particular. The labeled branch points on the tree (V-Z) represent various common ancestors. Let's say that only since 50,000 years ago has there been enough variation between the lineages depicted here to separate them into distinct species, and only the tips of the lineages on this tree represent distinct species.



48) How many distinct species, both living and extinct, are depicted in this tree?

- A) five
- B) six
- C) nine
- D) eleven

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 22.3

49) Which of the five common ancestors, labeled V-Z, is the common ancestor of the greatest number of species, both living and extinct?

- A) V
- B) W
- C) Y
- D) Z

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 22.3

50) Which of the five species, labeled V-Z, is the common ancestor of the fewest number of species?

- A) V
- B) W
- C) Y
- D) Z

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 22.3

51) Evolutionary trees such as this are properly understood by scientists to be _____.

- A) theories
- B) hypotheses
- C) dogmas
- D) facts

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 22.3

52) About thirteen different species of finches inhabit the Galápagos Islands today, all descendants of a common ancestor from the South American mainland that arrived a few million years ago. Genetically, there are four distinct lineages, but the thirteen species are currently classified among three genera. The first lineage to diverge from the ancestral lineage was the warbler finch (genus *Certhidea*). Next to diverge was the vegetarian finch (genus *Camarhynchus*), followed by five tree finch species (also in genus *Camarhynchus*) and six ground finch species (genus *Geospiza*). If the six ground finch species have evolved most recently, then which of these is the most logical prediction?

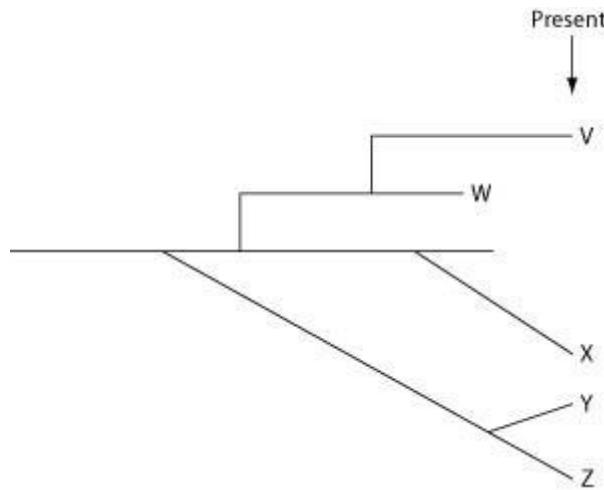
- A) They should be limited to the six islands that most recently emerged from the sea.
- B) Their genomes should be more similar to each other than are the genomes of the five tree finch species.
- C) They should share fewer anatomical homologies with each other than they share with the tree finches.
- D) The chances of hybridization between two ground finch species should be less than the chances of hybridization between two tree finch species.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 22.3

The questions below refer to the following evolutionary tree, in which the horizontal axis represents time (present time is on the far right) and the vertical axis represents morphological change.



53) Which species is most closely related to species W?

- A) V is most closely related to species W.
- B) X is most closely related to species W.
- C) Y and Z are equally closely related to W.
- D) It is not possible to say from this tree.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 22.3

54) Which of these is the extant (that is, living) species most closely related to species X?

- A) V
- B) W
- C) Y
- D) Z

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 22.3

55) Logically, which of these should cast the most doubt on the relationships depicted by an evolutionary tree?

- A) Some of the organisms depicted by the tree lived in different habitats.
- B) The skeletal remains of the organisms depicted by the tree were incomplete (in other words, some bones were missing).
- C) Transitional fossils had not been found.
- D) Relationships between DNA sequences among the species did not match relationships between skeletal patterns.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 22.3

22.2 Student Edition End-of-Chapter Questions

- 1) Which of the following is *not* an observation or inference on which natural selection is based?
- A) There is heritable variation among individuals.
 - B) Poorly adapted individuals never produce offspring.
 - C) Species produce more offspring than the environment can support.
 - D) Only a fraction of an individual's offspring may survive.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 2) Which of the following observations helped Darwin shape his concept of descent with modification?
- A) Species diversity declines farther from the equator.
 - B) Fewer species live on islands than on the nearest continents.
 - C) Birds live on islands located farther from the mainland than the birds' maximum nonstop flight distance.
 - D) South American temperate plants are more similar to the tropical plants of South America than to the temperate plants of Europe.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 3) Within six months of effectively using methicillin to treat *S. aureus* infections in a community, all new *S. aureus* infections were caused by MRSA. How can this best be explained?
- A) A patient must have become infected with MRSA from another community.
 - B) In response to the drug, *S. aureus* began making drug-resistant versions of the protein targeted by the drug.
 - C) Some drug-resistant bacteria were present at the start of treatment, and natural selection increased their frequency.
 - D) *S. aureus* evolved to resist vaccines.

Answer: C

Bloom's Taxonomy: Application/Analysis

- 4) The upper forelimbs of humans and bats have fairly similar skeletal structures, whereas the corresponding bones in whales have very different shapes and proportions. However, genetic data suggest that all three kinds of organisms diverged from a common ancestor at about the same time. Which of the following is the most likely explanation for these data?
- A) Forelimb evolution was adaptive in people and bats, but not in whales.
 - B) Natural selection in an aquatic environment resulted in significant changes to whale forelimb anatomy.
 - C) Genes mutate faster in whales than in humans or bats.
 - D) Whales are not properly classified as mammals.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 5) DNA sequences in many human genes are very similar to the sequences of corresponding genes in chimpanzees. The most likely explanation for this result is that
- A) humans and chimpanzees share a relatively recent common ancestor.
 - B) humans evolved from chimpanzees.
 - C) chimpanzees evolved from humans.
 - D) convergent evolution led to the DNA similarities.

Answer: A

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 23 The Evolution of Populations

23.1 Multiple-Choice Questions

1) Which of the following is the best modern definition of evolution?

- A) descent with modification
- B) change in the number of genes in a population over time
- C) survival of the fittest
- D) inheritance of acquired characters

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 23.1

2) Microevolutions occur when _____.

- A) a bird has a beak of a particular size that does not grow larger during a drought
- B) changes in allele frequencies in a population occur over generations
- C) gene flow evenly transfers alleles between populations
- D) individuals within all species vary in their phenotypic traits

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 23.1

3) Which statement about the beak size of finches on the island of Daphne Major during prolonged drought is true?

- A) Each bird evolved a deeper, stronger beak as the drought persisted.
- B) Each bird's survival was strongly influenced by the depth and strength of its beak as the drought persisted.
- C) Each bird that survived the drought produced only offspring with deeper, stronger beaks than seen in the previous generation.
- D) The frequency of the strong-beak alleles increased in each bird as the drought persisted.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 23.1

4) Which statement about variation is true?

- A) All phenotypic variation is the result of genotypic variation.
- B) All genetic variation produces phenotypic variation.
- C) All nucleotide variability results in neutral variation.
- D) All new alleles are the result of nucleotide variability.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.1

- 5) Which of the following descriptions illustrates phenotype variation caused by environment?
- A) inheritance of body builder "physique"
 - B) diet of caterpillars changes their morphology
 - C) variation in horse coat color
 - D) average beak depth during drought

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 23.1

- 6) Genetic variation _____.
- A) is created by the direct action of natural selection
 - B) arises in response to changes in the environment
 - C) must be present in a population before natural selection can act upon the population
 - D) tends to be reduced when diploid organisms produce gametes

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 23.1

- 7) HIV's genome of RNA includes the code for reverse transcriptase (RT), an enzyme that acts early in infection to synthesize a DNA genome off of an RNA template. The HIV genome also codes for protease (PR), an enzyme that acts later in infection by cutting long viral polyproteins into smaller, functional proteins. Both RT and PR represent potential targets for antiretroviral drugs. Drugs called nucleoside analogs (NA) act against RT, whereas drugs called protease inhibitors (PI) act against PR.

Which of the following treatment options would most likely avoid the evolution of drug-resistant HIV (assuming no drug interactions or side effects)?

- A) Use a series of NAs, one at a time, and change about once a week.
- B) Use a single PI, but slowly increase the dosage over the course of a week.
- C) Use high doses of NA and a PI at the same time for a period not to exceed one day.
- D) Use moderate doses of NA and two different PIs at the same time for several months.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 23.1

8) HIV's genome of RNA includes the code for reverse transcriptase (RT), an enzyme that acts early in infection to synthesize a DNA genome off of an RNA template. The HIV genome also codes for protease (PR), an enzyme that acts later in infection by cutting long viral polyproteins into smaller, functional proteins. Both RT and PR represent potential targets for antiretroviral drugs. Drugs called nucleoside analogs (NA) act against RT, whereas drugs called protease inhibitors (PI) act against PR.

Which mechanism produces variation for evolution by shuffling existing alleles?

- A) rapid reproduction
- B) sexual reproduction
- C) mutation
- D) changes in chromosome numbers

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 23.1

9) The following experiment is used for the corresponding question.

A researcher discovered a species of moth that lays its eggs on oak trees. Eggs are laid at two distinct times of the year: early in spring when the oak trees are flowering and in midsummer when flowering is past. Caterpillars from eggs that hatch in spring feed on oak flowers and look like oak flowers. But caterpillars that hatch in summer feed on oak leaves and look like oak twigs.

How does the same population of moths produce such different-looking caterpillars on the same trees? To answer this question, the biologist caught many female moths from the same population and collected their eggs. He put at least one egg from each female into eight identical cups. The eggs hatched, and at least two larvae from each female were maintained in one of the four temperature and light conditions listed below.

Temperature	Day Length
Springlike	Springlike
Springlike	Summerlike
Summerlike	Springlike
Summerlike	Summerlike

In each of the four environments, one of the caterpillars was fed oak flowers, the other oak leaves. Thus, there were a total of eight treatment groups (4 environments \times 2 diets).

Which of the following is a testable hypothesis that would explain the differences in caterpillar appearance observed in this population?

- A) The longer day lengths of summer trigger the development of twig-like caterpillars.
- B) Winter causes ugly caterpillar and trees.
- C) Differences in air pressure, due to differences in elevation, trigger the development of different types of caterpillars.
- D) Differences in diet trigger the development of different types of caterpillars.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 23.1

10) Genetic drift produces variation for evolution when _____.

- A) a gene pool decreases because a smaller group establishes a new population
- B) chance events cause allele frequencies to fluctuate unpredictably
- C) sudden change in environment drastically reduces the gene pool
- D) a population has heritable traits better suited to the environment

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 23.3

11) Homozygotes with two sickle-cell alleles are selected against because of mortality. However, heterozygotes for sickle-cell allele experience little effects of sickle allele and are more likely to survive malaria. The net effect of this exposure produced evolutionary change in areas where malaria is endemic by _____.

- A) causing sickle-cell allele
- B) increasing sickle-cell allele frequency
- C) distortion of red blood cells
- D) increasing the number of infected mosquitoes

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 23.4

12) Cystic fibrosis is a genetic disorder in homozygous recessives that causes death during the teenage years. If 9 in 10,000 newborn babies have the disease, what are the expected frequencies of the dominant (A_1) and recessive (A_2) alleles according to the Hardy-Weinberg equation?

- A) $f(A_1) = 0.9997, f(A_2) = 0.0003$
- B) $f(A_1) = 0.9800, f(A_2) = 0.0200$
- C) $f(A_1) = 0.9700, f(A_2) = 0.0300$
- D) $f(A_1) = 0.9604, f(A_2) = 0.0392$

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 23.2

13) Suppose 64% of a remote mountain village can taste phenylthiocarbamide (PTC) and must, therefore, have at least one copy of the dominant PTC taster allele. If this population conforms to Hardy-Weinberg equilibrium for this gene, what percentage of the population must be heterozygous for this trait?

- A) 16%
- B) 32%
- C) 40%
- D) 48%

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.2

14) If individuals tend to mate within a subset of the population, there is _____.

- A) no selection
- B) no genetic drift
- C) no gene flow
- D) random mating

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 23.2

15) Which Hardy-Weinberg condition is affected by population size?

- A) selection
- B) genetic drift
- C) gene flow
- D) no mutation

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 23.2

16) Use the following information to answer the question below.

Researchers studying a small milkweed population note that some plants produce a toxin and other plants do not. They identify the gene responsible for toxin production. The dominant allele (T) codes for an enzyme that makes the toxin, and the recessive allele (t) codes for a nonfunctional enzyme that cannot produce the toxin. Heterozygotes produce an intermediate amount of toxin. The genotypes of all individuals in the population are determined (see chart) and used to determine the actual allele frequencies in the population.

Genotype Frequencies			Allele Frequencies	
TT	Tt	tt	T	t
0.56	0.28	0.16		

Is this population in Hardy-Weinberg equilibrium?

- A) Yes.
- B) No; there are more heterozygotes than expected.
- C) No; there are more homozygotes than expected.
- D) More information is needed to answer this question.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 23.2

17) Which one of the following conditions would allow gene frequencies to change by chance?

- A) large population
- B) small populations
- C) mutation
- D) gene flow

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 23.2

18) The higher the proportion of loci that are "fixed" in a population, the lower are that population's _____.
A) nucleotide variability
B) chromosome number
C) average heterozygosity
D) nucleotide variability and average heterozygosity

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 23.2

19) Whenever diploid populations are in Hardy-Weinberg equilibrium at a particular locus,
_____.
A) the allele's frequency should not change from one generation to the next
B) natural selection, gene flow, and genetic drift are acting equally to change an allele's frequency
C) two alleles are present in equal proportions
D) individuals within the population are evolving

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 23.2

20) In the formula for determining a population's genotype frequencies, the "2" in the term $2pq$ is necessary because _____.
A) the population is diploid
B) heterozygotes can come about in two ways
C) the population is doubling in number
D) heterozygotes have two alleles

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 23.2

21) In the formula for determining a population's genotype frequencies, the " pq " in the term $2pq$ is necessary because _____.
A) the population is diploid
B) heterozygotes can come about in two ways
C) the population is doubling in number
D) heterozygotes have two alleles

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 23.2

22) In a Hardy-Weinberg population with two alleles, A and a , that are in equilibrium, the frequency of the allele a is 0.3. What is the frequency of individuals that are homozygous for this allele?

- A) 0.09
- B) 0.49
- C) 0.9
- D) 9.0

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 23.2

23) In a Hardy-Weinberg population with two alleles, A and a , that are in equilibrium, the frequency of allele a is 0.2. What is the frequency of individuals that are heterozygous for this allele?

- A) 0.020
- B) 0.04
- C) 0.16
- D) 0.32

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.2

24) In a Hardy-Weinberg population with two alleles, A and a , that are in equilibrium, the frequency of allele a is 0.1. What is the frequency of individuals with AA genotype?

- A) 0.20
- B) 0.32
- C) 0.42
- D) 0.81

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.2

25) You sample a population of butterflies and find that 56% are heterozygous at a particular locus. What should be the frequency of the homozygous individuals in this population?

- A) 0.08
- B) 0.09
- C) 0.70
- D) 0.50

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.2

26) In peas, a gene controls flower color such that R = purple and r = white. In an isolated pea patch, there are 36 purple-flowering plants and 64 white-flowering plants. Assuming Hardy-Weinberg equilibrium, what is the value of q for this population?

- A) 0.36
- B) 0.64
- C) 0.75
- D) 0.80

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.2

27) A large population of laboratory animals has been allowed to breed randomly for a number of generations. After several generations, 25% of the animals display a recessive trait (aa), the same percentage as at the beginning of the breeding program. The rest of the animals show the dominant phenotype, with heterozygotes indistinguishable from the homozygous dominants.

What is the most reasonable conclusion that can be drawn from the fact that the frequency of the recessive trait (aa) has not changed over time?

- A) The two phenotypes are about equally adaptive under laboratory conditions.
- B) The genotype AA is lethal.
- C) There has been a high rate of mutation of allele A to allele a .
- D) There has been sexual selection favoring allele a .

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 23.2

28) A large population of laboratory animals has been allowed to breed randomly for a number of generations. After several generations, 25% of the animals display a recessive trait (aa), the same percentage as at the beginning of the breeding program. The rest of the animals show the dominant phenotype, with heterozygotes indistinguishable from the homozygous dominants.

What is the estimated frequency of allele A in the gene pool?

- A) 0.25
- B) 0.50
- C) 0.75
- D) 0.125

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 23.2

29) A large population of laboratory animals has been allowed to breed randomly for a number of generations. After several generations, 25% of the animals display a recessive trait (aa), the same percentage as at the beginning of the breeding program. The rest of the animals show the dominant phenotype, with heterozygotes indistinguishable from the homozygous dominants.

What proportion of the population is probably heterozygous (Aa) for this trait?

- A) 0.05
- B) 0.25
- C) 0.50
- D) 0.75

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 23.2

30) Which one of these processes describes bottleneck effect?

- A) chance events that change allele frequency
- B) alleles transferred to the next generation in portions that differ from previous generation
- C) transfer of alleles in and out of a population due to movement of fertile individuals
- D) sudden change in environments that alters gene frequency of a population

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.3

31) Comparisons of Neanderthal DNA revealed that there are more similarities to non-African DNA than reference sequences from West Africans. Additionally, scientists found that Neanderthal DNA is as closely related to East Asians as to Europeans. This indicates that interbreeding occurred before human migration further east. What process of population genetics generated these results?

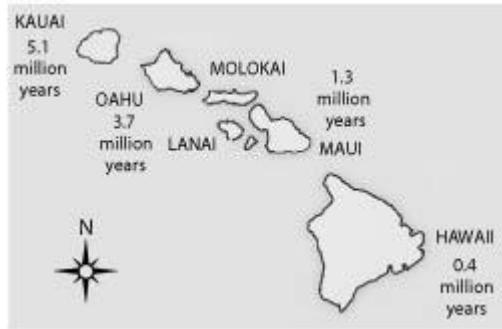
- A) adaptive evolution
- B) gene flow
- C) gene drift
- D) nonrandom mating

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 23.3

32)



Soon after the island of Hawaii rose above the sea surface (somewhat less than one million years ago), the evolution of life on this new island should have been most strongly influenced by _____.

- A) a genetic bottleneck
- B) sexual selection
- C) habitat differentiation
- D) the founder effect

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.3

33) In 1983, a population of dark-eyed junco birds became established on the campus of the University of California, San Diego (UCSD), which is located many miles from the junco's normal habitat in the mixed-coniferous temperate forests in the mountains. Juncos have white outer tail feathers that the males display during aggressive interactions and during courtship displays. Males with more white in their tail are more likely to win aggressive interactions, and females prefer to mate with males with more white in their tails. Females have less white in their tails than do males, and display it less often. (Pamela J. Yeh. 2004. Rapid evolution of a sexually selected trait following population establishment in a novel habitat. *Evolution* 58[1]:166-74.)

The UCSD campus male junco population tails were, on average, 36% white, whereas the tails of males from nearby mountain populations averaged 40-45% white. If this observed trait difference were due to a difference in the original colonizing population, it would most likely be due to _____.

- A) mutations in the UCSD population
- B) gene flow between populations
- C) a genetic bottleneck
- D) a founder effect

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.3

34) In 1983, a population of dark-eyed junco birds became established on the campus of the University of California, San Diego (UCSD), which is located many miles from the junco's normal habitat in the mixed-coniferous temperate forests in the mountains. Juncos have white outer tail feathers that the males display during aggressive interactions and during courtship displays. Males with more white in their tail are more likely to win aggressive interactions, and females prefer to mate with males with more white in their tails. Females have less white in their tails than do males, and display it less often. (Pamela J. Yeh. 2004. Rapid evolution of a sexually selected trait following population establishment in a novel habitat. *Evolution* 58[1]:166-74.)

The UCSD campus male junco population tails are about 36% white, whereas the tails of males from nearby mountain populations are about 40-45% white. The founding stock of UCSD birds was likely from the nearby mountain populations because some of those birds overwinter on the UCSD campus each year. Population sizes on the UCSD campus have been reasonably large, and there are significant habitat differences between the UCSD campus and the mountain coniferous forests; UCSD campus has a more open environment (making birds more visible) and a lower junco density (decreasing intraspecific competition) than the mountain forests. Given this information, which of the following evolutionary mechanisms do you think is most likely responsible for the difference between the UCSD and mountain populations?

- A) natural selection
- B) genetic drift
- C) gene flow
- D) mutation

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 23.3

35) The Dunkers are a religious group that moved from Germany to Pennsylvania in the mid-1700s. They do not marry with members outside their own immediate community. Today, the Dunkers are genetically unique and differ in gene frequencies, at many loci, from all other populations including those in their original homeland. Which of the following mechanisms likely explains the genetic uniqueness of this population?

- A) population bottleneck and Hardy-Weinberg equilibrium
- B) heterozygote advantage and stabilizing selection
- C) mutation and natural selection
- D) founder effect and genetic drift

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.3

36) An earthquake decimates a ground-squirrel population, killing 98% of the squirrels. The surviving population happens to have broader stripes, on average, than the initial population. If broadness of stripes is genetically determined, what effect has the ground-squirrel population experienced during the earthquake?

- A) directional selection
- B) disruptive selection
- C) a founder event
- D) a genetic bottleneck

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.3

37) Which of the following is the most predictable outcome of increased gene flow between two populations?

- A) lower average fitness in both populations
- B) higher average fitness in both populations
- C) increased genetic difference between the two populations
- D) decreased genetic difference between the two populations

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.3

38) In 1986, a nuclear power accident in Chernobyl, USSR (now Ukraine), led to high radiation levels for miles surrounding the plant. The high levels of radiation caused elevated mutation rates in the surviving organisms, and evolutionary biologists have been studying rodent populations in the Chernobyl area ever since. Based on your understanding of evolutionary mechanisms, which of the following most likely occurred in the rodent populations following the accident?

- A) Mutations caused major changes in rodent physiology over time.
- B) Mutation led to increased genetic variation.
- C) Mutation caused genetic drift and decreased fitness.
- D) Mutation caused the fixation of new alleles.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 23.3

39) Over time, the movement of people on Earth has steadily increased. This has altered the course of human evolution by increasing _____.

- A) nonrandom mating
- B) geographic isolation
- C) genetic drift
- D) gene flow

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 23.3

40) You are maintaining a small population of fruit flies in the laboratory by transferring the flies to a new culture bottle after each generation. After several generations, you notice that the viability of the flies has decreased greatly. Recognizing that small population size is likely to be linked to decreased viability, the best way to reverse this trend is to _____.

- A) cross your flies with flies from another lab
- B) reduce the number of flies that you transfer at each generation
- C) transfer only the largest flies
- D) change the temperature at which you rear the flies

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 23.3

41) The inability of organisms to evolve anything that could be an advantage reflects _____.

- A) the limits of choices of genes within a species
- B) the inability to compromise
- C) the consequences of random mutations
- D) the consequences of inbreeding

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 23.4

42) Why does the fitness of a phenotype depend on frequency-dependent selection?

- A) Because selection favors the least common phenotype.
- B) Because the least number of alleles are at that locus.
- C) Because sexual selection produces dimorphism.
- D) Because frequency-dependent selection acts against extreme phenotypes.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.4

43) On the Bahamian island of Andros, mosquitofish populations live in various, now-isolated, freshwater ponds that were once united. Currently, some predator-rich ponds have mosquitofish that can swim in short, fast bursts; other predator-poor ponds have mosquitofish that can swim continuously for a long time. When placed together in the same body of water, the two kinds of female mosquitofish exhibit exclusive breeding preferences.

If one builds a canal linking a predator-rich pond to a predator-poor pond, then what type of selection should subsequently be most expected among the mosquitofish in the original predator-rich pond, and what type should be most expected among the mosquitofish in the formerly predator-poor pond?

- A) stabilizing selection; directional selection
- B) stabilizing selection; stabilizing selection
- C) less-intense directional selection; more-intense directional selection
- D) less-intense disruptive selection; more-intense disruptive selection

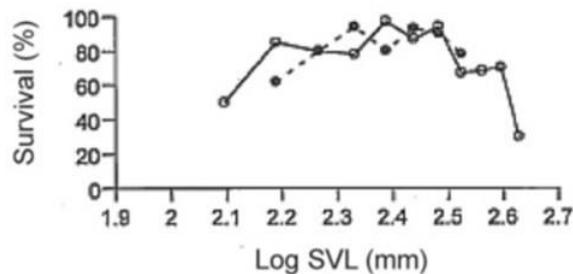
Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 23.4

44) Use the following information to answer the question below.

Martin Wikelski and L. Michael Romero (Body size, performance and fitness in Galápagos marine iguanas, *Integrative and Comparative Biology* 43 [2003]:376-86) measured the snout-to-vent (anus) length of Galápagos marine iguanas and observed the percent survival of different-sized animals, all of the same age. The graph shows the log snout-vent length (SVL, a measure of overall body size) plotted against the percent survival of these different size classes for males and females.



Examine the figure. What type of selection for body size appears to be occurring in these marine iguanas?

- A) directional selection
- B) stabilizing selection
- C) disruptive selection
- D) You cannot determine the type of selection from the above information.

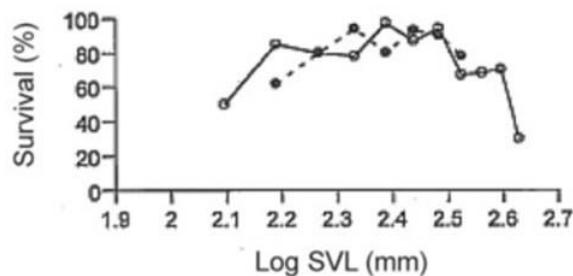
Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 23.4

45) Use the following information to answer the question below.

Martin Wikelski and L. Michael Romero (Body size, performance and fitness in Galápagos marine iguanas, *Integrative and Comparative Biology* 43 [2003]:376-86) measured the snout-to-vent (anus) length of Galápagos marine iguanas and observed the percent survival of different-sized animals, all of the same age. The graph shows the log snout-vent length (SVL, a measure of overall body size) plotted against the percent survival of these different size classes for males and females.



Currently the only predators of Galápagos marine iguanas are Galápagos hawks. Iguana body size is not correlated with risk of hawk predation, although small iguanas can sprint faster than large iguanas. If predators (for example, cats) that preferably catch and eat slower iguanas are introduced to the island, iguana body size is likely to _____ in the absence of other factors; the iguanas would then be under _____ selection.

- A) increase; directional
- B) increase; disruptive
- C) decrease; directional
- D) decrease; disruptive

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 23.4

46) Three-spined stickleback fish (*Gasterosteus aculeatus*) show substantial heritable variation in gill-raker length related to differences in their diets. Longer gill rakers appear to function better for capturing open-water prey, while shorter gill rakers function better for capturing shallow-water prey. Which of the following types of selection is most likely to be found in a large lake (open water in the middle and shallow water around the sides) with a high density of these fish?

- A) directional selection
- B) stabilizing selection
- C) disruptive selection
- D) sexual selection

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 23.4

47) A biologist doing a long-term study on a wild spider population observes increased variation in silk thickness. Which of the following could the spider population be experiencing?

- A) directional selection
- B) stabilizing selection
- C) disruptive selection
- D) genetic drift

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 23.4

48) In some jacana species, males take care of the eggs and young, and females compete among themselves for territories that contain one to several males. Female jacanas are significantly larger than males. Which of these statements would you predict to be true of this bird species?

1. Male jacana fitness is primarily limited by ability to take care of eggs and raise young.
2. Female jacana fitness is limited by the number of males in her territory with which a female mates.
3. Variation in reproductive success should be greater in male jacanas than in females.
4. Variation in reproductive success should be greater in female jacanas than in males.
5. Males and females have equal variation in reproductive success.

- A) 1 and 3
- B) 2 and 4
- C) 1, 2, and 4
- D) 5

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 23.4

49) The restriction enzymes of bacteria protect the bacteria from successful attack by bacteriophages, whose genomes can be degraded by the restriction enzymes. The bacterial genomes are not vulnerable to these restriction enzymes because bacterial DNA is methylated. This situation selects for bacteriophages whose genomes are also methylated. As new strains of resistant bacteriophages become more prevalent, this in turn selects for bacteria whose genomes are not methylated and whose restriction enzymes instead degrade methylated DNA. The outcome of the conflict between bacteria and bacteriophages at any point in time results from _____.

- A) frequency-dependent selection
- B) evolutionary imbalance
- C) heterozygote advantage
- D) neutral variation

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 23.4

50) The restriction enzymes of bacteria protect the bacteria from successful attack by bacteriophages, whose genomes can be degraded by the restriction enzymes. The bacterial genomes are not vulnerable to these restriction enzymes because bacterial DNA is methylated. This situation selects for bacteriophages whose genomes are also methylated. As new strains of resistant bacteriophages become more prevalent, this in turn selects for bacteria whose genomes are not methylated and whose restriction enzymes instead degrade methylated DNA. Over the course of evolutionary time, what should occur?

- A) Methylated DNA should become fixed in the gene pools of bacterial species.
- B) Nonmethylated DNA should become fixed in the gene pools of bacteriophages.
- C) Methylated DNA should become fixed in the gene pools of bacteriophages.
- D) Methylated and nonmethylated strains should be maintained among both bacteria and bacteriophages, with ratios that vary over time.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.4

51) Arrange the following in order from most general to most specific.

- 1 natural selection
- 2 microevolution
- 3 intrasexual selection
- 4 evolution
- 5 sexual selection

- A) 4, 1, 2, 3, 5
- B) 4, 2, 1, 3, 5
- C) 4, 2, 1, 5, 3
- D) 1, 4, 2, 5, 3

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 23.4

52) Adult male humans generally have deeper voices than do adult female humans, which is the direct result of higher levels of testosterone causing growth of the larynx. If the fossil records of apes and humans alike show a trend toward decreasing larynx size in adult females and increasing larynx size in adult males, then _____.

- A) sexual dimorphism was evolving over time in these species
- B) intrasexual selection seems to have occurred in both species
- C) stabilizing selection was occurring in these species concerning larynx size
- D) selection was acting more directly upon genotype than upon phenotype

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 23.4

53) Most Swiss starlings produce four to five eggs in each clutch. Starlings producing fewer or more than this have reduced fitness. Which of the following terms best describes this situation?

- A) directional selection
- B) stabilizing selection
- C) disruptive selection
- D) sexual selection

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 23.4

54) When imbalances occur in the sex ratio of sexual species that have two sexes (that is, other than a 50:50 ratio), the members of the minority sex often receive a greater proportion of care and resources from parents than do the offspring of the majority sex. This is most clearly an example of _____.

- A) sexual selection
- B) balancing selection
- C) stabilizing selection
- D) frequency-dependent selection

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.4

55) A proficient engineer can easily design skeletal structures that are more functional than those currently found in the forelimbs of such diverse mammals as horses, whales, and bats. The actual forelimbs of these mammals do not seem to be optimally arranged because _____.

- A) natural selection has not had sufficient time to create the optimal design in each case, but will do so given enough time
- B) in many cases, phenotype is determined by genotype and the environment
- C) though we may not consider the fit between the current skeletal arrangements and their functions excellent, we should not doubt that natural selection ultimately produces the best design
- D) natural selection is generally limited to modifying structures that were present in previous generations and in previous species

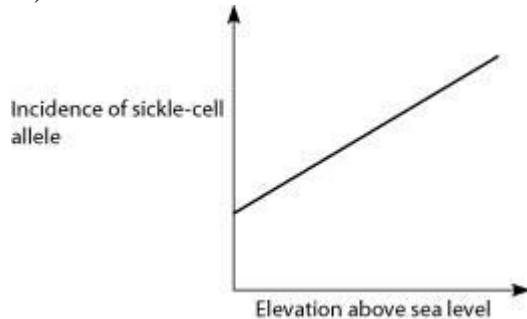
Answer: D

Bloom's Taxonomy: Application/Analysis

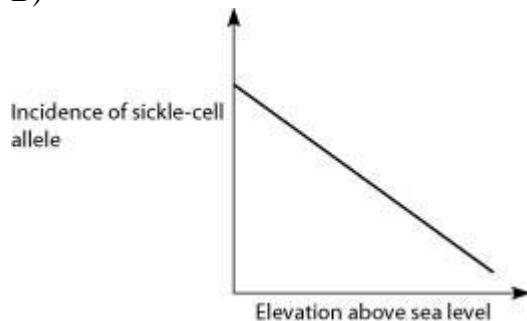
Section: 23.4

56) Anopheles mosquitoes, which carry the malaria parasite, cannot live above elevations of 5,900 feet. In addition, oxygen availability decreases with higher altitude. Consider a hypothetical human population that is adapted to life on the slopes of Mt. Kilimanjaro in Tanzania, a country in equatorial Africa. Mt. Kilimanjaro's base is about 2,600 feet above sea level and its peak is 19,341 feet above sea level. If the incidence of the sickle-cell allele in the population is plotted against altitude (feet above sea level), which of the following distributions is most likely, assuming little migration of people up or down the mountain?

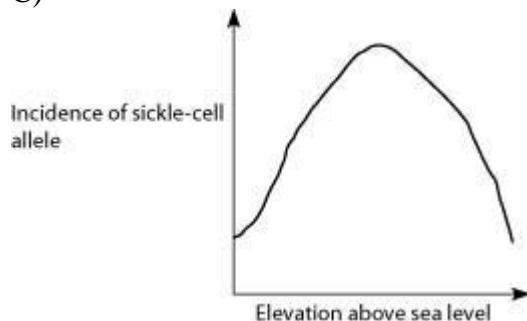
A)



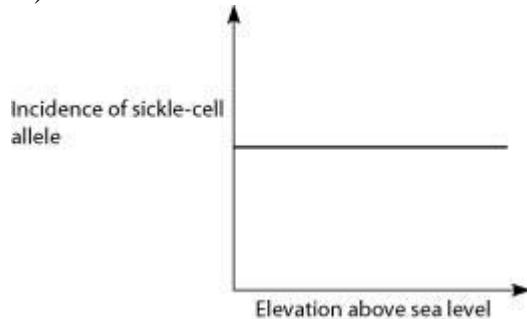
B)



C)



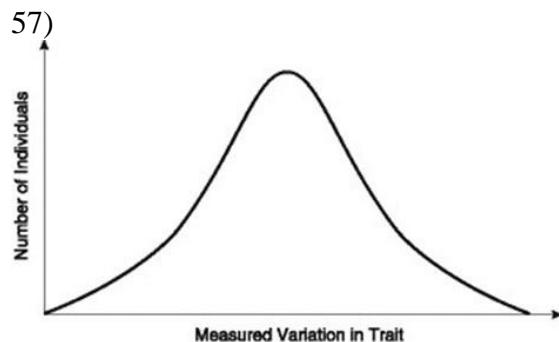
D)



Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 23.4



In a very large population, a quantitative trait has the following distribution pattern. If there is no gene flow, the curve shifts to the left or to the right, and the population size consequently increases over successive generations, which of the following is most likely occurring?

- A) immigration or emigration
- B) directional selection
- C) disruptive selection
- D) genetic drift

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 23.4

58) Use the following information to answer the question below.

In those parts of equatorial Africa where the malaria parasite is most common, the sickle-cell allele constitutes 20% of the β hemoglobin alleles in the human gene pool.

In the United States, the parasite that causes malaria is not present, but it is present in African-Americans whose ancestors were from equatorial Africa. What should be happening to the sickle-cell allele in the United States, and what should be happening to it in equatorial Africa?

- A) stabilizing selection; disruptive selection
- B) disruptive selection; stabilizing selection
- C) directional selection; disruptive selection
- D) directional selection; stabilizing selection

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 23.4

59) Swine are vulnerable to infection by bird flu virus and human flu virus, which can both be present in an individual pig at the same time. When this occurs, it is possible for genes from bird flu virus and human flu virus to be combined. If the human flu virus contributes a gene for Tamiflu resistance (Tamiflu is an antiviral drug) to the new virus, and if the new virus is introduced to an environment lacking Tamiflu, then what is most likely to occur?

- A) The new virus will maintain its Tamiflu-resistance gene, in case of future exposure to Tamiflu.
- B) The Tamiflu-resistance gene will undergo mutations that convert it into a gene that has a useful function in this environment.
- C) If the Tamiflu-resistance gene involves a cost, it will experience directional selection leading to reduction in its frequency.
- D) If the Tamiflu-resistance gene confers no benefit in the current environment, and has no cost, the virus will increase in frequency.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 23.4

23.2 Student Edition End-of-Chapter Questions

1) Natural selection changes allele frequencies because some _____ survive and reproduce better than others.

- A) alleles
- B) loci
- C) species
- D) individuals

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

2) No two people are genetically identical, except for identical twins. The main source of genetic variation among humans is

- A) new mutations that occurred in the preceding generation.
- B) genetic drift.
- C) the reshuffling of alleles in sexual reproduction.
- D) environmental effects.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

3) If the nucleotide variability of a locus equals 0%, what is the gene variability and number of alleles at that locus?

- A) gene variability = 0%; number of alleles = 0
- B) gene variability = 0%; number of alleles = 1
- C) gene variability = 0%; number of alleles = 2
- D) gene variability > 0%; number of alleles = 2

Answer: B

Bloom's Taxonomy: Application/Analysis

4) There are 25 individuals in population 1, all with genotype AA , and there are 40 individuals in population 2, all with genotype aa . Assume that these populations are located far from each other and that their environmental conditions are very similar. Based on the information given here, the observed genetic variation most likely resulted from

- A) genetic drift.
- B) gene flow.
- C) nonrandom mating.
- D) directional selection.

Answer: A

Bloom's Taxonomy: Application/Analysis

5) A fruit fly population has a gene with two alleles, $A1$ and $A2$. Tests show that 70% of the gametes produced in the population contain the $A1$ allele. If the population is in Hardy-Weinberg equilibrium, what proportion of the flies carry both $A1$ and $A2$?

- A) 0.7
- B) 0.49
- C) 0.42
- D) 0.21

Answer: C

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 24 The Origin of Species

24.1 Multiple-Choice Questions

1) Use the following information to answer the question.

Two populations of birds with somewhat different coloration live on opposite sides of a peninsula. The habitat between the populations is not suitable for these birds. When birds from the two populations are brought together, they produce young whose appearance is intermediate between the two parents. These offspring will breed with each other or with birds from either parent population, and all offspring of these pairings appear intermediate to various degrees.

What keeps the two populations separate?

- A) temporal reproductive isolation
- B) lack of hybrid viability
- C) behavior isolates reproductive activities
- D) habitat isolation

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.1

2) If biological species are defined in terms of reproductive compatibility, the formation of a new species hinges on _____.

- A) gene flow
- B) reproductive isolation
- C) hybrid formation
- D) gene pool expansion

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.1

3) Which of the following statements describes mechanical isolation prezygotic barrier?

- A) two species live in different habitats
- B) two species mate at different times
- C) two species share courtship activities
- D) two snails have shells that spiral in different directions

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.1

4) Three populations of crickets look very similar, but the males have courtship songs that sound different. What function would this difference in song likely serve if the populations came in contact?

- A) a temporal reproductive isolating mechanism
- B) a postzygotic isolating mechanism
- C) a behavioral reproductive isolating mechanism
- D) a gametic reproductive isolating mechanism

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.1

5) Many songbirds breed in North America in the spring and summer, and then migrate to Central and South America in the fall. They spend the winter in these warmer areas where they feed and prepare for the spring migration north and another breeding season. Two hypothetical species of sparrow, A and B, overwinter together in mixed flocks in Costa Rica. In spring, species A goes to the east coast of North America, and species B goes to the west coast. What can you say about the isolating mechanisms of these two species?

- A) They must have strong postzygotic isolating mechanisms to spend winter in such close proximity.
- B) They must have strong prezygotic isolating mechanisms to spend winter in such close proximity.
- C) These two species mate in different climates.
- D) Reinforcement must be occurring when they winter together.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 24.1

6) The peppered moth provides a well-known example of natural selection. The light-colored form of the moth was predominant in England before the Industrial Revolution. In the mid-19th century, a dark-colored form appeared. The difference is produced by a dominant allele of one gene. By about 1900, approximately 90% of the moths around industrial areas were dark colored, whereas light-colored moths were still abundant elsewhere. Apparently, birds could readily find the light moths against the soot-darkened background in industrial areas and, therefore, were eating more light moths. Recently, use of cleaner fuels has greatly reduced soot in the landscape, and the dark-colored moths have been disappearing. Should the two forms of moths be considered separate species?

- A) Yes; natural selection has affected the frequency of the two different forms.
- B) Yes; they have completely different coloration.
- C) Yes; they are reproductively isolated based on habitat.
- D) No; they still can interbreed.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 24.1

- 7) Which statement describes unity within a species?
- A) A species can be distinguished by body shape and other structural features.
 - B) Members have the potential to interbreed in nature and produce viable, fertile offspring.
 - C) A species is described in terms of its interaction with living and non-living environment.
 - D) The DNA sequence lacks similarities.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.1

- 8) The common edible frog of Europe is a hybrid between two species, *Rana lessonae* and *Rana ridibunda*. The hybrids were first described in 1758 and have a wide distribution, from France across central Europe to Russia. Both male and female hybrids exist, but when they mate among themselves, they are rarely successful in producing offspring. What can you infer from this information?

- A) Postzygotic isolation exists between the two frog species.
- B) Prezygotic isolation exists between the two frog species.
- C) These two species are likely in the process of fusing back into one species.
- D) The hybrids form a separate species under the biological species concept.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 24.1

- 9) Macroevolution is _____.

- A) the same as microevolution, but includes the origin of new species
- B) evolution above the species level
- C) defined as the evolution of microscopic organisms into organisms that can be seen with the naked eye
- D) defined as a change in allele or gene frequency over the course of many generations

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.1

- 10) Which of the various species concepts distinguishes two species based on the degree of genetic exchange between their gene pools?

- A) genetic
- B) ecological
- C) biological
- D) morphological

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.1

11) There is still some controversy among biologists about whether Neanderthals should be placed within the same species as modern humans or into a separate species of their own. Most DNA sequence data analyzed so far indicate that there was probably little or no gene flow between Neanderthals and *Homo sapiens*. Which species concept describing species relationship between modern humans and Neanderthals is most applicable in these observations?

- A) genetic
- B) ecological
- C) morphological
- D) biological

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 24.1

12) You are confronted with a box of preserved grasshoppers of various species that are new to science and have not been described. Your assignment is to separate them into species. There is no accompanying information as to where or when they were collected. Which species concept will you have to use?

- A) biological
- B) genetic
- C) ecological
- D) morphological

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 24.1

13) Dog breeders maintain the purity of breeds by keeping dogs of different breeds apart when they are fertile. This kind of isolation is most similar to which of the following reproductive isolating mechanisms?

- A) temporal isolation
- B) behavioral isolation
- C) habitat isolation
- D) gametic isolation

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 24.1

14) Rank the following in order from most general to most specific.

1. gametic isolation
2. reproductive isolating mechanism
3. sperm-egg incompatibility in sea urchins
4. prezygotic isolating mechanism

- A) 2, 3, 1, 4
- B) 2, 4, 1, 3
- C) 4, 1, 2, 3
- D) 4, 2, 1, 3

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 24.1

15) Two species of frogs belonging to the same genus occasionally mate, but the embryos stop developing after a day and then die. These two frog species separate by _____.

- A) reduced hybrid viability
- B) hybrid breakdown
- C) reduced hybrid fertility
- D) gametic isolation

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.1

16) The production of sterile mules by interbreeding between female horses (mares) and male donkeys (jacks) is an example of _____.

- A) reduced hybrid viability
- B) hybrid breakdown
- C) reduced hybrid fertility
- D) mechanical isolation

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.1

17) Which postzygotic barriers prevent formation of hybrids beyond the first generations?

- A) increased hybrid vulnerability
- B) increased hybrid fertility
- C) hybrid breakdown
- D) hybrid gamete isolation

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 24.1

18) Rocky Mountain juniper (*Juniperus scopulorum*) and one-seeded juniper (*J. monosperma*) have overlapping ranges. Pollen grains (which contain sperm cells) from one species are unable to germinate and make pollen tubes on female ovules (which contain egg cells) of the other species. These two juniper species are kept separate by _____.

- A) habitat isolation
- B) temporal isolation
- C) gametic isolation
- D) behavioral isolation

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 24.1

19) What does the biological species concept use as the primary criterion for determining species boundaries?

- A) geographic isolation
- B) niche differences
- C) gene flow
- D) morphological similarity

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.1

20) The largest unit within which gene flow can readily occur is _____.

- A) a population
- B) a species
- C) the entire range of a genus
- D) the hybrid zone

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.1

21) Use the following information to answer the question.

About 3 million years ago, the Isthmus of Panama (a narrow strip of land connecting North and South America) formed, dividing marine organisms into Pacific and Caribbean populations. Researchers have examined species of snapping shrimp on both sides of the isthmus. Based on the morphological species concept, there appeared to be seven pairs of species, with one species of each pair in the Pacific and the other in the Caribbean. The different species pairs live at somewhat different depths in the ocean. Using mitochondrial DNA sequences, the researchers estimated phylogenies and found that each of these species pairs, separated by the isthmus, were indeed each other's closest relatives. The researchers investigated mating in the lab and found that many species pairs were not very interested in courting with each other, and any that did mate almost never produced fertile offspring. (Reference: Y. Kondo and A. Kashiwagi. 2004. Experimentally induced autotetraploidy and allotetraploidy in two Japanese pond frogs. Journal of Herpetology 38(3):381-92.)

If the isthmus formed gradually rather than suddenly, what pattern of genetic divergence would you expect to find in these species pairs?

- A) similar percentages of difference in DNA sequence between all pairs of sister species
- B) greater percentage of difference in DNA sequence between species that inhabit deep water than between species that inhabit shallow water
- C) greater percentage of difference in DNA sequence between species that inhabit shallow water than between species that inhabit deep water
- D) smaller percentage of difference DNA sequence between species that inhabit than between shallow water

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 24.2

22) Which of the following describes the most likely order of events in allopatric speciation?

- A) genetic drift, genetic isolation, divergence
- B) genetic isolation, divergence, genetic drift
- C) divergence, genetic drift, genetic isolation
- D) genetic isolation, genetic drift, divergence

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.2

23) You want to study divergence of populations, and you need to maximize the rate of divergence to see results within the period of your grant funding. You will form a new population by taking some individuals from a source population and isolating them so the two populations cannot interbreed. What combination of characteristics would maximize your chance of seeing divergence in this study?

1. Choose a random sample of individuals to form the new population.
2. Choose individuals from one extreme to form the new population.
3. Choose a species to study that produces many offspring.
4. Choose a species to study that produces a few, large offspring.
5. Place the new population in the same type of environment as the source population.
6. Place the new population in a novel environment compared to that of the source population.

- A) 1, 3, and 6
B) 1, 4, and 6
C) 2, 3, and 5
D) 2, 3, and 6

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 24.2

24) Which of these animals could overcome the geographic barrier of water that causes allopatric speciation?

- A) birds
B) pollen
C) small rodents
D) mountain lions

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.2

25) How are two different species most likely to evolve from one ancestral species?

- A) sympatrically, by a point mutation affecting morphology or behavior
B) sympatrically, due to extensive inbreeding
C) allopatrically, due to extensive inbreeding
D) allopatrically, after the ancestral species has split into two populations

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 24.2

26) House finches were found only in western North America until 1939, when a few individuals were released in New York City. These individuals established a breeding population and gradually expanded their range. The western population also expanded its range somewhat eastward, and the two populations have recently come in contact. If the two forms were unable to interbreed when their expanding ranges met, it would be an example of _____.

- A) prezygotic isolation
- B) reinforcement
- C) allopatric speciation
- D) sympatric speciation

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 24.2

27) Most causes of speciation are relatively slow in that they may take many generations to see changes, with the exception of _____.

- A) polyploidy
- B) reinforcement
- C) colonization
- D) natural selection

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.2

28) Two researchers experimentally formed tetraploid frogs by fertilizing diploid eggs from *Rana porosa brevipoda* with diploid sperm from *Rana nigromaculata*. When they mated these tetraploid frogs with each other, most of the offspring that survived to maturity were tetraploid, with chromosome sets of both diploid parent species. Based on these results, if this type of tetraploid formed in the wild, what would be the result? (Reference: Y. Kondo and A.

Kashiwagi. 2004. Experimentally induced autotetraploidy and allotetraploidy in two Japanese pond frogs. Journal of Herpetology 38(3):381–92.)

- A) The two parent species would interbreed and fuse into one species.
- B) The two parent species would recognize each other as mates.
- C) The tetraploids would be reproductively isolated from both parent species.
- D) The tetraploids would be selected against.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 24.2

29) How can reproductive barriers form sympatric populations while their members remain in the same geographic area?

- A) increased gene flow
- B) polyploidy
- C) decreased sexual selection
- D) habitat sharing

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 24.2

30) Two species of tree frogs that live sympatrically in the northeastern United States differ in ploidy: *Hyla chrysoscelis* is diploid, and *Hyla versicolor* is tetraploid. The frogs are identical in appearance, but their mating calls, which females use to find mates, differ. Which difference most likely evolved first?

- A) polyploidy
- B) difference in mating calls
- C) habitat differentiation
- D) Polyploidy and different mating calls must have evolved at the same time.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 24.2

31) In a hypothetical situation, a certain species of flea feeds only on pronghorn antelopes. In the western United States, pronghorns and cattle often associate with one another in the same open rangeland. Some of these fleas develop a strong preference for cattle blood and mate only with other fleas that prefer cattle blood. The host mammal can be considered as the fleas' habitat. If this situation persists, and new species evolve, this would be an example of _____.

- A) sympatric speciation and habitat isolation
- B) sympatric speciation and temporal isolation
- C) allopatric speciation and habitat isolation
- D) allopatric speciation and gametic isolation

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 24.2

32) The difference between geographic isolation and habitat differentiation (isolation) is the _____.

- A) relative location of two populations as speciation occurs
- B) speed (tempo) at which two populations undergo speciation
- C) amount of genetic variation that occurs among two gene pools as speciation occurs
- D) identity of the kingdom or domain in which these phenomena occur

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.2

33) Among known plant species, which of these have been the two most commonly occurring phenomena that have led to the origin of new species?

- A) allopatric speciation and sexual selection
- B) allopatric speciation and polyploidy
- C) sympatric speciation and sexual selection
- D) sympatric speciation and polyploidy

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.2

34) Beetle pollinators of a particular plant are attracted to its flowers' bright orange color. The beetles not only pollinate the flowers, but they mate while inside of the flowers. A mutant version of the plant with red flowers becomes more common with the passage of time. A particular variant of the beetle prefers the red flowers to the orange flowers. Over time, these two beetle variants diverge from each other to such an extent that interbreeding is no longer possible. What kind of speciation has occurred in this example, and what has driven it?

- A) allopatric speciation; ecological isolation
- B) sympatric speciation; habitat differentiation
- C) allopatric speciation; behavioral isolation
- D) sympatric speciation; allopolyploidy

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 24.2

35) Use the following description to answer the question.

On the volcanic, equatorial West African island of São Tomé, two species of fruit fly exist. *Drosophila yakuba* inhabits the island's lowlands and is also found on the African mainland, located about two hundred miles away. At higher elevations, and only on São Tomé, is found the very closely related *Drosophila santomea*. The two species can hybridize, though male hybrids are sterile. A hybrid zone exists at middle elevations, though hybrids there are greatly outnumbered by *D. santomea*. Studies of the two species' nuclear genomes reveal that *D. yakuba* on the island is more closely related to mainland *D. yakuba* than to *D. santomea* ($2n = 4$ in both species). São Tomé rose from the Atlantic Ocean about 14 million years ago.

Using only the information provided in the paragraph, which of the following is the best initial hypothesis for how *D. santomea* descended from *D. yakuba*?

- A) allopolyploidy
- B) autopolyploidy
- C) habitat differentiation
- D) sexual selection

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 24.2

36) Use the following description to answer the question.

On the Bahamian island of Andros, mosquitofish populations live in various, now-isolated freshwater ponds that were once united. Currently, some predator-rich ponds have mosquitofish that can swim in short, fast bursts; other predator-poor ponds have mosquitofish that can swim continuously for a long time. When placed together in the same body of water, the two kinds of female mosquitofish exhibit exclusive breeding preferences.

Which two of the following have operated to increase divergence between mosquitofish populations on Andros?

1. improved gene flow
2. bottleneck effect
3. sexual selection
4. founder effect
5. natural selection

- A) 1 and 3
B) 2 and 3
C) 2 and 4
D) 3 and 5

Answer: D

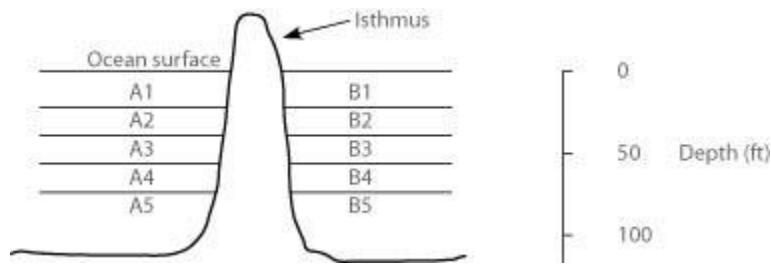
Bloom's Taxonomy: Application/Analysis

Section: 24.2

37) Use the following description to answer the question.

In the oceans on either side of the Isthmus of Panama are 30 species of snapping shrimp; some are shallow-water species, others are adapted to deep water. There are 15 species on the Pacific side and 15 different species on the Atlantic side. The Isthmus of Panama started rising about 10 million years ago. The oceans were completely separated by the isthmus about 3 million years ago.

In the figure, the isthmus separates the Pacific Ocean on the left (side A) from the Atlantic Ocean on the right (side B). The seawater on either side of the isthmus is separated into five depth habitats (1-5), with 1 being the shallowest.



Why should deepwater shrimp on different sides of the isthmus have diverged from each other earlier than shallow-water shrimp?

- A) They have been geographically isolated from each other for a longer time.
- B) Cold temperatures, associated with deep water, have accelerated the mutation rate, resulting in faster divergence in deepwater shrimp.
- C) The rise of the land bridge was accompanied by much volcanic activity. Volcanic ash contains heavy metals, which are known mutagens. Ash fall caused high levels of heavy metals in the ocean sediments underlying the deep water, resulting in accelerated mutation rates and faster divergence in deepwater shrimp.
- D) Fresh water entering the ocean from the canal is both less dense and cloudier than seawater. The cloudy fresh water interferes with the ability of shallow-water shrimp to locate mating partners, which reduces the frequency of mating, thereby slowing the introduction of genetic variation.

Answer: A

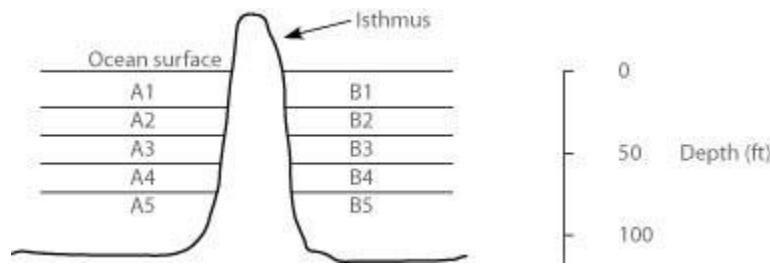
Bloom's Taxonomy: Synthesis/Evaluation

Section: 24.2

38) Use the following description to answer the question.

In the oceans on either side of the Isthmus of Panama are 30 species of snapping shrimp; some are shallow-water species, others are adapted to deep water. There are 15 species on the Pacific side and 15 different species on the Atlantic side. The Isthmus of Panama started rising about 10 million years ago. The oceans were completely separated by the isthmus about 3 million years ago.

In the figure, the isthmus separates the Pacific Ocean on the left (side A) from the Atlantic Ocean on the right (side B). The seawater on either side of the isthmus is separated into five depth habitats (1-5), with 1 being the shallowest.



In which habitat should one find snapping shrimp most closely related to shrimp that live in habitat A4?

- A) A3
- B) A5
- C) B4
- D) either A3 or A5

Answer: C

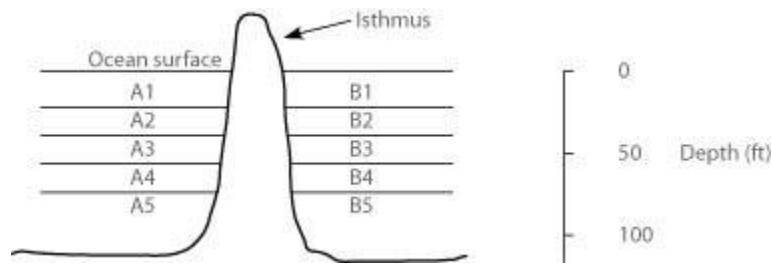
Bloom's Taxonomy: Application/Analysis

Section: 24.2

39) Use the following description to answer the question.

In the oceans on either side of the Isthmus of Panama are 30 species of snapping shrimp; some are shallow-water species, others are adapted to deep water. There are 15 species on the Pacific side and 15 different species on the Atlantic side. The Isthmus of Panama started rising about 10 million years ago. The oceans were completely separated by the isthmus about 3 million years ago.

In the figure, the isthmus separates the Pacific Ocean on the left (side A) from the Atlantic Ocean on the right (side B). The seawater on either side of the isthmus is separated into five depth habitats (1-5), with 1 being the shallowest.



Which of these habitats is likely to harbor the most recently diverged species?

- A) A5
- B) B4
- C) A3
- D) A1

Answer: D

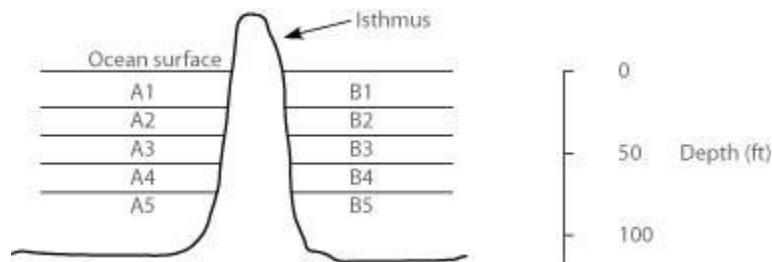
Bloom's Taxonomy: Application/Analysis

Section: 24.2

40) Use the following description to answer the question.

In the oceans on either side of the Isthmus of Panama are 30 species of snapping shrimp; some are shallow-water species, others are adapted to deep water. There are 15 species on the Pacific side and 15 different species on the Atlantic side. The Isthmus of Panama started rising about 10 million years ago. The oceans were completely separated by the isthmus about 3 million years ago.

In the figure, the isthmus separates the Pacific Ocean on the left (side A) from the Atlantic Ocean on the right (side B). The seawater on either side of the isthmus is separated into five depth habitats (1-5), with 1 being the shallowest.



Which habitats should harbor snapping shrimp species with the greatest degree of genetic divergence from each other?

- A) A1 and A5
- B) A1 and B5
- C) A5 and B5
- D) Both A1/A5 and B1/B5 should have the greatest, but equal amounts of, genetic divergence

Answer: C

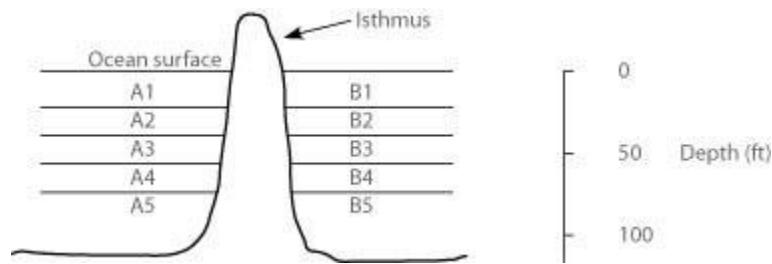
Bloom's Taxonomy: Application/Analysis

Section: 24.2

41) Use the following description to answer the question.

In the oceans on either side of the Isthmus of Panama are 30 species of snapping shrimp; some are shallow-water species, others are adapted to deep water. There are 15 species on the Pacific side and 15 different species on the Atlantic side. The Isthmus of Panama started rising about 10 million years ago. The oceans were completely separated by the isthmus about 3 million years ago.

In the figure, the isthmus separates the Pacific Ocean on the left (side A) from the Atlantic Ocean on the right (side B). The seawater on either side of the isthmus is separated into five depth habitats (1-5), with 1 being the shallowest.



Which factor is most important for explaining why there are equal numbers of snapping shrimp species on either side of the isthmus?

- A) the relative shortness of time they have been separated
- B) the depth of the sea
- C) the number of actual depth habitats between the surface and the sea floor
- D) the elevation of the isthmus above sea level

Answer: A

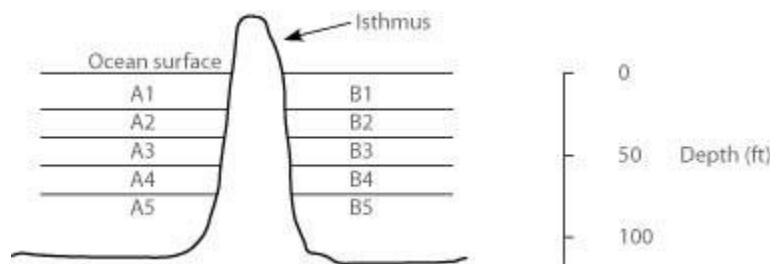
Bloom's Taxonomy: Synthesis/Evaluation

Section: 24.2

42) Use the following description to answer the question.

In the oceans on either side of the Isthmus of Panama are 30 species of snapping shrimp; some are shallow-water species, others are adapted to deep water. There are 15 species on the Pacific side and 15 different species on the Atlantic side. The Isthmus of Panama started rising about 10 million years ago. The oceans were completely separated by the isthmus about 3 million years ago.

In the figure, the isthmus separates the Pacific Ocean on the left (side A) from the Atlantic Ocean on the right (side B). The seawater on either side of the isthmus is separated into five depth habitats (1-5), with 1 being the shallowest.



The Panama Canal was completed in 1914, and its depth is about 50 feet. After 1914, snapping shrimp species from which habitats should be most likely to form hybrids as the result of the canal?

- A) A5 and B5
- B) A3 and B3
- C) A1 and B1
- D) A1-A3 and B1-B3 have equal likelihoods of harboring snapping shrimp species that can hybridize.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 24.2

43) Plant species A has a diploid number of 12. Plant species B has a diploid number of 16. A new species, C, arises as an allopolyploid from A and B. The diploid number for species C would probably be _____.

- A) 14
- B) 16
- C) 28
- D) 56

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 24.2

44) A small number of birds arrive on an island from a neighboring larger island. This small population begins to adapt to the new food plants available on the island, and their beaks begin to change. About twice a year, one or two more birds from the neighboring island arrive. These new arrivals _____.

- A) speed up the process of speciation
- B) tend to promote adaptation to the new food plants
- C) tend to slow adaptation to the new food plants
- D) represent a colonizing event response

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 24.3

45) How do hybrid zones slow reproductive isolation?

- A) species with incomplete mating barriers
- B) decreased embryonic mortality
- C) increased gene flow
- D) morphologic abnormalities

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 24.3

46) What happens to the hybrid zone when gene flow is established?

- A) A population merges with another population.
- B) Hybrids cease to be formed.
- C) weakening of reproductive barriers
- D) continued production of hybrids

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 24.3

47) Reinforcement is most likely to occur when _____.

- A) the environment is changing
- B) hybrids have lower fitness than either parent population
- C) prezygotic isolating mechanisms are in place
- D) gene flow is low

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 24.3

48) The phenomenon of fusion is likely to occur when, after a period of geographic isolation, two populations meet again and _____.

- A) an increasing number of infertile hybrids is produced over the course of the next 100 generations
- B) no reproduction occurs in the hybrid zone
- C) an increasing number of viable, fertile hybrids is produced over the course of the next 100 generations
- D) a decreasing number of viable, fertile hybrids is produced over the course of the next 100 generations

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 24.3

49) A hybrid zone is properly defined as _____.

- A) an area where the ranges of two closely related species overlap but do not interbreed
- B) an area where mating occurs between members of two closely related species, producing viable offspring
- C) a zone where sterile hybrids form, kept separate by postzygotic barriers
- D) an area where members of two closely related species intermingle, but gene flow is prevented by prezygotic barriers

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.3

50) In hybrid zones where reinforcement is occurring, we should see a decline in _____.

- A) gene flow between distinct gene pools
- B) speciation
- C) the genetic distinctness of two gene pools
- D) mutation rates

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.3

51) Other than predation by introduced Nile perch, the most likely explanation for the recent decline in cichlid species diversity in Lake Victoria is _____.

- A) reinforcement
- B) fusion
- C) stability
- D) polyploidy

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 24.3

52) A narrow hybrid zone separates the toad species *Bombina bombina* and *Bombina variegata*. What is true of those alleles that are unique to the parental species?

- A) Such alleles should be absent.
- B) Their allele frequency should be nearly the same as the allele frequencies in toad populations distant from the hybrid zone.
- C) The alleles heterozygosity should be higher among the hybrid toads than in toad populations distant from the hybrid zone.
- D) Their allele frequency on one edge of the hybrid zone should roughly equal their frequency on the opposite edge of the hybrid zone.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 24.3

53) Use the following description to answer the question.

On the volcanic, equatorial West African island of São Tomé, two species of fruit fly exist. *Drosophila yakuba* inhabits the island's lowlands and is also found on the African mainland, located about two hundred miles away. At higher elevations, and only on São Tomé, is found the very closely related *Drosophila santomea*. The two species can hybridize, though male hybrids are sterile. A hybrid zone exists at middle elevations, though hybrids there are greatly outnumbered by *D. santomea*. Studies of the two species' nuclear genomes reveal that *D. yakuba* on the island is more closely related to mainland *D. yakuba* than to *D. santomea* ($2n = 4$ in both species). São Tomé rose from the Atlantic Ocean about 14 million years ago.

The observation that island *D. yakuba* are more closely related to mainland *D. yakuba* than island *D. yakuba* are to *D. santomea* is best explained by proposing that *D. santomea* _____.

- A) descended from a now-extinct, non-African fruit fly
- B) arrived on the island before *D. yakuba*
- C) descended from a single colony of *D. yakuba*, which had been introduced from elsewhere, with no subsequent colonization events
- D) descended from an original colony of *D. yakuba*, of which there are no surviving members.

The current island *D. yakuba* represent a second colonization event from elsewhere

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 24.3

54) Use the following description to answer the question.

On the Bahamian island of Andros, mosquitofish populations live in various, now-isolated freshwater ponds that were once united. Currently, some predator-rich ponds have mosquitofish that can swim in short, fast bursts; other predator-poor ponds have mosquitofish that can swim continuously for a long time. When placed together in the same body of water, the two kinds of female mosquitofish exhibit exclusive breeding preferences.

What is the best way to promote fusion between two related populations of mosquitofish, one of which lives in a predator-rich pond and the other of which lives in a predator-poor pond?

- A) Build a canal linking the two ponds that permits free movement of mosquitofish, but not of predators.
- B) Transfer only female mosquitofish from a predator-rich pond to a predator-poor pond.
- C) Perform a reciprocal transfer of females between predator-rich and predator-poor ponds.
- D) Remove predators from a predator-rich pond and transfer them to a predator-poor pond.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 24.3

55) Suppose that a group of male pied flycatchers migrated from a region where there were no collared flycatchers to a region where both species were present. Assuming events like this are very rare, which of the following scenarios is *least* likely?

- A) Migrant pied males would produce fewer offspring than would resident pied males.
- B) Pied females would rarely mate with collared males.
- C) Migrant males would mate with collared females more often than with pied females.
- D) The frequency of hybrid offspring would decrease.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 24.3

56) The following question refers to this hypothetical situation.

A female fly, full of fertilized eggs, is swept by high winds to an island far out to sea. She is the first fly to arrive on this island and the only fly to arrive in this way. Thousands of years later, her numerous offspring occupy the island, but none of them resembles her. There are, instead, several species, each of which eats only a certain type of food. None of the species can fly and their balancing organs (halteres) are now used in courtship displays. The male members of each species bear modified halteres that are unique in appearance to their species. Females bear vestigial halteres. The ranges of all of the daughter species overlap.

Fly species W, found in a certain part of the island, produces fertile offspring with species Y. Species W does not produce fertile offspring with species X or Z. If no other species can hybridize, then which of the following statements about species W and Y are true?

- I) Species W and Y have genomes that are still similar enough for successful meiosis to occur in hybrid flies.
- II) Species W and Y have more genetic similarity with each other than either did with the other two species.
- III) Species W and Y may fuse into a single species if their hybrids remain fertile over the course of many generations.

- A) Only I is correct.
- B) Only II is correct.
- C) Only III is correct.
- D) I, II, and III are correct.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 24.3

57) According to the concept of punctuated equilibrium, the "sudden" appearance of a new species in the fossil record means that _____.

- A) the species is now extinct
- B) speciation occurred in one generation
- C) speciation occurred rapidly in geologic time
- D) the species will consequently have a relatively short existence compared with other species

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.4

58) How is length of time for speciation estimated?

- A) genetic evidence indicates that species originate
- B) time that elapses when populations of a newly formed species diverge
- C) time it takes for speciation to be complete
- D) speciation precedes divergence

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 24.4

59) Speciation _____.

- A) occurs at such a slow pace that no one has ever observed the emergence of new species
- B) occurs only by the accumulation of small genetic changes over vast expanses of time
- C) must begin with the geographic isolation of a small, frontier population
- D) can involve changes to a single gene

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.4

60) According to the biological species concept, for speciation to occur, _____.

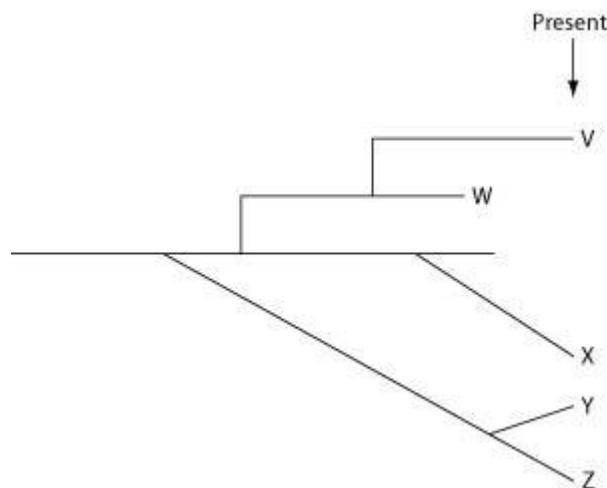
- A) the number of chromosomes in the gene pool must change
- B) changes to centromere location or chromosome size must occur
- C) large numbers of genes that affect numerous phenotypic traits must change
- D) at least one gene, affecting one reproductive barrier, must change

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 24.4

61) The question refers to the following evolutionary tree, in which the horizontal axis represents time (present time is on the far right), and the vertical axis represents morphological change.



Which conclusion can be drawn from this evolutionary tree?

- A) A single clade (that is, a group of species that share a common ancestor) can include species that formed by gradualism and other species that formed by punctuated equilibrium.
- B) A single clade (that is, a group of species that share a common ancestor) will either include species that formed by gradualism or species that formed by punctuated equilibrium.
- C) Assuming that the tip of each line represents a species, there are five extant (that is, not extinct) species resulting from the earliest common ancestor.
- D) Species X and Z best represent species that evolved by punctuated equilibrium.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 24.4

24.2 Student Edition End-of-Chapter Questions

1) The *largest* unit within which gene flow can readily occur is a

- A) population.
- B) species.
- C) genus.
- D) hybrid.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

2) Males of different species of the fruit fly *Drosophila* that live in the same parts of the Hawaiian Islands have different elaborate courtship rituals. These rituals involve fighting other males and making stylized movements that attract females. What type of reproductive isolation does this represent?

- A) habitat isolation
- B) temporal isolation
- C) behavioral isolation
- D) gametic isolation

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

3) According to the punctuated equilibria model,

- A) given enough time, most existing species will branch gradually into new species.
- B) most new species accumulate their unique features relatively rapidly as they come into existence, then change little for the rest of their duration as a species.
- C) most evolution occurs in sympatric populations.
- D) speciation is usually due to a single mutation.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

4) Bird guides once listed the myrtle warbler and Audubon's warbler as distinct species.

Recently, these birds have been classified as eastern and western forms of a single species, the yellow-rumped warbler. Which of the following pieces of evidence, if true, would be cause for this reclassification?

- A) The two forms interbreed often in nature, and their offspring survive and reproduce well.
- B) The two forms live in similar habitats and have similar food requirements.
- C) The two forms have many genes in common.
- D) The two forms are very similar in appearance.

Answer: A

Bloom's Taxonomy: Application/Analysis

- 5) Which of the following factors would *not* contribute to allopatric speciation?
- A) The separated population is small, and genetic drift occurs.
 - B) The isolated population is exposed to different selection pressures than the ancestral population.
 - C) Different mutations begin to distinguish the gene pools of the separated populations.
 - D) Gene flow between the two populations is extensive.

Answer: D

Bloom's Taxonomy: Application/Analysis

- 6) Plant species A has a diploid chromosome number of 12. Plant species B has a diploid number of 16. A new species, C, arises as an allopolyplloid from A and B. The diploid number for species C would probably be

- A) 14.
- B) 16.
- C) 28.
- D) 56.

Answer: C

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 25 The History of Life on Earth

25.1 Multiple-Choice Questions

1) Which of the following is the correct sequence of events in the origin of life?

- I. Formation of protocells
- II. Synthesis of organic monomers
- III. Synthesis of organic polymers
- IV. Formation of DNA-based genetic systems

- A) I, II, III, IV
- B) I, III, II, IV
- C) II, III, I, IV
- D) II, III, IV, I

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.1

2) Which of the following is a defining characteristic that all protocells had in common?

- A) the ability to synthesize enzymes
- B) a surrounding membrane or membrane-like structure
- C) RNA genes
- D) the ability to replicate RNA

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.1

3) The first genetic material on Earth was probably _____.

- A) DNA produced by reverse transcriptase from abiotically produced RNA
- B) DNA molecules whose information was transcribed to RNA and later translated in polypeptides
- C) self-replicating RNA molecules
- D) oligopeptides located within protocells

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.1

4) In 2013, researchers constructed a vesicle with replicated RNA. Why was this significant evidence for abiotic origin of life?

- A) RNA molecules could pass on information to their "daughters."
- B) RNA molecules were not able to replicate.
- C) RNA would be used up by protocells.
- D) RNA is a stable repository.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 25.1

5) Which of the following statements suggests natural selection as a mechanism in the evolution of ribozymes?

- A) Single-stranded RNA has many shapes.
- B) Replication of RNA is flawless.
- C) Some strands of RNA replicate less often.
- D) Some strands of RNA replicate more often and with more mutations.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 25.1

6) How was early Earth from more than three billion years ago different from today's Earth?

Unlike Earth today, early Earth _____.

- A) had an atmosphere rich in gases released from volcanic eruptions
- B) had an oxidizing atmosphere
- C) experienced little high-energy radiation from the sun
- D) had an atmosphere with significant quantities of ozone

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.1

7) Which hypothesis for the abiotic formation of organic molecules suggests that early Earth's atmosphere was a neutral atmosphere?

- A) The energy for this synthesis could have come from lightning and UV radiation.
- B) Some evidence suggests that the early atmosphere was made up primarily of nitrogen and carbon dioxide.
- C) Amino acids were found near volcanic eruption sites.
- D) Organic compounds were first produced in deep-sea hydrothermal vents.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.1

- 8) Why are fossils considered to be an incomplete record of evolution?
- A) The fossil record shows changes in kinds of organisms that lived on earth.
 - B) The fossil record shows that many animals are extinct.
 - C) The fossil record is biased for organisms that had hard shells and skeletons.
 - D) Fossils document how new organisms come from preexisting organisms.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.2

- 9) What is the most accurate method used to measure the age of a fossil?

- A) radiometric dating
- B) sequence fossils in rock strata
- C) use uranium-238
- D) use whole-life decay

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 25.2

- 10) Which of the following organisms would be most likely to form a fossil?

- A) a rare worm
- B) a common worm
- C) a rare squirrel
- D) a common squirrel

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 25.2

- 11) Which of the following would be *least* likely to appear in the fossil record?

- A) burrowing species
- B) marine-dwelling species
- C) marsh-dwelling species
- D) desert-dwelling species

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 25.2

- 12) If the half-life of carbon-14 is about 5,730 years, then a fossil that has 1/16 of the normal proportion of carbon-14 to carbon-12 should be about how many years old?

- A) 2,800
- B) 11,200
- C) 16,800
- D) 22,900

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 25.2

13) What is true of the fossil record of mammalian origins?

- A) It shows that mammals and birds evolved from the same kind of dinosaur.
- B) It includes transitional forms with progressively specialized teeth.
- C) It indicates that mammals and dinosaurs did not overlap in geologic time.
- D) It includes a series that shows the gradual change of scales into fur.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.2

14) If a fossil is encased in a stratum of sedimentary rock without any strata of volcanic rock (for example, lava or ash) nearby, then it should be _____.

- A) easy to determine the absolute age of the fossil, because the radioisotopes in the sediments will not have been "reset" by the heat of the igneous rocks
- B) easy to determine the absolute age of the fossil, because the igneous rocks will not have physically obstructed the deposition of sediment of a single age next to the fossil
- C) difficult to determine the absolute age of the fossil, because the "marker fossils" common to igneous rock will be absent
- D) difficult to determine the absolute age of the fossil, because radiometric dating of sedimentary rock is less accurate than that of igneous rock

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.2

15) Use the following information to answer the question.

A sediment core is removed from the floor of an inland sea. The sea has been in existence, off and on, throughout the entire time that terrestrial life has existed. Researchers wish to locate and study the terrestrial organisms fossilized in this core. The core is illustrated as a vertical column, with the top of the column representing the most recent strata and the bottom representing the time when land was first colonized by life.

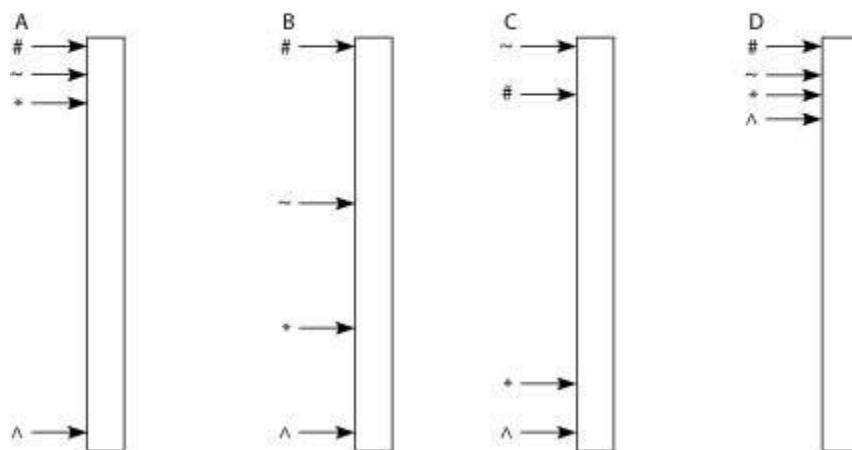
Key:

= carnivorous tetrapods

~ = herbivorous invertebrates

* = plants and fungi

Δ = terrestrial cyanobacteria



To assign absolute dates to fossils in this sediment core, it would be most helpful if _____.

- A) you knew the order in which the fossils occurred
- B) the sediments had not been affected by underwater currents during their deposition
- C) volcanic ash layers were regularly interspersed between the sedimentary strata
- D) fossils throughout the column were equally spaced apart

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 25.2

16) Refer to the following information to answer the question.

Fossils of *Lystrosaurus*, a dicynodont therapsid, are most common in parts of modern-day South America, South Africa, Madagascar, India, South Australia, and Antarctica. The animal apparently lived in arid regions and was mostly herbivorous. It originated during the mid-Permian period, survived the Permian extinction, and dwindled by the late Triassic, though there is evidence of a relict population in Australia during the Cretaceous period. Some dicynodonts had two large tusks, extending down from their upper jaws. The tusks were not used for food gathering, and in some species were limited to males. Food was gathered using an otherwise toothless beak. Judging from the fossil record in sedimentary rocks, these pig-sized organisms were the most common mammal-like reptiles of the Permian.

What is thought to be the correct sequence of these events, from earliest to most recent, in the evolution of life on Earth?

1. origin of mitochondria
2. origin of multicellular eukaryotes
3. origin of chloroplasts
4. origin of cyanobacteria
5. origin of fungal-plant symbioses

- A) 4, 3, 2, 1, 5
- B) 4, 1, 2, 3, 5
- C) 4, 1, 3, 2, 5
- D) 4, 3, 1, 5, 2

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.3

17) Which of the following showed their greatest diversity during the Mesozoic era but were a small, less diverse group during the Paleozoic era?

- A) gymnosperms
- B) fungi
- C) flowering plants
- D) mammals

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 25.3

18) Which listing of geological periods is in the correct order, from oldest to most recent?

- A) Cambrian, Devonian, Permian, Cretaceous
- B) Devonian, Cambrian, Permian, Cretaceous
- C) Cambrian, Permian, Devonian, Cretaceous
- D) Permian, Cambrian, Cretaceous, Devonian

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.3

19) You are the lucky student of a wacky professor who develops a time machine. He asks if you will test it with him. You get in, and there is an immediate glitch—the date readout fails so that when you land, you are not sure what era you are in. Your professor begins to panic, but you see something that tells you are in the Cenozoic era. Which of the following could it be?

- A) a rabbit eating a daisy
- B) a water lily floating in a pond
- C) masses of green ferns with dragonflies hovering above them
- D) a bee pollinating a flower

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 25.3

20) You are the lucky student of a wacky professor who develops a time machine. He asks if you will test it with him. You get in, and there is an immediate glitch—the date readout fails so that when you land, you are not sure what era you are in. As your time machine lands, you see an unusual landscape before you. As you open the door, you realize you cannot breathe. You quickly shut the door, realizing you are in the _____.

- A) Archaean eon
- B) Cambrian period
- C) Cenozoic era
- D) Mesozoic era

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.3

21) An early consequence of the release of oxygen gas by plant and bacterial photosynthesis was to _____.

- A) change the atmosphere from oxidizing to reducing
- B) make it easier to maintain reduced molecules
- C) cause iron in ocean water and terrestrial rocks to rust (oxidize)
- D) prevent the formation of an ozone layer

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.3

22) What is true of the Cambrian explosion?

- A) There are fossils of animals in geological strata that are older than the Cambrian explosion.
- B) Only the fossils of microorganisms are found in geological strata older than the Cambrian explosion.
- C) The Cambrian explosion is evidence for the instantaneous creation of life on Earth.
- D) The Cambrian explosion marks the appearance of filter-feeding animals in the fossil record.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.3

23) Which of the following characteristics are expected in the first animals to have colonized land?

- I) They were probably herbivores (ate photosynthesizers).
- II) Animals had four appendages.
- III) Animals had the ability to resist dehydration.
- IV) Animals had lobe-finned fishes as ancestors.
- V) Invertebrates

- A) III only
- B) III and V
- C) I, III and V
- D) I, II, III and IV

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 25.3

24) Use the following information to answer the question.

A sediment core is removed from the floor of an inland sea. The sea has been in existence, off and on, throughout the entire time that terrestrial life has existed. Researchers wish to locate and study the terrestrial organisms fossilized in this core. The core is illustrated as a vertical column, with the top of the column representing the most recent strata and the bottom representing the time when land was first colonized by life.

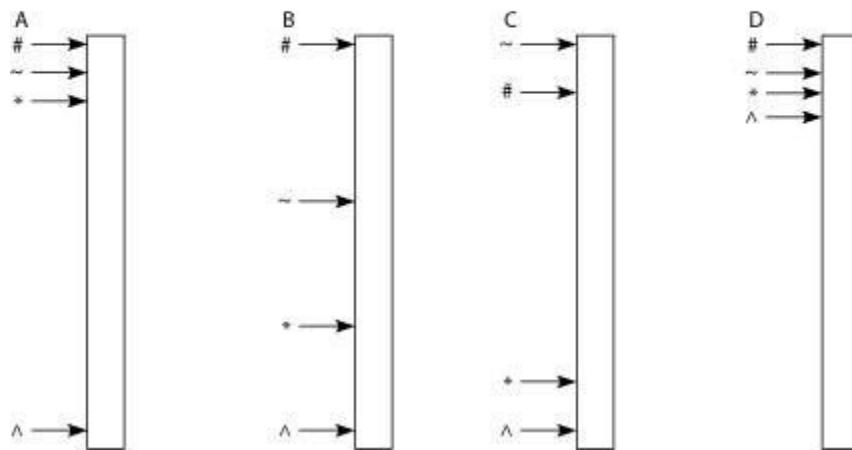
Key:

= carnivorous tetrapods

~ = herbivorous invertebrates

* = plants and fungi

Δ = terrestrial cyanobacteria



If arrows indicate locations in the column where fossils of a particular type (see key) first appear, then which core in the figure above has the most accurate arrangement of fossils?

- A) core A
- B) core B
- C) core C
- D) core D

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 25.3

25) Which factor most likely caused animals and plants in India to differ greatly from species in nearby southeast Asia?

- A) The climates of the two regions are similar.
- B) India is in the process of separating from the rest of Asia.
- C) Life in India was wiped out by ancient volcanic eruptions.
- D) India was a separate continent until 45 million years ago.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.4

26) What concept explains the evolution of complex eyes?

- A) Complex eyes evolved through a series of steps that benefited the eyes.
- B) Mollusc eyes evolved from a different ancestor than vertebrate eyes.
- C) Through evolutionary history, eyes lose function of vision.
- D) Mollusc eye's evolution was dependent on vertebrate eye evolution.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 25.6

27) How does continental drift explain the uniqueness of Australian fauna?

- A) Marsupials fill the ecological niche as eutherians on other continents.
- B) Fossil evidence suggests that marsupials originated in Asia and reached Australia via South America.
- C) The subsequent separation of the southern continents formed an island of marsupials.
- D) In Australia, marsupials diversified, and eutherians became extinct.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 25.4

28) Which period had the greatest increase in the number of extant species?

- A) Paleozoic
- B) Mesozoic
- C) Cenozoic
- D) Permian

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.4

29) What adaptions by mammals helped their adaptive radiation after extinction of terrestrial dinosaurs?

- A) nocturnal vision
- B) small size
- C) increase in diversity
- D) outcompeting for food

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 25.4

30) What major innovations of the three radiations was associated with defying gravity to facilitate life on land?

- A) stems
- B) waxy covering
- C) insect pollination
- D) new sources of food

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.4

31) The Permian period ended and then rapid speciation occurred as new animal and plant forms evolved. The most likely explanation for this is _____.

- I) adaptive radiation
- II) ecological opportunity
- III) lack of competition
- IV) morphological innovation

- A) just one of the above
- B) two of the above
- C) three of the above
- D) all of the above

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 25.4

32) According to the theory of seafloor spreading, oceanic islands, such as the Hawaiian Islands, form as oceanic crustal plates move over a stationary "hot spot" in the mantle. Currently, the big island of Hawaii is thought to be over a hot spot, which is why it is the only one of the seven large islands that has active volcanoes. What should be true of the island of Hawaii?

- I) Scientists in search of ongoing speciation events are more likely to find them here than on the other six large islands.
- II) Its species should be more closely related to those of nearer islands than to those of farther islands.
- III) It should have a rich fossil record of terrestrial organisms.
- IV) It should have species that are not found anywhere else on Earth.
- V) On average, it should have fewer species per-unit surface area than the other six islands.

- A) I, II and III
- B) I, II and V
- C) I, II, III and IV
- D) I, II, IV and V

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 25.4

33) Hawaii is the most southeastern of the seven largest islands and is also closest to the seafloor spreading center from which the Pacific plate originates, which lies about 5,600 km farther to the southeast. Assuming equal sedimentation rates, what should be the location of the thickest sediment layer and thus the area with the greatest diversity of fossils above the oceanic crust?

- A) between the island of Hawaii and the seafloor spreading center
- B) around the base of the island of Hawaii
- C) around the base of Kauai, the oldest of the large Hawaiian islands
- D) where the islands are most concentrated (highest number of islands per unit surface area)

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 25.4

34) Upon being formed, oceanic islands, such as the Hawaiian Islands, should feature what characteristic, leading to which phenomenon?

- A) mass extinctions, leading to bottleneck effect
- B) major evolutionary innovations, leading to rafting to nearby continents
- C) a variety of empty ecological niches, leading to adaptive radiation
- D) adaptive radiation, leading to founder effect

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.4

35) How did the Cretaceous and Permian extinctions affect the numbers of prey organisms?

- A) After the Permian extinction, the numbers of prey organisms increased then leveled off.
- B) After the Cretaceous extinction, the number of predators continuously increased.
- C) The Permian predators removed all Cretaceous predators.
- D) Predators and prey decreased in numbers.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.4

36) Bagworm moth caterpillars feed on evergreens and carry a silken case or bag around with them in which they eventually pupate. Adult female bagworm moths are larval in appearance; they lack the wings and other structures of the adult male and instead retain the appearance of a caterpillar even though they are sexually mature and can lay eggs within the bag. This is a good example of _____.

- A) allometric growth
- B) paedomorphosis
- C) sympatric speciation
- D) adaptive radiation

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 25.5

37) The loss of ventral spines by modern freshwater sticklebacks is due to natural selection operating on the phenotypic effects of *Pitx1* gene _____.

- A) duplication (gain in number)
- B) elimination (loss)
- C) mutation (change)
- D) silencing (loss of expression)

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.5

38) The following question refers to this hypothetical situation.

A female fly, full of fertilized eggs, is swept by high winds to an island far out to sea. She is the first fly to arrive on this island and the only fly to arrive in this way. Thousands of years later, her numerous offspring occupy the island, but none of them resembles her. There are, instead, several species, each of which eats only a certain type of food. None of the species can fly, and their balancing organs (halteres) are now used in courtship displays. The male members of each species bear modified halteres that are unique in appearance to their species. Females bear vestigial halteres. The ranges of all of the daughter species overlap.

In each fly species, the entire body segment that gave rise to the original flight wings is missing. The mutation(s) that led to the flightless condition could have _____.

- A) duplicated all of the *Hox* genes in these flies' genomes
- B) resulted in paedomorphosis
- C) altered the expression of a *Hox* gene
- D) originated in another species

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 25.5

39) A genetic change that caused a certain *Hox* gene to be expressed along the tip of a vertebrate limb bud instead of farther back helped make possible the evolution of the tetrapod limb. This type of change is illustrative of _____.

- A) the influence of environment on development
- B) paedomorphosis
- C) a change in a developmental gene or its regulation that altered the spatial organization of body parts
- D) heterochrony

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 25.5

40) The duplication of homeotic (*Hox*) genes has been significant in the evolution of animals because it _____.

- A) permitted the evolution of novel forms
- B) caused the extinction of major groups
- C) reduced morphological diversity into simpler forms of life
- D) allowed animals to survive on significantly fewer calories

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.5

41) Why would gene duplication events, such as those seen in the *Hox* gene complex, set the stage for adaptive radiation?

- A) There are more copies of genes, meaning speciation had occurred by polyploidy.
- B) The original gene copy is the outgroup, and the new gene copies are the adaptive radiation.
- C) Without duplicated genes, species would be vulnerable to extinction.
- D) One copy of a gene can perform the original function, while other copies are available to take on new functions.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 25.5

42) A swim bladder is a gas-filled sac that helps fish maintain buoyancy. The evolution of the swim bladder from lungs of an ancestral fish is an example of _____.

- A) exaptation
- B) changes in *Hox* gene expression
- C) paedomorphosis
- D) adaptive radiation

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 25.5

43) Which of the following is a limit of evolution that results in exaptations?

- A) Natural selection and sexual selection can work at cross purposes to each other.
- B) Evolution is limited by historical constraints.
- C) Adaptations are often compromises.
- D) Chance events affect the evolutionary history of populations in environments that can change unpredictably.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 25.5

44) Insect wings may have begun to evolve as lateral extensions of the body that were used as heat dissipaters for thermoregulation. When they had become sufficiently large, these extensions became useful for gliding through the air. Additional selection refined them as flight-producing wings. If this hypothesis is correct, modern insect wings would be an example of _____.

- A) the loss of *Hox* genes in the evolution of new form
- B) mutations
- C) an exaptation
- D) an adaptive radiation

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 25.5

45) If one organ is an exaptation of another organ, then these two organs _____.

- A) are homologous
- B) are undergoing convergent evolution
- C) are found in the same species
- D) have the same function

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.5

46) Many species of snakes lay eggs. However, in the forests of northern Minnesota, where growing seasons are short, only live-bearing snake species are present. This trend toward species that have live births in a particular environment is an example of _____.

- A) an exaptation
- B) sexual selection
- C) species selection
- D) goal direction in evolution

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 25.6

47) The existence of evolutionary trends, such as increasing body sizes among horse species, is evidence that _____.

- A) a larger volume-to-surface area ratio is adaptive in many mammals
- B) evolution generally progresses toward some goal
- C) evolution tends toward increased complexity or increased size
- D) in particular environments, similar adaptations can be beneficial to more than one species

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.5

48) The following question is based on the observation that several dozen different proteins comprise the prokaryotic flagellum and its attachment to the prokaryotic cell, producing a highly complex structure.

If the complex protein assemblage of the prokaryotic flagellum arose by the same general processes as those of the complex eyes of molluscs (such as squids and octopi), then _____.
A) natural selection cannot account for the rise of the prokaryotic flagellum
B) ancestral versions of this protein assemblage were either less functional or had different functions than modern prokaryotic flagella
C) neither eyes nor flagella could have arisen by evolution because both are too complex to have evolved
D) the need for more complex structure must have driven evolution

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 25.5

49) The following question is based on the observation that several dozen different proteins comprise the prokaryotic flagellum and its attachment to the prokaryotic cell, producing a highly complex structure.

Certain proteins of the complex motor that drives bacterial flagella are modified versions of proteins that had previously belonged to plasma membrane pumps. This evidence supports the claim that _____.

A) natural selection produces organs that will be needed in future environments
B) the motors of bacterial flagella must have originated in other organisms
C) natural selection can produce new structures by coupling together parts of other structures
D) bacteria that possess flagella must have lost the ability to pump certain chemicals across their plasma membranes

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 25.5

50) The following question refers to this hypothetical situation.

A female fly, full of fertilized eggs, is swept by high winds to an island far out to sea. She is the first fly to arrive on this island and the only fly to arrive in this way. Thousands of years later, her numerous offspring occupy the island, but none of them resembles her. There are, instead, several species, each of which eats only a certain type of food. None of the species can fly and their balancing organs (halteres) are now used in courtship displays. The male members of each species bear modified halteres that are unique in appearance to their species. Females bear vestigial halteres. The ranges of all of the daughter species overlap.

Which of these fly organs, as they exist in the description, best illustrates an exaptation?

- A) the vestigial halteres
- B) the halteres
- C) the mouthparts
- D) the eggs

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 25.6

51) One hypothesis that has been proposed regarding the origin of life suggests that life evolved from an "RNA world" to today's "DNA world." Considering the properties of RNA and DNA molecules, which questions would direct an investigation of the most insightful test of this hypothesis?

- A) Is it likely that RNA molecules functioned as ribozymes to synthesize DNA from amino acids, and that this role was reversed when DNA became the information source?
- B) Is it likely that simple, yet stable RNA molecules served as a primitive precursor to a less stable DNA molecule that was more capable of storing more information?
- C) Could RNA have provided a template for DNA assembly, thereby enabling a more stable molecule that is replicated more accurately?
- D) Since ribozymes could freely enter and leave the vesicles, could these molecules have brought external DNA into the cell as a less stable, but more reliable storage molecule of double-stranded DNA?

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 25.1

52) Endosymbiosis is an evolutionary theory that explains the origin of eukaryotes and suggests a specific order in which this might have occurred. Ancestral cells engulfed and then began to use the metabolic processes of the smaller cells. Based on shared-core processes and features, which statement most accurately describes the order, the theory, and the evolutionary implications for all organisms within domain Eukarya?

- A) Ancestral heterotrophic eukaryotes most likely engulfed both a heterotrophic and an autotrophic prokaryote, whereas ancestral photosynthetic eukaryotes probably provided the host cell for the first mitochondria. Over time, natural selection favored these relationships, and these cells became ancestors of all eukaryotes.
- B) All ancestral eukaryotes would have most likely consumed a nucleus-like prokaryote that eventually became the eukaryotic nucleus. These new eukaryotic cells would have had an advantage over prokaryotic cells by acquiring a nuclear command center for regulating cellular activities.
- C) As carbon dioxide levels were increasing over time, natural selection would have favored organisms that acquired a photosynthetic prokaryote to convert carbon dioxide into sugars. These would have likely been the first eukaryotic cells. These ancestral cells engulfed mitochondria-like prokaryotes, which would have provided an even greater advantage for cells in this environment.
- D) As Earth was becoming more aerobic, mitochondria would have provided an advantage to host cells by converting "toxic" oxygen into energy for heterotrophic cells. Since mitochondria are found in all eukaryotes, these combinations likely evolved first. Photosynthetic eukaryotes probably acquired an autotrophic prokaryote, which developed an advantageous symbiotic relationship with the host cell.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 25.3

25.2 Student Edition End-of-Chapter Questions

- 1) Fossilized stromatolites
- A) formed around deep-sea vents.
 - B) resemble structures formed by bacterial communities that are found today in some shallow marine bays.
 - C) provide evidence that plants moved onto land in the company of fungi around 500 million years ago.
 - D) contain the first undisputed fossils of eukaryotes.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 2) The oxygen revolution changed Earth's environment dramatically. Which of the following took advantage of the presence of free oxygen in the oceans and atmosphere?
- A) the evolution of cellular respiration, which used oxygen to help harvest energy from organic molecules
 - B) the persistence of some animal groups in anaerobic habitats
 - C) the evolution of photosynthetic pigments that protected early algae from the corrosive effects of oxygen
 - D) the evolution of chloroplasts after early protists incorporated photosynthetic cyanobacteria

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 3) Which factor most likely caused animals and plants in India to differ greatly from species in nearby southeast Asia?
- A) The species became separated by convergent evolution.
 - B) The climates of the two regions are similar.
 - C) India is in the process of separating from the rest of Asia.
 - D) India was a separate continent until 45 million years ago.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Adaptive radiations can be a direct consequence of three of the following four factors. Select the exception.
- A) vacant ecological niches
 - B) genetic drift
 - C) colonization of an isolated region that contains suitable habitat and few competitor species
 - D) evolutionary innovation

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

5) Which of the following steps has *not* yet been accomplished by scientists studying the origin of life?

- A) synthesis of small RNA polymers by ribozymes
- B) formation of molecular aggregates with selectively permeable membranes
- C) formation of protocells that use DNA to direct the polymerization of amino acids
- D) abiotic synthesis of organic molecules

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

6) A genetic change that caused a certain *Hox* gene to be expressed along the tip of a vertebrate limb bud instead of farther back helped make possible the evolution of the tetrapod limb. This type of change is illustrative of

- A) the influence of environment on development.
- B) paedomorphosis.
- C) a change in a developmental gene or in its regulation that altered the spatial organization of body parts.
- D) heterochrony.

Answer: C

Bloom's Taxonomy: Application/Analysis

7) A swim bladder is a gas-filled sac that helps fish maintain buoyancy. The evolution of the swim bladder from the air-breathing organ (a simple lung) of an ancestral fish is an example of

- A) exaptation.
- B) changes in *Hox* gene expression.
- C) paedomorphosis.
- D) adaptive radiation.

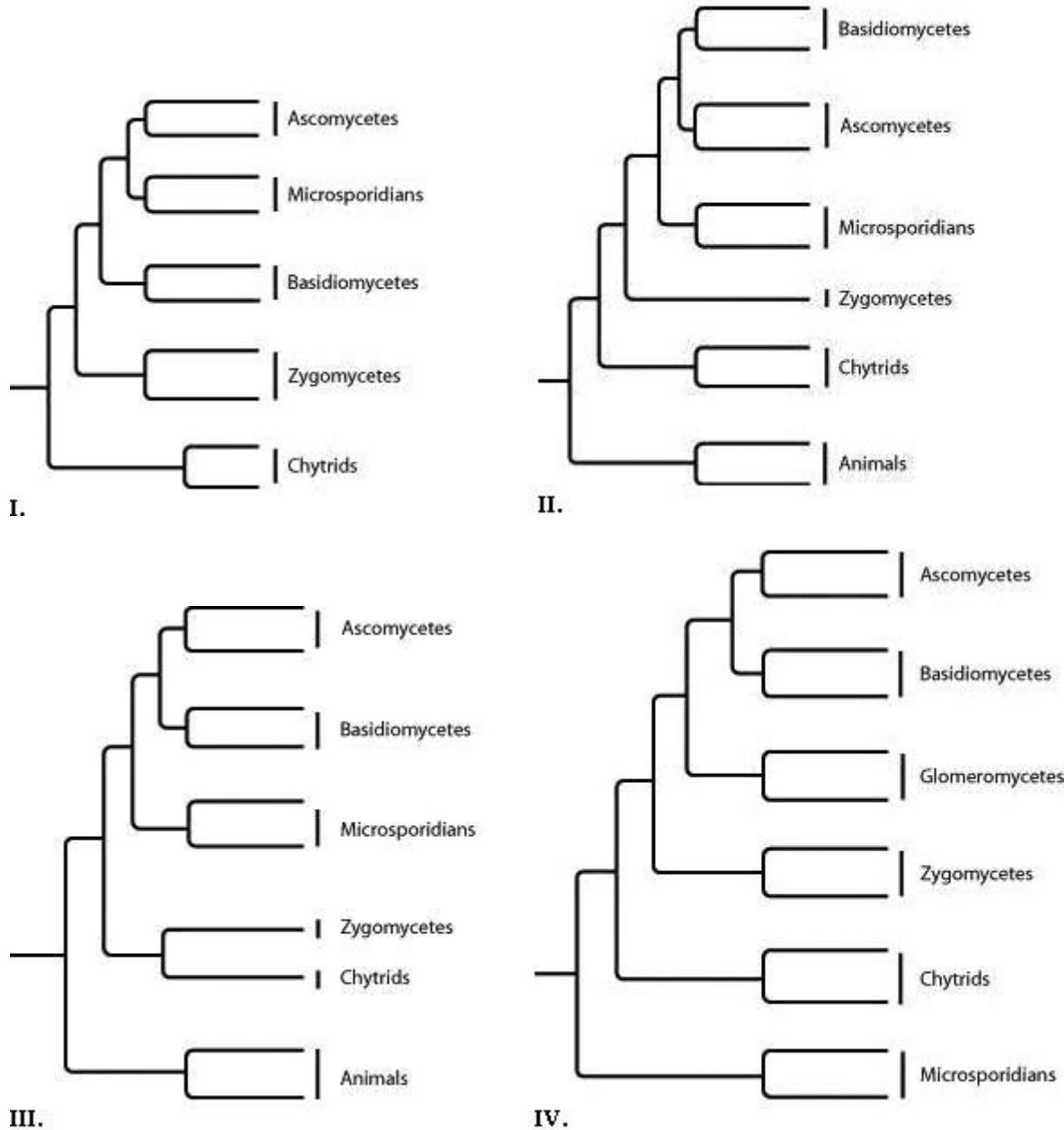
Answer: A

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 26 Phylogeny and the Tree of Life

26.1 Multiple-Choice Questions

1) The following question refers to the following phylogenetic trees.



Which tree depicts the microsporidians as a sister group of the ascomycetes?

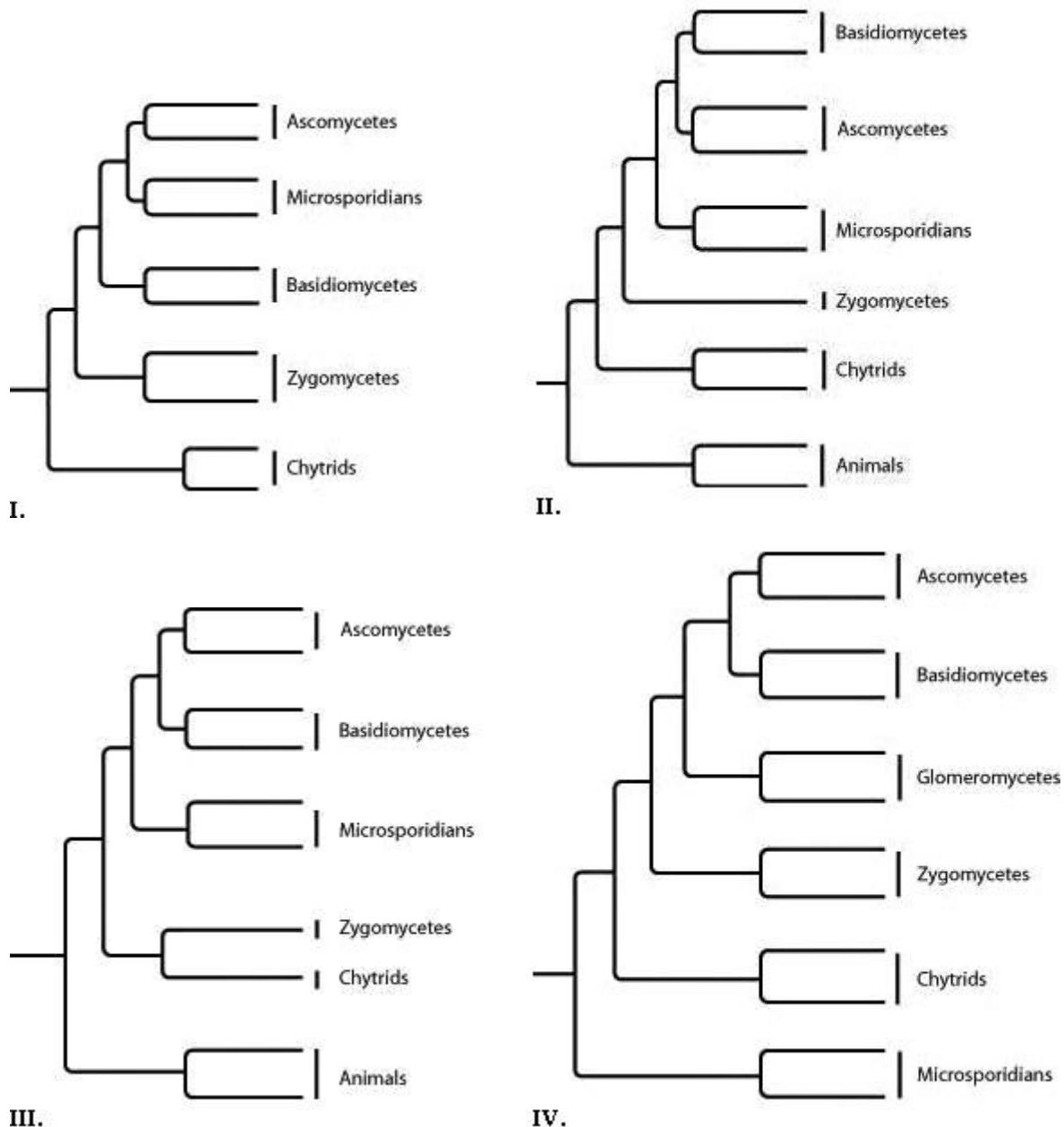
- A) I
- B) II
- C) III
- D) IV

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 26.1

2) The following question refers to the following phylogenetic trees.



Which tree depicts the closest relationship between zygomycetes and chytrids?

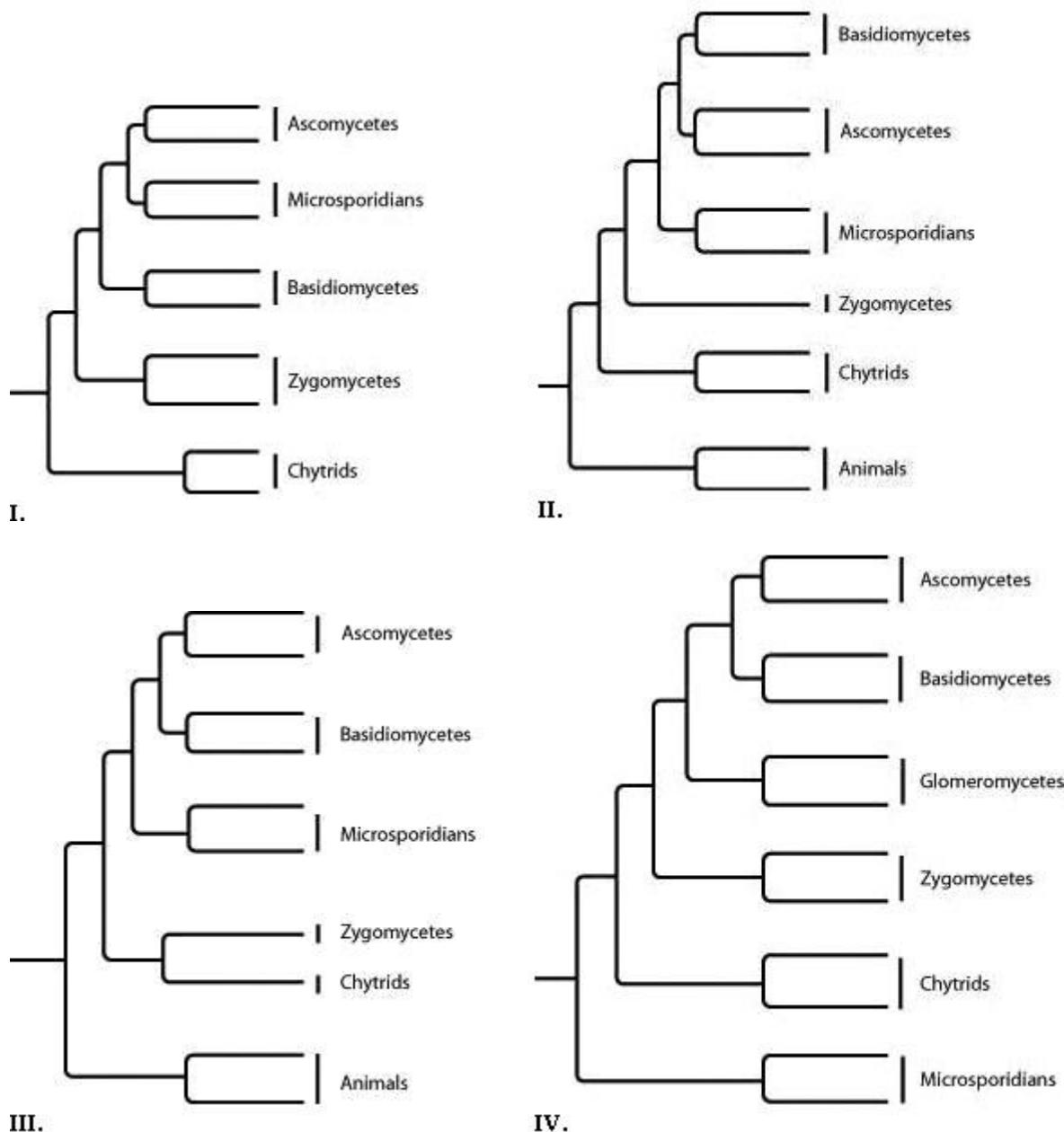
- A) I
- B) II
- C) III
- D) IV

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 26.1

3) The following question refers to the following phylogenetic trees.



Which tree shows the greatest evolutionary distance between chytrids and ascomycetes?

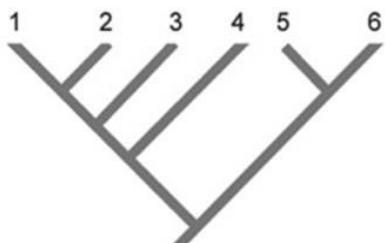
- A) I
- B) II
- C) III
- D) IV

Answer: A

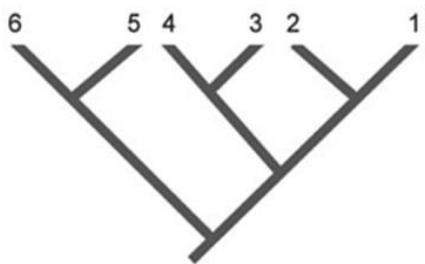
Bloom's Taxonomy: Application/Analysis

Section: 26.1

4)



Tree 1



Tree 2

In the phylogenetic trees, numbers represent species, and the same species are shown in both trees. Which two species are represented as sister species in Tree 2 but are not shown as sister species in Tree 1?

- A) 1 and 2
- B) 2 and 3
- C) 3 and 4
- D) 4 and 5

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 26.1

5) The legless condition that is observed in several groups of extant reptiles is the result of _____.

- A) their common ancestor having been legless
- B) a shared adaptation to an arboreal (living in trees) lifestyle
- C) several instances of the legless condition arising independently of each other
- D) individual lizards adapting to a fossorial (living in burrows) lifestyle during their lifetimes

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.1

6) The various taxonomic levels (for example, phyla, genera, classes) of the hierarchical classification system differ from each other on the basis of _____.
A) how widely the organisms assigned to each are distributed throughout the environment
B) their inclusiveness

- C) the relative genome sizes of the organisms assigned to each
D) morphological characters that are applicable to all organisms

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.1

7) If organisms A, B, and C belong to the same class but to different orders and if organisms C, D, and E belong to the same order but to different families, which of the following pairs of organisms would be expected to show the greatest degree of structural homology?

- A) A and D
B) B and D
C) B and C
D) D and E

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 26.2

8) Carolus Linnaeus believed that species remained fixed in the form in which they had been created. Linnaeus would have been uncomfortable with _____.
A) a hierarchical classification scheme

- B) taxonomy
C) phylogenies
D) nested, increasingly inclusive categories of organisms

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 26.1

9) The best classification system is that which most closely _____.
A) unites organisms that possess similar morphologies

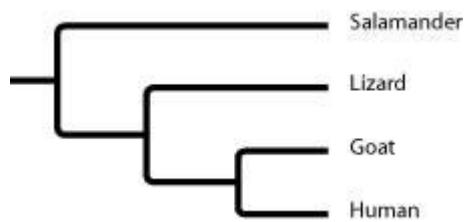
- B) conforms to traditional, Linnaean taxonomic practices
C) reflects evolutionary history
D) reflects the basic separation of prokaryotes from eukaryotes

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.1

10) Based on this tree, which statement is correct?



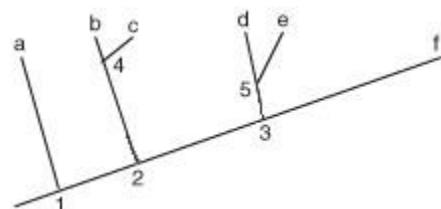
- A) The human lineage is a basal taxon.
- B) Salamanders are a sister group to the group containing lizards, goats, and humans.
- C) Salamanders are as closely related to lizards as to humans.
- D) Goats are more closely related to salamanders than to humans.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 26.1

11) The following phylogeny shows six living species (a-f) and five ancestral (now extinct) species (#1-5). If the phylogeny had been developed on the basis of similarities in bone structure, which of the following predictions would you make in terms of the structure of a particular enzyme?



- A) The enzymes of species b and f are very similar.
- B) The enzymes of species b and c are more similar to ancestor #4 than to ancestor 2
- C) The enzymes of species a and b are the same as that of ancestor #2.
- D) The enzyme of species c is very similar to that of species d.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 26.1

12) Some beetles and flies have antler-like structures on their heads, much like male deer. The existence of antlers in beetle, fly, and deer species with strong male-male competition is an example of _____.

- A) convergent evolution
- B) similarity due to shared ancestry
- C) homology
- D) parsimony

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.2

13) The term *convergent evolution* is most applicable to which of the following features?

- A) the legless condition found in various lineages of extant lizards
- B) the five-digit condition of human hands and bat wings
- C) the fur that covers Australian moles and North American moles
- D) the bones of bat forelimbs and the bones of bird forelimbs

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.2

14) If, someday, an archaeal cell is discovered whose rRNA sequence is more similar to that of humans than the sequence of mouse rRNA is to that of humans, the best explanation for this apparent discrepancy would be _____.

- A) homology
- B) convergent evolution
- C) common ancestry
- D) retro-evolution by humans

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 26.2

15) Which of the following pairs are the best examples of homologous structures?

- A) eyelessness in the Australian mole and eyelessness in the North American mole
- B) owl wing and hornet wing
- C) bat wing and bird wing
- D) bones in the bat wing and bones in the human forelimb

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.2

16) Some molecular data place the giant panda in the bear family (Ursidae) but place the lesser panda in the raccoon family (Procyonidae). If the molecular data best reflect the evolutionary history of these two groups, then the morphological similarities of these two species is most likely due to _____.

- A) the inheritance of acquired characteristics
- B) sexual selection
- C) possession of analogous (convergent) traits
- D) possession of shared primitive characters

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.2

17) The importance of computers and of computer software to modern systematics is most closely linked to advances in _____.

- A) light microscopy
- B) radiometric dating
- C) fossil discovery techniques
- D) molecular genetics

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.2

18) The common ancestors of birds and mammals were very early (stem) reptiles, which almost certainly possessed three-chambered hearts (two atria, one ventricle). Birds and mammals, however, are alike in having four-chambered hearts (two atria, two ventricles). The four-chambered hearts of birds and mammals are best described as _____.

- A) structural homologies
- B) vestiges
- C) structural analogies
- D) the result of shared ancestry

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 26.2

19) Imagine that a phylogeny was developed for a group of mammals based on bone structure. Which of the following statements would be a reasonable prediction about a phylogeny for the same group of species based on similarities and differences in the structure of a particular enzyme?

- A) The same phylogeny would be unlikely.
- B) The same phylogeny would be predicted.
- C) No prediction could be made.
- D) The amino acid sequence would be identical in all species.

Answer: A

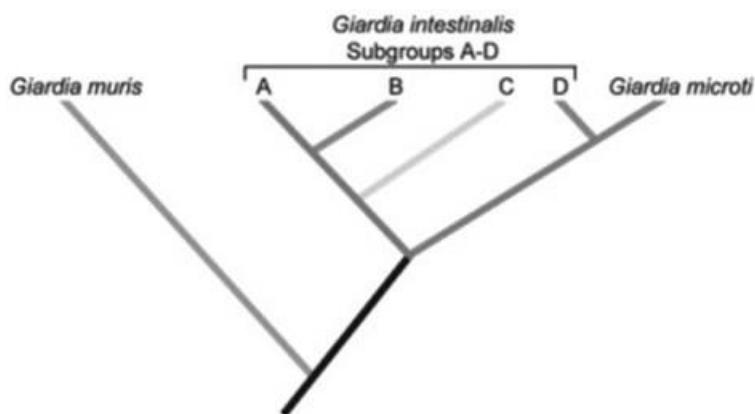
Bloom's Taxonomy: Synthesis/Evaluation

Section: 26.2

20) Use the following information to answer the question.

Giardia intestinalis can cause disease in several different mammalian species, including humans. *Giardia* organisms (*G. intestinalis*) that infect humans are similar morphologically to those that infect other mammals, thus they have been considered a single species. However, *G. intestinalis* has been divided into different subgroups based on their host and a few other characteristics.

In 1999, a DNA sequence comparison study tested the hypothesis that these subgroups actually constitute different species. The following phylogenetic tree was constructed from the sequence comparison of rRNA from several subgroups of *G. intestinalis* and a few other morphologically distinct species of *Giardia*. The researchers concluded that the subgroups of *Giardia* are sufficiently different from one another genetically that they could be considered different species. (T. Monis, et al. 1999. Molecular systematics of the parasitic protozoan *Giardia intestinalis*. *Mol. Biol. Evol.* 16[9]:1135-44.)



According to the phylogenetic tree in the figure above, *G. intestinalis* constitutes a _____ group.

- A) analytic
- B) monophyletic
- C) polyphyletic
- D) paraphyletic

Answer: D

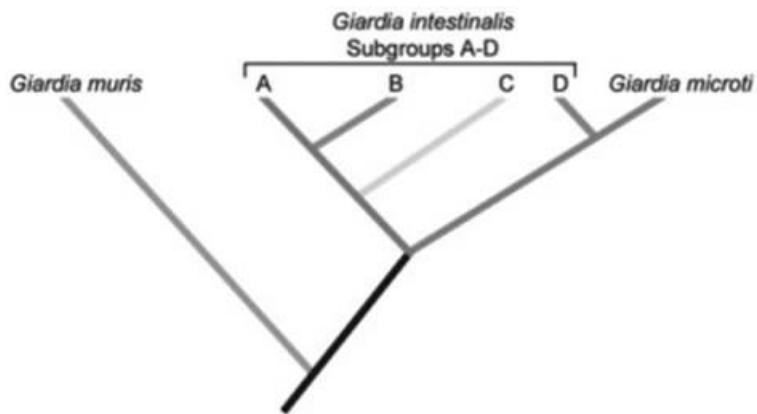
Bloom's Taxonomy: Application/Analysis

Section: 26.3

21) Use the following information to answer the question.

Giardia intestinalis can cause disease in several different mammalian species, including humans. *Giardia* organisms (*G. intestinalis*) that infect humans are similar morphologically to those that infect other mammals, thus they have been considered a single species. However, *G. intestinalis* has been divided into different subgroups based on their host and a few other characteristics.

In 1999, a DNA sequence comparison study tested the hypothesis that these subgroups actually constitute different species. The following phylogenetic tree was constructed from the sequence comparison of rRNA from several subgroups of *G. intestinalis* and a few other morphologically distinct species of *Giardia*. The researchers concluded that the subgroups of *Giardia* are sufficiently different from one another genetically that they could be considered different species. (T. Monis, et al. 1999. Molecular systematics of the parasitic protozoan *Giardia intestinalis*. *Mol. Biol. Evol.* 16[9]:1135-44.)



By examining the phylogenetic tree diagrammed in the figure above, what conclusion can you draw about the species *G. microti*?

- A) It evolved before *G. intestinalis*.
- B) It is more closely related to *G. muris* than to *G. intestinalis*.
- C) It should not be labeled a species distinct from *G. intestinalis*.
- D) It is part of a monophyletic group that also includes *G. intestinalis*.

Answer: D

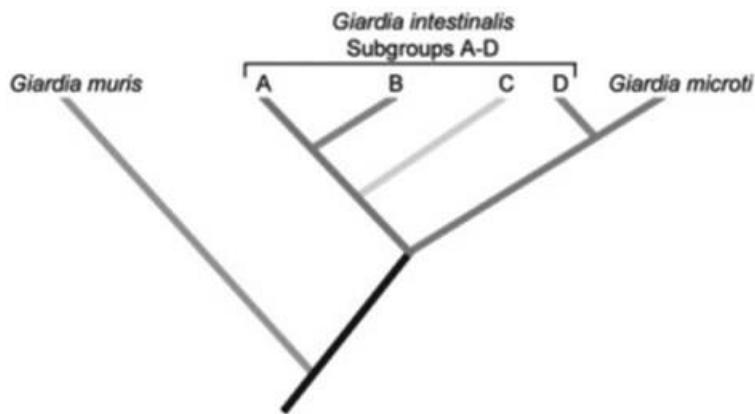
Bloom's Taxonomy: Application/Analysis

Section: 26.3

22) Use the following information to answer the question.

Giardia intestinalis can cause disease in several different mammalian species, including humans. *Giardia* organisms (*G. intestinalis*) that infect humans are similar morphologically to those that infect other mammals, thus they have been considered a single species. However, *G. intestinalis* has been divided into different subgroups based on their host and a few other characteristics.

In 1999, a DNA sequence comparison study tested the hypothesis that these subgroups actually constitute different species. The following phylogenetic tree was constructed from the sequence comparison of rRNA from several subgroups of *G. intestinalis* and a few other morphologically distinct species of *Giardia*. The researchers concluded that the subgroups of *Giardia* are sufficiently different from one another genetically that they could be considered different species. (T. Monis, et al. 1999. Molecular systematics of the parasitic protozoan *Giardia intestinalis*. *Mol. Biol. Evol.* 16[9]:1135-44.)



Which of the following changes would a modern systematist be most likely to make after learning of the results of the rRNA analyses?

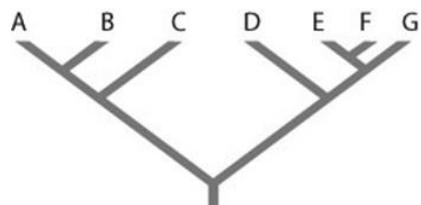
- A) continue to keep subgroups A-D as members of the species *G. intestinalis*
- B) break the species *G. intestinalis* into four separate species, A, B, C, and D
- C) combine subgroup D and *G. microti* into one species
- D) combine all the subgroups of *G. intestinalis* (A-D) and *G. microti* to make one species

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.3

23) Use the following information to answer the question.



Refer to the figure. Which of the following forms a monophyletic group?

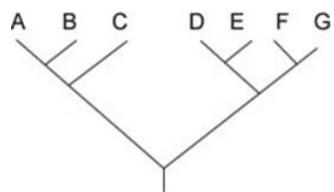
- A) A, B, C, D
- B) C and D
- C) D, E, and F
- D) E, F, and G

Answer: D

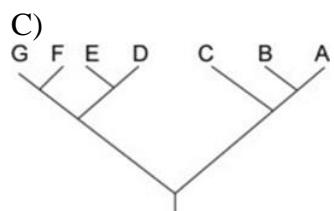
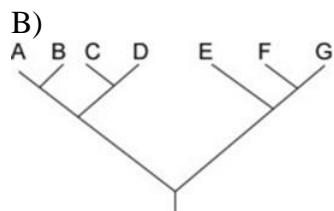
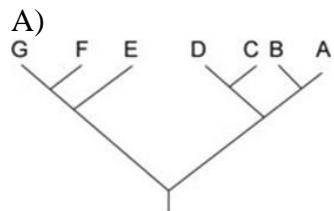
Bloom's Taxonomy: Application/Analysis

Section: 26.3

24) Use the following information to answer the question.



Which of the following trees, if any, depicts the same relationship among species as shown above?



Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 26.3

25) Which of the following would be most useful in creating a phylogenetic tree of a taxon?

- A) morphological data from fossil and living species
- B) a knowledge of color patterns in fossil and living species
- C) a knowledge of mutation rates in modern species
- D) morphological data from fossil species

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 26.3

26) Your professor wants you to construct a phylogenetic tree of orchids. She gives you tissue from seven orchid species and one lily. What is the most likely reason she gave you the lily?

- A) to serve as an outgroup
- B) to see if the lily is a cryptic orchid species
- C) to see if the lily and the orchids show all the same shared derived characters
- D) to demonstrate likely homoplasies

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 26.3

27) Which of the following statements best describes the rationale for applying the principle of maximum parsimony in constructing phylogenetic trees?

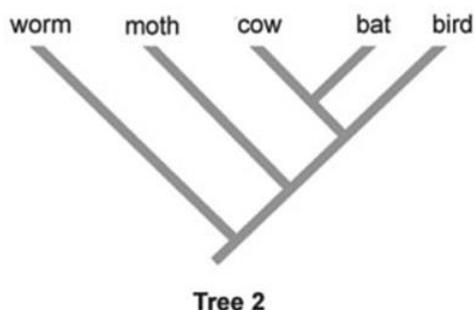
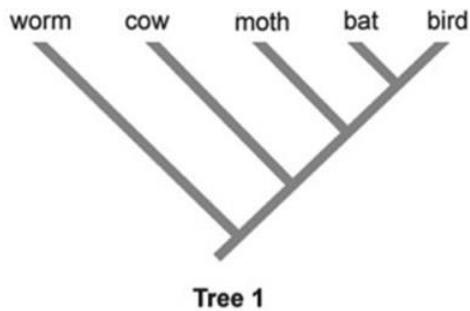
- A) Parsimony allows the researcher to "root" the tree.
- B) Similarity due to common ancestry should be more common than similarity due to convergent evolution.
- C) The molecular clock validates the principle of parsimony.
- D) The outgroup roots the tree, allowing the principle of parsimony to be applied.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 26.3

28) Use the following information to answer the question.



Applying the principle of parsimony to the trait "ability to fly," which of the two phylogenetic trees is better?

- A) Tree 1
- B) Tree 2
- C) Both trees are equally parsimonious.
- D) Since the trees show different evolutionary relationships, you cannot determine which is more parsimonious.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 26.3

29) Which of the following statements is accurate with regard to a phylogeny, as represented by a phylogenetic tree?

- A) Descendant groups (branches) from the same node likely share many derived characters.
- B) A monophyletic group can be properly based on convergent features.
- C) The ancestral group often has all the derived characters of the descendant species.
- D) Shared ancestral characters are excellent traits to use in developing a phylogeny.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 26.3

30) Given that phylogenies are based on shared derived characteristics, which of the following traits is useful in generating a phylogeny of species W, X, Y, and Z?

	Species W	Species X	Species Y	Species Z
Trait 1	A	A	A	A
Trait 2	A	A	B	B
Trait 3	A	B	C	D

- A) Trait 1
- B) Trait 2
- C) Trait 3
- D) Traits 1, 2, and 3

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 26.3

31) Which of the following is (are) problematic when the goal is to construct phylogenies that accurately reflect evolutionary history?

- A) polyphyletic taxa
- B) paraphyletic taxa
- C) monophyletic taxa
- D) polyphyletic taxa and paraphyletic taxa

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.3

32) Phylogenetic trees constructed from evidence from molecular systematics are based on similarities in _____.

- A) morphology
- B) the pattern of embryological development
- C) biochemical pathways
- D) mutations to homologous genes

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.2

33) There is some evidence that reptiles called cynodonts may have had whisker-like hairs around their mouths. If true, then hair is a shared _____.

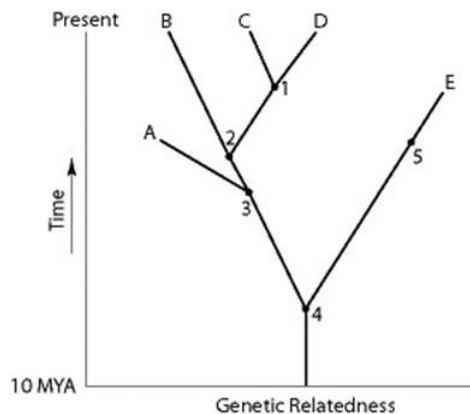
- A) derived character of mammals, even if cynodonts continue to be classified as reptiles
- B) derived character of all vertebrates and not of the mammal clade
- C) ancestral character of the all vertebrates, but only if cynodonts are reclassified as mammals
- D) derived character of mammals, but only if cynodonts are reclassified as mammals

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 26.3

34) Use the figure to answer the following question.



Which *extinct* species should be the best candidate to serve as the outgroup for the clade whose common ancestor occurs at position 2 in the figure?

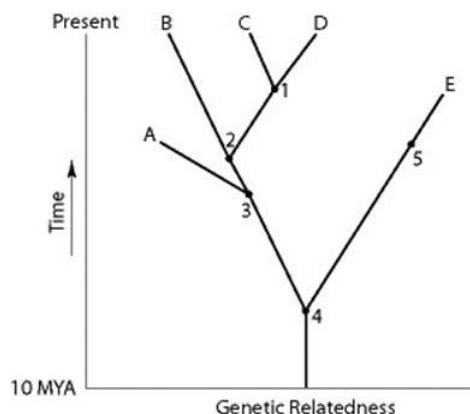
- A) A
- B) B
- C) C
- D) E

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 26.3

35) Use the figure to answer the following question.



If the figure above is an accurate depiction of relatedness, then which of the following should be an accurate statement?

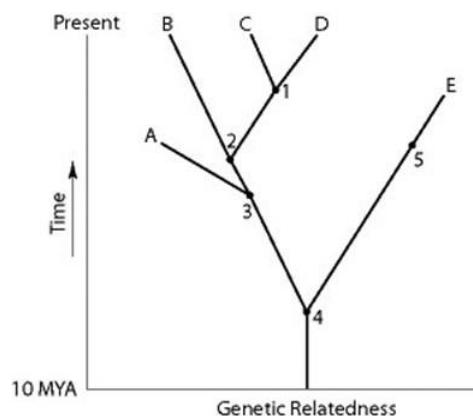
- A) The entire tree is based on minimum parsimony.
- B) If all species depicted here make up a taxon, this taxon is paraphyletic.
- C) The last common ancestor of species B and C occurred more recently than the last common ancestor of species D and E.
- D) Species A is the direct ancestor of both species B and species C.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 26.3

36) Use the figure to answer the following question.



If the figure is an accurate depiction of relatedness, then which of the following should be an accurate statement?

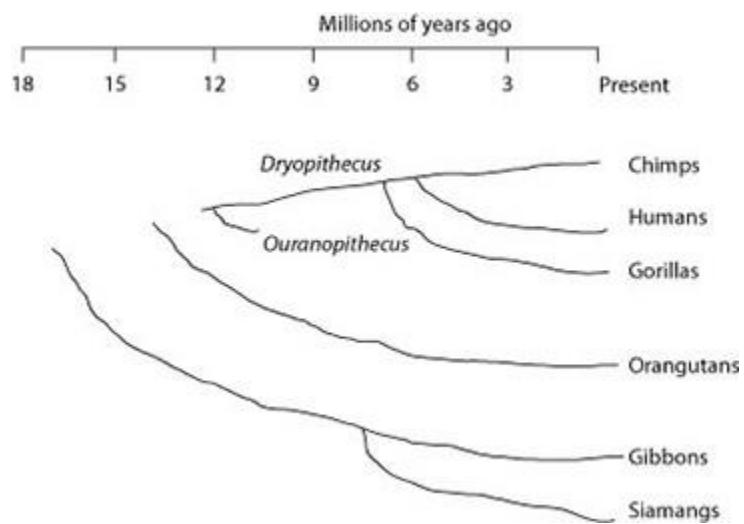
- A) If all species depicted here make up a taxon, this taxon is monophyletic.
- B) The species present at position 4 is ancestral to species E, but not species D.
- C) Species C is more closely related to species B than D is to B
- D) The species present at position 3 is ancestral to C, D, and E.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 26.3

37) Use the following figure and description to answer the question.



Humans, chimpanzees, gorillas, and orangutans are members of a clade called the great apes, which shared a common ancestor about 15 million years ago. Gibbons and siamangs comprise a clade called the lesser apes. Tree-branch lengths indicate elapsed time.

Assuming chimps and gorillas are humans' closest relatives, removing humans from the great ape clade and placing them in a different clade has the effect of making the phylogenetic tree of the great apes _____.

- A) polyphyletic
- B) paraphyletic
- C) monophyletic
- D) into a new order

Answer: B

Bloom's Taxonomy: Application/Analysis

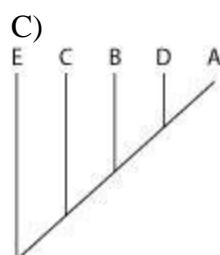
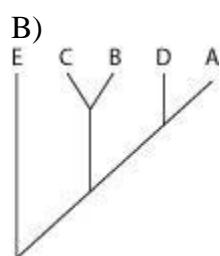
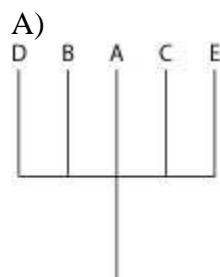
Section: 26.3

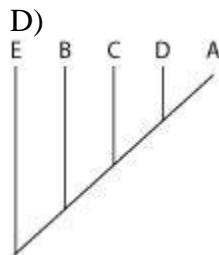
38) The question refers to the following table, which compares the percent sequence homology of four different parts (two introns and two exons) of a gene that is found in five different eukaryotic species. Each part is numbered to indicate its distance from the promoter (for example, Intron I is the one closest to the promoter). The data reported for species A were obtained by comparing DNA from one member of species A to another member of species A.

% Sequence Homology

Species	Intron I	Exon I	Intron VI	Exon V
A	100%	100%	100%	100%
B	98%	99%	82%	96%
C	98%	99%	89%	96%
D	99%	99%	92%	97%
E	98%	99%	80%	94%

Based on the tabular data, and assuming that time advances vertically, which phylogenetic tree is the most likely depiction of the evolutionary relationships among these five species?





Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 26.3

39) The question refers to the following table, which compares the percent sequence homology of four different parts (two introns and two exons) of a gene that is found in five different eukaryotic species. Each part is numbered to indicate its distance from the promoter (for example, Intron I is the one closest to the promoter). The data reported for species A were obtained by comparing DNA from one member of species A to another member of species A.

% Sequence Homology

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D	99%	99%	92%	97%
E	98%	99%	80%	94%

Regarding these sequence homology data, the principle of maximum parsimony would be applicable in _____.

- A) distinguishing introns from exons
- B) determining degree of sequence homology
- C) selecting appropriate genes for comparison among species
- D) inferring evolutionary relatedness from the number of sequence differences

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 26.3

40) In a comparison of birds and mammals, having four limbs is _____.

- A) a shared ancestral character
- B) a shared derived character
- C) a character useful for distinguishing birds from mammals
- D) an example of analogy rather than homology

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.3

41) To apply the principle of maximum parsimony to construction of a phylogenetic tree,

- _____.
- A) choose the tree that assumes all evolutionary changes are equally probable
 - B) choose the tree in which the branch points are based on as many shared derived characters as possible
 - C) choose the tree that represents the fewest evolutionary changes, either in DNA sequences or morphology
 - D) choose the tree with the fewest branch points

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.3

42) If you were using cladistics to build a phylogenetic tree of cats, which of the following would be the best outgroup?

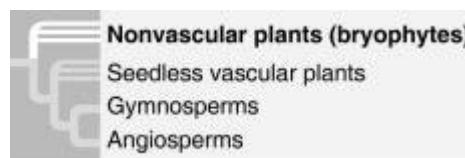
- A) lion
- B) domestic cat
- C) wolf
- D) leopard

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 26.3

43) Use the figure to answer the following question.



The phylogenetic tree shown _____.

- A) depicts uncertainty about whether the bryophytes or the vascular plants evolved first
- B) depicts an evolutionary hypothesis
- C) includes evolution of convergent characteristics
- D) indicates that seeds are a shared ancestral character of all vascular plants

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 26.3

44) Concerning growth in genome size over evolutionary time, which of these is *least* associated with the others?

- A) orthologous genes
- B) gene duplications
- C) paralogous genes
- D) gene families

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.4

45) Eukaryotes that are not closely related and that do not share many anatomical similarities can still be placed together on the same phylogenetic tree by comparing their _____.

- A) plasmids
- B) mitochondrial genomes
- C) homologous genes that are poorly conserved
- D) homologous genes that are highly conserved

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 26.4

46) A phylogenetic tree constructed using sequence differences in mitochondrial DNA would be most valid for discerning the evolutionary relatedness of _____.

- A) archaeans and bacteria
- B) fungi and animals
- C) chimpanzees and humans
- D) sharks and dolphins

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 26.4

47) The lakes of northern Minnesota are home to many similar species of damselflies of the genus *Enallagma*. These species have apparently undergone speciation from ancestral stock since the last glacial retreat about 10 thousand years ago. Sequencing which of the following would probably be most useful in sorting out evolutionary relationships among these closely related species?

- A) conserved regions of nuclear DNA
- B) mitochondrial DNA
- C) amino acids in proteins
- D) ribosomal RNA

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 26.4

48) Which statement represents the best explanation for the observation that the nuclear DNA of wolves and domestic dogs has a very high degree of sequence homology? Dogs and wolves _____.

- A) have very similar morphologies
- B) belong to the same order
- C) are both members of the order Carnivora
- D) share a very recent common ancestor

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

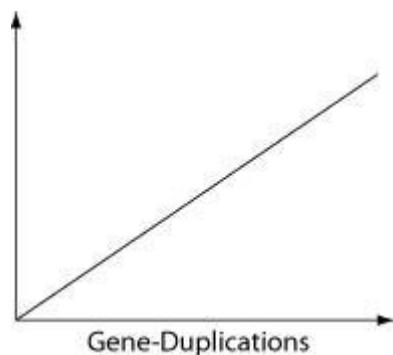
Section: 26.4

- 49) The reason that paralogous genes can diverge from each other within the same gene pool, whereas orthologous genes diverge only after gene pools are isolated from each other, is that _____.
- A) having multiple copies of genes is essential for the occurrence of sympatric speciation in the wild
 - B) paralogous genes can occur only in diploid species, thus they are absent from most prokaryotes
 - C) polyploidy is a necessary precondition for the occurrence of sympatric speciation in the wild
 - D) having an extra copy of a gene permits modifications to the copy without loss of the original gene product

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension
Section: 26.4

- 50) Which of the following items is *most* likely to form a simple linear relationship with the number of gene-duplication events, when placed as the label on the vertical axis of the following graph?



- A) number of mitochondria
- B) number of cells/organism
- C) genome size
- D) phenotypic complexity

Answer: C

Bloom's Taxonomy: Application/Analysis
Section: 26.4

- 51) The most important feature that permits a gene to act as a molecular clock is _____.
A) a large number of base pairs
B) being acted upon by natural selection
C) a reliable average rate of mutation
D) a recent origin by a gene-duplication event

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension
Section: 26.5

52) Molecular clocks are more reliable when _____.

- A) the surrounding pH is close to 7.0
- B) most mutations of highly conserved DNA sequences should have no functional effect
- C) the DNA codes for amino acid sequences whose side groups (or R groups) have a neutral pH
- D) a significant proportion of mutations are not acted upon by natural selection

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.5

53) Which of the following would, if it had acted upon a gene, prevent this gene from acting as a reliable molecular clock?

- A) neutral mutations
- B) genetic drift
- C) mutations within introns
- D) natural selection

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.5

54) The question refers to the following table, which compares the percent sequence homology of four different parts (two introns and two exons) of a gene that is found in five different eukaryotic species. Each part is numbered to indicate its distance from the promoter (for example, Intron I is the one closest to the promoter). The data reported for species A were obtained by comparing DNA from one member of species A to another member of species A.

% Sequence Homology

Species	Intron I	Exon I	Intron VI	Exon V
A	100%	100%	100%	100%
B	98%	99%	82%	96%
C	98%	99%	89%	96%
D	99%	99%	92%	97%
E	98%	99%	80%	94%

Which of these four gene parts should allow the construction of the most accurate phylogenetic tree, assuming that this is the only part of the gene that has acted as a reliable molecular clock?

- A) Intron I
- B) Exon I
- C) Intron VI
- D) Exon V

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 26.5

55) Based on cladistics, which eukaryotic kingdom is polyphyletic and, therefore, unacceptable?

- A) Plantae
- B) Fungi
- C) Animalia
- D) Protista

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.6

56) Which eukaryotic kingdom includes members that are the result of endosymbioses that included an ancient aerobic bacterium and an ancient cyanobacterium?

- A) Plantae
- B) Fungi
- C) Animalia
- D) Protista

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 26.6

57) A large proportion of archaeans are *extremophiles*, so called because they inhabit extreme environments with high acidity, salinity, and/or temperature. Such environments are thought to have been much more common on primitive Earth. Thus, modern extremophiles survive only in places that their ancestors became adapted to long ago. Which of the following is, consequently, a valid statement about modern extremophiles, assuming that their habitats have remained relatively unchanged?

- A) Among themselves, they should share relatively few ancestral traits, especially those that enabled ancestral forms to adapt to extreme conditions.
- B) On a phylogenetic tree whose branch lengths are proportional to the amount of genetic change, the branches of the extremophiles should be shorter than the non-extremophilic archaeans.
- C) They should contain genes that originated in eukaryotes that are the hosts for numerous species of bacteria.
- D) They should currently be undergoing a high level of horizontal gene transfer with non-extremophilic archaeans.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 26.6

58) Use the following information to answer the question.

Paulinella chromatophora is one of the few cercozoans that is autotrophic, carrying out aerobic photosynthesis with its two elongated "chromatophores." The chromatophores are contained within vesicles of the host cell, and each is derived from a cyanobacterium, though not the same type of cyanobacterium that gave rise to the chloroplasts of algae and plants.

A crucial photosynthetic gene of the cyanobacterium that gave rise to the chromatophore is called *psaE*. This gene is present in the nuclear genome of the cercozoan, but is not in the genome of the chromatophore. This is evidence of _____.

- A) reciprocal mutations in the chromatophore and nuclear genomes
- B) horizontal gene transfer from bacterium to eukaryotes
- C) genetic recombination involving a protist and an archaean
- D) transduction by a phage that infects both prokaryotes and eukaryotes

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 26.6

59) What kind of evidence has recently made it necessary to assign the prokaryotes to either of two different domains, rather than assigning all prokaryotes to the same kingdom?

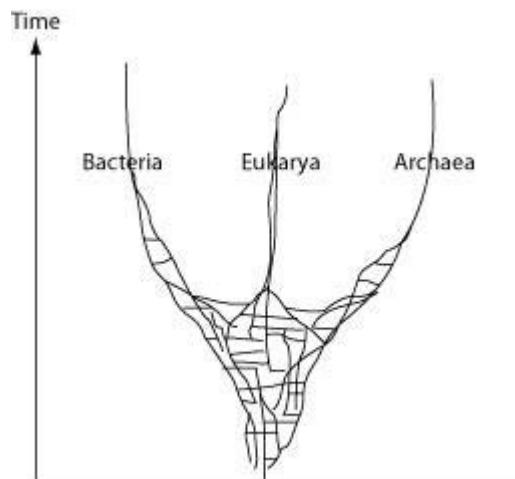
- A) mtDNA
- B) rRNA genes
- C) morphological
- D) ecological

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.6

60) The following question refers to this phylogenetic tree, depicting the origins of life and the three domains. Horizontal lines indicate instances of gene or genome transfer.



A possible phylogenetic tree for the three domains of life.

If the early history of life on Earth is accurately depicted by the figure, then which statement is most in agreement with the hypothesis proposed by this tree?

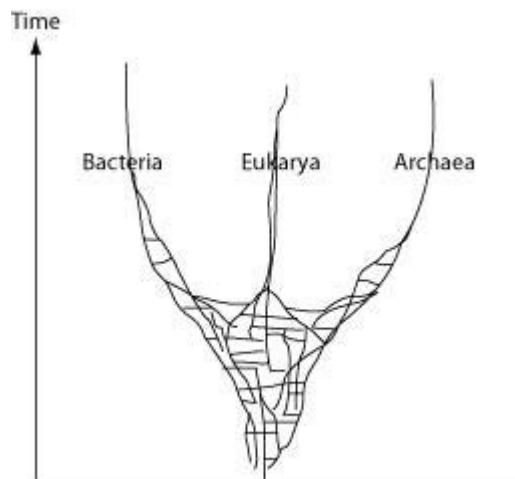
- A) The last universal common ancestor of all extant species is one individual species.
- B) The origin of the three domains appears as a polytomy.
- C) Archaean genomes should not contain genes that originated in bacteria, and vice versa.
- D) Eukaryotes are more closely related to archaeans than to bacteria.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 26.6

61) The following question refers to this phylogenetic tree, depicting the origins of life and the three domains. Horizontal lines indicate instances of gene or genome transfer.



A possible phylogenetic tree for the three domains of life.

Which of these processes can be included among those responsible for the horizontal components of the figure?

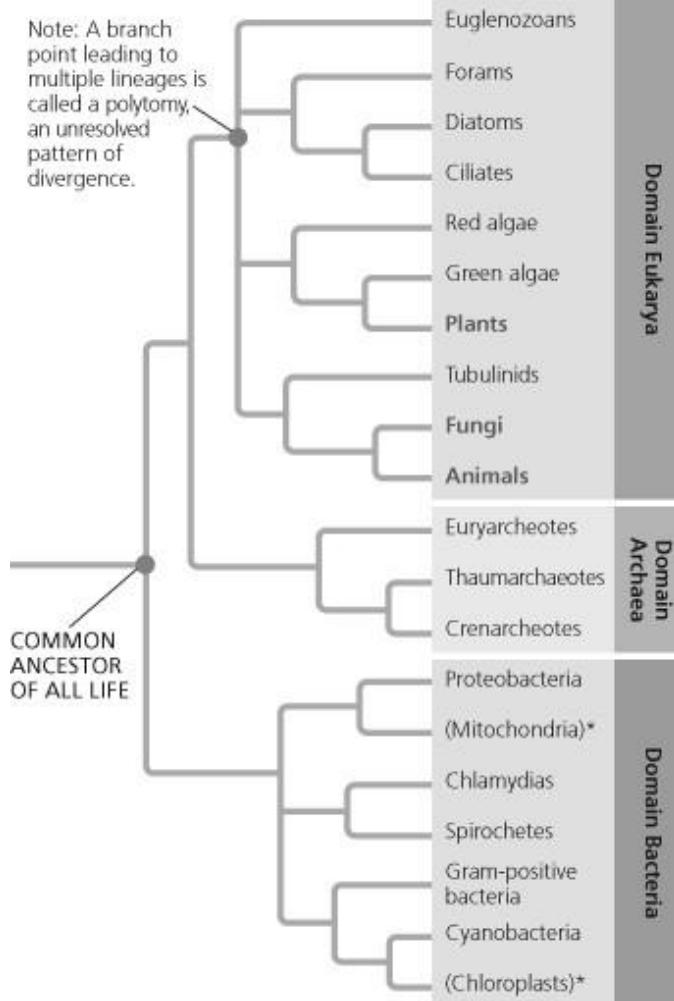
- A) endosymbiosis
- B) mitosis
- C) binary fission
- D) point mutations

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 26.5

62)



A phylogenetic tree is shown for the three domains of life (Eukarya, Archaea, and Bacteria). The tree branches in two directions from the first point, labeled Common ancestor of all life. One branch leads in the direction of Eukarya and Archaea, and the other branch leads to Bacteria. The branch leading to Eukarya and Archaea divide, one branch leading to each domain. The branch leading to Eukarya divides into four branches. One leads to Euglenozoans, and the other three lead to branching points. The first leads to Forams in one direction, and another branching point in the other that leads to Diatoms and Ciliates. The second branching point leads to Red algae in one direction, and a branching point that leads to green algae and land plants in the other direction. The third branching point leads to amoebas in one direction, and a branching point that leads to fungi and animals in the other direction. Land plants, Fungi and Animals are all highlighted.

Cyanobacteria were once called blue-green algae because they are photosynthetic. According to the phylogeny shown, the cyanobacteria are more closely related to gram-positive bacteria than to _____.

- A) proteobacteria
- B) green algae
- C) euglenozoans
- D) crenarcheotes

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.6

63) Which of the following statements is accurate, at least according to our present knowledge?

A) Eukaryotes acquired nuclear genes only in the distant past; these genes can allow survival in anaerobic environments.

B) Genes from prokaryotes have been acquired by some eukaryotes; these genes can allow survival in extreme environments.

C) Prokaryotes acquired genes from eukaryotes many times; these genes can allow survival in extreme environments.

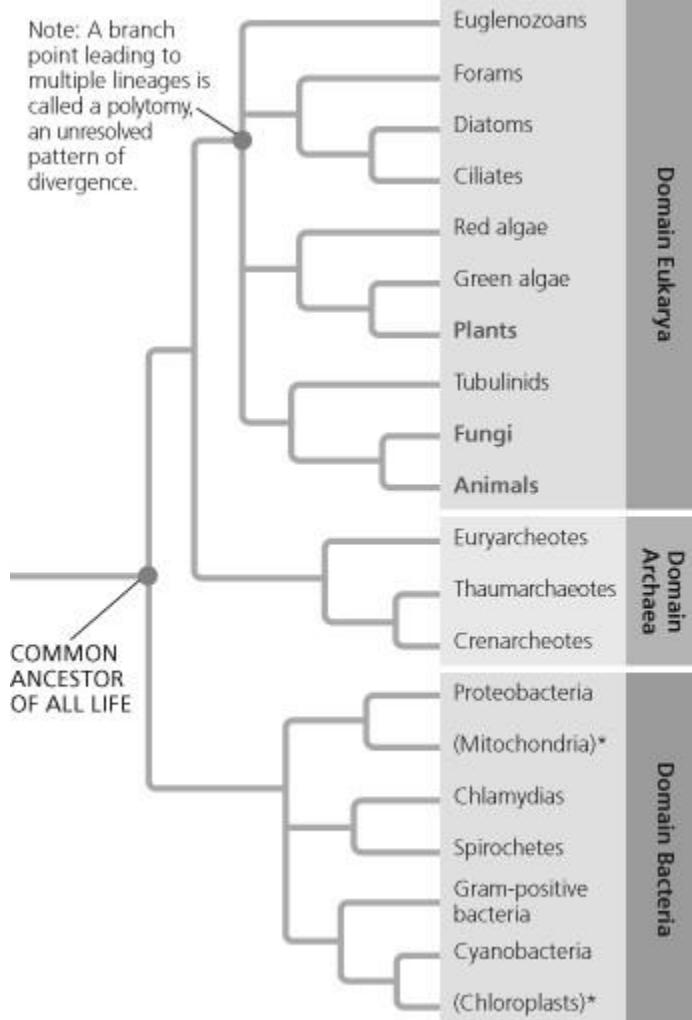
D) Prokaryotes acquired genes from fungi; these genes can allow the digestion of cellulose.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.6

64)



A phylogenetic tree is shown for the three domains of life (Eukarya, Archaea, and Bacteria). The tree branches in two directions from the first point, labeled Common ancestor of all life. One branch leads in the direction of Eukarya and Archaea, and the other branch leads to Bacteria. The branch leading to Eukarya and Archaea divide, one branch leading to each domain. The branch leading to Eukarya divides into four branches. One leads to Euglenozoans, and the other three lead to branching points. The first leads to Forams in one direction, and another branching point in the other that leads to Diatoms and Ciliates. The second branching point leads to Red algae in one direction, and a branching point that leads to green algae and land plants in the other direction. The third branching point leads to amoebas in one direction, and a branching point that leads to fungi and animals in the other direction. Land plants, Fungi and Animals are all highlighted.

Examine the figure. If you were a graduate student trying to develop a thesis project that would resolve polytomies, which of the following groups would you study?

- A) animals and fungi
- B) euglenozoans, euryarcheotes, and gram-positive bacteria
- C) forams, red algae, and amoebas
- D) red algae, green algae, and cyanobacteria

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 26.6

65) If additional DNA sequence evidence shows that yeast genes for synthesizing proteins are more similar to protein-synthesizing genes in bacteria than those in archaea, a modern systematist would _____.

- A) redraw the phylogeny to show eukaryotes sharing a more recent common ancestor with bacteria than archaea
- B) redraw the phylogeny to show more recent common ancestry between archaea and yeast than between eukaryotes and archaea
- C) retain the phylogeny that shows a more recent common ancestor between eukaryotes and archaea
- D) retain the phylogeny that shows a more recent common ancestor between bacteria and archaea

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 26.6

66) Which of the following statements about horizontal gene transfer is accurate?

- A) Horizontal gene transfer was quite common in the early stages of evolution of life on Earth.
- B) Horizontal gene transfer among organisms does not occur today.
- C) Horizontal gene transfer moves only genes that play a role in metabolism.
- D) Horizontal gene transfer occurs only among closely related organisms.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 26.6

67) The kingdom Monera was dismantled because of which of the following reasons?

- A) Some Monera contained nuclei in their cells.
- B) The Monera, as originally constituted, contained both plants and animals.
- C) The Monera, as originally constituted, was monophyletic.
- D) Some, but not all, of the organisms in Monera contained DNA sequences that were similar to those of eukaryotes.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 26.6

68) Imagine that you discovered the following information:

Feature	Bacteria	Archaea	Eukaryotes
RNA polymerase	small, simple	complex	complex
Introns	absent	present	present
Antibiotic sensitivity	sensitive	insensitive	insensitive
Membrane Lipids	C chains unbranched	C chains branched	C chains branched

These data would support which of the following conclusions?

- A) Eukaryotes share a more recent common ancestor with bacteria than with archaea.
- B) Bacteria are the only one of the three groups that lacks a nucleus.
- C) Archaea are more similar to bacteria than to eukaryotes.
- D) Eukaryotes are more similar to archaea than to bacteria.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 26.6

26.2 Student Edition End-of-Chapter Questions

1) In a comparison of birds and mammals, the condition of having four limbs is

- A) a shared ancestral character.
- B) a shared derived character.
- C) a character useful for distinguishing birds from mammals.
- D) an example of analogy rather than homology.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

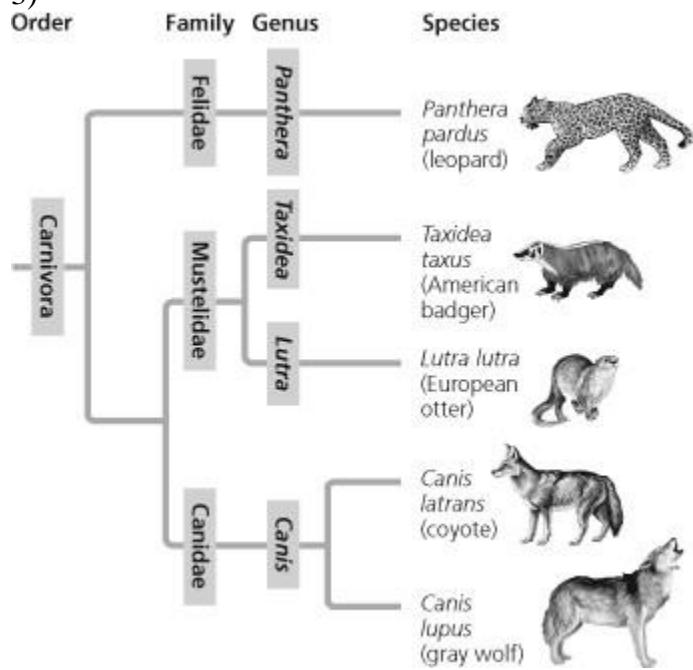
2) To apply parsimony to constructing a phylogenetic tree,

- A) choose the tree that assumes all evolutionary changes are equally probable.
- B) choose the tree in which the branch points are based on as many shared derived characters as possible.
- C) choose the tree that represents the fewest evolutionary changes, in either DNA sequences or morphology.
- D) choose the tree with the fewest branch points.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

3)



In Figure 26.4, which similarly inclusive taxon is represented as descending from the same common ancestor as Canidae?

- A) Felidae
- B) Mustelidae
- C) Carnivora
- D) *Lutra*

Answer: B

Bloom's Taxonomy: Application/Analysis

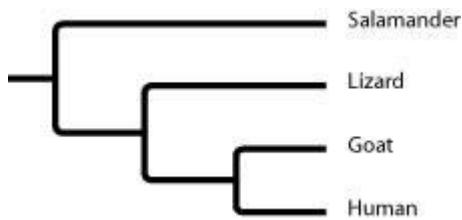
4) Three living species X, Y, and Z share a common ancestor T, as do extinct species U and V. A grouping that consists of species T, X, Y, and Z (but not U or V) makes up
A) a monophyletic taxon.

- B) an ingroup, with species U as the outgroup.
- C) a paraphyletic group.
- D) a polyphyletic group.

Answer: C

Bloom's Taxonomy: Application/Analysis

5) Based on the tree below, which statement is *not* correct?



- A) Goats and humans form a sister group.
- B) Salamanders are a sister group to the group containing lizards, goats, and humans.
- C) Salamanders are as closely related to goats as to humans.
- D) Lizards are more closely related to salamanders than to humans.

Answer: D

Bloom's Taxonomy: Application/Analysis

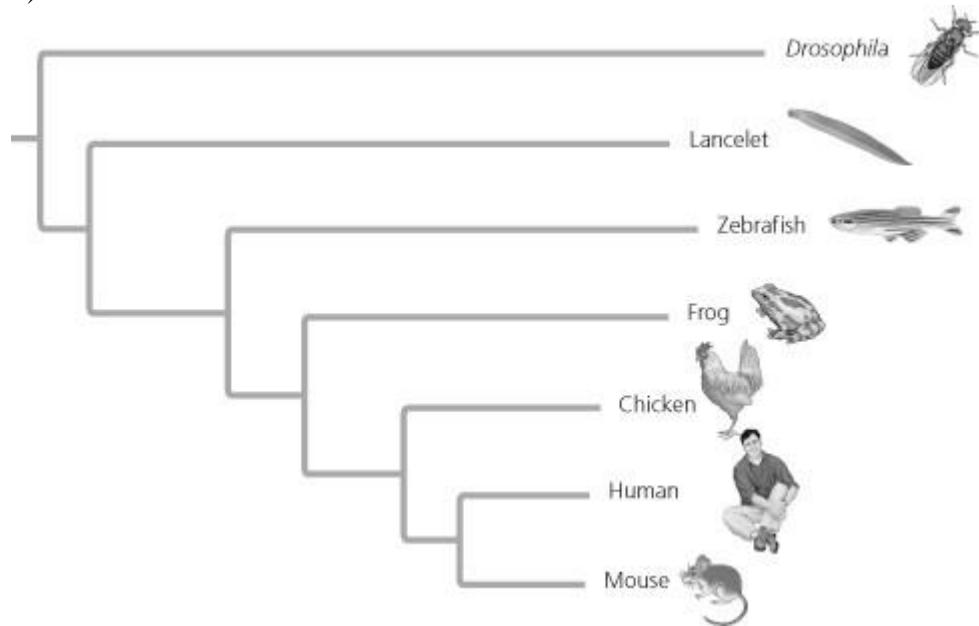
6) If you were using cladistics to build a phylogenetic tree of cats, which of the following would be the best outgroup?

- A) wolf
- B) domestic cat
- C) lion
- D) leopard

Answer: A

Bloom's Taxonomy: Application/Analysis

7)



The relative lengths of the frog and mouse branches in the phylogenetic tree in Figure 26.13 indicate that

- A) frogs evolved before mice.
- B) mice evolved before frogs.
- C) the homolog has evolved more rapidly in mice.
- D) the homolog has evolved more slowly in mice.

Answer: D

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 27 Bacteria and Archaea

27.1 Multiple-Choice Questions

1) The predatory bacterium *Bdellovibrio bacteriophorus* drills into a prey bacterium and, once inside, digests it. In an attack upon a gram-negative bacterium that has a slimy cell covering, what is the correct sequence of structures penetrated by *B. bacteriophorus* on its way to the prey's cytoplasm?

- A) phospholipid membrane, capsule, peptidoglycan, lipopolysaccharide membrane
- B) lipopolysaccharide membrane, peptidoglycan, capsule, phospholipid membrane
- C) lipopolysaccharide membrane, capsule, peptidoglycan, phospholipid membrane
- D) capsule, lipopolysaccharide membrane, peptidoglycan, phospholipid membrane

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 27.1

2) Jams, jellies, preserves, honey, and other foods with high sugar content hardly ever become contaminated by bacteria, even when the food containers are left open at room temperature. This is because bacteria that encounter such an environment _____.

- A) undergo death as a result of water loss from the cell
- B) are unable to metabolize the glucose or fructose, and thus starve to death
- C) are obligate anaerobes
- D) are unable to swim through these thick and viscous materials

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.1

3) Use the information in the following paragraph to answer the question.

A hypothetical bacterium swims among human intestinal contents until it finds a suitable location on the intestinal lining. It adheres to the intestinal lining using a feature that also protects it from phagocytes, bacteriophages, and dehydration. Fecal matter from a human in whose intestine this bacterium lives can spread the bacterium, even after being mixed with water and boiled. The bacterium is not susceptible to the penicillin family of antibiotics. It contains no plasmids and relatively little peptidoglycan.

This bacterium's ability to survive in a human who is taking penicillin pills may be due to the presence of _____.

- A) gram-negative cell wall
- B) peptidoglycan in the cell wall
- C) lipopolysaccharides in the cytoplasm
- D) long polypeptides in the cell wall

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.1

4) Use the information in the following paragraph to answer the question.

A hypothetical bacterium swims among human intestinal contents until it finds a suitable location on the intestinal lining. It adheres to the intestinal lining using a feature that also protects it from phagocytes, bacteriophages, and dehydration. Fecal matter from a human in whose intestine this bacterium lives can spread the bacterium, even after being mixed with water and boiled. The bacterium is not susceptible to the penicillin family of antibiotics. It contains no plasmids and relatively little peptidoglycan.

Adherence to the intestinal lining by this bacterium is due to its possession of _____.

- A) fimbriae
- B) pili
- C) a capsule
- D) a flagellum

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.1

5) Use the information in the following paragraph to answer the question.

A hypothetical bacterium swims among human intestinal contents until it finds a suitable location on the intestinal lining. It adheres to the intestinal lining using a feature that also protects it from phagocytes, bacteriophages, and dehydration. Fecal matter from a human in whose intestine this bacterium lives can spread the bacterium, even after being mixed with water and boiled. The bacterium is not susceptible to the penicillin family of antibiotics. It contains no plasmids and relatively little peptidoglycan.

Which of the following statements about the cell wall is most probable?

- A) Its innermost layer is composed of a phospholipid bilayer.
- B) After it has been subjected to Gram staining, the cell should remain purple.
- C) It has an outer membrane of lipopolysaccharide.
- D) It is mostly composed of a complex, cross-linked polysaccharide.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.1

6) Use the information in the following paragraph to answer the question.

A hypothetical bacterium swims among human intestinal contents until it finds a suitable location on the intestinal lining. It adheres to the intestinal lining using a feature that also protects it from phagocytes, bacteriophages, and dehydration. Fecal matter from a human in whose intestine this bacterium lives can spread the bacterium, even after being mixed with water and boiled. The bacterium is not susceptible to the penicillin family of antibiotics. It contains no plasmids and relatively little peptidoglycan.

In which feature should one be able to locate a complete chromosome of this bacterium?

- A) mitochondrion
- B) nucleoid
- C) nucleus
- D) plasmid

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 27.1

7) The following table depicts characteristics of five prokaryotic species (A-E). Use the information in the table to answer the following question.

Trait	Species A	Species B	Species C	Species D	Species E
Plasmid	R	None	R	F	None
Gram Staining Results	Variable	Variable	Negative	Negative	Negative
Nutritional Mode	Chemoheterotroph	Chemoautotroph	Chemoheterotroph	Chemoheterotroph	Photoautotroph
Specialized Metabolic Pathways	Aerobic methanotroph (obtains carbon and energy from methane)	Anaerobic methanogen	Anaerobic butylic fermentation	Anaerobic lactic acid fermentation	Anaerobic nitrogen fixation and aerobic photosystems I and II
Other Features	Fimbriae	Internal membranes	Flagellum	Pili	Thylakoids

Which two species should have much more phospholipid, in the form of bilayers, in their cytoplasms than most other bacteria?

- A) species A and B
- B) species A and C
- C) species B and E
- D) species C and D

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.1

8) The following table depicts characteristics of five prokaryotic species (A-E). Use the information in the table to answer the following question.

Trait	Species A	Species B	Species C	Species D	Species E
Plasmid	R	None	R	F	None
Gram Staining Results	Variable	Variable	Negative	Negative	Negative
Nutritional Mode	Chemoheterotroph	Chemoautotroph	Chemoheterotroph	Chemoheterotroph	Photoautotroph
Specialized Metabolic Pathways	Aerobic methanotroph (obtains carbon and energy from methane)	Anaerobic methanogen	Anaerobic butanolic fermentation	Anaerobic lactic acid fermentation	Anaerobic nitrogen fixation and aerobic photosystems I and II
Other Features	Fimbriae	Internal membranes	Flagellum	Pili	Thylakoids

Which species is capable of directed movement?

- A) species A
- B) species B
- C) species C
- D) species D

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.1

9) The following table depicts characteristics of five prokaryotic species (A-E). Use the information in the table to answer the following question.

Trait	Species A	Species B	Species C	Species D	Species E
Plasmid	R	None	R	F	None
Gram Staining Results	Variable	Variable	Negative	Negative	Negative
Nutritional Mode	Chemoheterotroph	Chemoautotroph	Chemoheterotroph	Chemoheterotroph	Photoautotroph
Specialized Metabolic Pathways	Aerobic methanotroph (obtains carbon and energy from methane)	Anaerobic methanogen	Anaerobic butanolic fermentation	Anaerobic lactic acid fermentation	Anaerobic nitrogen fixation and aerobic photosystems I and II
Other Features	Fimbriae	Internal membranes	Flagellum	Pili	Thylakoids

How many of these species probably have a cell wall that consists partly of an outer membrane of lipopolysaccharide?

- A) only one species
- B) two species
- C) three species
- D) four species

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.1

10) Which of the following observations about flagella is accurate and is consistent with the scientific conclusion that the flagella from eukaryotes and bacteria evolved independently?

- A) The flagella of both eukaryotes and bacteria are made of the same protein, but the configuration is different.
- B) The mechanics of movement and protein structure are the same in these flagella, but there are significant genetic differences.
- C) Although the mechanism of movement in both flagella is the same, the protein that accomplishes the movement is different.
- D) The protein structure and the mechanism of movement in eukaryotes flagella are different from those of bacteria flagella.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 27.1

11) Which of the following observations about flagella is accurate and is consistent with the scientific conclusion that the flagella from archaea and bacteria evolved independently?

- A) The flagella of the two groups differ in size.
- B) The protein structures in the flagella are different.
- C) The mechanisms of rotation are similar.
- D) Both groups have flagella like those found in eukaryotes.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 27.1

12) In a bacterium that possesses antibiotic resistance and the potential to persist through very adverse conditions, such as freezing, drying, or high temperatures, DNA should be located within, or be part of, which structures?

- A) nucleoid, fimbriae, and plasmids
- B) endospore, fimbriae, and plasmids
- C) fimbriae, nucleoid, and endospore
- D) plasmids, nucleoid, and endospore

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 27.1

13) If a bacterium regenerates from an endospore that did not possess any of the plasmids that were contained in its original parent cell, the regenerated bacterium will probably also lack _____.

- A) antibiotic-resistant genes
- B) a cell wall
- C) a chromosome
- D) water in its cytoplasm

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.2

14) Chloramphenicol is an antibiotic that targets prokaryotic (70S) ribosomes, but not eukaryotic (80S) ribosomes. Which of these questions stems from this observation, plus an understanding of eukaryotic origins?

- A) Can chloramphenicol also be used to control human diseases that are caused by archaeans?
- B) Can chloramphenicol pass through the capsules possessed by many cyanobacteria?
- C) If chloramphenicol inhibits prokaryotic ribosomes, should it not also inhibit mitochondrial ribosomes?
- D) Why aren't prokaryotic ribosomes identical to eukaryotic ribosomes?

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.1

15) Termites eat wood, but many do not produce enzymes themselves that will digest the cellulose in the wood. Instead, some termites house a complex community of protozoa, bacteria, and archaea that could help digest the cellulose. Imagine an experiment that fed termites either wood only or wood and antibiotics, and then measured the amount of energy extracted from the wood. If both groups gained equal amounts of energy, which of the conclusions is the most logical?

- A) We would conclude that the protozoa contributed to digestion of cellulose and lignin.
- B) We would conclude that the archaea contributed to digestion of cellulose and lignin.
- C) We would conclude that the bacteria did not contribute to digestion of cellulose and lignin.
- D) We would conclude that none of the three groups were needed to digest cellulose and lignin.

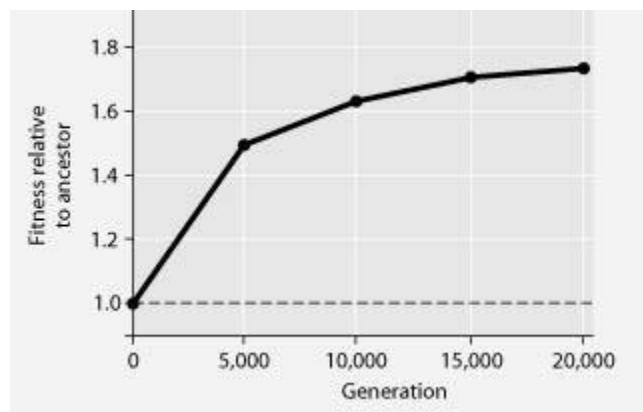
Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.1

16) The following question refers to the figure.

In this eight-year experiment, 12 populations of *E. coli*, each begun from a single cell, were grown in low-glucose conditions for 20,000 generations. Each culture was introduced to fresh growth medium every 24 hours. Occasionally, samples were removed from the populations, and their fitness in low-glucose conditions was tested against that of members sampled from the ancestral (common ancestor) *E. coli* population.



The cells in the 12 cell lines grown in low-glucose conditions showed the effects of which of the following processes?

- A) gene flow and genetic drift
- B) natural selection and mutation
- C) natural selection and gene flow
- D) conjugation and transformation

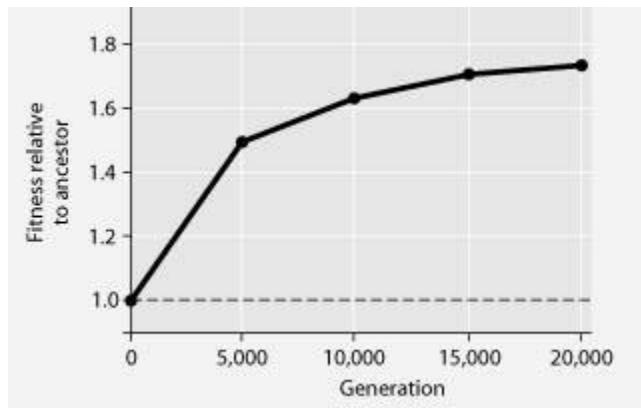
Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.2

17) The following question refers to the figure.

In this eight-year experiment, 12 populations of *E. coli*, each begun from a single cell, were grown in low-glucose conditions for 20,000 generations. Each culture was introduced to fresh growth medium every 24 hours. Occasionally, samples were removed from the populations, and their fitness in low-glucose conditions was tested against that of members sampled from the ancestral (common ancestor) *E. coli* population.



Imagine that after generation 20,000, the experimental cells were grown in high-glucose conditions for 20,000 generations (using the same transfer process described). Refer to the y-axis on the graph and predict the fitness of the new lines when tested in low- and high-glucose conditions.

- A) low: 1.0; high: 1.0
- B) low: 1.6; high: 1.6
- C) low: 1.0; high: 1.6
- D) low: 1.6; high: 1.0

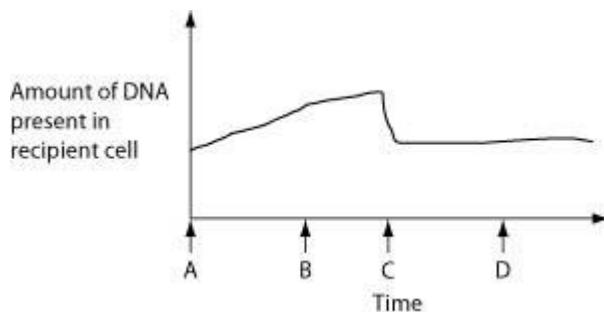
Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.2

18) Use the following information and graph to answer the question.

The figure below depicts changes to the amount of DNA present in a recipient cell that is engaged in conjugation with an Hfr cell. Hfr cell DNA begins entering the recipient cell at Time A. Assume that reciprocal crossing over occurs (in other words, a fragment of the recipient's chromosome is exchanged for a homologous fragment from the Hfr cell's DNA).



What process is occurring at Time C that is decreasing the DNA content?

- A) crossing over
- B) cytokinesis
- C) degradation of DNA that was not retained in the recipient's chromosome
- D) reversal of the direction of conjugation

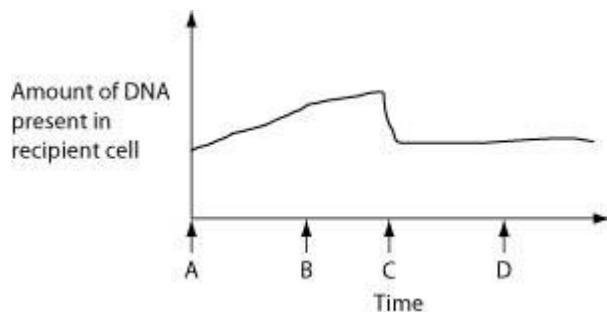
Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.2

19) Use the following information and graph to answer the question.

The figure below depicts changes to the amount of DNA present in a recipient cell that is engaged in conjugation with an Hfr cell. Hfr cell DNA begins entering the recipient cell at Time A. Assume that reciprocal crossing over occurs (in other words, a fragment of the recipient's chromosome is exchanged for a homologous fragment from the Hfr cell's DNA).



How is the recipient cell different at Time D than it was at Time A?

- A) It has a greater number of genes.
- B) It has a greater mass of DNA.
- C) It has a different sequence of base pairs.
- D) It contains bacteriophage DNA.

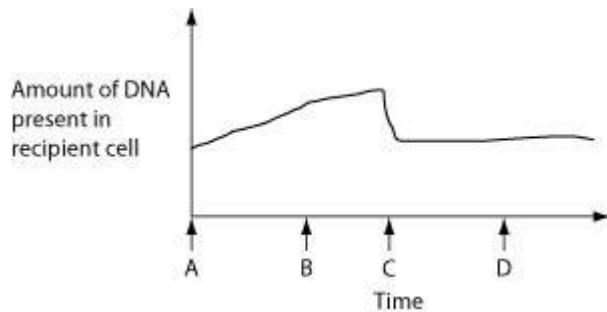
Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.2

20) Use the following information and graph to answer the question.

The figure below depicts changes to the amount of DNA present in a recipient cell that is engaged in conjugation with an Hfr cell. Hfr cell DNA begins entering the recipient cell at Time A. Assume that reciprocal crossing over occurs (in other words, a fragment of the recipient's chromosome is exchanged for a homologous fragment from the Hfr cell's DNA).



Which two processes are responsible for the shape of the curve at Time B?

- A) transduction and rolling circle replication of single-stranded Hfr DNA
- B) entry of single-stranded Hfr DNA and rolling circle replication of single-stranded Hfr DNA
- C) rolling circle replication of single-stranded Hfr DNA and activation of DNA pumps in the plasma membrane
- D) transduction and activation of DNA pumps in the plasma membrane

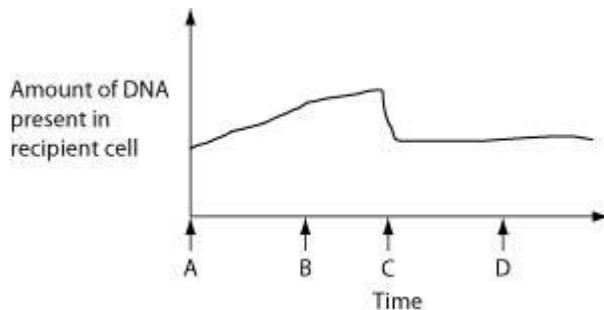
Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.2

21) Use the following information and graph to answer the question.

The figure below depicts changes to the amount of DNA present in a recipient cell that is engaged in conjugation with an Hfr cell. Hfr cell DNA begins entering the recipient cell at Time A. Assume that reciprocal crossing over occurs (in other words, a fragment of the recipient's chromosome is exchanged for a homologous fragment from the Hfr cell's DNA).



During which two times can the recipient accurately be described as "recombinant" due to the sequence of events portrayed in the figure?

- A) during times C and D
- B) during times A and C
- C) during times A and B
- D) during times B and D

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.2

22) A hypothetical bacterium swims among human intestinal contents until it finds a suitable location on the intestinal lining. It adheres to the intestinal lining using a feature that also protects it from phagocytes, bacteriophages, and dehydration. Fecal matter from a human in whose intestine this bacterium lives can spread the bacterium, even after being mixed with water and boiled. The bacterium is not susceptible to the penicillin family of antibiotics. It contains no plasmids and relatively little peptidoglycan. The cell also lacks F factors and F plasmids. Which of the following statements about the bacteria is most probably accurate?

- A) The bacterium cannot donate DNA through conjugation with another cell.
- B) The bacterium cannot take up DNA from its external environment.
- C) The bacterium cannot form an endospore.
- D) The bacterium cannot reproduce.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.2

23) The following table depicts characteristics of five prokaryotic species (A-E). Use the information in the table to answer the question.

Trait	Species A	Species B	Species C	Species D	Species E
Plasmid	R	None	R	F	None
Gram Staining Results	Variable	Variable	Negative	Negative	Negative
Nutritional Mode	Chemoheterotroph	Chemoautotroph	Chemoheterotroph	Chemoheterotroph	Photoautotroph
Specialized Metabolic Pathways	Aerobic methanotroph (obtains carbon and energy from methane)	Anaerobic methanogen	Anaerobic butanolic fermentation	Anaerobic lactic acid fermentation	Anaerobic nitrogen fixation and aerobic photosystems I and II
Other Features	Fimbriae	Internal membranes	Flagellum	Pili	Thylakoids

Species D is pathogenic if it gains access to the human intestine. Which other species, if it cohabitated a human intestine along with species D, is most likely to become a recombinant species that is both pathogenic and resistant to some antibiotics?

- A) species A
- B) species B
- C) species C
- D) species E

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.2

24) The following table depicts characteristics of five prokaryotic species (A-E). Use the information in the table to answer the question.

Trait	Species A	Species B	Species C	Species D	Species E
Plasmid	R	None	R	F	None
Gram Staining Results	Variable	Variable	Negative	Negative	Negative
Nutritional Mode	Chemoheterotroph	Chemoautotroph	Chemoheterotroph	Chemoheterotroph	Photoautotroph
Specialized Metabolic Pathways	Aerobic methanotroph (obtains carbon and energy from methane)	Anaerobic methanogen	Anaerobic butanolic fermentation	Anaerobic lactic acid fermentation	Anaerobic nitrogen fixation and aerobic photosystems I and II
Other Features	Fimbriae	Internal membranes	Flagellum	Pili	Thylakoids

Which species might include cells that are Hfr cells?

- A) species A
- B) species B
- C) species C
- D) species D

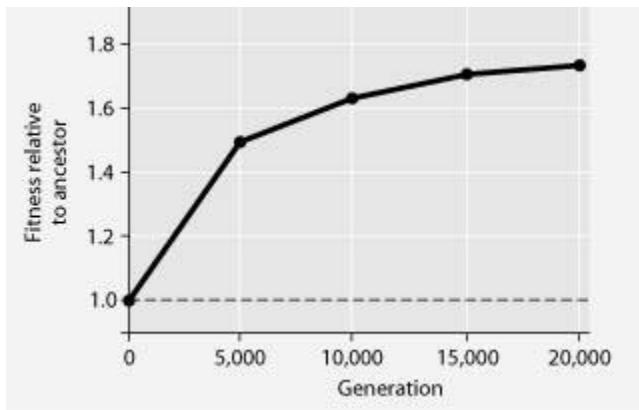
Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 27.2

25) The following question refers to the figure.

In this eight-year experiment, 12 populations of *E. coli*, each begun from a single cell, were grown in low-glucose conditions for 20,000 generations. Each culture was introduced to fresh growth medium every 24 hours. Occasionally, samples were removed from the populations, and their fitness in low-glucose conditions was tested against that of members sampled from the ancestral (common ancestor) *E. coli* population.



Which term best describes what has occurred among the experimental populations of cells over this eight-year period?

- A) microevolution
- B) speciation
- C) adaptive radiation
- D) stabilizing selection

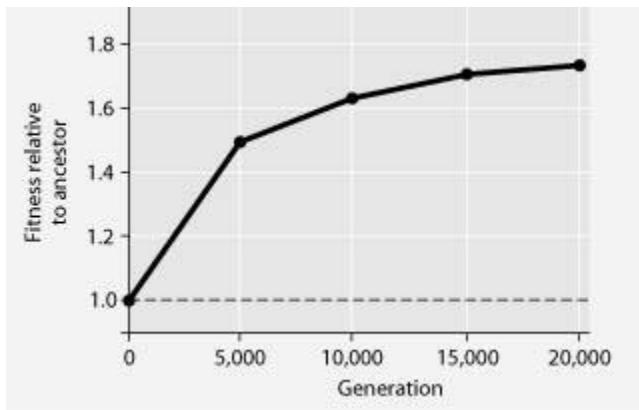
Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.2

26) The following question refers to the figure.

In this eight-year experiment, 12 populations of *E. coli*, each begun from a single cell, were grown in low-glucose conditions for 20,000 generations. Each culture was introduced to fresh growth medium every 24 hours. Occasionally, samples were removed from the populations, and their fitness in low-glucose conditions was tested against that of members sampled from the ancestral (common ancestor) *E. coli* population.



Compare the bacteria in the figure above in generation 1 and generation 20,000. The bacteria in generation 1 have a greater _____.

- A) efficiency at exporting glucose from the cell to the environment
- B) ability to survive on simple sugars, other than glucose
- C) ability to synthesize glucose from amino acid precursors
- D) reliance on glycolytic enzymes

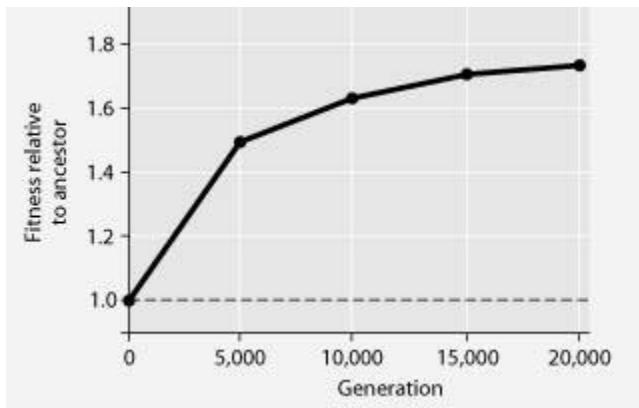
Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 27.2

27) The following question refers to the figure.

In this eight-year experiment, 12 populations of *E. coli*, each begun from a single cell, were grown in low-glucose conditions for 20,000 generations. Each culture was introduced to fresh growth medium every 24 hours. Occasionally, samples were removed from the populations, and their fitness in low-glucose conditions was tested against that of members sampled from the ancestral (common ancestor) *E. coli* population.



If the vertical axis of the figure above refers to relative fitness, then which of the following is the most valid and accurate measure of fitness?

- A) number of daughter cells produced per mother cell per generation
- B) average swimming speed of cells through the growth medium
- C) amount of glucose synthesized per unit time
- D) number of generations per unit time

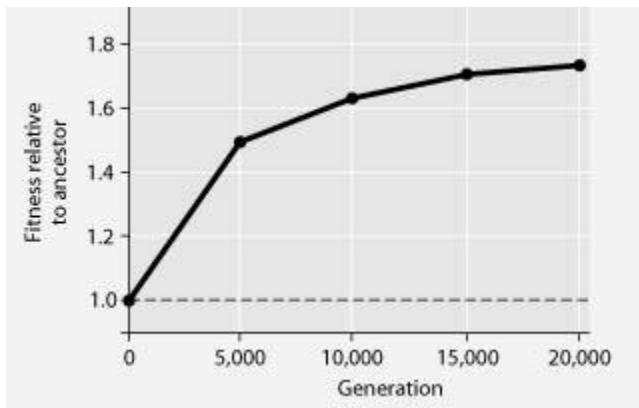
Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.2

28) The following question refers to the figure.

In this eight-year experiment, 12 populations of *E. coli*, each begun from a single cell, were grown in low-glucose conditions for 20,000 generations. Each culture was introduced to fresh growth medium every 24 hours. Occasionally, samples were removed from the populations, and their fitness in low-glucose conditions was tested against that of members sampled from the ancestral (common ancestor) *E. coli* population.



E. coli cells typically make most of their ATP by metabolizing glucose. Under the conditions of this experiment, *E. coli* generation times in the experimental lines and low-glucose conditions should _____.

- A) be the same as in the typical environment
- B) be faster than in the typical environment
- C) be slower than in the typical environment
- D) increase over time in the experimental cells

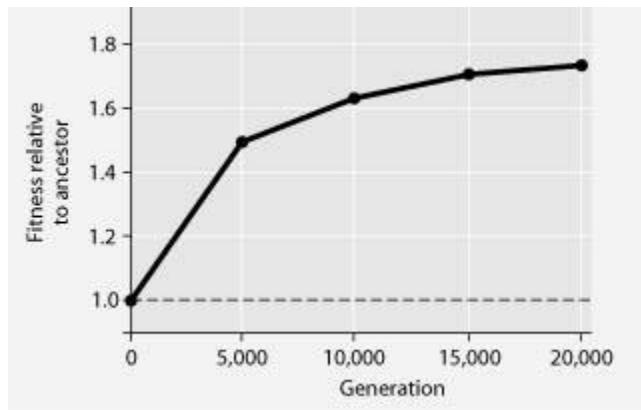
Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.2

29) The following question refers to the figure.

In this eight-year experiment, 12 populations of *E. coli*, each begun from a single cell, were grown in low-glucose conditions for 20,000 generations. Each culture was introduced to fresh growth medium every 24 hours. Occasionally, samples were removed from the populations, and their fitness in low-glucose conditions was tested against that of members sampled from the ancestral (common ancestor) *E. coli* population.



If the experimental population of *E. coli* lacks an F factor or F plasmid, and if bacteriophages are excluded from the bacterial cultures, then beneficial mutations might be transmitted horizontally to other *E. coli* cells via _____.

- A) sex pili
- B) transduction
- C) conjugation
- D) transformation

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 27.2

30) In a hypothetical situation, the genes for sex pilus construction and for tetracycline resistance are located on the same plasmid within a particular bacterium. If this bacterium readily performs conjugation involving a copy of this plasmid, then the result should be the _____.

- A) temporary possession by this bacterium of a completely diploid genome
- B) rapid spread of tetracycline resistance to other bacteria in that habitat
- C) subsequent loss of tetracycline resistance from this bacterium
- D) production of endospores among the bacterium's progeny

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 27.2

31) Which of the following is *least* associated with the others?

- A) horizontal gene transfer
- B) conjugation
- C) transformation
- D) binary fission

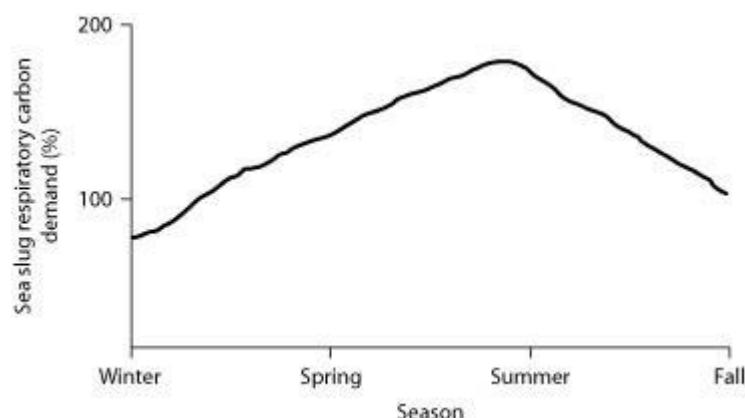
Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 27.2

32) Use the following information and figure to answer the question.

The sea slug *Pteraeolidia ianthina* (*P. ianthina*) can harbor living dinoflagellates (photosynthetic protists) in its skin. These endosymbiotic dinoflagellates reproduce quickly enough to maintain their populations. Low populations of the dinoflagellates do not affect the sea slugs very much, but high populations ($> 5 \times 10^5$ cells/mg of sea slug protein) can promote sea slug survival.



Percent of sea slug respiratory carbon demand provided by indwelling dinoflagellates.

If we assume that carbon is the sole nutrient needed by sea slugs to drive their cellular respiration, then based on the graph, during which season(s) is it *least* necessary for *P. ianthina* to act as a chemoheterotroph?

- A) winter
- B) spring
- C) summer
- D) fall

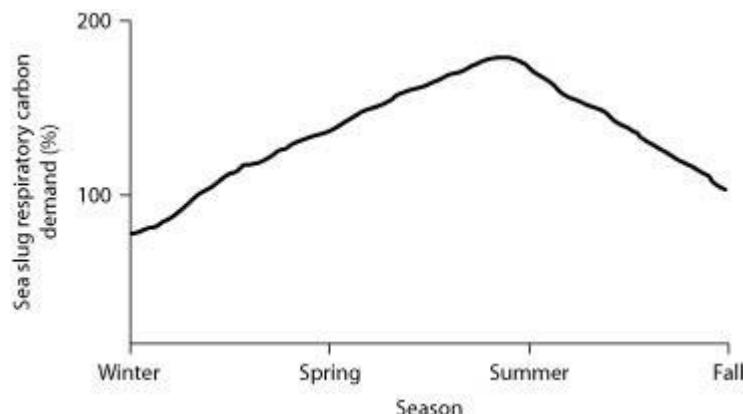
Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.3

33) Use the following information and figure to answer the question.

The sea slug *Pteraeolidia ianthina* (*P. ianthina*) can harbor living dinoflagellates (photosynthetic protists) in its skin. These endosymbiotic dinoflagellates reproduce quickly enough to maintain their populations. Low populations of the dinoflagellates do not affect the sea slugs very much, but high populations ($> 5 \times 10^5$ cells/mg of sea slug protein) can promote sea slug survival.



Percent of sea slug respiratory carbon demand provided by indwelling dinoflagellates.

Which of the following would be a potential disadvantage to the sea slugs of housing the dinoflagellates?

- A) The CO₂ produced by the dinoflagellates would poison the sea slug.
- B) The dinoflagellates would be an energy drain on the sea slug.
- C) The sea slugs are exposed to predators when they spend time in the sunlit areas needed by the dinoflagellates.
- D) The dinoflagellates will reduce the ability of the sea slugs to move.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.3

34) Use of synthetic fertilizers often leads to the contamination of groundwater with nitrates. Nitrate pollution is also a suspected cause of anoxic "dead zones" in the ocean. Which of the following might help reduce nitrate pollution?

- A) growing improved crop plants that have nitrogen-fixing enzymes
- B) adding nitrifying bacteria to the soil
- C) adding denitrifying bacteria to the soil
- D) using ammonia instead of nitrate as a fertilizer

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.3

35) Biologists sometimes divide living organisms into two groups: autotrophs and heterotrophs. These two groups differ in _____.

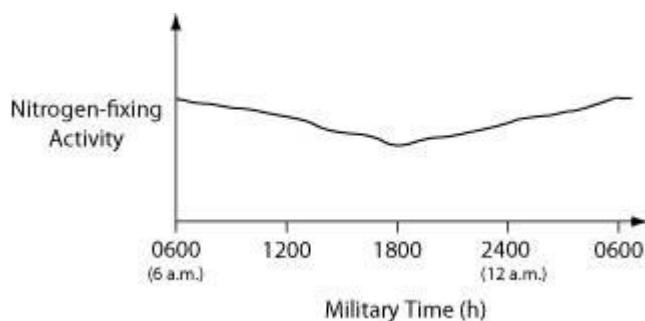
- A) their sources of carbon
- B) their electron acceptors
- C) their mode of inheritance
- D) the way that they generate ATP

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.3

36) Data were collected from the heterocysts of a nitrogen-fixing cyanobacterium inhabiting equatorial ponds. Study the graph and choose the most likely explanation for the shape of the curve.



- A) Enough oxygen (O_2) enters heterocysts during hours of peak photosynthesis to have a somewhat inhibitory effect on nitrogen fixation.
- B) Atmospheric nitrogen (N_2) levels increase at night because plants are no longer metabolizing this gas, so they are not absorbing this gas through their stomata.
- C) Heterocyst walls become less permeable to nitrogen (N_2) influx during darkness.
- D) The amount of fixed nitrogen that is dissolved in the pond water in which the cyanobacteria are growing peaks at the close of the photosynthetic day (1800 hours).

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.3

37) A hypothetical bacterium swims among human intestinal contents until it finds a suitable location on the intestinal lining. It adheres to the intestinal lining using a feature that also protects it from phagocytes, bacteriophages, and dehydration. Fecal matter from a human in whose intestine this bacterium lives can spread the bacterium, even after being mixed with water and boiled. The bacterium is not susceptible to the penicillin family of antibiotics. It contains no plasmids and relatively little peptidoglycan. This bacterium derives nutrition by digesting human intestinal contents. Thus, this bacterium is an _____.

- A) aerobic chemoheterotroph
- B) aerobic chemoautotroph
- C) anaerobic chemoheterotroph
- D) anaerobic chemoautotroph

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.3

38) Use the following information to answer the question.

Nitrogenase, the enzyme that catalyzes nitrogen fixation, is inhibited whenever free oxygen (O_2) reaches a critical concentration. Consequently, nitrogen fixation cannot occur in cells wherein photosynthesis produces free O_2 . Consider the colonial aquatic cyanobacterium, *Anabaena*, whose heterocysts are described as having "...a thickened cell wall that restricts entry of O_2 produced by neighboring cells. Intercellular connections allow heterocysts to transport fixed nitrogen to neighboring cells in exchange for carbohydrates."

Given that the enzymes that catalyze nitrogen fixation are inhibited by oxygen, what mechanism might nitrogen-fixing prokaryotes use to protect these enzymes from oxygen?

- A) couple the nitrogen fixation enzymes with photosystem II (the photosystem that splits water)
- B) package the nitrogen fixation enzymes in membranes that are impermeable to all gases
- C) live only in anaerobic environments
- D) package the nitrogen fixation enzymes in membranes that are impermeable to nitrogen gas (N_2).

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.3

39) Use the following information to answer the question.

Nitrogenase, the enzyme that catalyzes nitrogen fixation, is inhibited whenever free oxygen (O_2) reaches a critical concentration. Consequently, nitrogen fixation cannot occur in cells wherein photosynthesis produces free O_2 . Consider the colonial aquatic cyanobacterium, *Anabaena*, whose heterocysts are described as having "...a thickened cell wall that restricts entry of O_2 produced by neighboring cells. Intercellular connections allow heterocysts to transport fixed nitrogen to neighboring cells in exchange for carbohydrates."

Think about this description of the colonial aquatic cyanobacterium, *Anabaena*. Which of the following questions below is important for understanding how nitrogen (N_2) enters heterocysts, and how oxygen (O_2) is kept out of heterocysts?

- A) If carbohydrates can enter the heterocysts from neighboring cells via the "intercellular connections," how is it that O_2 doesn't also enter via this route?
- B) If the cell walls of *Anabaena* photosynthetic cells are permeable to O_2 and carbon dioxide (CO_2), are they also permeable to N_2 ?
- C) If the nuclei of the photosynthetic cells contain the genes that code for nitrogen fixation, how can these cells fail to perform nitrogen fixation?
- D) If the nuclei of the heterocysts contain the genes that code for photosynthesis, how can these cells fail to perform photosynthesis?

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.3

40) The following table depicts characteristics of five prokaryotic species (A-E). Use the information in the table to answer the question.

Trait	Species A	Species B	Species C	Species D	Species E
Plasmid	R	None	R	F	None
Gram Staining Results	Variable	Variable	Negative	Negative	Negative
Nutritional Mode	Chemoheterotroph	Chemoautotroph	Chemoheterotroph	Chemoheterotroph	Photoautotroph
Specialized Metabolic Pathways	Aerobic methanotroph (obtains carbon and energy from methane)	Anaerobic methanogen	Anaerobic butanolic fermentation	Anaerobic lactic acid fermentation	Anaerobic nitrogen fixation and aerobic photosystems I and II
Other Features	Fimbriae	Internal membranes	Flagellum	Pili	Thylakoids

Which two species might be expected to cooperate metabolically, perhaps forming a biofilm wherein one species surrounds cells of the other species?

- A) species A and B
- B) species A and C
- C) species B and E
- D) species C and D

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.3

41) If plaque on teeth is actually a biofilm, which of the following characteristics would you expect to find in plaque?

- A) multiple species of bacteria, production of chemicals that attract other bacteria, and production of chemicals that allow the bacteria to adhere to enamel
- B) single species of bacteria, production of antibiotics, and mechanisms in the biofilm that allow inner cells to expel wastes
- C) multiple species of bacteria, production of antibiotics, and mechanisms in the biofilm that allow inner cells to expel wastes
- D) single species of bacteria, production of chemicals that attract other bacteria, and production of chemicals that allow the bacteria to adhere to enamel

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.3

42) Use the following information to answer the question.

For several decades now, amphibian species worldwide have been in decline. A significant proportion of the decline seems to be due to the spread of the chytrid fungus, *Batrachochytrium dendrobatidis* (Bd). Chytrid sporangia reside within the epidermal cells of infected animals, animals that consequently show areas of sloughed skin. They can also be lethargic, which is expressed through failure to hide and failure to flee. The infection cycle typically takes four to five days, at the end of which zoospores are released from sporangia into the environment. In some amphibian species, mortality rates approach 100%; other species seem able to survive the infection.

If infection primarily involves the outermost layers of adult amphibian skin, and if the chytrids use the skin as their sole source of nutrition, then which term best applies to the chytrids?

- A) anaerobic chemoautotroph
- B) aerobic chemoautotroph
- C) anaerobic chemoheterotroph
- D) aerobic chemoheterotroph

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 27.3

43) While examining a rock surface, you have discovered an interesting new organism. Which of the following criteria will allow you to classify the organism as belonging to Bacteria but not Archaea or Eukarya?

- A) Cell walls are made primarily of peptidoglycan.
- B) The organism does not have a nucleus.
- C) The lipids in its plasma membrane consist of glycerol bonded to straight-chain fatty acids.
- D) It can survive at a temperature over 100°C.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.4

44) Which of the following describe all existing bacteria?

- A) pathogenic, omnipresent, morphologically diverse
- B) extremophiles, tiny, abundant
- C) tiny, ubiquitous, metabolically diverse
- D) morphologically diverse, metabolically diverse, extremophiles

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.4

45) You have found a new prokaryote. What line of evidence would support your hypothesis that the organism is a cyanobacterium?

- A) It is able to form colonies and produce oxygen.
- B) It is an endosymbiont.
- C) It forms chains called mycelia.
- D) It lacks cell walls.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.4

46) Which statement about the domain Archaea is accurate?

- A) Genetic prospecting has recently revealed the existence of many previously unknown archaean species.
- B) The genomes of archaeans are unique, containing no genes that originated within bacteria.
- C) No archaeans can inhabit solutions that are nearly 30% salt.
- D) No archaeans are adapted to waters with temperatures above the boiling point.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 27.4

47) Which of the following traits do archaeans and bacteria share?

- A) composition of the cell wall
- B) composition of the cell wall and lack of a nuclear envelope
- C) lack of a nuclear envelope and presence of circular chromosome
- D) presence of plasma membrane and composition of the cell wall

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 27.4

48) Which of the following traits do archaeans and eukaryotes share?

- A) presence of a nuclear envelope
- B) presence of peptidoglycan in the cell wall
- C) sensitivity to streptomycin
- D) presence of introns

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 27.4

49) Assuming that each of these possesses a cell wall, which prokaryotes should be expected to be most strongly resistant to plasmolysis in hypertonic environments?

- A) extreme halophiles
- B) extreme thermophiles
- C) methanogens
- D) cyanobacteria

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.4

50) The thermoacidophile *Sulfolobus acidocaldarius* lacks peptidoglycan, but still possesses a cell wall. Which of the following statements is likely to be an accurate description of this species?

- A) It is a bacterium.
- B) The optimal pH of its enzymes will lie above pH 7.
- C) It could inhabit hydrothermal springs.
- D) It could inhabit alkaline hot springs.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.4

51) A fish that has been salt-cured subsequently develops a reddish color. You suspect that the fish has been contaminated by the extreme halophile *Halobacterium*. Which of these features of cells removed from the surface of the fish, if confirmed, would support your suspicion?

- A) the presence of the same photosynthetic pigments found in cyanobacteria and cell walls that lack peptidoglycan
- B) cell walls that lack peptidoglycan and are isotonic to conditions on the surface of the fish
- C) cells unable to survive salt concentrations lower than 9% and cells containing many ion pumps on the plasma membrane
- D) the presence of the same photosynthetic pigments found in cyanobacteria and cells that are isotonic to conditions on the surface of the fish

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 27.4

52) The following table depicts characteristics of five prokaryotic species (A-E). Use the information in the table to answer the question.

Trait	Species A	Species B	Species C	Species D	Species E
Plasmid	R	None	R	F	None
Gram Staining Results	Variable	Variable	Negative	Negative	Negative
Nutritional Mode	Chemoheterotroph	Chemoautotroph	Chemoheterotroph	Chemoheterotroph	Photoautotroph
Specialized Metabolic Pathways	Aerobic methanotroph (obtains carbon and energy from methane)	Anaerobic methanogen	Anaerobic butanolic fermentation	Anaerobic lactic acid fermentation	Anaerobic nitrogen fixation and aerobic photosystems I and II
Other Features	Fimbriae	Internal membranes	Flagellum	Pili	Thylakoids

Which species is most likely to be found in sewage treatment plants and in the guts of cattle?

- A) species A
- B) species B
- C) species C
- D) species D

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 27.4

53) Which of the following extremophiles might researchers most likely use as a model for the earliest organisms on Earth?

- A) a bacterium found on another planet or moon
- B) an archaeon capable of surviving in the polar ice caps
- C) an anaerobic archaeon species
- D) a bacterium that thrives in a highly acidic environment

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.4

54) Mitochondria are thought to be the descendants of certain alpha proteobacteria. They are, however, no longer able to lead independent lives because most genes originally present on their chromosomes have moved to the nuclear genome. Which phenomenon accounts for the movement of these genes?

- A) plasmolysis
- B) conjugation
- C) translation
- D) horizontal gene transfer

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 27.2 and 27.4

55) Recently, a microbe that is able to digest cellulose was discovered in a hot spring with an average temperature of 95°C. Predict the group to which this microbe most likely belongs.

- A) Archaea
- B) Proteobacteria
- C) Cyanobacteria
- D) Fungi

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 27.4

56) Bacteria perform each of the following ecological roles. Which role typically does *not* involve symbiosis?

- A) skin commensalist
- B) decomposer
- C) aggregator with methane-consuming archaea
- D) gut mutualist

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 27.5

57) Use the following information to answer the question.

Healthy individuals of *Paramecium bursaria* contain photosynthetic algal endosymbionts of the genus *Chlorella*. When within their hosts, the algae are referred to as zoochlorellae. In aquaria with light coming from only one side, *P. bursaria* gather at the well-lit side, whereas other species of *Paramecium* gather at the opposite side. The zoochlorellae provide their hosts with glucose and oxygen, and *P. bursaria* provides its zoochlorellae with protection and motility. *P. bursaria* can lose its zoochlorellae in two ways: (1) if kept in darkness, the algae will die; and (2) if prey items (mostly bacteria) are absent from its habitat, *P. bursaria* will digest its zoochlorellae.

A *P. bursaria* cell that has lost its zoochlorellae is aposymbiotic. If aposymbiotic cells have population growth rates the same as those of healthy, zoochlorella-containing *P. bursaria* in well-lit environments with plenty of prey items, then such an observation would be consistent with which type of relationship?

- A) parasitic
- B) commensalistic
- C) toxic
- D) mutualistic

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 27.5

58) Use the following information to answer the question.

Healthy individuals of *Paramecium bursaria* contain photosynthetic algal endosymbionts of the genus *Chlorella*. When within their hosts, the algae are referred to as zoochlorellae. In aquaria with light coming from only one side, *P. bursaria* gather at the well-lit side, whereas other species of *Paramecium* gather at the opposite side. The zoochlorellae provide their hosts with glucose and oxygen, and *P. bursaria* provides its zoochlorellae with protection and motility. *P. bursaria* can lose its zoochlorellae in two ways: (1) if kept in darkness, the algae will die; and (2) if prey items (mostly bacteria) are absent from its habitat, *P. bursaria* will digest its zoochlorellae.

Which of the following experimental results would suggest that the zoochlorellae and *P. bursaria* are mutualists?

- A) The reproductive rate of *P. bursaria* is higher with zoochlorellae than without.
- B) The mortality rate of *P. bursaria* is higher with zoochlorellae than without.
- C) Zoochlorellae reproduce more slowly than free-living *Chlorella*.
- D) The swimming speed of *P. bursaria* is higher with zoochlorellae than without.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.5

59) If all prokaryotes on Earth suddenly vanished, which of the following would be the most likely and most direct result?

- A) Human populations would thrive in the absence of disease.
- B) Bacteriophage numbers would dramatically increase.
- C) The recycling of nutrients would be greatly reduced, at least initially.
- D) There would be no more pathogens on Earth.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.5

60) In a hypothetical situation, a bacterium lives on the surface of a leaf, where it obtains nutrition from the leaf's nonliving, waxy covering while inhibiting the growth of other microbes that are plant pathogens. If this bacterium gains access to the inside of a leaf, however, it causes a fatal disease in the plant. Once the plant dies, the bacterium and its offspring decompose the plant. What is the correct sequence of ecological roles played by the bacterium in the situation described here?

- A) nutrient recycler, commensal, pathogen
- B) mutualist, commensal, pathogen
- C) mutualist, pathogen, nutrient recycler
- D) nutrient recycler, mutualist, primary producer

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 27.5

61) What is the goal of bioremediation?

- A) to improve human health with the help of living organisms such as bacteria
- B) to clean up areas polluted with toxic compounds by using bacteria
- C) to improve soil quality for plant growth by using bacteria
- D) to improve bacteria for production of useful chemicals

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 27.6

62) Foods can be preserved in many ways by slowing or preventing bacterial growth. Which of these methods should be *least* effective at inhibiting bacterial growth?

- A) refrigeration: slows bacterial metabolism and growth
- B) closing previously opened containers: prevents more bacteria from entering, and excludes oxygen
- C) pickling: creates a pH at which most bacterial enzymes cannot function
- D) canning in heavy sugar syrup: creates osmotic conditions that remove water from most bacterial cells

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 27.6

63) Broad-spectrum antibiotics inhibit the growth of most intestinal bacteria. Consequently, assuming that nothing is done to counter the reduction of intestinal bacteria, a hospital patient who is receiving broad-spectrum antibiotics is most likely to become _____.

- A) unable to fix carbon dioxide
- B) antibiotic resistant
- C) unable to synthesize peptidoglycan
- D) deficient in certain vitamins and nutrients

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 27.6

64) The pathogenic prokaryotes that cause cholera are _____.

- A) archaea that release an exotoxin
- B) archaea that release an endotoxin
- C) bacteria that release an exotoxin
- D) bacteria that release an endotoxin

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 27.6

65) Leaf-cutter ants harvest plant leaves and bring them back to their nests. There, in the warm, moist environments of their underground nests, they grow fungi (*Leucoagaricus*) that they then eat. These ants also host bacteria on their exoskeleton. Another fungus, *Escovopsis*, kills *Leucoagaricus* when the ants are removed from the nest. Knowing that the bacteria on the ants are in the same phylogenetic group of other bacteria that produce antibiotics, which of the following research hypotheses is most likely correct?

- A) The bacteria on the exoskeleton produce chemicals that kill *Leucoagaricus*.
- B) The bacteria on the exoskeleton produce chemicals that kill *Escovopsis*.
- C) The bacteria on the exoskeleton provide nutrition to the ants.
- D) The bacteria on the exoskeleton cause disease in the ants.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.6

66) When a virus infects a bacterial cell, often new viruses are assembled and released when the host bacterial cell is lysed. If these new viruses go on to infect new bacterial cells, the new host cells may not be lysed. What is the most plausible explanation for this?

- A) The bacterial cell must be resistant to infection by the virus.
- B) The virus carries genes that confer resistance to the host bacterial cell.
- C) The host bacterium couples the viral infection with transformation.
- D) The virus has entered the genome of the bacterial cell and is in the lysogenic stage.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.2

67) Sexual reproduction in eukaryotes increases genetic variation. In prokaryotes, transformation, transduction, and conjugation are mechanisms that increase genetic variation. A fundamental difference between the generation of genetic variation in the two domains is _____.

- A) eukaryotes are able to generate mutations in response to environmental stress while prokaryotes only generate random variation
- B) eukaryotic variation occurs primarily within a single generation while prokaryotic variation occurs over many generations
- C) crossing over is a major mechanism in creating genetic variation in prokaryotes while independent assortment is a major mechanism in eukaryotes
- D) eukaryotic genetic variation occurs when adults transmit genes to their offspring while prokaryotic genetic variation occurs with horizontal gene transfer

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 26.6; 27.2

68) In prokaryotes, new mutations accumulate quickly in populations, while in eukaryotes, new mutations accumulate much more slowly. The primary reasons for this are _____.

- A) prokaryotes have short generation times and large population sizes
- B) prokaryotes have random mutations while eukaryotes can target genes for mutations; thus mutations may not accumulate as quickly in eukaryotes, but they are more useful to the organism
- C) the DNA in prokaryotes is not as stable as eukaryotic DNA and is thus more likely to mutate
- D) prokaryote mutations are less effective than eukaryote mutations in providing variation for evolution

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 27.2

69) Compared to eukaryotes, prokaryotes are _____.

- A) less sensitive to the physical environment
- B) simpler morphologically and more evolutionarily primitive
- C) simpler morphologically, but not more evolutionarily primitive
- D) more complex morphologically and more primitive

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 27.2

27.2 Student Edition End-of-Chapter Questions

- 1) Genetic variation in bacterial populations cannot result from
A) transduction.
B) conjugation.
C) mutation.
D) meiosis.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 2) Photoautotrophs use
A) light as an energy source and CO₂ as a carbon source.
B) light as an energy source and methane as a carbon source.
C) N₂ as an energy source and CO₂ as a carbon source.
D) CO₂ as both an energy source and a carbon source.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 3) Which of the following statements is *not* true?
A) Archaea and bacteria have different membrane lipids.
B) The cell walls of archaea lack peptidoglycan.
C) Only bacteria have histones associated with DNA.
D) Only some archaea use CO₂ to oxidize H₂, releasing methane.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Which of the following involves metabolic cooperation among prokaryotic cells?
A) binary fission
B) endospore formation
C) biofilms
D) photoautotrophy

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 5) Bacteria perform the following ecological roles. Which role typically does *not* involve symbiosis?

- A) skin commensalist
B) decomposer
C) gut mutualist
D) pathogen

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 6) Plantlike photosynthesis that releases O₂ occurs in
- A) cyanobacteria.
 - B) gram-positive bacteria.
 - C) archaea.
 - D) chemoautotrophic bacteria.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

28.1 Multiple-Choice Questions

- 1) According to the endosymbiotic theory, why was it adaptive for the larger (host) cell to keep the engulfed cell alive, rather than digesting it as food?
- A) The engulfed cell provided the host cell with adenosine triphosphate (ATP).
 - B) The engulfed cell provided the host cell with carbon dioxide.
 - C) The engulfed cell allowed the host cell to metabolize glucose.
 - D) The host cell was able to survive anaerobic conditions with the engulfed cell alive.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 28.1

- 2) The chloroplasts of land plants are thought to have been derived according to which evolutionary sequence?
- A) cyanobacteria → green algae → land plants
 - B) cyanobacteria → green algae → fungi → land plants
 - C) red algae → brown algae → green algae → land plants
 - D) cyanobacteria → red algae → green algae → land plants

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.1

- 3) A particular species of protist has obtained a chloroplast via secondary endosymbiosis. You know this because the chloroplasts _____.
- A) have nuclear and cyanobacterial genes
 - B) are exceptionally small
 - C) have three or four membranes
 - D) have only a single pigment

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 28.1

- 4) All protists are _____.
- A) unicellular
 - B) eukaryotic
 - C) symbionts
 - D) mixotrophic

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.1

5) An individual mixotroph loses its plastids, yet continues to survive. Which of the following most likely accounts for its continued survival?

- A) It relies on photosystems that float freely in its cytosol.
- B) It must have gained extra mitochondria when it lost its plastids.
- C) It engulfs organic material by phagocytosis or by absorption.
- D) It has an endospore.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 28.1

6) Which of the following have chloroplasts (or structures since evolved from chloroplasts) thought to be derived from ancestral green algae?

- A) stramenopiles
- B) apicomplexans
- C) dinoflagellates
- D) chlorarachniophytes

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.1

7) Use the following information to answer the question.

Paulinella chromatophora is one of the few cercozoans that is autotrophic, carrying out aerobic photosynthesis with its two elongated "chromatophores." The chromatophores are contained within vesicles of the host cell, and each is derived from a cyanobacterium, though not the same type of cyanobacterium that gave rise to the chloroplasts of algae and plants.

The closest living relative of *P. chromatophora* is the heterotroph *P. ovalis*. *P. ovalis* uses threadlike pseudopods to capture its prey, which it digests internally. Which of the following, if observed, would be the best reason for relabeling *P. chromatophora* as a mixotroph instead of an autotroph?

- A) a pigmented central vacuole, surrounded by a nucleomorph
- B) a vacuole with food inside
- C) a secretory vesicle
- D) a contractile vacuole

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 28.1

8) Use the following information to answer the question.

Paulinella chromatophora is one of the few cercozoans that is autotrophic, carrying out aerobic photosynthesis with its two elongated "chromatophores." The chromatophores are contained within vesicles of the host cell, and each is derived from a cyanobacterium, though not the same type of cyanobacterium that gave rise to the chloroplasts of algae and plants.

Which process could have allowed the nucleomorphs of chlorarachniophytes to be reduced, without the net loss of any genetic information?

- A) conjugation
- B) horizontal gene transfer
- C) phagocytosis
- D) meiosis

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 28.1

9) Use the following information to answer the question.

Giardia intestinalis is an intestinal parasite of humans and other mammals that causes intestinal ailments in most people who ingest the cysts. Upon ingestion, each cyst releases two motile cells, called trophozoites. These attach to the small intestine's lining via a ventral adhesive disk. The trophozoites anaerobically metabolize glucose from the host's intestinal contents to produce ATP. Reproduction is completely asexual, occurring by longitudinal binary fission of trophozoites, with each daughter cell receiving two haploid nuclei ($n = 5$). A trophozoite will often encyst as it passes into the large intestine by secreting around itself a case that is resistant to cold, heat, and dehydration. Infection usually occurs by drinking untreated water that contains cysts.

The cysts of *Giardia* function most like the _____.

- A) mitochondria of ancestral diplomonads
- B) nuclei of archaeans
- C) endospores of bacteria
- D) capsids of viruses

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 28.2

10) Consider the following data: (a) Most ancient eukaryotes are unicellular. (b) All eukaryotes alive today have a nucleus and cytoskeleton. (c) Most ancient eukaryotes lack a cell wall. Which of the following conclusions could reasonably follow the data presented? The first eukaryote may have been _____.

- A) very similar to a plant cell
- B) anaerobic
- C) capable of phagocytosis
- D) photosynthetic

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 28.2

11) Use the following information to answer the question.

Giardia intestinalis is an intestinal parasite of humans and other mammals that causes intestinal ailments in most people who ingest the cysts. Upon ingestion, each cyst releases two motile cells, called trophozoites. These attach to the small intestine's lining via a ventral adhesive disk. The trophozoites anaerobically metabolize glucose from the host's intestinal contents to produce ATP. Reproduction is completely asexual, occurring by longitudinal binary fission of trophozoites, with each daughter cell receiving two haploid nuclei ($n = 5$). A trophozoite will often encyst as it passes into the large intestine by secreting around itself a case that is resistant to cold, heat, and dehydration. Infection usually occurs by drinking untreated water that contains cysts.

Giardia's mitosome can be said to be "doubly degenerate," because it is a degenerate type of _____, an organelle that is itself a degenerate form of _____.

- A) nucleus; archaean
- B) nucleus; bacterium
- C) mitochondria; proteobacterium
- D) mitochondria; spirochete

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.2

12) Use the following information to answer the question.

Giardia intestinalis is an intestinal parasite of humans and other mammals that causes intestinal ailments in most people who ingest the cysts. Upon ingestion, each cyst releases two motile cells, called trophozoites. These attach to the small intestine's lining via a ventral adhesive disk. The trophozoites anaerobically metabolize glucose from the host's intestinal contents to produce ATP. Reproduction is completely asexual, occurring by longitudinal binary fission of trophozoites, with each daughter cell receiving two haploid nuclei ($n = 5$). A trophozoite will often encyst as it passes into the large intestine by secreting around itself a case that is resistant to cold, heat, and dehydration. Infection usually occurs by drinking untreated water that contains cysts.

The mitosome of *Giardia* has no DNA within it. If it did contain DNA, then what predictions should we be able to make about its DNA?

- A) It is linear, has many introns, and is not associated with histone proteins.
- B) It is linear, has few introns, and is complexed with histone proteins.
- C) It is circular, has many introns, and is complexed with histone proteins.
- D) It is circular, has few introns, and is not associated with histone proteins.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 28.2

13) Use the following information to answer the question.

Giardia intestinalis is an intestinal parasite of humans and other mammals that causes intestinal ailments in most people who ingest the cysts. Upon ingestion, each cyst releases two motile cells, called trophozoites. These attach to the small intestine's lining via a ventral adhesive disk. The trophozoites anaerobically metabolize glucose from the host's intestinal contents to produce ATP. Reproduction is completely asexual, occurring by longitudinal binary fission of trophozoites, with each daughter cell receiving two haploid nuclei ($n = 5$). A trophozoite will often encyst as it passes into the large intestine by secreting around itself a case that is resistant to cold, heat, and dehydration. Infection usually occurs by drinking untreated water that contains cysts.

Given its mode of reproduction and internal structures, which of the following should be expected to occur in *Giardia* at some stage of its life cycle?

- A) separation (segregation) of daughter chromosomes
- B) crossing over
- C) meiosis
- D) synapsis

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 28.2

14) Use the following information to answer the question.

Giardia intestinalis is an intestinal parasite of humans and other mammals that causes intestinal ailments in most people who ingest the cysts. Upon ingestion, each cyst releases two motile cells, called trophozoites. These attach to the small intestine's lining via a ventral adhesive disk. The trophozoites anaerobically metabolize glucose from the host's intestinal contents to produce ATP. Reproduction is completely asexual, occurring by longitudinal binary fission of trophozoites, with each daughter cell receiving two haploid nuclei ($n = 5$). A trophozoite will often encyst as it passes into the large intestine by secreting around itself a case that is resistant to cold, heat, and dehydration. Infection usually occurs by drinking untreated water that contains cysts.

If the mitosomes of *Giardia* contain no DNA, yet are descendants of what were once free-living organisms, then where are we likely to find the genes that encode their structures, and what accounts for their current location there?

- A) plasmids; conjugation
- B) plasmids; transformation
- C) nucleus; horizontal gene transfer
- D) nucleus; S phase

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 28.2

15) Trypanosome infections evade attacks by host immune systems through which of the following mechanisms?

- A) production of new cell-surface proteins with a different molecular structure by each new generation
- B) production of toxins that kill lymphocytes
- C) insertion of its DNA into the nuclear DNA of host cells
- D) infection of lymphocytes leading to a decline in the host's ability to fight infection

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.2

16) Many parasitic members of the excavates lack plastids and have highly reduced mitochondria. Which of the following statements explains these observations?

- A) These parasites live in dark, low-oxygen conditions, and therefore it was adaptive to move all plastid and mitochondrial genes to the nucleus.
- B) The original, eukaryotic ancestors of these parasites did not engulf prokaryotes.
- C) These parasites live in dark, low-oxygen conditions and therefore loss of genes for plastids and mitochondria did not result in lower fitness.
- D) In the future, natural selection will favor descendants that acquire new plastid genes from today's prokaryotes.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 28.2

17) Prokaryotic and eukaryotic flagella _____.

- A) have the same evolutionary origin
- B) have different structures
- C) require different sources of energy
- D) contain their own DNA

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.2

18) When a mosquito infected with *Plasmodium* first bites a human, the *Plasmodium* _____.

- A) gametes fuse, forming an oocyst
- B) cells infect the human liver cells
- C) cells cause lysing of the human red blood cells
- D) oocyst undergoes meiosis

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3

19) Which two genera have members that can evade the human immune system by frequently changing their surface proteins?

- A) *Plasmodium* and *Trypanosoma*
- B) *Trichomonas* and *Paramecium*
- C) *Trichomonas* and *Trypanosoma*
- D) *Trypanosoma* and *Entamoeba*

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3

20) Which of the following pairs of protists and their ecological roles are correctly matched?

- A) apicomplexans—parasites of animals
- B) euglenozoans—primarily mixotrophic
- C) dinoflagellates—parasites of plants
- D) entamoebas—free-living soil organisms

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3

21) Dinoflagellates _____.

- A) possess two flagella
- B) are all autotrophic
- C) lack mitochondria
- D) include species that cause malaria

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3

22) You are given an unknown organism to identify. It is unicellular and heterotrophic. It is motile, using many short extensions of the cytoplasm, each featuring the 9 + 2 filament pattern. It has well-developed organelles and two nuclei, one large and one small. This organism is most likely to be a _____.

- A) foraminiferan
- B) radiolarian
- C) ciliate
- D) kinetoplastid

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 28.3

23) Which of the following is characteristic of ciliates?

- A) They use pseudopods as feeding structures.
- B) They are often multinucleate.
- C) They can exchange genetic material with other ciliates by the process of mitosis.
- D) Most live as solitary autotrophs in fresh water.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3

24) Diatoms are mostly asexual members of the phytoplankton. Diatoms lack any organelles that might have the 9 + 2 pattern. They obtain their nutrition from functional chloroplasts, and each diatom is encased within two porous, glasslike valves. Which question would be most important for one interested in the day-to-day survival of individual diatoms?

- A) How do diatoms get transported from one location on the water's surface layers to another location on the surface?
- B) How do diatoms with their glasslike valves keep from sinking into poorly lit waters?
- C) How do diatoms with their glasslike valves avoid being shattered by the action of waves?
- D) How do diatom sperm cells locate diatom egg cells?

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 28.3

25) A large seaweed that floats freely on the surface of deep bodies of water would be expected to have which of the following?

- A) rigid stems
- B) bladders
- C) true roots
- D) gel-forming proteins

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3

26) Reinforced, threadlike pseudopods that can perform phagocytosis are generally characteristic of _____.

- A) foraminifera
- B) water molds
- C) dinoflagellates
- D) oomycetes

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3

27) A porous test (shell) of calcium carbonate, through which pseudopodia protrude, is characteristic of _____.

- A) diatoms
- B) foraminiferans
- C) ciliates
- D) water molds

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3

28) You are given the task of designing an aquatic protist that is a primary producer. It cannot swim on its own, yet must stay in well-lit surface waters. It must be resistant to physical damage from wave action. It should be most similar to a(n) _____.

- A) diatom
- B) dinoflagellate
- C) apicomplexan
- D) red alga

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 28.3

29) A gelatinous seaweed that grows in shallow, cold water and undergoes heteromorphic alternation of generations is most probably what type of alga?

- A) red
- B) green
- C) brown
- D) yellow

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3

30) You are given four test tubes, each containing an unknown protist, and your task is to read the following description and match these four protists to the correct test tube.

When light, especially red and blue light, is shone on the tubes, oxygen bubbles accumulate on the inside of test tubes 1 and 2. Chemical analysis of test tube 1 indicates the presence of a chemical that is toxic to fish and humans. Chemical analysis of test tube 2 indicates the presence of substantial amounts of silica. Microscopic analysis of organisms in test tubes 1, 3, and 4 reveals the presence of permanent, membrane-bounded sacs just under the plasma membrane. Microscopic analysis of organisms in test tube 3 reveals the presence of an apicoplast in each. Microscopic analysis of the contents in test tube 4 reveals the presence of one large nucleus and one small nucleus in each organism.

Test tube 3 contains _____.

- A) *Paramecium*
- B) *Pfiesteria* (dinoflagellate)
- C) *Entamoeba*
- D) *Plasmodium*

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 28.3

31) You are given four test tubes, each containing an unknown protist, and your task is to read the following description and match these four protists to the correct test tube.

When light, especially red and blue light, is shone on the tubes, oxygen bubbles accumulate on the inside of test tubes 1 and 2. Chemical analysis of test tube 1 indicates the presence of a chemical that is toxic to fish and humans. Chemical analysis of test tube 2 indicates the presence of substantial amounts of silica. Microscopic analysis of organisms in test tubes 1, 3, and 4 reveals the presence of permanent, membrane-bounded sacs just under the plasma membrane. Microscopic analysis of organisms in test tube 3 reveals the presence of an apicoplast in each. Microscopic analysis of the contents in test tube 4 reveals the presence of one large nucleus and one small nucleus in each organism.

Test tube 4 contains _____.

- A) *Paramecium*
- B) *Pfiesteria* (dinoflagellate)
- C) *Entamoeba*
- D) *Plasmodium*

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 28.3

32) You are given four test tubes, each containing an unknown protist, and your task is to read the following description and match these four protists to the correct test tube.

When light, especially red and blue light, is shone on the tubes, oxygen bubbles accumulate on the inside of test tubes 1 and 2. Chemical analysis of test tube 1 indicates the presence of a chemical that is toxic to fish and humans. Chemical analysis of test tube 2 indicates the presence of substantial amounts of silica. Microscopic analysis of organisms in test tubes 1, 3, and 4 reveals the presence of permanent, membrane-bounded sacs just under the plasma membrane. Microscopic analysis of organisms in test tube 3 reveals the presence of an apicoplast in each. Microscopic analysis of the contents in test tube 4 reveals the presence of one large nucleus and one small nucleus in each organism.

Test tube 1 contains _____.

- A) *Paramecium*
- B) *Pfiesteria* (dinoflagellate)
- C) *Entamoeba*
- D) *Plasmodium*

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 28.3

33) You are given four test tubes, each containing an unknown protist, and your task is to read the following description and match these four protists to the correct test tube.

When light, especially red and blue light, is shone on the tubes, oxygen bubbles accumulate on the inside of test tubes 1 and 2. Chemical analysis of test tube 1 indicates the presence of a chemical that is toxic to fish and humans. Chemical analysis of test tube 2 indicates the presence of substantial amounts of silica. Microscopic analysis of organisms in test tubes 1, 3, and 4 reveals the presence of permanent, membrane-bounded sacs just under the plasma membrane. Microscopic analysis of organisms in test tube 3 reveals the presence of an apicoplast in each. Microscopic analysis of the contents in test tube 4 reveals the presence of one large nucleus and one small nucleus in each organism.

Test tube 2 contains _____.

- A) *Paramecium*
- B) *Pfiesteria* (dinoflagellate)
- C) *Entamoeba*
- D) *Triceratium* (diatom)

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 28.3

34) Use the following description and table to answer the question.

Diatoms are encased in petri-plate-like cases (valves) made of translucent hydrated silica whose thickness can be varied. The material used to store excess calories can also be varied. At certain times, diatoms store excess calories in the form of the liquid polysaccharide, laminarin, and at other times as oil. The following are data concerning the density (specific gravity) of various components of diatoms, and of their environment.

Specific Gravities of Materials Relevant to Diatoms

Material	Specific Gravity (kg/m ³)
Pure water	1000
Seawater	1026
Hydrated silica	2250
Liquid laminarin	1500
Diatom oil	910

Water's density and, consequently, its buoyancy decrease at warmer temperatures. Based on this consideration, and using data from the table above, at which time of year should one expect diatoms to be storing excess calories mostly as oil?

- A) mid-winter
- B) early spring
- C) late summer
- D) late fall

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 28.3

35) Use the following description and table to answer the question.

Diatoms are encased in petri-plate-like cases (valves) made of translucent hydrated silica whose thickness can be varied. The material used to store excess calories can also be varied. At certain times, diatoms store excess calories in the form of the liquid polysaccharide, laminarin, and at other times as oil. The following are data concerning the density (specific gravity) of various components of diatoms, and of their environment.

Specific Gravities of Materials Relevant to Diatoms

Material	Specific Gravity (kg/m ³)
Pure water	1000
Seawater	1026
Hydrated silica	2250
Liquid laminarin	1500
Diatom oil	910

Water's density and, consequently, its buoyancy decrease at warmer temperatures. Considering the impact of temperature, and the table above, in which environment should diatoms sinking be slowest?

- A) cold fresh water
- B) warm fresh water
- C) cold seawater
- D) warm seawater

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 28.3

36) Use the following information to answer the question.

Healthy individuals of *Paramecium bursaria* contain photosynthetic algal endosymbionts of the genus *Chlorella*. When within their hosts, the algae are referred to as zoochlorellae. In aquaria with light coming from only one side, *P. bursaria* gather at the well-lit side, whereas other species of *Paramecium* gather at the opposite side. The zoochlorellae provide their hosts with glucose and oxygen, and *P. bursaria* provides its zoochlorellae with protection and motility. *P. bursaria* can lose its zoochlorellae in two ways: (1) if kept in darkness, the algae will die; and (2) if prey items (mostly bacteria) are absent from its habitat, *P. bursaria* will digest its zoochlorellae.

Which term best describes the symbiotic relationship of well-fed *P. bursaria* to their zoochlorellae?

- A) mutualistic
- B) parasitic
- C) predatory
- D) pathogenic

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 28.3

37) Use the following information to answer the question.

Healthy individuals of *Paramecium bursaria* contain photosynthetic algal endosymbionts of the genus *Chlorella*. When within their hosts, the algae are referred to as zoochlorellae. In aquaria with light coming from only one side, *P. bursaria* gather at the well-lit side, whereas other species of *Paramecium* gather at the opposite side. The zoochlorellae provide their hosts with glucose and oxygen, and *P. bursaria* provides its zoochlorellae with protection and motility. *P. bursaria* can lose its zoochlorellae in two ways: (1) if kept in darkness, the algae will die; and (2) if prey items (mostly bacteria) are absent from its habitat, *P. bursaria* will digest its zoochlorellae.

The motility that permits *P. bursaria* to move toward a light source is provided by _____.

- A) pseudopods
- B) a single flagellum featuring the 9 + 2 pattern
- C) many cilia
- D) contractile vacuoles

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 28.3

38) Use the following information to answer the question.

Healthy individuals of *Paramecium bursaria* contain photosynthetic algal endosymbionts of the genus *Chlorella*. When within their hosts, the algae are referred to as zoochlorellae. In aquaria with light coming from only one side, *P. bursaria* gather at the well-lit side, whereas other species of *Paramecium* gather at the opposite side. The zoochlorellae provide their hosts with glucose and oxygen, and *P. bursaria* provides its zoochlorellae with protection and motility. *P. bursaria* can lose its zoochlorellae in two ways: (1) if kept in darkness, the algae will die; and (2) if prey items (mostly bacteria) are absent from its habitat, *P. bursaria* will digest its zoochlorellae.

A *P. bursaria* cell that has lost its zoochlorellae is said to be *aposymbiotic*. It might be able to replenish its contingent of zoochlorellae by ingesting them without subsequently digesting them. Which of the following situations would be most favorable to the reestablishment of resident zoochlorellae, assuming compatible *Chlorella* are present in *P. bursaria*'s habitat?

- A) abundant light, no bacterial prey
- B) abundant light, abundant bacterial prey
- C) no light, no bacterial prey
- D) no light, abundant bacterial prey

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 28.3

39) A *P. bursaria* cell that has lost its zoochlorellae is *aposymbiotic*. If aposymbiotic cells have population growth rates the same as those of healthy, zoochlorella-containing *P. bursaria* in well-lit environments with plenty of prey items, then such an observation would be consistent with which type of relationship?

- A) parasitic
- B) competitive
- C) toxic
- D) mutualistic

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 28.3

40) Use the following information to answer the question.

Healthy individuals of *Paramecium bursaria* contain photosynthetic algal endosymbionts of the genus *Chlorella*. When within their hosts, the algae are referred to as zoochlorellae. In aquaria with light coming from only one side, *P. bursaria* gather at the well-lit side, whereas other species of *Paramecium* gather at the opposite side. The zoochlorellae provide their hosts with glucose and oxygen, and *P. bursaria* provides its zoochlorellae with protection and motility. *P. bursaria* can lose its zoochlorellae in two ways: (1) if kept in darkness, the algae will die; and (2) if prey items (mostly bacteria) are absent from its habitat, *P. bursaria* will digest its zoochlorellae.

Theoretically, *P. bursaria* can obtain zoochlorellae either vertically (via the asexual reproduction of its mother cell) or horizontally (by ingesting free-living *Chlorella* from its habitat). Consider a *P. bursaria* cell containing zoochlorellae but whose habitat lacks free-living *Chlorella*. If this cell subsequently undergoes many generations of asexual reproduction, if all of its daughter cells contain roughly the same number of zoochlorellae as it had originally contained, and if the zoochlorellae are all haploid and identical in appearance, then which statement is accurate? The zoochlorellae _____.

- A) also reproduced asexually, at an increasing rate over time
- B) also reproduced asexually, at a decreasing rate over time
- C) also reproduced asexually, at a fairly constant rate over time
- D) reproduced sexually, undergoing heteromorphic alternation of generations

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 28.3

41) Use the following information to answer the question.

Healthy individuals of *Paramecium bursaria* contain photosynthetic algal endosymbionts of the genus *Chlorella*. When within their hosts, the algae are referred to as zoochlorellae. In aquaria with light coming from only one side, *P. bursaria* gather at the well-lit side, whereas other species of *Paramecium* gather at the opposite side. The zoochlorellae provide their hosts with glucose and oxygen, and *P. bursaria* provides its zoochlorellae with protection and motility. *P. bursaria* can lose its zoochlorellae in two ways: (1) if kept in darkness, the algae will die; and (2) if prey items (mostly bacteria) are absent from its habitat, *P. bursaria* will digest its zoochlorellae.

Which process in *Paramecium* results in genetic recombination but no increase in population size?

- A) budding
- B) meiotic division
- C) conjugation
- D) binary fission

Answer: C

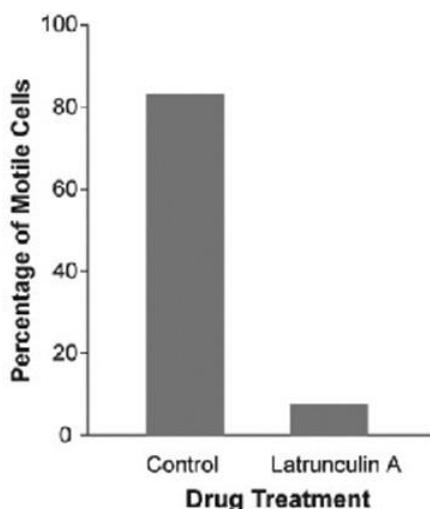
Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3

42) Use the following information to answer the question.

The mechanism of cell crawling in protist species is not well defined. Pseudopodia extension involves interactions between actin and myosin (the same molecules that are involved in vertebrate muscle contraction). However, prior to the study described below, no one had provided convincing data that actin and myosin were actually involved in cell crawling in protists. Anatomical studies had identified the cytoskeletal protein actin just below the surface of the cell membrane in several species of protist, but physiological studies had failed to show a functional link between actin, myosin, and cell crawling.

In a study by N. Poulsen et al. (*Diatom gliding is the result of an actin-myosin motility system*, *Cell Motility and the Cytoskeleton* 44 (1999):23-22), researchers tested whether motility in a particular species of diatom involves interactions between actin and myosin.



Refer to the study by Poulsen et al. and the figure above. Latrunculin A is a reversible toxin that disrupts the formation of actin fibers. A culture of a particular species of diatom was treated with this toxin diluted in a buffer, while another culture was treated only with the buffer (no toxin; control). The motility of cells in each culture was assessed by counting the number of cells that were moving during a defined period of time. Which of the following conclusions is reasonable based on the above figure?

- A) Formation of actin fibers is not necessary for the movement in this species of diatom.
- B) The buffer alone largely inhibited movement in this species of diatom.
- C) In this species of diatom, fully formed actin fibers are necessary for movement.
- D) In this species of diatom, fully formed myosin proteins are necessary for movement.

Answer: C

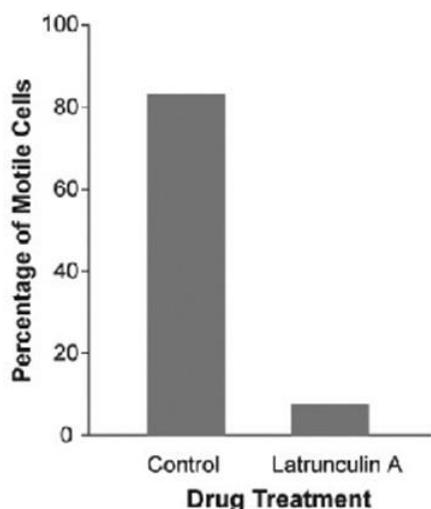
Bloom's Taxonomy: Application/Analysis

Section: 28.3

43) Use the following information to answer the question.

The mechanism of cell crawling in protist species is not well defined. Pseudopodia extension involves interactions between actin and myosin (the same molecules that are involved in vertebrate muscle contraction). However, prior to the study described below, no one had provided convincing data that actin and myosin were actually involved in cell crawling in protists. Anatomical studies had identified the cytoskeletal protein actin just below the surface of the cell membrane in several species of protist, but physiological studies had failed to show a functional link between actin, myosin, and cell crawling.

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Refer to the study by Poulsen et al. and the figure above. The data graphed in the figure could be an artifact if latrunculin A kills this species of diatoms (that is, that may be why the cells are not moving). Which of the following would be the best evidence that latrunculin A is *not* killing the cells?

- A) When the toxin was washed off the culture, the cells began to move again.
- B) There was still a small percentage of motile cells in the culture treated with the toxin.
- C) Most of the cells in the control were moving, indicating that they were alive.
- D) When the toxin was applied to another species of diatom, 25% of them continued to move.

Answer: A

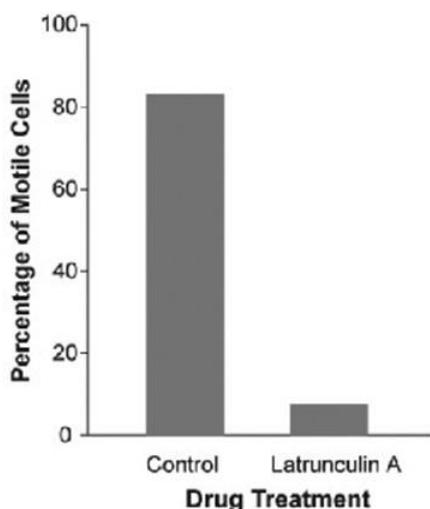
Bloom's Taxonomy: Application/Analysis

Section: 28.3

44) Use the following information to answer the question.

The mechanism of cell crawling in protist species is not well defined. Pseudopodia extension involves interactions between actin and myosin (the same molecules that are involved in vertebrate muscle contraction). However, prior to the study described below, no one had provided convincing data that actin and myosin were actually involved in cell crawling in protists. Anatomical studies had identified the cytoskeletal protein actin just below the surface of the cell membrane in several species of protist, but physiological studies had failed to show a functional link between actin, myosin, and cell crawling.

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Refer to the study by Poulsen et al. and the figure above. Cultures of a species of diatom were treated with BDM, a reversible inhibitor of myosin function. Which of the following predictions is consistent with the hypothesis that an actin-myosin interaction is necessary for motility?

- A) BDM will significantly decrease motility of the cells in culture.
- B) BDM will not significantly alter motility of the cells in culture.
- C) BDM will significantly increase motility of the cells in culture.
- D) BDM will significantly increase motility of the cells in their natural habitats.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 28.3

45) Use the following information to answer the question(s) below.

Paulinella chromatophora is one of the few cercozoans that is autotrophic, carrying out aerobic photosynthesis with its two elongated "chromatophores." The chromatophores are contained within vesicles of the host cell, and each is derived from a cyanobacterium, though not the same type of cyanobacterium that gave rise to the chloroplasts of algae and plants.

P. chromatophora secretes around itself a test, or case, of plates made of silica. Which of the following is another rhizarian that would be in competition with *P. chromatophora* for the silica needed to make these plates, assuming limited quantities of silica in the environment?

- A) radiolarians
- B) foraminiferans
- C) dinoflagellates
- D) diatoms

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3

46) Including the membrane of the surrounding vesicle, how many *phospholipid* (*not* lipopolysaccharide) bilayers should be found around each *P. chromatophora*'s chromatophore, and which one of these bilayers should have photosystems embedded in it?

- A) two; innermost
- B) two; outermost
- C) three; innermost
- D) three; outermost

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 28.3

47) Which of the following results would be most important in determining whether *P. chromatophora*'s chromatophore is still an endosymbiont, or is an organelle, as the term *chromatophore* implies?

- A) if *P. chromatophora* is less fit without its chromatophore than with it
- B) if the chromatophore is less fit without the host cercozoan than with it
- C) if there is ongoing metabolic cooperation between the chromatophore and the host cercozoan
- D) if there has been movement of genes from the chromatophore genome to the nuclear genome, such that these genes are no longer present in the chromatophore genome

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 28.3

48) The genome of modern chloroplasts is roughly 50% the size of the genome of the cyanobacterium from which it is thought to have been derived. In comparison, the genome of *P. chromatophora*'s chromatophore is only slightly reduced relative to the size of the genome of the cyanobacterium from which it is thought to have been derived. What is a valid hypothesis that can be drawn from this comparison?

- A) Lytic phage infections have targeted the chloroplast genome more often than the *P. chromatophora* genome.
- B) *P. chromatophora*'s chromatophore is the result of an evolutionarily recent endosymbiosis.
- C) The genome of the chloroplast ancestor contained many more introns that could be lost without harm compared to the chromatophore's genome.
- D) The genome of the cyanobacteria was smaller than the genome of *P. chromatophora*.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 28.3

49) A biologist discovers an alga that is marine, multicellular, and lives at a depth reached only by blue light. This alga is most likely a type of _____.

- A) red algae
- B) brown algae
- C) green algae
- D) golden algae

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.4

50) _____ is an important group of protists that produce _____, a substance useful to humans.

- A) Forams; diatomaceous earth
- B) Dinoflagellates; red tide compounds
- C) Diatoms; enzymes that digest cellulose
- D) Kelp; algin

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3, 28.4

51) The fact that amoebas are not monophyletic demonstrates that _____.

- A) movement by pseudopodia evolved only once
- B) scientists need to continue to investigate the origins and evolutionary history of protists
- C) evolutionary history cannot be discovered
- D) eukaryotes are also not monophyletic and need to be broken into many groups

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 28.3

52) SAR is a group defined by DNA similarities. This grouping represents _____.

- A) a paraphyletic group
- B) a hypothesis about evolutionary history
- C) a catch-all group that links many unrelated organisms
- D) a demonstration that DNA similarities cannot reveal evolutionary history

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3

53) Predict the most likely outcome of fertilizing areas of ocean with iron.

- A) an increase in dinoflagellate populations that will eliminate problems caused by red tides
- B) an increase in foram populations that will contribute to growth of corals and their symbionts
- C) an increase in diatom populations that will contribute to reducing atmospheric CO₂
- D) a decrease in slime mold populations and thus a decrease in decomposition rates

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.3

54) Green algae differ from land plants in that many green algae _____.

- A) are unicellular
- B) have plastids
- C) have alternation of generations
- D) have cell walls containing cellulose

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.4

55) You are given the task of designing an aerobic, mixotrophic protist that can perform photosynthesis in fairly deep water (for example, 250 meters deep) and can also crawl about and engulf small particles. With which two of the following structures would you provide your protist?

- A) hydrogenosomes and apicoplasts
- B) apicoplasts and pseudopods
- C) pseudopods and chloroplasts from red algae
- D) chloroplasts from both red and green algae

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 28.4

56) Similar to most amoebozoans, the forams and the radiolarians also have pseudopods, as do some of the white blood cells of animals (monocytes). If one were to erect a taxon that included all organisms that have cells with pseudopods, the taxon would _____.

- A) be polyphyletic
- B) be paraphyletic
- C) be monophyletic
- D) include all eukaryotes

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 28.4

57) Which of the following groups is matched with a correct anatomical feature?

- A) foraminifera → silicon-rich tests
- B) dinoflagellata → holdfast
- C) diatoms → tests made of cellulose
- D) brown algae → blade

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.4

58) Evidence that supports placing green algae and plants in the same phylogenetic group includes _____.

- A) similarities in mitochondrial structure and enzyme sequences
- B) similarities in chloroplast structure and pigment composition
- C) similarities in cell wall and membrane structure
- D) DNA sequence similarities in genes for ribosome structure

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.4

59) Many chlorophytes are unicellular, but others are bigger and more complex. The fact that increased size and complexity evolved in different ways indicates _____.

- A) the chlorophyte group is not monophyletic
- B) the chlorophyte group is monophyletic
- C) the chlorophyte group is the protist group most closely related to plants
- D) the chlorophyte group contained extensive genetic variability

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 28.4

60) Previously recognized similarities that seemed to connect slime molds and fungi are now considered to be _____.

- A) homologies
- B) examples of convergent evolution
- C) variations of common ancestral traits
- D) adaptations for much different functions

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.5

61) Branching points at the root of the eukaryotic phylogenetic tree _____.

- A) reveal that unikonts are derived from the SAR clade
- B) suggest that Archaeplastids were the first eukaryotes
- C) strongly suggest that fungi are more closely related to plants than animals
- D) are presently unclear

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.5

62) Super cells characteristic of plasmodial slime molds result when which one of the following common cellular processes does *not* occur?

- A) mitosis
- B) cytokinesis
- C) aerobic metabolism
- D) endocytosis

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.5

63) Which of the following is responsible for nearly 100,000 human deaths worldwide every year?

- A) *Entamoeba histolytica*
- B) *Amoeba proteus*
- C) plasmodial slime molds
- D) *Dictyostelium discoideum*

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.5

64) In order to determine the "root" of the eukaryote phylogenetic tree, scientists should _____.

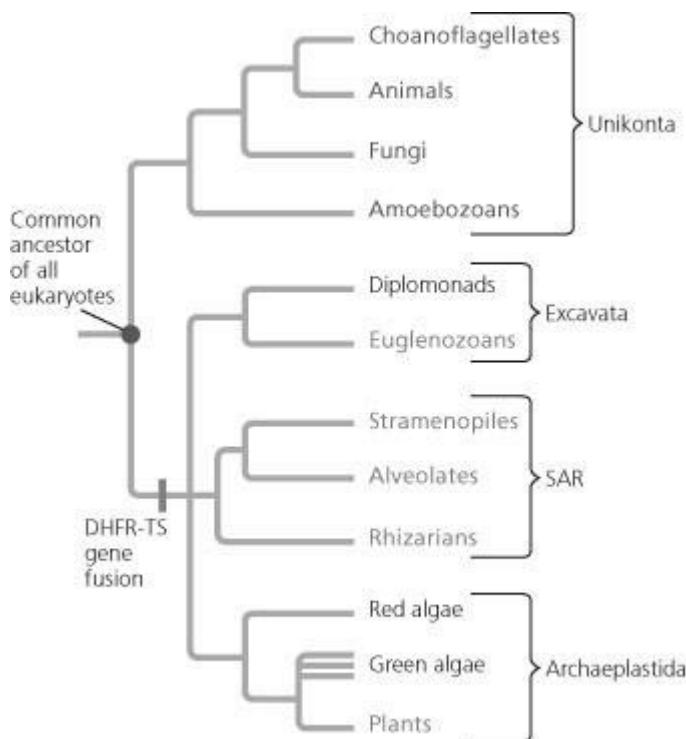
- A) compare the myosin genes in amoebozoans and opisthokonts
- B) compare the sequences of chloroplast genes of green algae and plants
- C) sequence more nuclear genes in green algae and plants
- D) sequence more nuclear genes in slime molds and other unikonts

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 28.5

65) Use the following figure to answer the question.



"Rare events" can help us understand evolutionary events, as shown in the figure. Which of the following statements explains the logic of this approach?

- A) Organisms with the mutation evolved convergently.
- B) The mutation provided an adaptive advantage to the organisms that contained it.
- C) Because the mutation likely occurred only once, all organisms with the mutation have a common ancestor with the mutation.
- D) "Reverse evolution" does not occur.

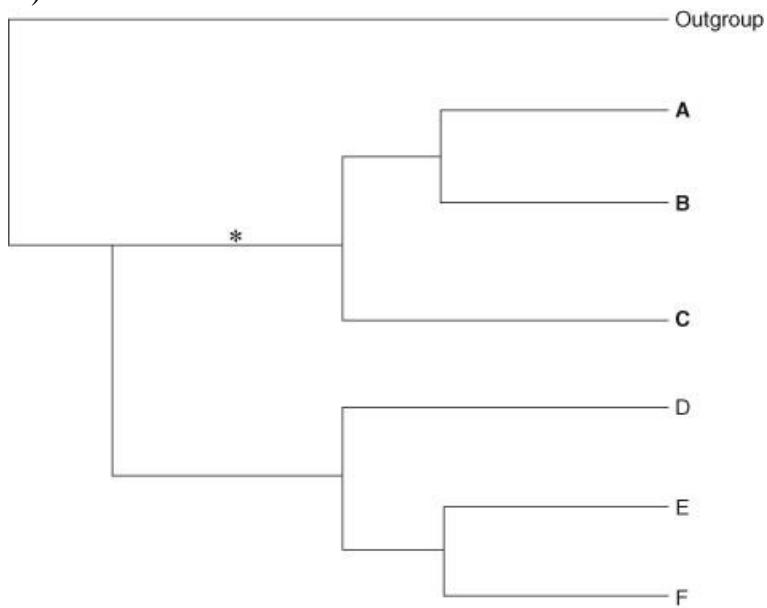
Answer: C

Bloom's Taxonomy: Application/Analysis

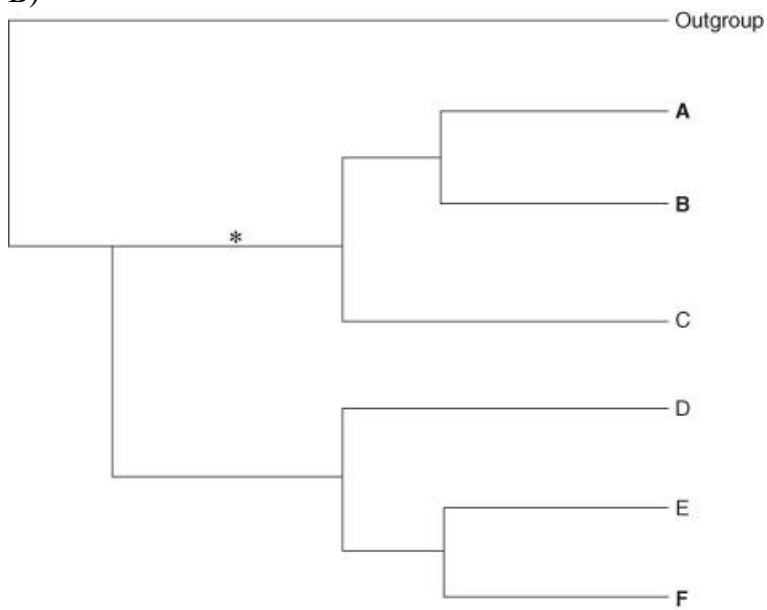
Section: 28.5

66) Which of the following phylogenetic trees appropriately groups organisms A to F? The asterisk shows the occurrence of a specific, rare mutation. The organisms that contain the rare mutation are also shown in **bold**.

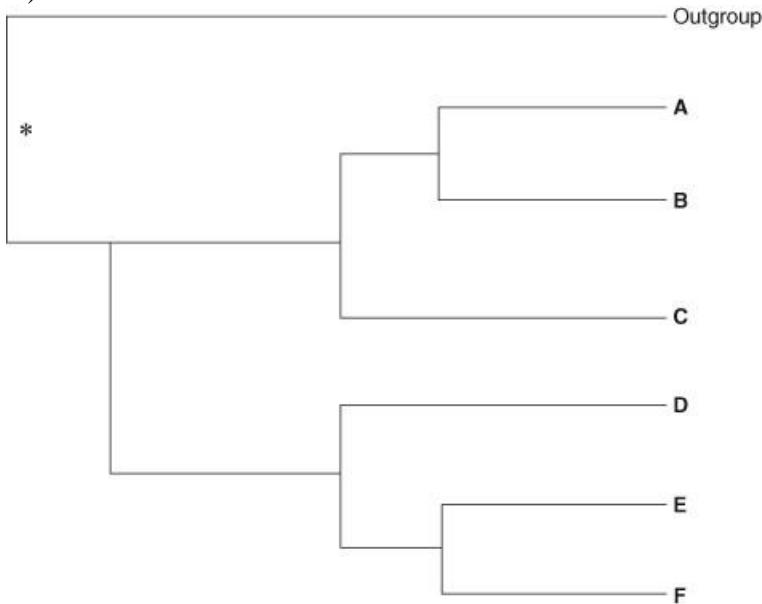
A)



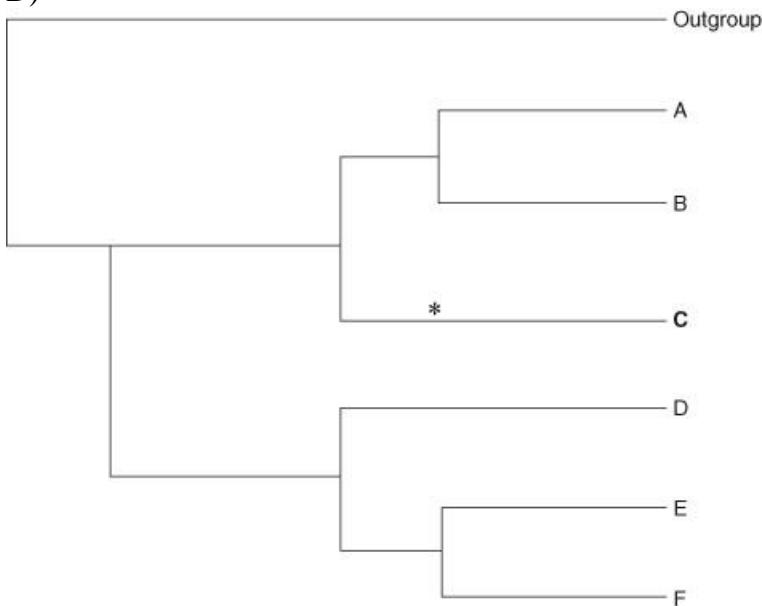
B)



C)



D)



Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 28.5

67) Imagine that some members of an aquatic species of motile, photosynthetic protists evolve to become parasitic to fish. They gain the ability to live in the fish gut, absorbing nutrients as the fish digests food. Over time, which of the following phenotypic changes would you expect to observe in this population of protists?

- A) loss of motility
- B) loss of chloroplasts
- C) gain of a rigid cell wall
- D) gain of meiosis

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 28.6

68) Use the following information to answer the question.

Healthy individuals of *Paramecium bursaria* contain photosynthetic algal endosymbionts of the genus *Chlorella*. When within their hosts, the algae are referred to as zoochlorellae. In aquaria with light coming from only one side, *P. bursaria* gather at the well-lit side, whereas other species of *Paramecium* gather at the opposite side. The zoochlorellae provide their hosts with glucose and oxygen, and *P. bursaria* provides its zoochlorellae with protection and motility. *P. bursaria* can lose its zoochlorellae in two ways: (1) if kept in darkness, the algae will die; and (2) if prey items (mostly bacteria) are absent from its habitat, *P. bursaria* will digest its zoochlorellae.

Which term most accurately describes the nutritional mode of healthy *P. bursaria*?

- A) photoautotroph
- B) photoheterotroph
- C) chemoautotroph
- D) mixotroph

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 28.6

69) Living diatoms contain brownish plastids. If global warming causes blooms of diatoms in the surface waters of Earth's oceans, how might this be harmful to the animals that build coral reefs?

- A) The coral animals, which capture planktonic organisms, may be outcompeted by the diatoms.
- B) The coral animals' endosymbiotic dinoflagellates may get "shaded out" by the diatoms.
- C) The coral animals may die from overeating the plentiful diatoms with their cases of silica.
- D) The diatoms' photosynthetic output may over-oxygenate the water.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 28.6

70) Which of the following organisms is a producer?

- A) kinetoplastids
- B) apicomplexans
- C) diatoms
- D) ciliates

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 28.6

71) Which of the following approaches would be most likely to cause evolution of a drug-resistant strain of *Plasmodium*?

- A) widespread, frequent spraying to kill mosquitoes
- B) use of a cocktail of three drugs in patients suffering from malaria
- C) widespread, frequent use of a single drug in patients suffering from malaria
- D) widespread use of anti-mosquito bed nets

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 28.2

72) Which of the following statements is accurate with regard to the observation that "income levels in countries hard hit by malaria are 33% lower than in similar countries free of the disease."

- A) This observation suggests that symptoms from malaria cause patients to lose pay because they miss work.
- B) This observation is an example of a correlation and therefore causality cannot be inferred as confidently as if we have results from a manipulated experiment.
- C) In order to understand the cause of this observation, scientists should eradicate malaria in ten countries but not in ten other comparable countries in order to experimentally test whether malaria caused the low income levels.
- D) The observation demonstrates that correlations provide excellent indications of causality.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 28.6

73) Which of the following results would be most likely if a layer of warm, light water caused by ocean surface warming blocks nutrient upwelling?

- A) reduced populations of fish because they avoid warm water
- B) increased populations of producers because they have access to more CO₂
- C) reduced populations of producers because they have access to fewer nutrients
- D) increased populations of producers because fewer fish are produced, and they eat fewer producers

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 28.6

28.2 Student Edition End-of-Chapter Questions

- 1) Plastids that are surrounded by more than two membranes are evidence of
A) evolution from mitochondria.
B) fusion of plastids.
C) origin of the plastids from archaea.
D) secondary endosymbiosis.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 2) Biologists think that endosymbiosis gave rise to mitochondria before plastids partly because
A) the products of photosynthesis could not be metabolized without mitochondrial enzymes.
B) all eukaryotes have mitochondria (or their remnants), whereas many eukaryotes do not have plastids.
C) mitochondrial DNA is less similar to prokaryotic DNA than is plastid DNA.
D) without mitochondrial CO₂ production, photosynthesis could not occur.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 3) Which group is *incorrectly* paired with its description?
A) diatoms—important producers in aquatic communities
B) red algae—eukaryotes that acquired plastids by secondary endosymbiosis
C) apicomplexans—unicellular parasites with intricate life cycles
D) diplomonads—unicellular eukaryotes with modified mitochondria

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 4) According to the phylogeny presented in this chapter, which protists are in the same eukaryotic supergroup as plants?
A) green algae
B) dinoflagellates
C) red algae
D) both A and C

Answer: D

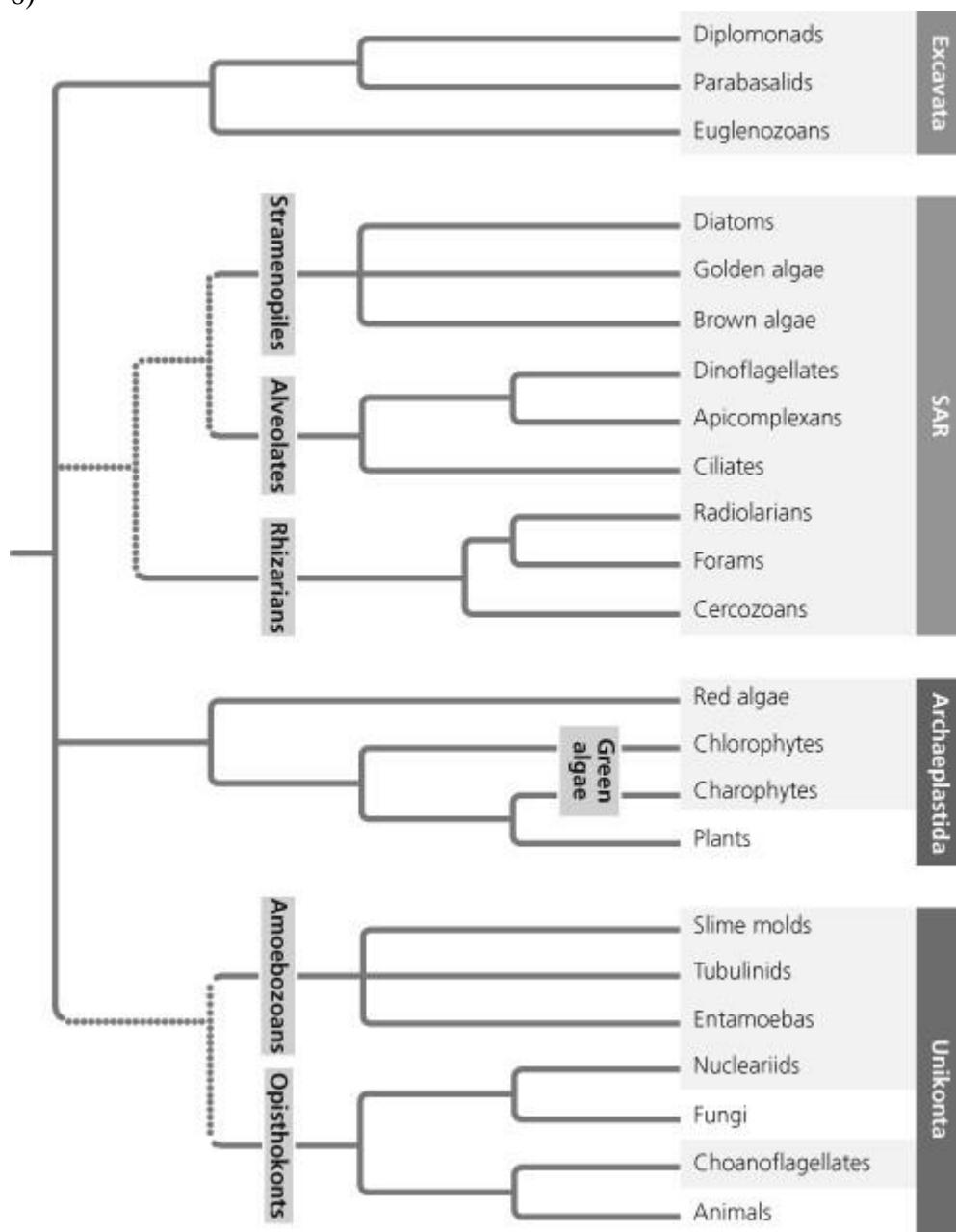
Bloom's Taxonomy: Knowledge/Comprehension

- 5) In a life cycle with alternation of generations, multicellular haploid forms alternate with
A) unicellular haploid forms.
B) unicellular diploid forms.
C) multicellular haploid forms.
D) multicellular diploid forms.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

6)



Based on the phylogenetic tree in Figure 28.2, which of the following statements is correct?

- The most recent common ancestor of Excavata is older than that of SAR.
- The most recent common ancestor of SAR is older than that of Unikonta.
- The most basal (first to diverge) eukaryotic supergroup cannot be determined.
- Excavata is the most basal eukaryotic supergroup.

Answer: C

Bloom's Taxonomy: Application/Analysis

29.1 Multiple-Choice Questions

- 1) Which of the following could occur only after plants moved from the oceans to land?
- A) Animals could also move onto land because there were opportunities for new food sources.
 - B) Animals could also move onto land because they had easier access to nitrogen.
 - C) Cyanobacteria could also move onto land because their host plants occurred there.
 - D) Plants in the oceans were able to evolve forms that lived in much deeper parts of the oceans.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 29.0

- 2) According to the fossil record, plants colonized terrestrial habitats _____.
A) in conjunction with insects that pollinated them
B) in conjunction with fungi that helped provide them with nutrients from the soil
C) to escape abundant herbivores in the oceans
D) only about 150 million years ago

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.1

- 3) The most direct ancestors of land plants were probably _____.
A) kelp (brown alga) that formed large beds near the shorelines
B) green algae
C) photosynthesizing prokaryotes (cyanobacteria)
D) liverworts and mosses

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.1

- 4) About 450 million years ago, the terrestrial landscape on Earth would have _____.
A) looked very similar to that of today, with flowers, grasses, shrubs, and trees
B) been completely bare rock, with little pools that contained cyanobacteria and protists
C) been covered with tall forests in swamps that would become today's coal
D) had non-vascular, green plants similar to liverworts forming green mats on rock

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.1

5) What evidence do paleobotanists look for that indicates the movement of plants from water to land?

- A) waxy cuticle to decrease evaporation from leaves
- B) loss of structures that produce spores
- C) sporopollenin to inhibit evaporation from leaves
- D) remnants of chloroplasts from photosynthesizing cells

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 29.1

6) Which of these events, based on plant fossils, came last (most recently)?

- A) extensive growth of gymnosperm forests
- B) colonization of land by early liverworts and mosses
- C) rise and diversification of angiosperms
- D) carboniferous swamps with giant horsetails and lycophytes

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.1

7) Why have biologists hypothesized that the first land plants had a low, sprawling growth habit?

- A) They were tied to the water for reproduction, thus needing to remain in close contact with the moist soil.
- B) The ancestors of land plants, green algae, lacked the structural support to stand erect in air.
- C) Land animals of that period were small and could not pollinate tall plants.
- D) There was less competition for space, so they simply spread out flat.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 29.1

8) Spores and seeds have basically the same function—dispersal—but are vastly different because spores _____.

- A) have a protective outer covering; seeds do not
- B) have an embryo; seeds do not
- C) have stored nutrition; seeds do not
- D) are unicellular; seeds are not

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.1

9) You find a green organism in a pond near your house and believe it is a plant, not an alga. The mystery organism is most likely a plant and not an alga if it _____.

- A) contains chloroplasts
- B) is surrounded by a cuticle
- C) does not contain vascular tissue
- D) has cell walls that are comprised largely of cellulose

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.1

10) Retaining the zygote on the living gametophyte of land plants _____.
A) protects the zygote from herbivores

- B) evolved concurrently with pollen
- C) helps in dispersal of the zygote
- D) allows it to be nourished by the parent plant

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.1

11) The structural integrity of bacteria is to peptidoglycan as the structural integrity of plant spores is to _____.
A) lignin

- B) cellulose
- C) secondary compounds
- D) sporopollenin

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.1

12) According to our current knowledge of plant evolution, which group of organisms should feature cell division most similar to that of land plants?
A) some unicellular green algae

- B) some cyanobacteria
- C) some charophytes
- D) some red algae

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.1

13) Which taxon is essentially equivalent to the "embryophytes"?
A) Plantae

- B) Pterophyta
- C) Bryophyta
- D) Charophyceae

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.1

14) If the kingdom Plantae is someday expanded to include the charophytes (stoneworts), then the shared derived characteristics of the kingdom will include _____.

- A) rings of cellulose-synthesizing complexes and ability to synthesize sporopollenin
- B) rings of cellulose-synthesizing complexes, chlorophylls *a* and *b*, and alternation of generations
- C) rings of cellulose-synthesizing complexes, alternation of generations, and ability to synthesize sporopollenin
- D) rings of cellulose-synthesizing complexes, chlorophylls *a* and *b*, cell walls of cellulose, and ability to synthesize sporopollenin

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 29.1

15) Which of the following environmental factors probably helped early plants to successfully colonize land?

- A) a decreased availability of CO₂
- B) relatively few competitors for light
- C) an increased availability of symbiotic partners
- D) air's relative lack of support, compared to water's support

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.1

16) A student encounters a pondweed that appears to be a charophyte. Which of the following features would help the student determine whether the sample comes from a charophyte or from some other type of green alga?

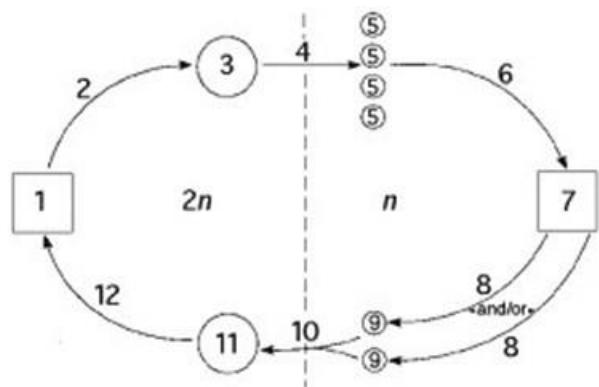
- A) molecular structure of enzymes inside the chloroplasts and presence of phragmoplasts
- B) molecular structure of enzymes inside the chloroplasts and rings of cellulose-synthesizing complexes
- C) structure of sperm cells and presence of phragmoplasts
- D) structure of sperm cells, presence of phragmoplasts, and rings of cellulose-synthesizing complexes

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.1

- 17) The following question refers to the generalized life cycle for land plants shown in the figure. Each number within a circle or square represents a specific plant or plant part, and each number over an arrow represents meiosis, mitosis, or fertilization.



In the figure, which number represents the mature gametophyte?

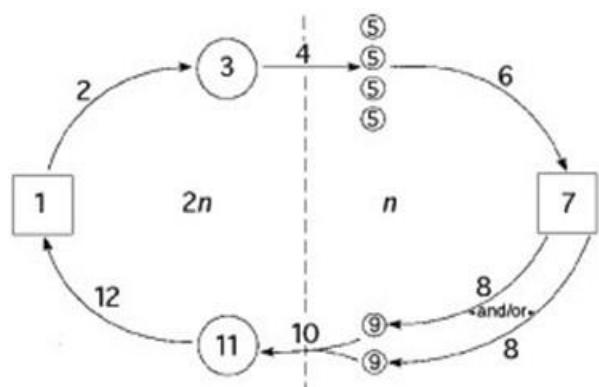
- A) 1
- B) 3
- C) 7
- D) 11

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 29.1

- 18) The following question refers to the generalized life cycle for land plants shown in the figure. Each number within a circle or square represents a specific plant or plant part, and each number over an arrow represents meiosis, mitosis, or fertilization.



In the figure, which number represents an embryo?

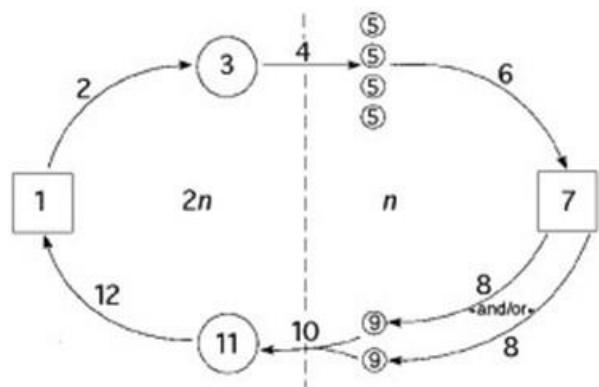
- A) 1
- B) 3
- C) 7
- D) 11

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.1

- 19) The following question refers to the generalized life cycle for land plants shown in the figure. Each number within a circle or square represents a specific plant or plant part, and each number over an arrow represents meiosis, mitosis, or fertilization.



In the figure, meiosis is most likely to be represented by which number(s)?

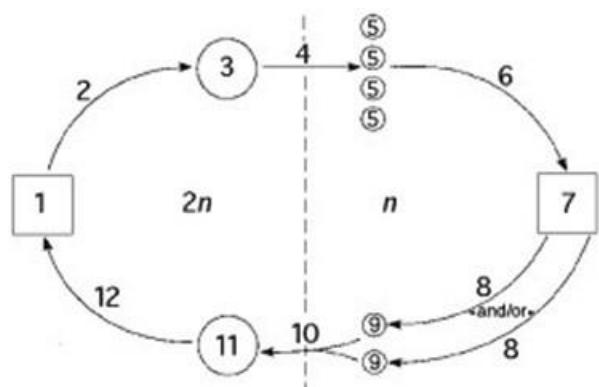
- A) 2
- B) 4
- C) 2 and 8
- D) 10 and 12

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.1

20) The following question refers to the generalized life cycle for land plants shown in the figure. Each number within a circle or square represents a specific plant or plant part, and each number over an arrow represents meiosis, mitosis, or fertilization.



Which number represents a megasporangium in the figure?

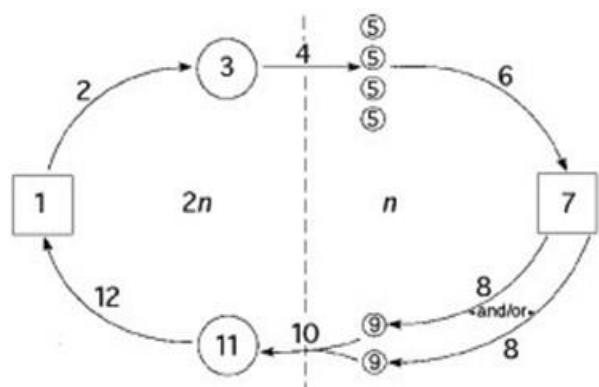
- A) 1
- B) 3
- C) 5
- D) 7

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.1

21) The following question refers to the generalized life cycle for land plants shown in the figure. Each number within a circle or square represents a specific plant or plant part, and each number over an arrow represents meiosis, mitosis, or fertilization.



In the figure, the process labeled "6" involves _____.

- A) mitosis
- B) meiosis
- C) fertilization
- D) binary fission

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 29.1

22) The fact that both charophytes and green plants contain chlorophylls *a* and *b* demonstrates which of the following?

- A) These derived traits show that green plants evolved from ancient charophytes.
- B) These shared traits show that green plants evolved from present-day charophytes.
- C) The common ancestor of these two groups contained chlorophylls *a* and *b*.
- D) These two groups are not closely related.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 29.1

23) Which of the following statements about the transition from ocean to land by plants is most likely to be accurate?

- A) The transition to land occurred within a few generations.
- B) The transition to land was likely gradual, with plants evolving traits that let them survive ever-drier conditions.
- C) Rising sea levels favored individuals that were able to survive ever-drier conditions.
- D) The high light levels of terrestrial systems favored individuals that contained flexible photosynthetic enzyme systems.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.1

- 24) Which of the following statements about the zygotes of plants is most likely to be accurate?
- A) Protection of the zygote from the drying effects of air was important.
 - B) Protection of the zygote from competitors for light was more important in air than in water.
 - C) Zygotes in plants are more independent of parental tissue than are algal zygotes.
 - D) Zygotes in plants are more likely to germinate quickly after release from the parent plant than are zygotes released from algal organisms.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 29.1

- 25) If animals had alternation of generations like plants, _____.
- A) they would have twice as rapid a population growth rate as compared to their current rates
 - B) the products of mitosis would undergo meiosis
 - C) the products of meiosis would immediately fuse to form a zygote and then undergo mitosis
 - D) the products of meiosis would undergo mitosis and become multicellular

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.1

- 26) Apical meristems _____.
- A) occur only in shoots of plants
 - B) occur only in roots of plants
 - C) occur in both roots and shoots of plants
 - D) allow plants to move from one place to another

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.1

- 27) Which of the following statements about stomata is accurate?
- A) Stomata are not important in algae because they do not need CO₂.
 - B) Stomata, when closed, allow CO₂ to diffuse into plants.
 - C) Stomata are important in terrestrial plants because they allow the roots to absorb water and nutrients from the soil.
 - D) Stomata are important in terrestrial plants because they allow CO₂ to diffuse into the plant.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.1

28) The presence of vascular tissue allowed plants to _____.

- A) absorb nutrients from the soil and form a symbiosis with fungi
- B) transport nutrients and water from below-ground tissues to above-ground tissues and grow taller
- C) transport nutrients and water from below-ground tissues and use them to protect developing embryos
- D) release toxins into the soil that reduced competition with other plants by poisoning nearby plants

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.1

29) Bryophytes (non-vascular plants) _____.

- A) are more similar to ancestral green algae than are vascular plants
- B) are more similar to ancestral red algae than are vascular plants
- C) can be included in the grade monilophyte because they do not have a complex vascular system
- D) are evolutionarily more advanced than seed plants

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 29.1

30) Grades, as opposed to clades, _____.

- A) indicate degrees of evolutionary relatedness
- B) show relatedness among living organisms
- C) are almost always monophyletic
- D) represent groups with similar traits

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.1

31) Stomata _____.

- A) occur in all land plants and define them as a monophyletic group
- B) open to allow gas exchange and close to decrease water loss
- C) occur in all land plants and are the same as pores
- D) open to increase both water absorption and gas exchange

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.1

32) Liverworts, hornworts, and mosses are grouped together as bryophytes. Besides not having vascular tissue, what do they all have in common?

- A) They are all wind pollinated.
- B) They are heterosporous.
- C) They can reproduce asexually by producing gemmae.
- D) They require water for reproduction.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.2

33) Most moss gametophytes do not have a cuticle and are 1-2 cells thick. What does this imply about moss gametophytes and their structure?

- A) They use stomata for gas exchange regulation.
- B) They can easily lose water to, and absorb water from, the atmosphere.
- C) Photosynthesis occurs throughout the entire gametophyte surface.
- D) They have branching veins in their leaves.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.2

34) As you stroll through a moist forest, you are most likely to see a _____.

- A) zygote of a green alga
- B) gametophyte of a moss
- C) sporophyte of a liverwort
- D) gametophyte of a fern

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.2

35) Which of these are spore-producing structures?

- A) sporophyte (capsule) of a moss
- B) antheridium of a moss or fern
- C) archegonium of a moss or fern
- D) gametophyte of a moss

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.2

36) What is an accurate statement about the genus *Sphagnum*?

- A) It is an economically important liverwort.
- B) It grows in extensive mats in grassland areas.
- C) It accumulates to form coal and is burned as a fuel.
- D) It represents a large repository of CO₂ that is likely to be released with global warming.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.2

37) How are bryophytes and seedless vascular plants alike?

- A) Plants in both groups have vascular tissue.
- B) In both groups, sperm swim from antheridia to archegonia.
- C) The dominant generation in both groups is the sporophyte.
- D) Plants in both groups have true roots, stems, and leaves.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.2

38) In general, liverworts have a cuticle and pores. However, some species do not have pores.

What would you predict concerning the cuticle of these species and why?

- A) The cuticle would be the same thickness as in those species with pores.
- B) The cuticle would be thicker than in those species with pores.
- C) The cuticle would be thinner than in those species with pores.
- D) The cuticle would be thick in some places and thin in other places.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 29.2

39) Archegonia _____.

- A) are the sites where male gametes are produced
- B) may contain sporophyte embryos
- C) have the same function as sporangia
- D) make asexual reproductive structures

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.2

40) Which of the following is an accurate statement about plant reproduction?

- A) Embryophytes are small plants in an early developmental stage.
- B) Male and female bryophytes each produce a type of gametangia.
- C) Eggs and sperm of most land plants swim toward one another.
- D) Bryophytes are limited to asexual reproduction.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.2

41) Assuming that they all belong to the same plant, which of the following sequences describes structures from largest to smallest?

- A) gametes, gametophytes, antheridia
- B) gametes, antheridia, gametophytes
- C) gametophytes, gametes, antheridia
- D) gametophytes, antheridia, gametes

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.2

- 42) Which of the following statements is accurate with regard to the life cycle of mosses?
- A) The haploid generation grows on the sporophyte generation.
 - B) Spores are primarily distributed by water currents.
 - C) Antheridia and archegonia are produced by gametophytes.
 - D) The sporophyte generation is dominant.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.2

- 43) At some time during their life cycles, bryophytes make _____.

- A) microphylls
- B) true roots
- C) true leaves
- D) sporangia

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.2

- 44) Two small, poorly drained lakes lie close to each other in a northern forest. The basins of both lakes are composed of the same geologic substratum. One lake is surrounded by a dense *Sphagnum* mat; the other is not. Compared to the pond with *Sphagnum*, the pond lacking the moss mat should have _____.

- A) lower numbers of bacteria
- B) reduced rates of decomposition
- C) reduced oxygen content
- D) water with a higher pH

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.2

- 45) The 1-meter height attainable by *Dawsonia* moss is at the upper end of the size range reached by mosses. What accounts for the relative tallness of *Dawsonia*?

- A) the cuticle that is found along the ridges of "leaves"
- B) "leaves" that are more than one cell layer thick
- C) reduced size, mass, and persistence of the sporophytes, which allows gametophores to grow taller
- D) the presence of conducting tissues in the "stem"

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.2

- 46) The haploid gametophytes of bryophytes are _____.
A) multicellular, just like the haploid stages of animal species
B) multicellular and produce zygotes
C) usually composed of single cells, just like the gametes of mammals
D) usually multicellular, but one cell thick

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.2

- 47) If bryophytes do not have vascular tissue, how can some mosses reach 60 centimeters tall?
A) The term *nonvascular plant* is actually a misnomer.
B) These tall mosses are more closely related to seed plants than to other mosses.
C) Some mosses independently evolved conducting tissues.
D) The rhizoids contain the conducting tissues.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 29.2

- 48) If you were asked to design a bryophyte that could be successful in a bare, moist area, which of the following possible adaptations would you include?
A) a symbiosis with phosphorus-absorbing mycorrhizae fungi
B) a symbiosis with nitrogen-fixing cyanobacteria
C) a symbiosis with iron-absorbing algae
D) a symbiosis with toxin-producing dinoflagellates

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 29.2

- 49) Moss sporophytes are typically green when young, but turn brown when ready to release their spores. This observation would lead you to think that the _____.
A) sporophyte photosynthesizes when young and contributes energy for spore production
B) sporophyte photosynthesizes at all ages—it just uses different wavelengths for photosynthesis at different ages
C) gametophyte cannot photosynthesize
D) cuticle rubs off of older sporophytes and exposes the color that is underneath

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 29.2

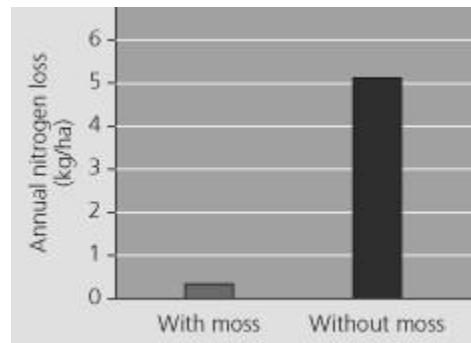
- 50) Assuming equal spore production rates, what is the likely consequence in a bryophyte with both asexual and sexual reproduction versus one with only sexual reproduction?
- A) Species with both types of reproduction have higher rates of genetic diversity than species with only sexual reproduction.
 - B) Species with both types of reproduction have higher population growth rates than species with only sexual reproduction.
 - C) Species with both types of reproduction are less evolutionarily advanced than species with only sexual reproduction.
 - D) Species with both types of reproduction occur primarily in dry environments.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.2

- 51) Use the figure to answer the following question.



Bowden showed that the presence of moss reduced nitrogen loss from soil. Which of the following questions would be the best follow-up study?

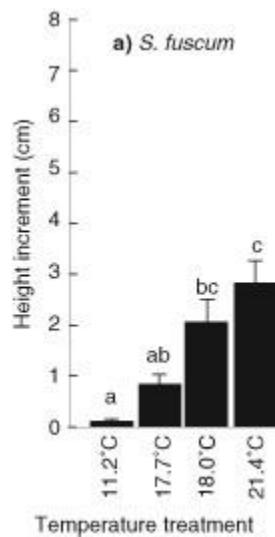
- A) Do new species colonize areas with a pH of 3 more rapidly or more slowly than areas with a pH of 7?
- B) Do new species colonize areas with added iron more rapidly or more slowly than areas without added iron?
- C) Do new species colonize areas with moss more rapidly or more slowly than areas without moss?
- D) Do new species colonize areas with added phosphorus more rapidly or more slowly than areas without added phosphorus?

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 29.2

52) Breeuwer et al. (2008) measured the effect of different temperature regimes on the growth of different *Sphagnum* species. The growth of *S. fuscum* at four temperatures is shown. Use the information in the graph to answer the following question.



Which of the following statements accurately reflects the effect of temperature on the growth of *S. fuscum*?

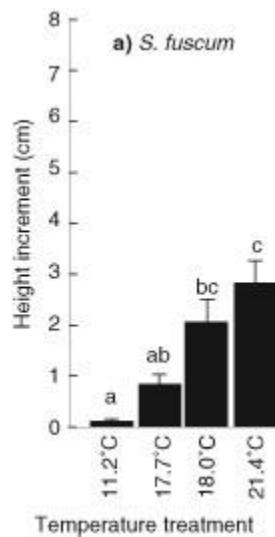
- A) *S. fuscum* grows higher at warmer temperatures.
- B) *S. fuscum* grows less at cooler and warmer temperatures than at moderate temperatures.
- C) *S. fuscum* grows less at warmer temperatures.
- D) *S. fuscum* would grow higher at 29°C.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 29.2

53) Breeuwer et al. (2008) measured the effect of different temperature regimes on the growth of different *Sphagnum* species. The growth of *S. fuscum* at four temperatures is shown. Use the information in the graph to answer the following question.



What would you expect to happen to the geographic range of *S. fuscum* as the temperature of Earth warms?

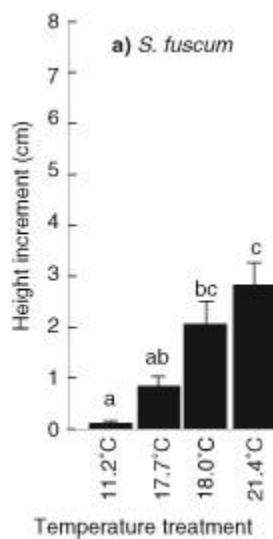
- A) The geographic range of *S. fuscum* will extend southward.
- B) The geographic range of *S. fuscum* will extend northward.
- C) The geographic range of *S. fuscum* will not change.
- D) The geographic range of *S. fuscum* will contract at both the northern and southern ends.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 29.2

54) Breeuwer et al. (2008) measured the effect of different temperature regimes on the growth of different *Sphagnum* species. The growth of *S. fuscum* at four temperatures is shown. Use the information in the graph to answer the following question.



Based on the data shown, what additional conclusions can you draw?

- A) With warmer temperatures, *S. fuscum* will be a better competitor.
- B) With warmer temperatures, decomposition rates will be higher.
- C) With warmer temperatures, decomposition rates will be lower.
- D) No additional conclusions can be drawn from these data.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 29.2

55) Which set contains the most closely related terms?

- A) megasporangium, megaspore, pollen, ovule
- B) microsporangium, microspore, egg, ovary
- C) megasporangium, megaspore, egg, ovule
- D) microsporangium, microspore, carpel, ovary

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 29.3

56) How could you determine if a plant is heterosporous?

- A) Male and female reproductive structures are located on separate plants.
- B) It has vascular tissue.
- C) It has multiple sporangia.
- D) Its diploid sporophyte produces spores via meiosis.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 29.3

57) A botanist discovers a new species of plant in a tropical rain forest. Investigation of its anatomy and life cycle shows the following characteristics: flagellated sperm, xylem with tracheids, separate gametophyte, and sporophyte generations with the sporophyte dominant, and no seeds. This plant is probably most closely related to _____.

- A) mosses
- B) ferns
- C) gymnosperms
- D) flowering plants

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.3

58) You are hiking in a forest and come upon a mysterious plant, which you determine is either a lycophyte sporophyte or a monilophyte sporophyte. Which of the following would be most helpful in determining the correct classification of the plant?

- A) whether or not it has true leaves
- B) whether it has microphylls or megaphylls
- C) whether or not it has seeds
- D) its height

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.3

59) Assuming that they all belong to the same plant, which of the following lists structures from largest to smallest (or from most inclusive to least inclusive)?

- A) sporophylls, sporangia, sporophytes, spores
- B) sporophylls, sporophytes, sporangia, spores
- C) sporophytes, spores, sporangia, sporophylls
- D) sporophytes, sporophylls, sporangia, spores

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 29.3

60) If humans had been present to build log structures during the Carboniferous period (they were not), which plant types would have been suitable sources of logs?

- A) horsetails and bryophytes
- B) lycophytes and bryophytes
- C) ferns, horsetails, and lycophytes
- D) charophytes (stoneworts), bryophytes, and gymnosperms

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 29.3

61) Arrange the following terms from most inclusive to least inclusive.

- A) embryophytes, green plants, tracheophytes, seedless vascular plants, ferns
- B) green plants, embryophytes, tracheophytes, seedless vascular plants, ferns
- C) green plants, tracheophytes, embryophytes, seedless vascular plants, ferns
- D) embryophytes, ferns, green plants, tracheophytes, seedless vascular plants

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.3

62) Use the following description to answer the question.

A biology student hiking in a forest happens upon an erect, 15-centimeter-tall plant that bears microphylls and a strobilus at its tallest point. When disturbed, the cone emits a dense cloud of brownish dust. A pocket magnifying glass reveals the dust to be composed of tiny spheres with a high oil content.

This student has probably found a _____.

- A) bryophyte sporophyte
- B) fern sporophyte
- C) horsetail gametophyte
- D) lycophyte sporophyte

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.3

63) Use the following description to answer the question.

A biology student hiking in a forest happens upon an erect, 15-centimeter-tall plant that bears microphylls and a strobilus at its tallest point. When disturbed, the cone emits a dense cloud of brownish dust. A pocket magnifying glass reveals the dust to be composed of tiny spheres with a high oil content.

Besides oil, what other chemical should be detected in substantial amounts upon chemical analysis of these small spheres?

- A) sporopollenins
- B) phenolics
- C) waxes
- D) terpenes

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 29.3

64) Use the following information to answer the question.

Big Bend National Park in Texas is mostly Chihuahuan desert, where rainfall averages about 25 centimeters per year. Yet, it is not uncommon when hiking in this extremely arid zone to encounter mosses and ferns. One such plant is called "flower of stone." It is not a flowering plant, nor does it produce seeds. Under arid conditions, its leaflike structures curl up. However, when it rains, it unfurls its leaves, which form a bright green rosette on the desert floor. Consequently, it is sometimes called the "resurrection plant." At first glance, it could be a fern, a true moss, or a spike moss.

What feature of both true mosses and ferns makes it most surprising that they can survive for many generations in dry deserts?

- A) flagellated sperm
- B) lack of vascular tissues
- C) lack of true roots
- D) lack of cuticle

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 29.3

65) Use the following information to answer the question.

Big Bend National Park in Texas is mostly Chihuahuan desert, where rainfall averages about 25 centimeters per year. Yet, it is not uncommon when hiking in this extremely arid zone to encounter mosses and ferns. One such plant is called "flower of stone." It is not a flowering plant, nor does it produce seeds. Under arid conditions, its leaflike structures curl up. However, when it rains, it unfurls its leaves, which form a bright green rosette on the desert floor. Consequently, it is sometimes called the "resurrection plant." At first glance, it could be a fern, a true moss, or a spike moss.

Which of the following features is most important for true mosses and ferns to reproduce in the desert?

- A) that the sporophytes occupy only permanently shady, north-facing habitats
- B) that the sporophytes hug the ground, growing no taller than a couple of inches
- C) either that their gametophytes grow close together, or that they be homosporous
- D) that the sporophytes have highly lignified vascular tissues

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 29.3

66) Use the following information to answer the question.

Big Bend National Park in Texas is mostly Chihuahuan desert, where rainfall averages about 25 centimeters per year. Yet, it is not uncommon when hiking in this extremely arid zone to encounter mosses and ferns. One such plant is called "flower of stone." It is not a flowering plant, nor does it produce seeds. Under arid conditions, its leaflike structures curl up. However, when it rains, it unfurls its leaves, which form a bright green rosette on the desert floor. Consequently, it is sometimes called the "resurrection plant." At first glance, it could be a fern, a true moss, or a spike moss.

Which of the following characteristics is (are) possessed in common by true mosses, ferns, and spike mosses, and therefore becomes useless at helping to determine to which of these groups "flower of stone" belongs?

- A) alternation of generations
- B) a sporophyte generation that is dominant and alternation of generations
- C) flagellated sperm and true leaves and roots
- D) flagellated sperm and alternation of generations

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.3

67) Use the following information to answer the question.

Big Bend National Park in Texas is mostly Chihuahuan desert, where rainfall averages about 25 centimeters per year. Yet, it is not uncommon when hiking in this extremely arid zone to encounter mosses and ferns. One such plant is called "flower of stone." It is not a flowering plant, nor does it produce seeds. Under arid conditions, its leaflike structures curl up. However, when it rains, it unfurls its leaves, which form a bright green rosette on the desert floor. Consequently, it is sometimes called the "resurrection plant." At first glance, it could be a fern, a true moss, or a spike moss.

Upon closer inspection of the leaves of "flower of stone," one can observe tiny, cone-like structures. Each cone-like structure emits spores of two different sizes. Further investigation also reveals that the roots of "flower of stone" branch only at the growing tip of the root, forming a Y-shaped structure. Based on these additional observations, which of the following can be properly inferred about "flower of stone"?

- A) It is heterosporous and has separate male and female gametophytes.
- B) It is a fern and the cone-like structures are sori.
- C) It is heterosporous, it is a fern, and the cone-like structures are sori.
- D) It is heterosporous, it is a lycophyte, and it has separate male and female gametophytes.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.3

68) Use the following information to answer the question.

Big Bend National Park in Texas is mostly Chihuahuan desert, where rainfall averages about 25 centimeters per year. Yet, it is not uncommon when hiking in this extremely arid zone to encounter mosses and ferns. One such plant is called "flower of stone." It is not a flowering plant, nor does it produce seeds. Under arid conditions, its leaflike structures curl up. However, when it rains, it unfurls its leaves, which form a bright green rosette on the desert floor. Consequently, it is sometimes called the "resurrection plant." At first glance, it could be a fern, a true moss, or a spike moss.

Upon closer inspection of the leaves of "flower of stone," one can observe tiny, cone-like structures. Each cone-like structure emits spores of two different sizes. Further investigation also reveals that the roots of "flower of stone" branch only at the growing tip of the root, forming a Y-shaped structure. Consequently, which of the following is the closest living relative of "flower of stone"?

- A) true moss
- B) club moss
- C) liverwort
- D) fern

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 29.3

69) Use the following information to answer the question.

Big Bend National Park in Texas is mostly Chihuahuan desert, where rainfall averages about 25 centimeters per year. Yet, it is not uncommon when hiking in this extremely arid zone to encounter mosses and ferns. One such plant is called "flower of stone." It is not a flowering plant, nor does it produce seeds. Under arid conditions, its leaflike structures curl up. However, when it rains, it unfurls its leaves, which form a bright green rosette on the desert floor. Consequently, it is sometimes called the "resurrection plant." At first glance, it could be a fern, a true moss, or a spike moss.

Upon closer inspection of the leaves of "flower of stone," one can observe tiny, cone-like structures. Each cone-like structure emits spores of two different sizes. Further investigation also reveals that the roots of "flower of stone" branch only at the growing tip of the root, forming a Y-shaped structure. Consequently, "flower of stone" should be expected to possess which other characteristics?

- A) a gametophyte generation that is dominant and lignified vascular tissues
- B) a gametophyte generation that is dominant and spores that are diploid when mature
- C) lignified vascular tissues and microphylls
- D) microphylls, filamentous rhizoids, but not true roots, and spores that are diploid when mature

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 29.3

70) Use the following information to answer the question.

Big Bend National Park in Texas is mostly Chihuahuan desert, where rainfall averages about 25 centimeters per year. Yet, it is not uncommon when hiking in this extremely arid zone to encounter mosses and ferns. One such plant is called "flower of stone." It is not a flowering plant, nor does it produce seeds. Under arid conditions, its leaflike structures curl up. However, when it rains, it unfurls its leaves, which form a bright green rosette on the desert floor. Consequently, it is sometimes called the "resurrection plant." At first glance, it could be a fern, a true moss, or a spike moss.

In which combination of locations would one who is searching for the gametophytes of "flower of stone" have the best chance of finding them?

- A) in moist soil
- B) in moist soil and underground, nourished there by symbiotic fungi
- C) in shady, moist places and underground, nourished there by symbiotic fungi
- D) in shady, moist places, far from any "flower of stone" sporophytes

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 29.3

71) Suppose an efficient conducting system evolved in a moss that could transport water and other materials as high as a tall tree. Which of the following statements about "trees" of such a species would be accurate?

- A) Fertilization would probably be easier.
- B) Spore dispersal distances would probably decrease.
- C) Females could produce only one archegonium.
- D) Individuals would probably compete more effectively for access to light.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.3

72) Which of the following features of how seedless land plants get sperm to egg are the same as for some of their algal ancestors?

- A) Conjugation tubes are formed between sperm and egg cells.
- B) Packets of sperm are delivered by wind to the eggs.
- C) Aquatic invertebrates carry sperm to eggs.
- D) Flagellated sperm swim to the eggs in a water drop.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 29.3

73) Increasing the number of stomata per unit surface area of a leaf when atmospheric carbon dioxide levels decline is most analogous to a human _____.

- A) breathing faster as atmospheric carbon dioxide levels increase
- B) putting more red blood cells into circulation when oxygen availability declines at high elevations
- C) breathing more slowly as atmospheric oxygen levels increase
- D) increasing the volume of its lungs when atmospheric carbon dioxide levels increase

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 29.3

74) Compared to nonvascular plants, the ancient relatives of vascular plants _____.

- A) produced sporophyte generations independent of, not dependent on, gametophyte generations
- B) produced much smaller sporophyte generations
- C) produced sporophyte generations that provided more nutrition to gametophyte generations
- D) probably experienced less competition for light

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.3

75) The evolution of a vascular system in plants allowed which of the following to occur?

- A) increased height, improved competition for water, and increased spore dispersal distances
- B) increased height, improved competition for light, and increased spore dispersal distances
- C) decreased height, improved competition for light, and decreased spore dispersal distances
- D) decreased height, improved competition for water, and decreased spore dispersal distances

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 29.3

76) If you walk through an area with mosses and ferns, you are seeing _____.

- A) both sporophyte and gametophyte generations
- B) only vascular plants
- C) both nonvascular and seed-bearing plants
- D) both seedless and seed-bearing plants

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 29.3

77) The coal and oil that we currently use as fuel sources _____.

- A) are remnants of *Sphagnum* moss bogs
- B) are releasing carbon that was trapped by photosynthesis in ancient vascular and seedless plants
- C) come from calcium and magnesium carbonates that Carboniferous roots released from rocks
- D) come from ancient, seed-bearing plants that grew during the Carboniferous period

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 29.3

29.2 Student Edition End-of-Chapter Questions

1) Three of the following are evidence that charophytes are the closest algal relatives of plants.

Select the exception.

- A) similar sperm structure
- B) the presence of chloroplasts
- C) similarities in cell wall formation during cell division
- D) genetic similarities in chloroplasts

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

2) Which of the following characteristics of plants is absent in their closest relatives, the charophyte algae?

- A) chlorophyll *b*
- B) cellulose in cell walls
- C) sexual reproduction
- D) alternation of multicellular generations

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

3) In plants, which of the following are produced by meiosis?

- A) haploid gametes
- B) diploid gametes
- C) haploid spores
- D) diploid spores

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

4) Microphylls are found in which plant group?

- A) lycophytes
- B) liverworts
- C) ferns
- D) hornworts

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

5) Suppose an efficient conducting system evolved in a moss that could transport water and other materials as high as a tall tree. Which of the following statements about "trees" of such a species would *not* be true?

- A) Spore dispersal distances would probably increase.
- B) Females could produce only one archegonium.
- C) Unless its body parts were strengthened, such a "tree" would probably flop over.
- D) Individuals would probably compete more effectively for access to light.

Answer: B

Bloom's Taxonomy: Application/Analysis

30.1 Multiple-Choice Questions

1) Which of the following is a major trend in land plant evolution?

- A) the trend toward smaller size
- B) the trend toward a gametophyte-dominated life cycle
- C) the trend toward a sporophyte-dominated life cycle
- D) the trend toward larger gametophytes

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.1

2) Which of the following lines of evidence would best support your assertion that a particular plant is an angiosperm?

- A) It produces seeds.
- B) It retains its fertilized egg within its archegonium.
- C) It lacks gametangia.
- D) It undergoes alternation of generations.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.1

3) Which of the following characteristics is functionally important in cells of the gametophytes of both angiosperms and gymnosperms?

- A) diploid nuclei
- B) mitochondria
- C) endosperm
- D) chloroplasts

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 30.1

4) In addition to seeds, which of the following characteristics is unique to the seed-producing plants?

- A) sporopollenin
- B) lignin present in cell walls
- C) pollen
- D) megaphylls

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.1

5) Suppose that the cells of seed plants, like the cells of human skin, produce a pigment upon increased exposure to ultraviolet radiation. Rank the following cells, from greatest to least, in terms of the likelihood of producing this pigment.

- A) epidermal cells of sporophyte megaphylls, cells of a gametophyte, cells of a megasporangium, cells in the interior of a subterranean root
- B) epidermal cells of sporophyte megaphylls, cells of a gametophyte, cells in the interior of a subterranean root, cells of a megasporangium
- C) epidermal cells of sporophyte megaphylls, cells of a megasporangium, cells of a gametophyte, cells in the interior of a subterranean root
- D) epidermal cells of sporophyte megaphylls, cells in the interior of a subterranean root, cells of a megasporangium, cells of a gametophyte

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.1

6) Arrange the following in the correct sequence, from earliest to most recent, in which these plant traits originated.

- A) sporophyte dominance, gametophyte independence; sporophyte dominance, gametophyte dependence; gametophyte dominance, sporophyte dependence
- B) sporophyte dominance, gametophyte dependence; sporophyte dominance, gametophyte independence; gametophyte dominance, sporophyte dependence
- C) gametophyte dominance, sporophyte dependence; sporophyte dominance, gametophyte dependence; sporophyte dominance, gametophyte independence
- D) gametophyte dominance, sporophyte dependence; sporophyte dominance, gametophyte independence; sporophyte dominance, gametophyte dependence

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.1

7) In seed plants, which of the following is part of a pollen grain and has a function most like that of the seed coat?

- A) sporophyll
- B) sporopollenin
- C) stigma
- D) sporangium

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 30.1

8) In terms of alternation of generations, the internal parts of the pollen grains of seed-producing plants are most similar to a _____.

- A) moss sporophyte
- B) moss gametophyte bearing both male and female gametangia
- C) fern sporophyte
- D) fern gametophyte bearing only antheridia

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 30.1

9) A researcher has developed two stains for use with seed plants. One stains sporophyte tissue blue; the other stains gametophyte tissue red. If the researcher exposes pollen grains to both stains, and then rinses away the excess stain, what should occur?

- A) The pollen grains will be pure red.
- B) The pollen grains will be pure blue.
- C) The pollen grains will have red interiors and blue exteriors.
- D) The pollen grains will have blue interiors and red exteriors.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 30.1

10) Which of the following sex and generation combinations directly produces the pollen tube of angiosperms?

- A) male gametophyte
- B) female gametophyte
- C) male sporophyte
- D) female sporophyte

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.1

11) The advantages of the reduced gametophytes in seed plants include _____.

- A) protection from ultraviolet radiation, gain of nutrients from its own photosynthesis, and protection from drying out
- B) protection from ultraviolet radiation, gain of nutrients from the sporophyte, and protection from drying out
- C) protection of the spores from ultraviolet radiation and drying out, and gain of nutrients from the sporophyte
- D) development of the seed

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.1

12) The advantages of seeds, compared to spores, include _____.

- A) using wind as a dispersal agent
- B) containing a nutrient store for a developing sporophyte
- C) relying on animals for pollination
- D) providing nutrition for animals

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.1

13) Unlike almost all ferns, seed plants _____.

- A) produce two kinds of spores
- B) have large gametophytes
- C) have vascular tissue
- D) can photosynthesize

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.1

14) One day, you go outside and see that the cars on the street are covered in a yellow "dust."

Which of the following statements can be correctly applied to this "dust"?

- A) The dust is pine pollen and is so abundant because the pines are wind-pollinated.
- B) The dust is the spore production of ferns and is so abundant because the spores are wind-dispersed.
- C) The dust is the seed production of ferns and is so abundant because the seeds are tiny and take very little energy to produce.
- D) The dust is the seed production of pines and is so abundant because the seeds are tiny and take very little energy to produce.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.1

15) The closest relatives of the familiar pine and spruce trees are _____.

- A) ferns, horsetails, lycophytes, and club mosses
- B) hornworts, liverworts, and mosses
- C) gnetophytes, cycads, and ginkgos
- D) elms, maples, and aspens

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.2

- 16) Spruces and pines both have needlelike leaves, with the adaptive advantage of _____.
A) increased surface area, increasing photosynthesis
B) increased surface area, increasing gas exchange
C) decreased surface area, reducing gas exchange
D) decreased surface area, reducing water loss

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 30.2

- 17) Which of the following statements correctly describes a portion of the pine life cycle?
A) Female gametophytes use mitosis to produce eggs.
B) Seeds are produced in pollen-producing cones.
C) Pollen grains contain female gametophytes.
D) A pollen tube slowly digests its way through the triploid endosperm.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.2

- 18) Which of the following statements about the pine life cycle is accurate?
A) The pine tree is a gametophyte.
B) Male and female gametophytes are in close proximity during gamete synthesis.
C) Double fertilization is a relatively common phenomenon.
D) Conifer pollen grains contain male gametophytes.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.2

- 19) Within a gymnosperm megasporangium, which of the following developmental sequences is correct, assuming fertilization occurs?
A) megaspore, female gametophyte, egg cell, sporophyte embryo
B) megaspore, sporophyte embryo, female gametophyte, egg cell
C) sporophyte embryo, megaspore, egg cell, female gametophyte
D) sporophyte embryo, megaspore, female gametophyte, egg cell

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 30.2

- 20) Arrange the following structures, which can be found on male pine trees, from the largest structure to the smallest structure (or from most inclusive to least inclusive).
A) sporophyte, pollen cone, microsporangia, microspores, pollen nuclei
B) sporophyte, microspores, microsporangia, pollen nuclei, pollen cone
C) pollen cone, sporophyte, microspores, microsporangia, pollen nuclei
D) pollen cone, microsporangia, microspores, pollen nuclei, sporophyte

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 30.2

21) Which of the following sex and generation combinations most directly produces the integument of a pine seed?

- A) male gametophyte
- B) female gametophyte
- C) male sporophyte
- D) female sporophyte

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.2

22) Which of the following sex and generation combinations directly produces the megasporangium of pine ovules?

- A) male gametophyte
- B) female gametophyte
- C) male sporophyte
- D) female sporophyte

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.2

23) Use the information to answer the following question.

The cycads, a mostly tropical phylum of gymnosperms, evolved about 300 million years ago and were dominant forms during the age of the dinosaurs. Though their sperm are flagellated, their ovules are pollinated by beetles. These beetles get nutrition from the pollen and shelter from the microsporophylls. Upon visiting megasporophylls, the beetles transfer pollen to the exposed ovules. In cycads, pollen cones and seed cones are borne on different plants. Cycads synthesize neurotoxins, especially in the seeds, that are effective against most animals, including humans.

Which feature of cycads distinguishes them from most other gymnosperms?

- A) They have exposed ovules.
- B) They have flagellated sperm.
- C) They are pollinated by animals.
- D) They have flagellated sperm and they are pollinated by animals.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 30.2

24) Use the information to answer the following question.

The cycads, a mostly tropical phylum of gymnosperms, evolved about 300 million years ago and were dominant forms during the age of the dinosaurs. Though their sperm are flagellated, their ovules are pollinated by beetles. These beetles get nutrition from the pollen and shelter from the microsporophylls. Upon visiting megasporophylls, the beetles transfer pollen to the exposed ovules. In cycads, pollen cones and seed cones are borne on different plants. Cycads synthesize neurotoxins, especially in the seeds, that are effective against most animals, including humans.

On the Pacific island of Guam, large herbivorous bats called "flying foxes" commonly feed on cycad seeds, a potent source of neurotoxins. The flying foxes do not visit male cones.

Consequently, which of the following statements should be accurate?

- A) Flying foxes are attracted to cycad fruit and eat the enclosed seeds only by accident.
- B) Flying foxes are highly susceptible to the effects of the neurotoxins because the toxin attacks the action of the central nervous system.
- C) Flying foxes assist the beetles as important pollinating agents of the cycads.
- D) Flying foxes disperse cycad seeds if the seeds sometimes get swallowed whole (in other words, without getting chewed).

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.2

25) Use the information to answer the following question.

The cycads, a mostly tropical phylum of gymnosperms, evolved about 300 million years ago and were dominant forms during the age of the dinosaurs. Though their sperm are flagellated, their ovules are pollinated by beetles. These beetles get nutrition from the pollen and shelter from the microsporophylls. Upon visiting megasporophylls, the beetles transfer pollen to the exposed ovules. In cycads, pollen cones and seed cones are borne on different plants. Cycads synthesize neurotoxins, especially in the seeds, that are effective against most animals, including humans.

On the Pacific island of Guam, large herbivorous bats called "flying foxes" commonly feed on cycad seeds, a potent source of neurotoxins. The flying foxes do not visit male cones. Which of the following proposed studies would be worth investigating *next*?

- A) investigating the effects of the neurotoxins on the beetles
- B) investigating the mechanism of action of the neurotoxin on the bats
- C) investigating the mechanism of action of the neurotoxin on the beetles
- D) measuring the effect of the neurotoxin on a nectar-feeding bat

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.2

26) Use the information to answer the following question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can then enter and allow the remaining seeds to germinate.

Orchid bees are to Brazil nut trees as _____ are to pine trees.

- A) breezes
- B) rain droplets
- C) seed-eating birds
- D) squirrels

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 30.3

27) Use the information to answer the following question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can then enter and allow the remaining seeds to germinate.

The large white part of a Brazil nut that people eat serves which of the following functions in nature?

- A) It attracts harpy eagles and encourages them to nest in the tree.
- B) It provides energy and nutrition to a germinating seedling.
- C) It serves as protection for the embryo from agoutis looking for food.
- D) It provides a water source for the developing embryo.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 30.3

28) Use the information to answer the following question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can then enter and allow the remaining seeds to germinate.

Predict the most likely outcome to the population of Brazil nut trees if a disease decimated the agouti population.

- A) The population of large Brazil nut trees would remain constant for a while, but the population of new seedlings would likely increase in the long run.
- B) The population of large Brazil nut trees would decline immediately, and the population of new seedlings would likely decrease in the future.
- C) The population of large Brazil nut trees would remain constant for a while, but the population of new seedlings would likely decrease in the long run.
- D) Both the population of large Brazil nut trees and new seedlings would increase in the long run.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.3

29) Many mammals have skins and mucous membranes that are sensitive to phenolic secretions of plants like poison oak (*Rhus*). These secondary compounds are primarily adaptations that _____.

- A) favor pollination
- B) foster seed dispersal
- C) decrease competition
- D) inhibit herbivory

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 30.3

30) Use the information to answer the following question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can then enter and allow the remaining seeds to germinate.

Entrepreneurs attempted, but failed, to harvest nuts from plantations grown in Southeast Asia. Attempts to grow Brazil nut trees in South American plantations also failed. In both cases, the trees grew vigorously, produced healthy flowers in profusion, but set no fruit. Consequently, what is the likely source of the problem?

- A) poor sporophyte viability
- B) failure to produce fertile ovules
- C) failure to produce pollen
- D) pollination failure

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 30.3

31) Use the information to answer the following question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can then enter and allow the remaining seeds to germinate.

The agouti is most directly involved with the Brazil nut tree's dispersal of _____.

- A) female gametophytes
- B) sporophyte embryos
- C) sporophyte megasporangia
- D) female gametes

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 30.3

32) Use the information to answer the following question.

Scarlet gilia (*Ipomopsis aggregata*) usually has red flowers in an inflorescence of up to 250 flowers. In certain populations in the Arizona mountains, however, the flowers range from red to pink to white. In early summer, most (but not all) of the flowers were red. Six to eight weeks later, the same individual plants were still present; the flowers ranged from pink to white, and few red flowers were present. The major pollinators early in the season were two species of hummingbirds active during the day; they emigrated to lower elevations, and the major pollinator later in the season was a hawk moth (a type of moth). The hawk moth was most active at sunset and later, and it preferred light pink to white flowers after dark. When hummingbirds were present, more red flowers than white flowers produced fruit. When only hawk moths were present, more white flowers produced fruit. (K. N. Paige and T. G. Whitham. 1985. Individual and population shifts in flower color by scarlet gilia: A mechanism for pollinator tracking. *Science* 227:315-17).

What is the significance of measuring fruit production?

- A) It is a measure of pollination success.
- B) It is a measure of seed dispersal success.
- C) It is easier than counting flowers.
- D) It is an indication of predation on the seeds of the plants.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 30.3

33) Use the information to answer the following question.

Scarlet gilia (*Ipomopsis aggregata*) usually has red flowers in an inflorescence of up to 250 flowers. In certain populations in the Arizona mountains, however, the flowers range from red to pink to white. In early summer, most (but not all) of the flowers were red. Six to eight weeks later, the same individual plants were still present; the flowers ranged from pink to white, and few red flowers were present. The major pollinators early in the season were two species of hummingbirds active during the day; they emigrated to lower elevations, and the major pollinator later in the season was a hawk moth (a type of moth). The hawk moth was most active at sunset and later, and it preferred light pink to white flowers after dark. When hummingbirds were present, more red flowers than white flowers produced fruit. When only hawk moths were present, more white flowers produced fruit (K. N. Paige and T. G. Whitham. 1985. Individual and population shifts in flower color by scarlet gilia: A mechanism for pollinator tracking. *Science* 227:315-17).

Late in the season, when only hawk moths were present, researchers painted the red flowers white. What would you expect?

- A) Unpainted red flowers would produce more fruits than white flowers would.
- B) Red flowers painted white would produce more fruits than red flowers would.
- C) Red and white flowers would produce the same numbers of fruits.
- D) Unpainted red flowers would produce the same number of fruits as the white flowers.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 30.3

34) Use the information to answer the following question.

Scarlet gilia (*Ipomopsis aggregata*) usually has red flowers in an inflorescence of up to 250 flowers. In certain populations in the Arizona mountains, however, the flowers range from red to pink to white. In early summer, most (but not all) of the flowers were red. Six to eight weeks later, the same individual plants were still present; the flowers ranged from pink to white, and few red flowers were present. The major pollinators early in the season were two species of hummingbirds active during the day; they emigrated to lower elevations, and the major pollinator later in the season was a hawk moth (a type of moth). The hawk moth was most active at sunset and later, and it preferred light pink to white flowers after dark. When hummingbirds were present, more red flowers than white flowers produced fruit. When only hawk moths were present, more white flowers produced fruit (K. N. Paige and T. G. Whitham. 1985. Individual and population shifts in flower color by scarlet gilia: A mechanism for pollinator tracking. *Science* 227:315-17).

Some plants continued to produce only dark (red) flowers whereas others produced lighter colored flowers later in the season. Which plants do you expect produced more fruit over the entire season?

- A) those that changed their color to a lighter shade
- B) those that stayed dark
- C) the same numbers of fruit on both
- D) the plants whose flowers were always light colored

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 30.3

35) Use the information to answer the following question.

Scarlet gilia (*Ipomopsis aggregata*) usually has red flowers in an inflorescence of up to 250 flowers. In certain populations in the Arizona mountains, however, the flowers range from red to pink to white. In early summer, most (but not all) of the flowers were red. Six to eight weeks later, the same individual plants were still present; the flowers ranged from pink to white, and few red flowers were present. The major pollinators early in the season were two species of hummingbirds active during the day; they emigrated to lower elevations, and the major pollinator later in the season was a hawk moth (a type of moth). The hawk moth was most active at sunset and later, and it preferred light pink to white flowers after dark. When hummingbirds were present, more red flowers than white flowers produced fruit. When only hawk moths were present, more white flowers produced fruit (K. N. Paige and T. G. Whitham. 1985. Individual and population shifts in flower color by scarlet gilia: A mechanism for pollinator tracking. *Science* 227:315-17).

Which of the following proposed controls would be most appropriate for the experiment when, late in the season, scientists painted some of the red flowers white?

- A) Some red flowers should be painted pink
- B) Some red and light colored flowers should be covered to prevent pollinator access.
- C) Plants with light and dark colored flowers should be fertilized.
- D) A necessary control would be to put red paint on some of the red flowers in order to control for the effects of paint.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.3

36) Immature seed cones of conifers are usually green before pollination, and flowers of grasses are inconspicuously colored. What does this indicate about their pollination?

- A) They probably self-fertilize and do not need pollen carried from one plant to another.
- B) Their pollinating insects are probably color blind.
- C) They are probably wind pollinated.
- D) They probably attract pollinators using strong fragrances.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 30.3

37) In onions (*Allium*), cells of the sporophyte have 16 chromosomes within each nucleus. Match the number of chromosomes present in each of the following onion tissues. How many chromosomes should be in a tube cell nucleus?

- A) 8
- B) 16
- C) 24
- D) 32

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 30.3

38) In onions (*Allium*), cells of the sporophyte have 16 chromosomes within each nucleus. Match the number of chromosomes present in each of the following onion tissues. How many chromosomes should be in an endosperm nucleus?

- A) 8
- B) 16
- C) 24
- D) 32

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 30.3

39) In onions (*Allium*), cells of the sporophyte have 16 chromosomes within each nucleus. Match the number of chromosomes present in each of the following onion tissues. How many chromosomes should be in a generative cell nucleus?

- A) 8
- B) 16
- C) 24
- D) 32

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 30.3

40) In onions (*Allium*), cells of the sporophyte have 16 chromosomes within each nucleus. Match the number of chromosomes present in each of the following onion tissues. How many chromosomes should be in the nucleus of an egg within the embryo sac prior to fertilization?

- A) 8
- B) 16
- C) 24
- D) 32

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 30.3

41) In onions (*Allium*), cells of the sporophyte have 16 chromosomes within each nucleus. Match the number of chromosomes present in each of the following onion tissues. How many chromosomes should be in an embryo nucleus after fertilization?

- A) 8
- B) 16
- C) 24
- D) 32

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 30.3

42) In onions (*Allium*), cells of the sporophyte have 16 chromosomes within each nucleus. Match the number of chromosomes present in each of the following onion tissues. How many chromosomes should be in a megasporangium nucleus?

- A) 8
- B) 16
- C) 24
- D) 32

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 30.3

43) Use the information to answer the following question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can then enter and allow the remaining seeds to germinate.

Animals that consume Brazil nuts derive nutrition mostly from tissue whose nuclei have how many chromosomes?

- A) 17
- B) 34
- C) 51
- D) 68

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 30.3

44) Which of the following sex and generation combinations directly produces the fruit of angiosperms?

- A) male gametophyte
- B) female gametophyte
- C) male sporophyte
- D) female sporophyte

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.3

45) Which of the following is a characteristic of all angiosperms?

- A) double internal fertilization
- B) free-living gametophytes
- C) carpels that contain microsporangia
- D) ovules that are not contained within ovaries

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.3

46) What adaptations should one expect of the seed coats of angiosperm species whose seeds are dispersed by frugivorous (fruit-eating) animals, as opposed to angiosperm species whose seeds are dispersed by other means?

- A) The seed coat, upon its complete digestion, should provide vitamins or nutrients to animals.
- B) The exterior of the seed coat should have barbs or hooks, and the seed coat should contain secondary compounds that irritate the lining of the animal's mouth.
- C) The seed coat should contain secondary compounds that irritate the lining of the animal's mouth, and the seed coat should be able to withstand high acidity.
- D) The seed coat should be able to withstand high acidity, and the seed coat should be resistant to the animal's digestive enzymes.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 30.3

47) The generative cell of male angiosperm gametophytes is haploid. This cell divides to produce two haploid sperm cells. What type of cell division does the generative cell undergo to produce these sperm cells?

- A) binary fission
- B) mitosis
- C) meiosis
- D) meiosis without subsequent cytokinesis

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 30.3

48) Among plants known as legumes (beans, peas, alfalfa, clover, for example) the seeds are contained in a fruit that is itself called a legume, better known as a pod. Upon opening such pods, it is commonly observed that some ovules have become mature seeds, whereas other ovules have not. Thus, which of the following statements is/are likely accurate?

- A) The flowers that gave rise to such pods were not pollinated, and fruit can develop even if all ovules within have not been fertilized.
- B) Pollen tubes did not enter all of the ovules in such pods, and the ovules that failed to develop into seeds were derived from sterile floral parts.
- C) Pollen tubes did not enter all of the ovules in such pods, and fruit can develop even if all ovules within have not been fertilized.
- D) There was apparently not enough endosperm to distribute to all of the ovules in such pods, and fruit can develop even if all ovules within have not been fertilized.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.3

49) Arrange the following structures from largest to smallest, assuming that they belong to two generations of the same angiosperm.

- A) carpel, embryo sac, ovule, ovary, egg
- B) embryo sac, carpel, egg, ovary, ovule
- C) embryo sac, ovary, carpel, ovule, egg
- D) carpel, ovary, ovule, embryo sac, egg

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.3

50) Mistletoe is a plant that lives on trees and gains nutrition from them (that is, it is a parasite). The fruit of the mistletoe is a one-seeded berry and is consumed by birds. In members of the genus *Viscum*, the outside of the seed is viscous (sticky), which permits the seed to adhere to surfaces such as the branches of host plants or the beaks of birds. What should be expected of the fruit if the viscosity of *Viscum* seeds is primarily an adaptation for dispersal rather than an adaptation for infecting host plant tissues? The fruit _____.

- A) is drab in color
- B) is colored so as to provide it with camouflage
- C) is nutritious to the dispersing organisms
- D) secretes enzymes that can digest bark

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 30.3

51) Use the information to answer the following question.

The cycads, a mostly tropical phylum of gymnosperms, evolved about 300 million years ago and were dominant forms during the age of the dinosaurs. Though their sperm are flagellated, their ovules are pollinated by beetles. These beetles get nutrition from the pollen and shelter from the microsporophylls. Upon visiting megasporophylls, the beetles transfer pollen to the exposed ovules. In cycads, pollen cones and seed cones are borne on different plants. Cycads synthesize neurotoxins, especially in the seeds, that are effective against most animals, including humans.

Which feature of cycads makes them similar to many angiosperms?

- A) They have exposed ovules.
- B) They have flagellated sperm.
- C) They are pollinated by animals.
- D) They have flagellated sperm, and they are pollinated by animals.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 30.3

52) Use the information to answer the following question.

The cycads, a mostly tropical phylum of gymnosperms, evolved about 300 million years ago and were dominant forms during the age of the dinosaurs. Though their sperm are flagellated, their ovules are pollinated by beetles. These beetles get nutrition from the pollen and shelter from the microsporophylls. Upon visiting megasporophylls, the beetles transfer pollen to the exposed ovules. In cycads, pollen cones and seed cones are borne on different plants. Cycads synthesize neurotoxins, especially in the seeds, that are effective against most animals, including humans.

If the beetles survive by consuming cycad pollen, then whether the beetles should be considered mutualists with, or parasites of, the cycads depends upon the _____.

- A) extent to which their overall activities affect cycad reproduction
- B) extent to which the beetles are affected by the neurotoxins
- C) extent to which the beetles damage the cycad flowers
- D) distance the beetles must travel between cycad microsporophylls and cycad megasporophylls

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 30.3

53) If one were to propose a new taxon of plants that included all the plants that are pollinated by animals, but excluded all plants that are not pollinated by animals, then this new taxon would be _____.

- A) monophyletic
- B) paraphyletic
- C) polyphyletic
- D) identical in composition to the phylum Anthophyta

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 30.3

54) Use the information to answer the following question.

Oviparous (egg-laying) animals have internal fertilization (sperm cells encounter eggs within the female's body). Yolk and/or albumen is (are) provided to the embryo, and a shell is then deposited around the embryo and its food source. Eggs are subsequently deposited in an environment that promotes their further development, or are incubated by one or both parents.

The yolk of an animal egg has what type of analog in angiosperms?

- A) endosperm
- B) carpels
- C) fruit
- D) seed coat

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 30.3

55) Use the information to answer the following question.

Oviparous (egg-laying) animals have internal fertilization (sperm cells encounter eggs within the female's body). Yolk and/or albumen is (are) provided to the embryo, and a shell is then deposited around the embryo and its food source. Eggs are subsequently deposited in an environment that promotes their further development, or are incubated by one or both parents.

The shell of a fertilized animal egg has what type of analog in angiosperms?

- A) endosperm
- B) carpels
- C) fruit
- D) seed coat

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 30.3

56) Use the information to answer the following question.

Oviparous (egg-laying) animals have internal fertilization (sperm cells encounter eggs within the female's body). Yolk and/or albumen is (are) provided to the embryo, and a shell is then deposited around the embryo and its food source. Eggs are subsequently deposited in an environment that promotes their further development, or are incubated by one or both parents.

The internal fertilization that occurs prior to shell deposition has what type of analog in angiosperms?

- A) endosperm proliferation
- B) growth of pollen tube and delivery of sperm nuclei
- C) fusion of carpels into a fruit
- D) seed coat hardening

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 30.3

57) Use the information to answer the following question.

Oviparous (egg-laying) animals have internal fertilization (sperm cells encounter eggs within the female's body). Yolk and/or albumen is (are) provided to the embryo, and a shell is then deposited around the embryo and its food source. Eggs are subsequently deposited in an environment that promotes their further development, or are incubated by one or both parents.

The laying of eggs has what type of analog in angiosperms?

- A) endosperm breakdown
- B) fusion of carpels into a fruit
- C) fruit dispersal
- D) seed coat hardening

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 30.3

58) Use the information to answer the following question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can then enter and allow the remaining seeds to germinate.

If a female orchid bee has just left a Brazil nut tree with nectar in her stomach, and if she visits another flower on a different Brazil nut tree, what is the sequence in which the following events should occur?

- A) pollination, pollen tube emerges from pollen grain, pollen tube enters micropyle, double fertilization
- B) pollination, pollen tube enters micropyle, pollen tube emerges from pollen grain, double fertilization
- C) pollen tube emerges from pollen grain, pollination, pollen tube enters micropyle, double fertilization
- D) pollen tube enters micropyle, pollen tube emerges from pollen grain, pollination, double fertilization

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 30.3

59) Stamens, sepals, petals, carpels, and pinecone scales are all _____.

- A) female reproductive parts
- B) capable of photosynthesis
- C) modified leaves
- D) found on flowers

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.3

60) Compared to animal-pollinated plants, wind-pollinated angiosperms _____.

- A) produce fewer seeds because winds disperse seeds in a targeted manner
- B) produce more seeds because winds disperse seeds greater distances
- C) produce much less pollen because winds disperse pollen in a highly targeted manner
- D) produce much more pollen because winds disperse pollen randomly

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 30.3

61) *Archaefructus*, an early fossil angiosperm, was herbaceous and probably aquatic. Other seed plant fossils were woody and terrestrial. What should scientists conclude?

- A) The earliest angiosperms were herbaceous and aquatic.
- B) The earliest angiosperms were woody and terrestrial.
- C) Other data must be considered in order to make a valid conclusion.
- D) We cannot know the real history of angiosperms.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.3

62) Imagine that you wanted to know if speciation is more rapid in plant groups pollinated by bees or hummingbirds. To do this, you identified 20 genera of angiosperms that contained species pollinated by both types of animals. There were substantially more species in the groups that were pollinated by bees. What conclusions can you draw from your data?

- A) Hummingbirds promoted speciation more than did bees.
- B) Hummingbirds promoted speciation less than did bees.
- C) Each genus should be split into two new genera.
- D) The rates of speciation were similar in groups pollinated by hummingbirds and bees.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.3

63) Use the information to answer the following question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can then enter and allow the remaining seeds to germinate.

The harpy eagle, *Harpia harpyja*, is the largest, most powerful raptor in the Americas. It nests only in trees taller than 25 meters. It is a "sloth specialist," but will also take agouti. Thus, if these eagles capture too many agoutis from a particular locale, they might contribute to their own demise by _____.

- A) having too many offspring
- B) decreasing their habitat
- C) decreasing atmospheric carbon dioxide
- D) increasing the number of sloths

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 30.4

64) Use the information to answer the following question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can then enter and allow the remaining seeds to germinate.

Native peoples traditionally use Brazil nuts to treat stomachache, inflammation, hypersensitivity, and hepatitis. Consequently, a scientist should be interested in promoting _____.

- A) better education for the native peoples so that they will overcome their old ways
- B) clear-cutting forests containing Brazil nut trees to make way for crops with proven medical benefits
- C) an increase in the living standards of the native peoples so that they might be able to purchase modern pharmaceuticals
- D) the evaluation of Brazil nut chemicals for use as potential drugs

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 30.4

65) Use the information to answer the following question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can then enter and allow the remaining seeds to germinate.

People who attempted to plant Brazil nuts in hopes of establishing plantations of Brazil nut trees played roles most similar to those of _____.

- A) agoutis
- B) orchid bees
- C) pollen tubes
- D) harpy eagles

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 30.4

66) Use the information to answer the following question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can then enter and allow the remaining seeds to germinate.

The same bees that pollinate the flowers of the Brazil nut trees also pollinate orchids, which are epiphytes (in other words, plants that grow on other plants); however, orchids cannot grow on Brazil nut trees. These observations explain _____.

- A) the coevolution of Brazil nut trees and orchids
- B) why Brazil nut trees do not set fruit in monoculture (all one species) plantations
- C) why male orchid bees do not pollinate Brazil nut tree flowers
- D) why male orchid bees are smaller than female orchid bees

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.4

67) Use the information to answer the following question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can now enter. The uneaten seeds may subsequently germinate.

The taller a Brazil nut tree is, _____.

- A) the more valuable it is as a source of lumber
- B) the more valuable it is as a source of lumber, and the less useful it is to harpy eagles
- C) the more valuable it is as a source of lumber, and the greater its photosynthetic production is relative to neighboring plants
- D) the less useful it is to harpy eagles, and the greater its photosynthetic production is relative to neighboring plants

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.4

68) Use the information to answer the following question.

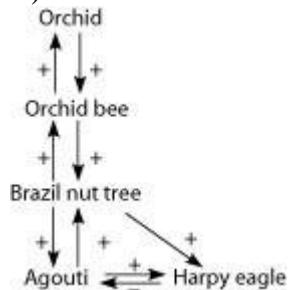
The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can then enter and allow the remaining seeds to germinate.

Ecologists often build models to depict the relationships between organisms. In such models, an arrow is used to link two organisms in a relationship. The arrowhead is next to the organism that is affected. If the effect is positive, the arrow is labeled with (+), and if negative, then the label is (-). Which of the following models best illustrates the direct relationships of the Brazil nut tree and the other organisms associated with it?

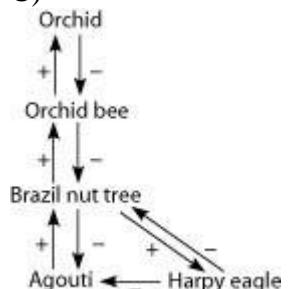
A)



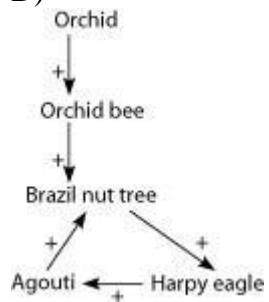
B)



C)



D)



Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.3

69) Use the information to answer the following question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, a source of high-quality lumber, and a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can then enter and allow the remaining seeds to germinate.

Ecologists often build models to depict the relationships between organisms. In such models, an arrow is used to link two organisms in a relationship. The arrowhead is next to the organism that is affected. If the effect is positive, the arrow is labeled with (+), and if negative, then the label is (-). Capuchin monkeys have been known to use rocks to smash open the fruits of Brazil nut trees. On the rare occasions when this has been observed, the monkeys consume all of the Brazil nuts. Thus, which of the following correctly depicts the direct relationship between capuchin monkeys and Brazil nut trees?

A)



B)



C)



D)



Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.3

70) Robbie and Saurab are pre-med and pre-pharmacy students, respectively. They complain to their biology professor that they should not have to study plants because plants have little relevance to their chosen professions. Which adaptations of land plants are likely to cause human health problems and provide Robbie with future patients?

- A) sporophyte dominance and defenses against herbivory
- B) defenses against herbivory and adaptations related to wind dispersal of pollen
- C) sporophyte dominance and adaptations related to wind dispersal of pollen
- D) sporophyte dominance, defenses against herbivory, and adaptations related to wind dispersal of pollen

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.4

71) Robbie and Saurab are pre-med and pre-pharmacy students, respectively. They complain to their biology professor that they should not have to study plants because plants have little relevance to their chosen professions. Which of the following statements are correct with regard to what physicians and pharmacists need to know about plants?

- A) Land plants produce poisons and medicines.
- B) Crop plants can often interbreed with their wild relatives.
- C) Crop plants often produce more seeds than their wild relatives.
- D) Land plants often provide food for pollinators.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 30.4

72) Which of the following problems will likely increase if the human population continues to increase?

- A) reduction in available medicines
- B) decrease in global temperature
- C) increase in disease-causing organisms
- D) reduction in plant and animal diversity

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 30.4

73) Use the information to answer the following question.

Theobroma cacao (cacao) is the tree that produces seeds that are turned into chocolate. These trees provide many poor people in the tropics with some cash income. However, these farmers face many obstacles to production of their crop, including temperature and rainfall changes caused by atmospheric CO₂ increases, and many diseases and pests. Analysis of the cacao genome showed that there is some (but not a lot) of genetic variation in the 10 major varieties.

Which of the following strategies would be most useful in the long term in reducing pressures faced by cacao farmers?

- A) Plant more trees in the temperate zone.
- B) Crossbreed cacao strains that produce high-quality cacao beans and ones resistant to a disease.
- C) Plant trees farther apart so that disease transmission rates from one tree to the next will be lower.
- D) Fertilize the trees in closely spaced areas and add fungicides and pesticides to eliminate pests.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.4

74) Use the information to answer the following question.

Theobroma cacao (cacao) is the tree that produces seeds that are turned into chocolate. These trees provide many poor people in the tropics with some cash income. However, these farmers face many obstacles to production of their crop, including temperature and rainfall changes caused by atmospheric CO₂ increases, and many diseases and pests. Analysis of the cacao genome showed that there is some (but not a lot) of genetic variation in the 10 major varieties.

Currently, cacao is harvested by cutting the cacao pods off trees with machetes. Which of the following strategies would increase the ease of harvesting?

- A) Breed trees that are shorter.
- B) Breed trees that produce fruits that attach more strongly to the tree.
- C) Breed trees resistant to diseases and pests.
- D) Provide fertilizer in small quantities.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.4

75) Use the information to answer the following question.

Açaí berries come from trees that are native to the Amazon River Basin and now are the basis of many popular fruit drinks. Farmers with small areas harvest the berries in their family farms. Sometimes, they plant additional açai trees, weed out underbrush, and remove other trees in an effort to increase açai production. A recent study compared the forest characteristics of unmanipulated plots versus those where the farmers modified the plants in the plots. This study produced the following results:

Characteristics	Unmanipulated Plots	Manipulated Plots
Açaí density (mean # clumps/plot)	625	1,000
Number of vines	800/plot	4,100/plot
Stem density of all plants	4,680/plot	77.35/plot
Density of non-palm stems	1,400/plot	4,000/plot

Which of the following conclusions are most reasonable to draw from the data presented?

- A) Açaí production will help keep the biodiversity of the Amazonian rainforest intact even when farmers manipulate their plots.
- B) Açaí production helps alleviate poverty by Amazonian people with small farms.
- C) Açaí production does not affect the composition of the forest even when farmers manipulate their plots.
- D) Açaí production changes the character of the forest when farmers manipulate their plots.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 30.4

30.2 Student Edition End-of-Chapter Questions

1) Where in an angiosperm would you find a megasporangium?

- A) in the style of a flower
- B) enclosed in the stigma of a flower
- C) within an ovule contained within an ovary of a flower
- D) packed into pollen sacs within the anthers found on a stamen

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

2) Key features of seed plants facilitating life on land include three of the following four traits.

Select the exception.

- A) homospory
- B) pollen
- C) reduced gametophytes
- D) seeds

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

3) With respect to angiosperms, which of the following is *incorrectly* paired with its chromosome count?

- A) egg— n
- B) megasporangium— $2n$
- C) microsporangium— n
- D) zygote— $2n$

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

4) Which of the following is *not* a characteristic that distinguishes gymnosperms and angiosperms from other plants?

- A) dependent gametophytes
- B) ovules
- C) pollen
- D) alternation of generations

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

5) Gymnosperms and angiosperms have the following in common *except*

- A) seeds.
- B) pollen.
- C) ovaries.
- D) ovules.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Campbell Biology, 11e (Urry)
Chapter 31 Fungi

31.1 Multiple-Choice Questions

1) Use the following information to answer the question.

In the United States and Canada, bats use one of two strategies to survive winter. They either migrate south, or they hibernate. Recently, those that hibernate seem to have come under attack by a fungus, *Geomyces destructans* (Gd), an attack that is occurring from Missouri to New England, Canada, and even the state of Washington. Many infected bats have a delicate, white filamentous mat on their muzzles, which is referred to as white-nose syndrome (WNS). The fungus invades the bat tissues, causes discomfort, and awakens the bat from its hibernation. The bat fidgets and wastes calories, using up its stored fat. The bat then behaves abnormally, leaving its cave during daytime in winter to search for food. Their food, primarily insects, is scarce during the winter, and the bats ultimately starve to death. Since 2006, it is estimated that over six million bats have perished from WNS.

The Gd mat on the fur of the bats should be expected to consist of _____.

- A) hyphae
- B) haustoria
- C) yeasts
- D) basidia

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 31.1

2) What do fungi and arthropods have in common?

- A) The haploid state is dominant in both groups.
- B) Both groups are predominantly autotrophs that produce their own food.
- C) Both groups use chitin for support.
- D) Both groups have cell walls.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 31.1

- 3) Fungi have an extremely high surface-to-volume ratio. What is the advantage of this characteristic to an organism that gets most of its nutrition through absorption?
- A) The high ratio allows for more material to be acquired from the surroundings and transported through the cell membrane.
 - B) The lower volume prevents the cells from drying out too quickly, which can interfere with absorption.
 - C) This high ratio creates more room inside the cells for additional organelles involved in absorption.
 - D) This high ratio means that fungi have a thick, fleshy structure that allows the fungi to store more of the food it absorbs.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 31.1

4) Use the following information to answer the question.

Suzanne Simard and colleagues knew that the same mycorrhizal fungal species could colonize multiple types of trees. They wondered if the same fungal individual would colonize different trees, forming an underground network that potentially could transport carbon and nutrients from one tree to another (S. Simard et al. 1997. Net transfer of carbon between mycorrhizal tree species in the field. *Nature* 388:579-82).

Pots containing seedlings of three different tree species were set up and grown under natural conditions for three years (Fig. A). Two of the three species (Douglas fir, birch) could form ectomycorrhizal connections with the same fungal species, but the third species (cedar) could not form an ectomycorrhizal connection with the fungal species. In some of the pots, the researchers placed airtight bags over the Douglas fir and birch seedlings and injected carbon dioxide made from carbon-13 into the bags with the Douglas fir and carbon dioxide made from carbon-14 into the bags with the birch. (^{13}C and ^{14}C are different isotopes of carbon that can be detected and measured by researchers.) As the seedlings photosynthesized, the carbon dioxide was converted into sugars that could be tracked and measured by the researchers. The researchers measured whether the sugars in each plant contained only the carbon isotope that was in the air of their plastic bag or also the carbon isotope from the air around the other plant.

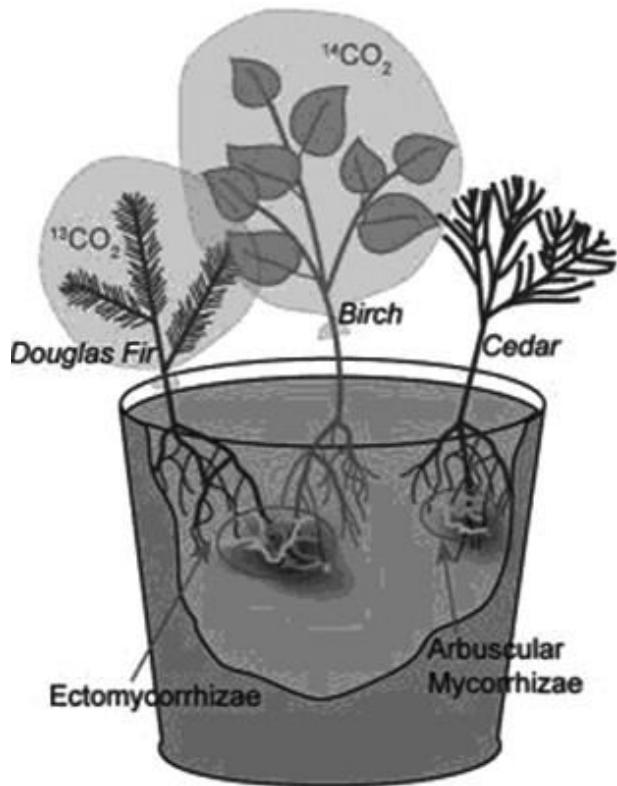


Figure A

Which of the following results would support Simard et al.'s (1997) hypothesis that fungi can move carbon from one plant to another? [Hypothesis: Sugars made by one plant during photosynthesis can travel through a mycorrhizal fungus and be incorporated into the tissues of another plant.]

- A) Carbon-14 is found in the birch seedling's tissues and carbon-13 in the Douglas fir.
- B) Carbon-14 is found in the Douglas fir seedling's tissues and carbon-13 in the birch.
- C) Either carbon-13 or carbon-14 is found in the fungal tissues.
- D) Either carbon-13 or carbon-14 is found in the cedar seedling's tissues.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.1

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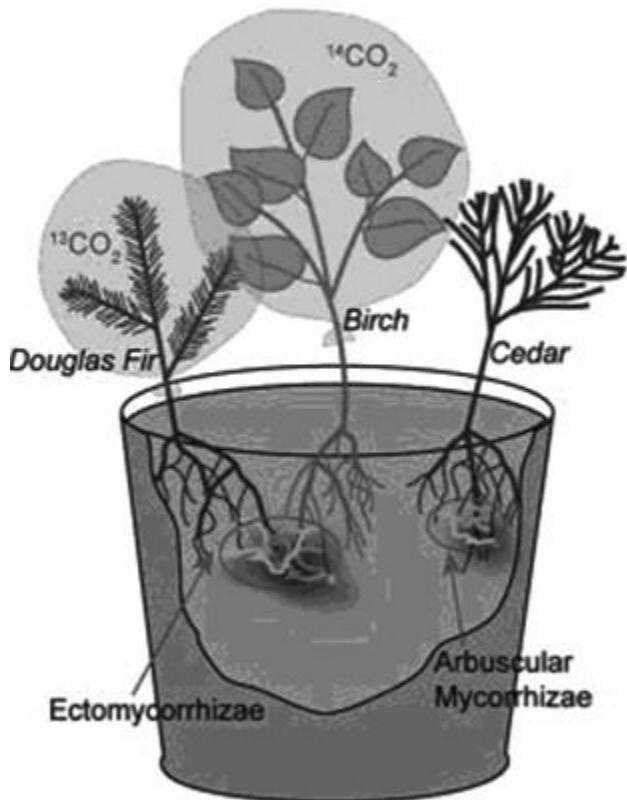


Figure A

Based on the idea that fungi have pores between their cell walls that allow cytoplasm to move from one end of the mycelium to the other, which of the following hypotheses is the most plausible?

- A) If a single mycorrhizal fungus formed symbiotic associations with more than one tree, carbon could travel from one plant to another.
- B) Parasitic fungi steal nutrients from their hosts.
- C) Predatory fungi capture their prey by encircling them with hyphae, and the flowing of the cytoplasm through the pores helps the hyphae to move around the prey.
- D) Fungi function as part of the global carbon cycle, not only by converting carbon from one form to another, but by physically moving it from one location to another.

Answer: A

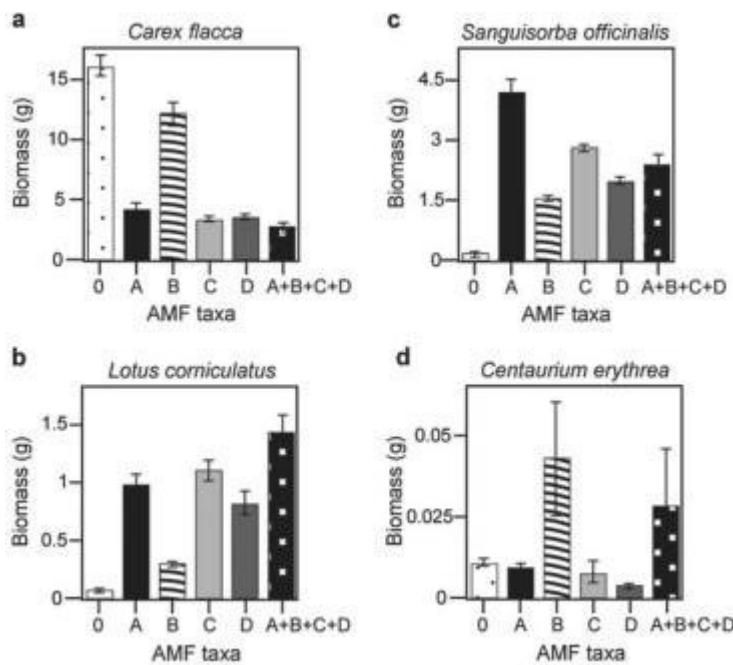
Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.1

6) Use the following information to answer the question.

There is much discussion in the media about protecting biodiversity. But does biodiversity really matter? Canadian and Swiss researchers wanted to know if the diversity of arbuscular mycorrhizal fungi (AMF) was important to the productivity of grasslands (M.G.A. van der Heijden, J. N. Klironomos, M. Ursic, P. Moutoglis, R. Streitwolf-Engel, T. Boler, A. Wiemken, and I. R. Sanders. 1998. Mycorrhizal fungal diversity determines plant biodiversity, ecosystem variability, and productivity. *Nature* 396:69-72). Specifically, they wanted to know if it mattered which specific AMF species were present, or just that some type of AMF was present. They grew various plants in combination with one of four AMF species (A, B, C, and D), no AMF species (0), or all four AMF species together (A + B + C + D); and they measured plant growth under each set of conditions. All plant species were grown in each plot, so they always competed with each other, with the only difference being which AMF species were present.

On the graphs, the x-axis labels indicate the number and identity of AMF species (bar 0 = no fungi; bars A - D = individual AMF species; bar A + B + C + D = all AMF species together). The y-axis indicates the amount (grams) of plant biomass for the species shown in italics above each graph.



Based on the graphs in the figure, which of the following plant species is most likely *not* to form mycorrhizal associations?

- A) *Carex flacca* (graph a)
- B) *Lotus corniculatus* (graph b)
- C) *Sanguisorba officinalis* (graph c)
- D) *Centaurium erythrea* (graph d)

Answer: A

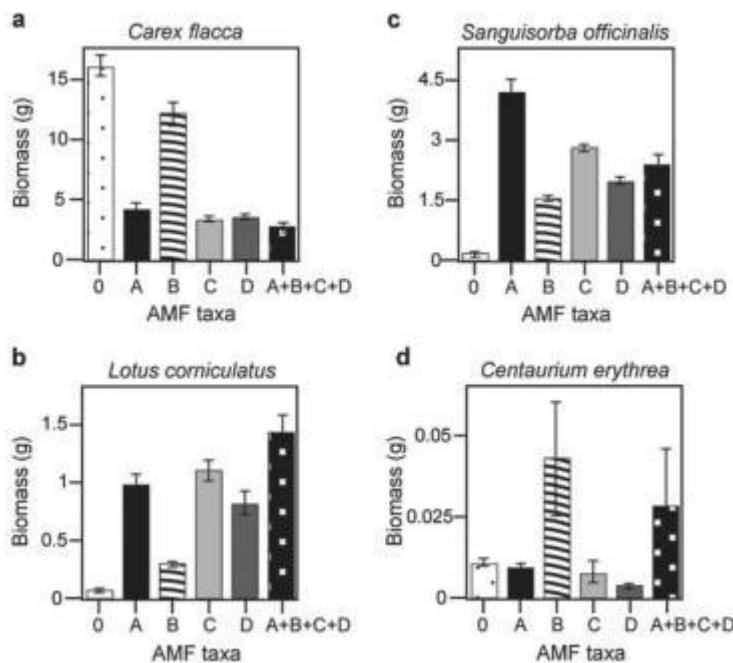
Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.1

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Examine the effect of AMF species on *Sanguisorba officinalis*. Which of the following conclusions can be correctly drawn from the data?

- A) Growth is best with AMF species D.
- B) Growth is best with AMF species A.
- C) Growth is best with a mixture of AMF species.
- D) AMF presence had no effect on *S. officinalis* growth.

Answer: B

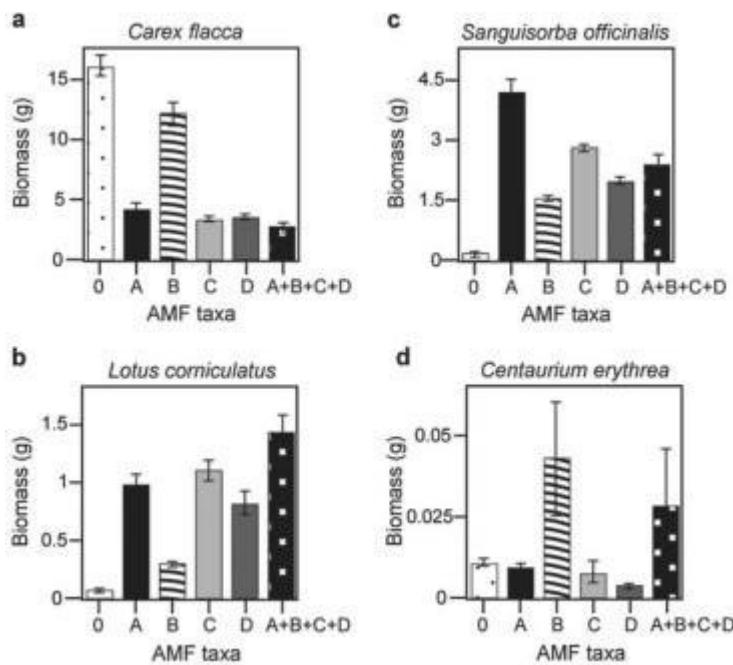
Bloom's Taxonomy: Application/Analysis

Section: 31.1

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Examine all four graphs and choose the plant species that grows best with a combination of AMF species.

- A) *Carex flacca* (graph a)
- B) *Lotus corniculatus* (graph b)
- C) *Sanguisorba officinalis* (graph c)
- D) *Centaurium erythraea* (graph d)

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.1

9) If all fungi in an environment that perform decomposition were to suddenly die, then which group of organisms should benefit most, due to the fact that their fungal competitors have been removed?

- A) flowering plants
- B) protists
- C) prokaryotes
- D) grasses

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 31.1

10) When a mycelium infiltrates an unexploited source of dead organic matter, what are most likely to appear within the food source soon thereafter?

- A) fungal haustoria
- B) fungal enzymes
- C) increased oxygen levels
- D) larger bacterial populations

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 31.1

11) A fungal spore germinates, giving rise to a mycelium that grows outward into the soil surrounding the site where the spore originally landed. Which of the following accounts for the fungal movement, as described here?

- A) karyogamy
- B) mycelial flagella
- C) breezes distributing spores
- D) cytoplasmic streaming in hyphae

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 31.1

12) When pathogenic fungi are found growing on the roots of grape vines, grape farmers sometimes respond by covering the ground around their vines with plastic sheeting and pumping a gaseous fungicide into the soil. The most important concern of grape farmers who engage in this practice should be that the _____.

- A) fungicide might also kill the native yeasts residing on the surfaces of the grapes
- B) lichens growing on the vines' branches are not harmed
- C) fungicide might also kill mycorrhizae
- D) sheeting is transparent so that photosynthesis can continue

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 31.1

13) The adaptive advantage associated with the filamentous nature of fungal mycelia is primarily related to _____.

- A) the ability to form haustoria and parasitize other organisms
- B) the potential to inhabit almost all terrestrial habitats
- C) the increased probability of contact between different mating types
- D) an extensive surface area well suited for invasive growth and absorptive nutrition

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 31.1

14) Some fungal species live in plants and can kill herbivores that feed on the plant. What type of relationship does this fungus have with its host?

- A) parasitic
- B) mutualistic
- C) commensal
- D) predatory

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 31.1

15) Use the following information to answer the question.

Suzanne Simard and colleagues knew that the same mycorrhizal fungal species could colonize multiple types of trees. They wondered if the same fungal individual would colonize different trees, forming an underground network that potentially could transport carbon and nutrients from one tree to another (S. Simard et al. 1997. Net transfer of carbon between mycorrhizal tree species in the field. *Nature* 388:579-82).

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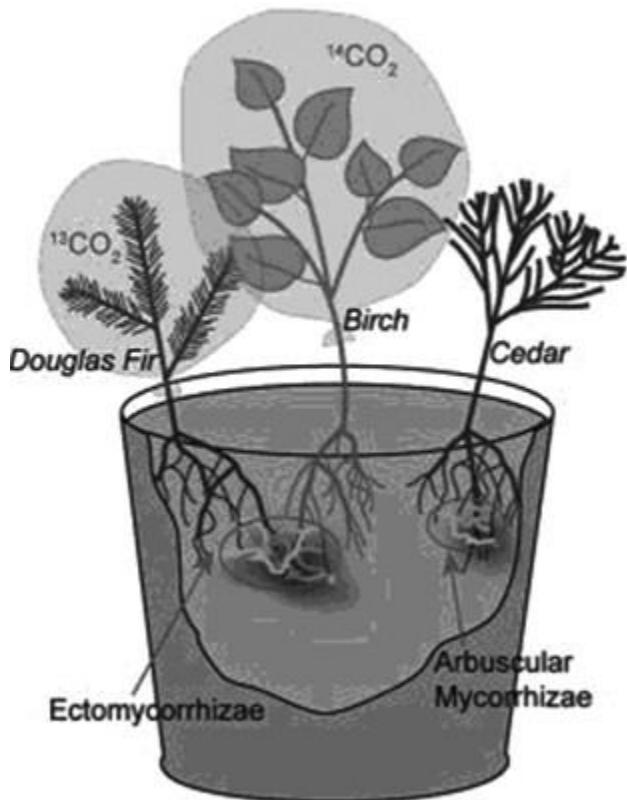


Figure A

Referring to Simard et al. (1997), what is the result that would most strongly refute their hypothesis? [Hypothesis: Sugars made by one plant during photosynthesis can travel through a mycorrhizal fungus and be incorporated into the tissues of another plant.]

- A) No movement: Carbon-14 is found in the birch seedling's tissues and carbon-13 in the Douglas fir.
- B) Reciprocal exchange: Carbon-14 is found in the Douglas fir seedling's tissues and carbon-13 in the birch.
- C) Either carbon-13 or carbon-14 is found in the fungal tissues.
- D) Either carbon-13 or carbon-14 is found in the cedar seedling's tissues.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.1

16) Use the following information to answer the question.

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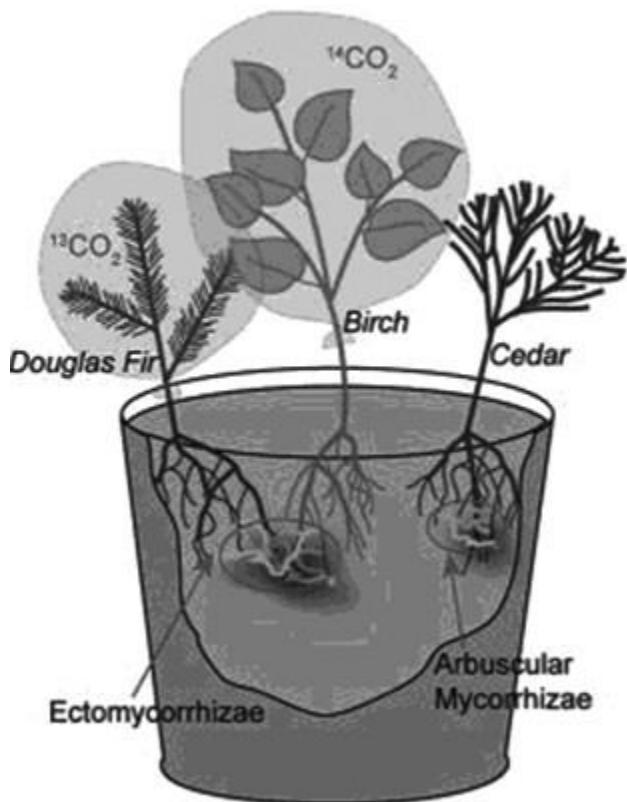


Figure A

Referring to Simard et al. (1997), which design element is the control in this experiment and why?

- A) the bags over the seedlings to contain the different types of carbon dioxide
- B) the fact that all the seedlings are different species
- C) the cedar seedling, because it is not bagged
- D) the cedar seedling, because it does not form ectomycorrhizal connections with the tested fungus

Answer: D

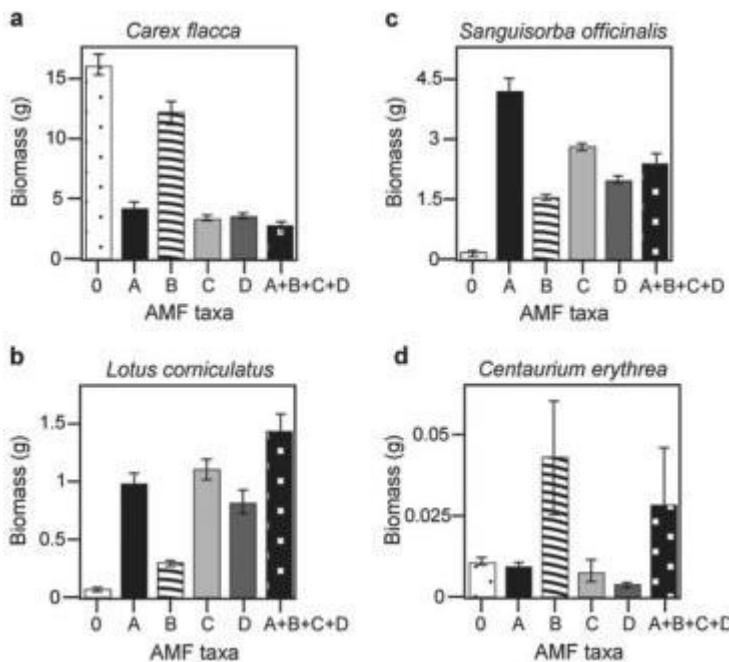
Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.1

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Simard et al. (1997) further hypothesized that if reciprocal transfer did occur, it would be a source-sink relationship driven by photosynthetic rates. That is, if one seedling is in full sun and the other in deep shade, there will be a net movement of carbon from the seedling in full sun to the one in deep shade. If a shade were placed over the birch seedlings and the cedar, and the Douglas fir was left in full sun, what result could Simard and colleagues expect?

- A) More ^{13}C would be found in the birch than ^{14}C in the Douglas fir.
- B) The amounts of ^{13}C and ^{14}C would be equal in the Douglas fir and in the birch.
- C) The most ^{13}C would be found in the cedar.
- D) The most ^{14}C would be found in the cedar.

Answer: A

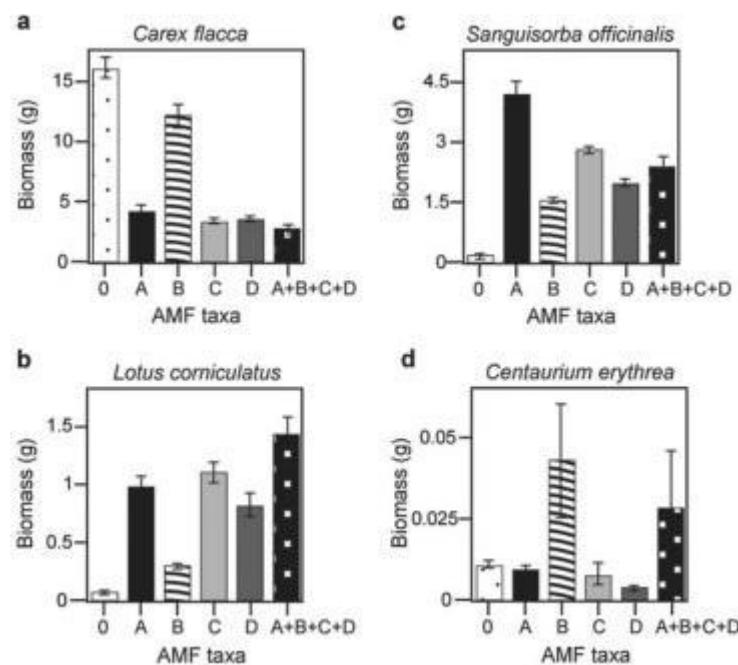
Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.1

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Based on the van der Heijden et al. (1998) graphs in the figure, which of the following is the best description of the data supporting the idea that a plant species did not form mycorrhizae with a fungus? Its biomass is greatest when _____.

- A) no AMF are present
- B) AMF species A is present
- C) AMF species B is present
- D) AMF species C is present

Answer: A

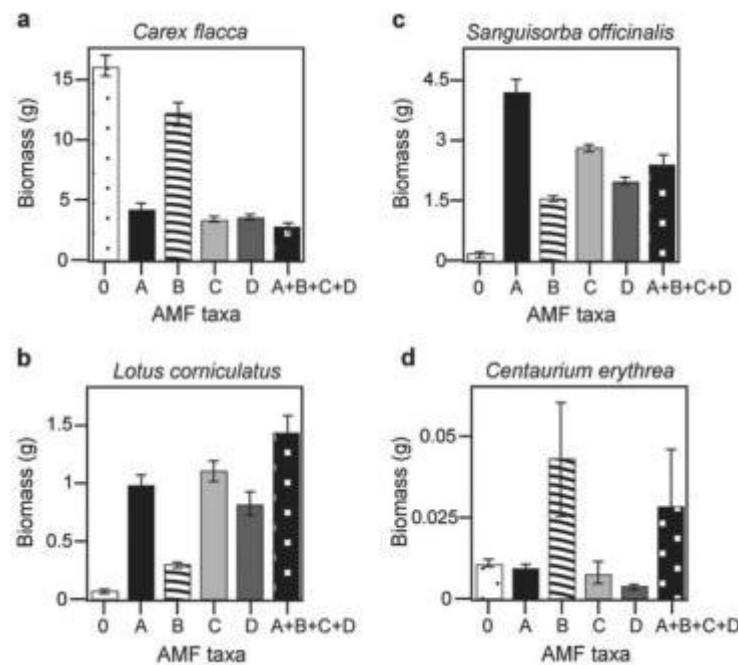
Bloom's Taxonomy: Application/Analysis

Section: 31.1

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In graph b in the figure, which of the following best explains the data given about *Lotus corniculatus*?

- A) This plant grows best when AMF taxa A or C is present.
- B) *Lotus corniculatus* does not form mycorrhizal associations.
- C) Mycorrhizal fungi parasitize the plant's roots when they are present, reducing its growth.
- D) This plant forms multiple AMF associations, growing best with increased fungal diversity.

Answer: D

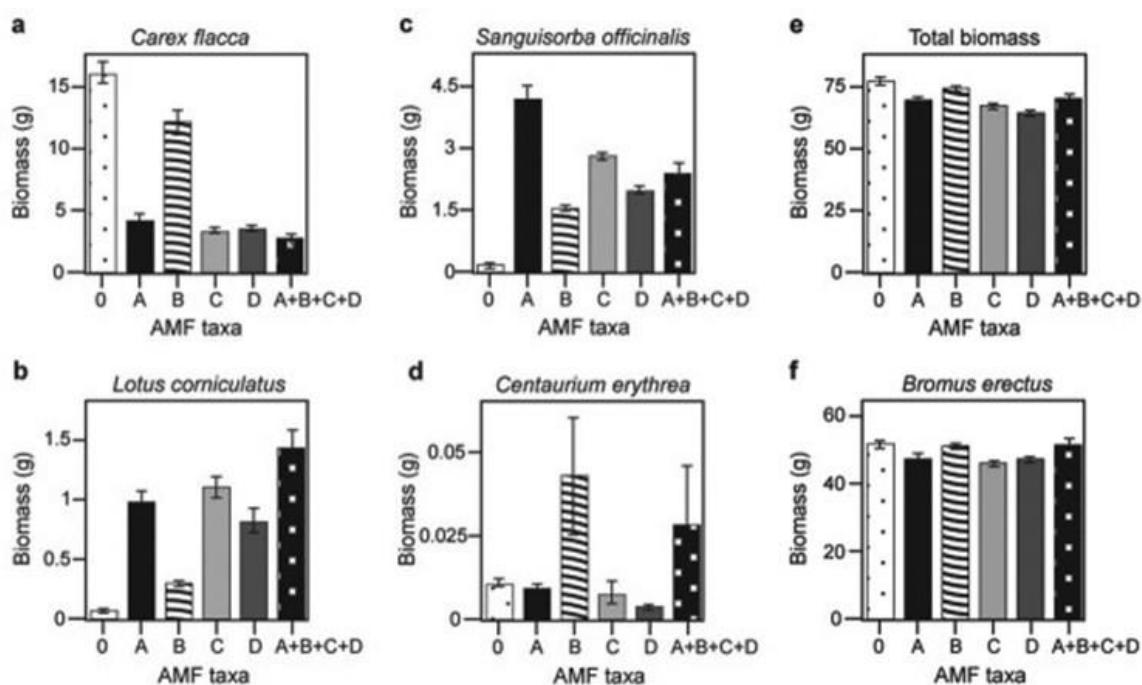
Bloom's Taxonomy: Application/Analysis

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What is the major difference between *Bromus erectus* (graph f) and the other plant species (graphs a-d) included in the study?

- A) *Bromus erectus* grows best with a diversity of fungal partners.
- B) *Bromus erectus* is unaffected by AMF diversity.
- C) *Bromus erectus* does not form mycorrhizal associations.
- D) *Bromus erectus* produces very little biomass regardless of AMF.

Answer: B

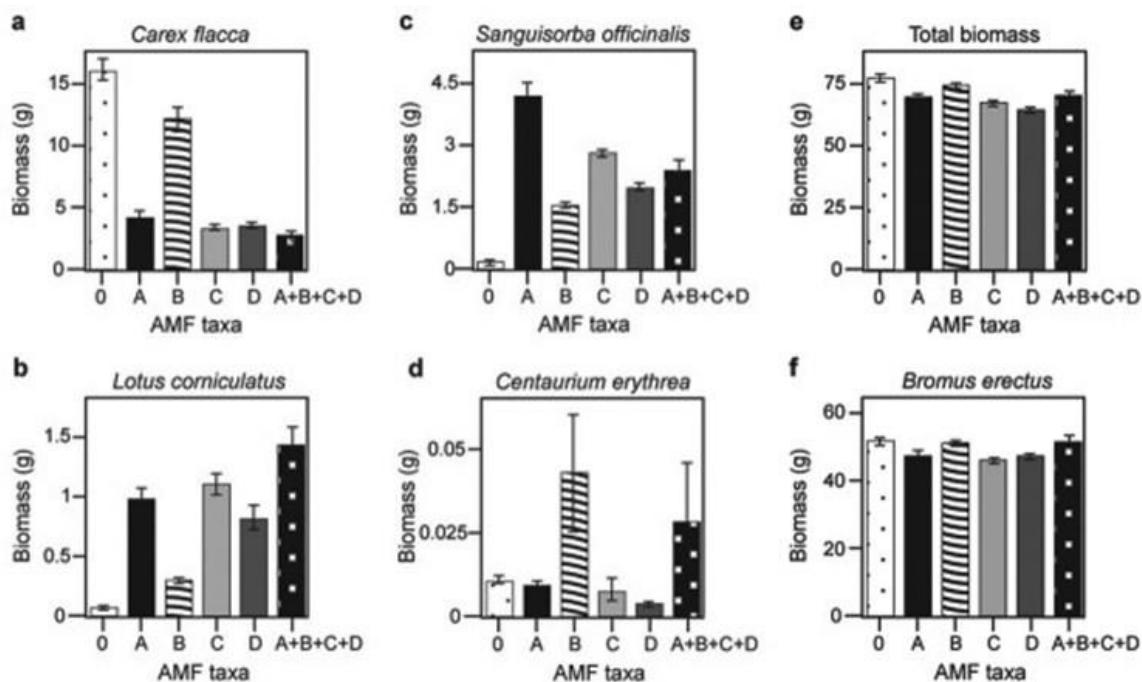
Bloom's Taxonomy: Application/Analysis

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What is the most likely explanation for the observation that total biomass (graph e) does not vary with AMF diversity?

- A) Plant growth is unaffected by fungal diversity.
- B) Most of the plants in this system do not form mycorrhizal associations.
- C) *Bromus erectus* is the dominant plant species.
- D) *Lotus corniculatus* is a rare species.

Answer: C

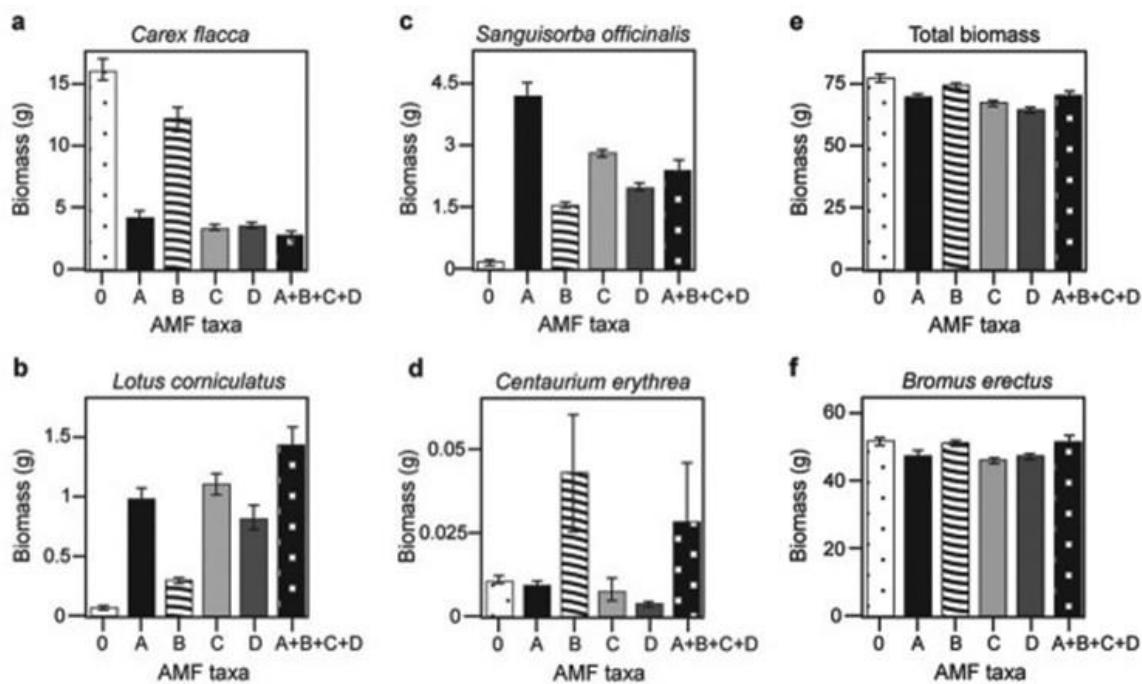
Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.1

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Based on graphs e and f, which is the most well-supported prediction for the effect on total plant biomass if AMF diversity were increased to eight species?

- A) No effect is predicted, because the dominant species is unaffected by AMF diversity.
- B) Total biomass for eight species would double in comparison to that for four species.
- C) Rare species would produce more biomass compared to the case when fewer AMF are present.
- D) No effect is predicted, because the dominant species is non-mycorrhizal.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.1

23) Some companies advertise and sell mycorrhizae to home gardeners and commercial farms, claiming that the presence of mycorrhizae improves plant growth and survival. If the company conducted experiments on plants with and without mycorrhizae, which of the following measurements would support their claim?

- A) smaller apple size in plants with mycorrhizae than in plants without mycorrhizae
- B) increased production of corn ears in plants with mycorrhizae than in plants without mycorrhizae
- C) increased need for fertilizer in plants with mycorrhizae than in plants without mycorrhizae
- D) increased mortality in plants with mycorrhizae than in plants without mycorrhizae

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.1

24) Some nematode worms suck plant juices from the roots of plants and are economically important agricultural pests. Some fungi are usually decomposers of plant material, but some trap and kill nematodes at times. *Arthrobotrys* traps and kills nematodes, especially when they lack nitrogen sources. These two facts suggest that farmers could find *Arthrobotrys* an important tool in combating nematode infestations. Which of the following research questions would make a good starting point for developing such a defense against plant-sucking nematodes?

- A) Does nitrogen fertilization of crops affect the likelihood that *Arthrobotrys* will trap and kill nematodes?
- B) Do nitrogen-fixing bacteria provide nitrogen to the fungi?
- C) What is the evolutionarily oldest method of trapping nematodes?
- D) What mechanisms do nematodes have that could allow them to escape from *Arthrobotrys*?

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.1

25) At which stage of a basidiomycete's life cycle would reproduction be halted if an enzyme that prevented the fusion of hyphae was introduced?

- A) fertilization
- B) karyogamy
- C) plasmogamy
- D) germination

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 31.2

26) Deuteromycetes _____.

- A) represent the phylum in which all the fungal components of lichens are classified
- B) are the group of fungi that have, at present, no known sexual stage
- C) are the group that includes molds, yeasts, and lichens
- D) include the imperfect fungi that lack hyphae

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 31.2

27) Use the following information to answer the question.

For several decades now, amphibian species worldwide have been in decline. A significant proportion of the decline seems to be due to the spread of the chytrid fungus, *Batrachochytrium dendrobatidis* (Bd). Chytrid sporangia reside within the epidermal cells of infected animals, animals that consequently show areas of sloughed skin. They can also be lethargic, which is expressed through failure to hide and failure to flee. The infection cycle typically takes four to five days, at the end of which zoospores are released from sporangia into the environment. In some amphibian species, mortality rates approach 100%; other species seem able to survive the infection.

Sexual reproduction has not been observed in Bd. If its morphology and genetics did not identify it as a chytridiomycete, then to which fungal group would Bd be assigned?

- A) zygomycetes
- B) glomeromycetes
- C) basidiomycetes
- D) deuteromycetes

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 31.2

28) Plasmogamy can directly result in which of the following?

- A) cells with a single haploid nucleus or dikaryotic cells
- B) heterokaryotic cells or dikaryotic cells
- C) heterokaryotic cells or cells with two diploid nuclei
- D) dikaryotic cells or cells with two diploid nuclei

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 31.2

29) After cytokinesis occurs in budding yeasts, the daughter cell has a _____.

- A) similar nucleus and more cytoplasm than the mother cell
- B) smaller nucleus and less cytoplasm than the mother cell
- C) larger nucleus and less cytoplasm than the mother cell
- D) similar nucleus and less cytoplasm than the mother cell

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 31.2

30) In most fungi, karyogamy does not immediately follow plasmogamy, which consequently _____.

- A) means that sexual reproduction can occur in specialized structures
- B) results in multiple diploid nuclei per cell
- C) allows fungi to reproduce asexually most of the time
- D) results in heterokaryotic or dikaryotic cells

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 31.2

31) Asexual reproduction in yeasts occurs by budding. Due to unequal cytokinesis, the "bud" cell receives less cytoplasm than the parent cell. Which of the following statements should be an accurate characterization of the smaller cell until it reaches the size of the larger cell?

- A) It should produce fewer fermentation products per unit time.
- B) It should be transcriptionally less active.
- C) It should have reduced motility.
- D) It should have a smaller nucleus.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 31.2

32) The ascomycete *Brachiola gambiae* parasitizes the mosquito *Anopheles gambiae*. Adult female mosquitoes must take blood meals for their eggs to develop, and it is while they take blood that they transmit malarial parasites to humans. Male mosquitoes drink flower nectar. If humans are to safely and effectively use *Brachiola gambiae* as a biological control to reduce human deaths from malaria, then which of the following statements should be correct?

- A) The ascomycete should not be harmful to other insects and must be harmful to male mosquitoes, but not to female mosquitoes.
- B) The ascomycete should kill the mosquitoes before the malarial parasite they carry reaches maturity and should not be harmful to other insects.
- C) The ascomycete should not be harmful to other insects and should infect mosquito larvae, rather than mosquito adults.
- D) The ascomycete should infect mosquito larvae, rather than mosquito adults, and the subsequent decline in anopheline mosquitoes should not significantly disrupt human food resources.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.4

33) Why are mycorrhizal fungi superior to plants at acquiring mineral nutrition from the soil?

- A) Hyphae are 100 to 1,000 times larger than plant roots.
- B) Hyphae have a smaller surface area-to-volume ratio than do the hairs on a plant root.
- C) Mycelia are able to grow in the direction of food.
- D) Fungi secrete extracellular enzymes that can break down large molecules.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 31.1

34) Fossil fungi date back to the origin and early evolution of plants. What combination of environmental and morphological change is similar in the evolution of both fungi and plants?

- A) presence of "coal forests" and change in mode of nutrition
- B) periods of drought and presence of filamentous body shape
- C) predominance in swamps and presence of cellulose in cell walls
- D) colonization of land and loss of flagellated cells

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 31.3

35) The multicellular condition of animals and fungi seems to have arisen _____.

- A) due to common ancestry
- B) by convergent evolution
- C) by inheritance of acquired traits
- D) by serial endosymbioses

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 31.3

36) Which feature seen in chytrids supports the hypothesis that they diverged earliest in fungal evolution?

- A) the absence of chitin within the cell wall
- B) coenocytic hyphae
- C) flagellated spores
- D) parasitic lifestyle

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 31.3

37) Chitin is a long-chain polymer derived from glucose. It strengthens cell walls of fungi and the outer covering (exoskeleton) of arthropods (including crabs, shrimps, and insects). The presence of chitin in these groups is likely due to _____.

- A) secondary endoparasitism
- B) horizontal gene transfer
- C) paraphyletic evolution
- D) convergent evolution

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.3

38) Early fungi probably formed mutualistic associations with early plants, providing nutrients to the plant and receiving energy-containing compounds. Evidence that plants' ability to form a mutualistic association with fungi is due to ancient genes includes which of the following occurrences?

- A) presence of genes in the earliest fungi that showed an ability to digest cellulose and lignin
- B) presence of genes for chitin in the oldest flowering plants and oldest fungi
- C) fossils that show hyphae wrapped around seeds
- D) restoration of the ability to form mycorrhizae with fungi by a flowering plant after biologists transferred a gene from a liverwort to the flowering plant

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 31.3

39) It has been hypothesized that fungi and plants have a mutualistic relationship because plants make sugars available for the fungi's use. What is the best evidence in support of this hypothesis?

- A) Fungi survive better when they are associated with plants.
- B) Radioactively labeled sugars produced by plants eventually show up in the fungi with which they are associated.
- C) Fungi associated with plants have the ability to undergo photosynthesis and produce their own sugars, while those not associated with plants do not produce their own sugars.
- D) Radioactive labeling experiments show that plants pass crucial raw materials to the fungus for manufacturing sugars.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.4

40) You observe the gametes of a fungal species under the microscope and realize that they resemble animal sperm. To which of the following groups does the fungus belong?

- A) chytrids
- B) zygomycetes
- C) Basidiomycota
- D) Ascomycota

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 31.4

41) Arrange the following in order from largest to smallest.

- A) ascomycete, ascocarp, ascus, ascospore
- B) ascomycete, ascus, ascospore, ascocarp
- C) ascocarp, ascomycete, ascus, ascospore
- D) ascocarp, ascus, ascospore, ascomycete

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 31.4

42) Arrange the following in order from largest to smallest, assuming that they all come from the same fungus.

- A) mycelium, gill, basidiocarp, basidium, basidiospore
- B) gill, basidiocarp, mycelium, basidium, basidiospore
- C) gill, basidiocarp, basidiospore, basidium, mycelium
- D) mycelium, basidiocarp, gill, basidium, basidiospore

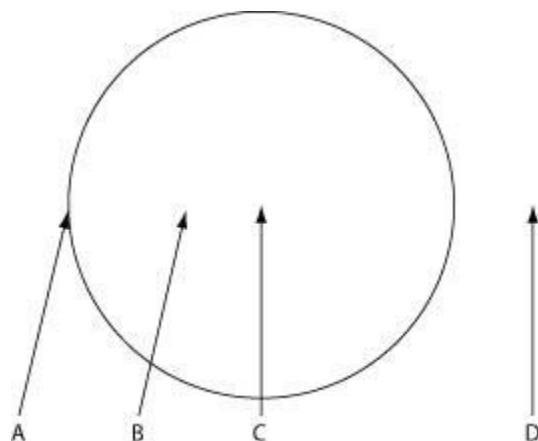
Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 31.4

43) Use the information to answer the following question.

The figure depicts the outline of a large fairy ring that has appeared overnight in an open meadow, as viewed from above. The fairy ring represents the furthest advance of this mycelium through the soil. Locations A-D are all 0.5 meters below the soil surface.

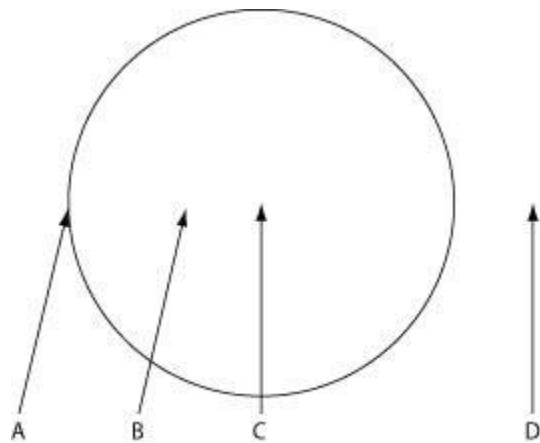


What is the most probable location of the oldest portion of this mycelium?

- A) A
 - B) B
 - C) C
 - D) D
- Answer: C
- Bloom's Taxonomy: Application/Analysis
- Section: 31.4

44) Use the information to answer the following question.

The figure depicts the outline of a large fairy ring that has appeared overnight in an open meadow, as viewed from above. The fairy ring represents the furthest advance of this mycelium through the soil. Locations A-D are all 0.5 meters below the soil surface.



Which location is nearest to basidiocarps?

- A) A
- B) B
- C) C
- D) D

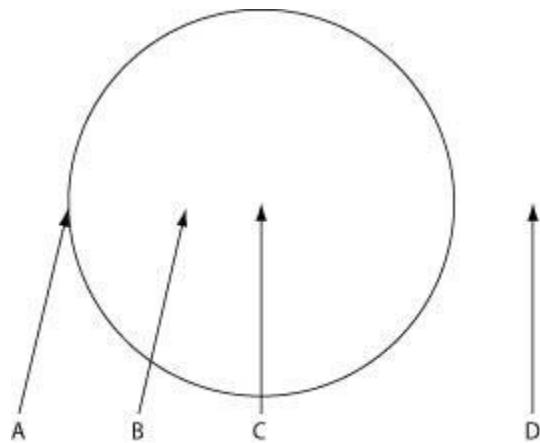
Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 31.4

45) Use the information to answer the following question.

The figure depicts the outline of a large fairy ring that has appeared overnight in an open meadow, as viewed from above. The fairy ring represents the furthest advance of this mycelium through the soil. Locations A-D are all 0.5 meters below the soil surface.



At which location is the mycelium currently absorbing the most nutrients per unit surface area, per unit time?

- A) A
- B) B
- C) C
- D) D

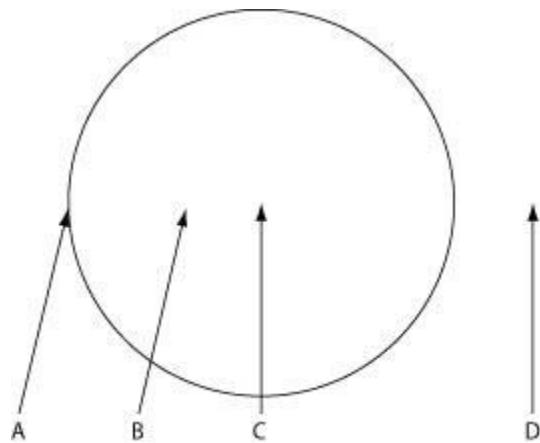
Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 31.4

46) Use the information to answer the following question.

The figure depicts the outline of a large fairy ring that has appeared overnight in an open meadow, as viewed from above. The fairy ring represents the furthest advance of this mycelium through the soil. Locations A-D are all 0.5 meters below the soil surface.



At which location should one find the lowest concentration of fungal enzymes, assuming that the enzymes do not diffuse far from their source and that no other fungi are present in this habitat?

- A) A
- B) B
- C) C
- D) D

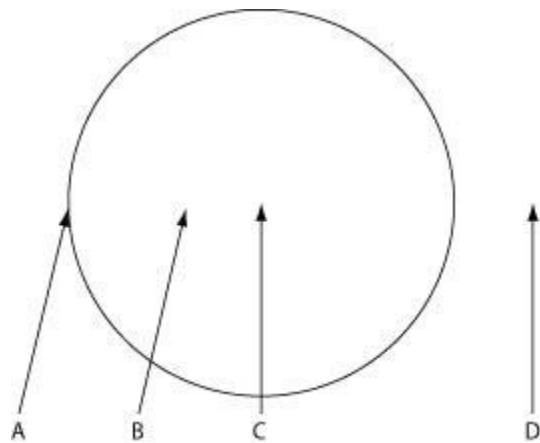
Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 31.4

47) Use the information to answer the following question.

The figure depicts the outline of a large fairy ring that has appeared overnight in an open meadow, as viewed from above. The fairy ring represents the furthest advance of this mycelium through the soil. Locations A-D are all 0.5 meters below the soil surface.



Assume that all four locations are 0.5 meters above the surface. On a breezy day with prevailing winds blowing from left to right, where should one expect to find the highest concentration of free basidiospores in an air sample?

- A) A
- B) B
- C) C
- D) D

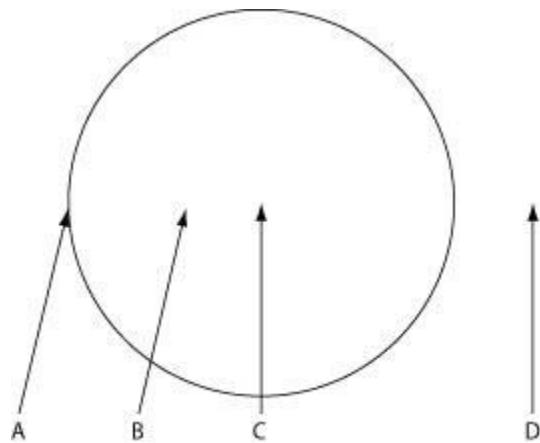
Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 31.4

48) Use the information to answer the following question.

The figure depicts the outline of a large fairy ring that has appeared overnight in an open meadow, as viewed from above. The fairy ring represents the furthest advance of this mycelium through the soil. Locations A-D are all 0.5 meters below the soil surface.



If the fungus that produced the fairy ring can also produce arbuscules, then which of the following is most likely to be buried at location "C"?

- A) tree stump
- B) deceased animal
- C) fire pit
- D) cement-capped well

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 31.4

49) Use the following information to answer the question.

For several decades now, amphibian species worldwide have been in decline. A significant proportion of the decline seems to be due to the spread of the chytrid fungus, *Batrachochytrium dendrobatidis* (Bd). Chytrid sporangia reside within the epidermal cells of infected animals, animals that consequently show areas of sloughed skin. They can also be lethargic, which is expressed through failure to hide and failure to flee. The infection cycle typically takes four to five days, at the end of which zoospores are released from sporangia into the environment. In some amphibian species, mortality rates approach 100%; other species seem able to survive the infection.

Apart from direct amphibian-to-amphibian contact, what is the most likely means by which the zoospores spread from one free-living amphibian to another?

- A) by wind-blown spores
- B) by flagella
- C) by cilia
- D) by hyphae

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 31.4

50) Use the following information to answer the question.

For several decades now, amphibian species worldwide have been in decline. A significant proportion of the decline seems to be due to the spread of the chytrid fungus, *Batrachochytrium dendrobatidis* (Bd). Chytrid sporangia reside within the epidermal cells of infected animals, animals that consequently show areas of sloughed skin. They can also be lethargic, which is expressed through failure to hide and failure to flee. The infection cycle typically takes four to five days, at the end of which zoospores are released from sporangia into the environment. In some amphibian species, mortality rates approach 100%; other species seem able to survive the infection.

When adult amphibian skin harbors populations of the bacterium *Janthinobacterium lividum* (Jl), chytrid infection seems to be inhibited. Which of the following represents the best experimental design to test whether this inhibition is real?

- A) Inoculate uninfected amphibians with Jl, and determine whether the amphibians continue to remain uninfected by chytrids.
- B) Inoculate infected amphibians with Jl and determine whether the amphibians recover from infection by chytrids.
- C) Take infected amphibians and assign them to two populations. Leave one population alone; inoculate the other with Jl. Measure the rate at which infection proceeds in both populations.
- D) Take infected amphibians and assign them to two populations. Inoculate one population with a high dose of Jl; inoculate the other with a low dose of Jl. Measure the survival frequency in both populations.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 31.4

51) Use the following information to answer the question.

For several decades now, amphibian species worldwide have been in decline. A significant proportion of the decline seems to be due to the spread of the chytrid fungus, *Batrachochytrium dendrobatidis* (Bd). Chytrid sporangia reside within the epidermal cells of infected animals, animals that consequently show areas of sloughed skin. They can also be lethargic, which is expressed through failure to hide and failure to flee. The infection cycle typically takes four to five days, at the end of which zoospores are released from sporangia into the environment. In some amphibian species, mortality rates approach 100%; other species seem able to survive the infection. However, when adult amphibian skin harbors populations of the bacterium *Janthinobacterium lividum* (Jl), chytrid infection seems to be inhibited.

A researcher took water in which a Jl population had been thriving, filtered the water to remove all bacterial cells, and then applied the water to the skins of adult amphibians to see if there would subsequently be a reduced infection rate by Bd when frog skins were inoculated with Bd. For which of the following hypotheses is the procedure described a potential test?

- A) A toxin secreted by Jl cells kills Bd cells when both are present together on frog skin.
- B) Jl cells infect and kill Bd cells when both are present together on frog skin.
- C) Jl outcompetes Bd when both are present together on a frog's skin.
- D) The presence of Jl on frog skin causes a skin reaction that prevents attachment by Bd cells.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 31.4

52) Diploid nuclei of the ascomycete *Neurospora crassa* contain 14 chromosomes. A single diploid cell in an ascus will undergo one round of meiosis, followed in each of the daughter cells by one round of mitosis, producing a total of eight ascospores. If a single, diploid G₂ nucleus in an ascus contains 400 nanograms (ng) of DNA, then a single ascospore nucleus of this species should contain how much DNA (ng), carried on how many chromosomes?

- A) 100 ng on 7 chromosomes
- B) 100 ng on 14 chromosomes
- C) 200 ng on 7 chromosomes
- D) 200 ng on 14 chromosomes

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 31.4

53) Which of the following characteristics would be most helpful in distinguishing among different species of fungi?

- A) morphology
- B) hyphae structure
- C) DNA sequence
- D) life cycle

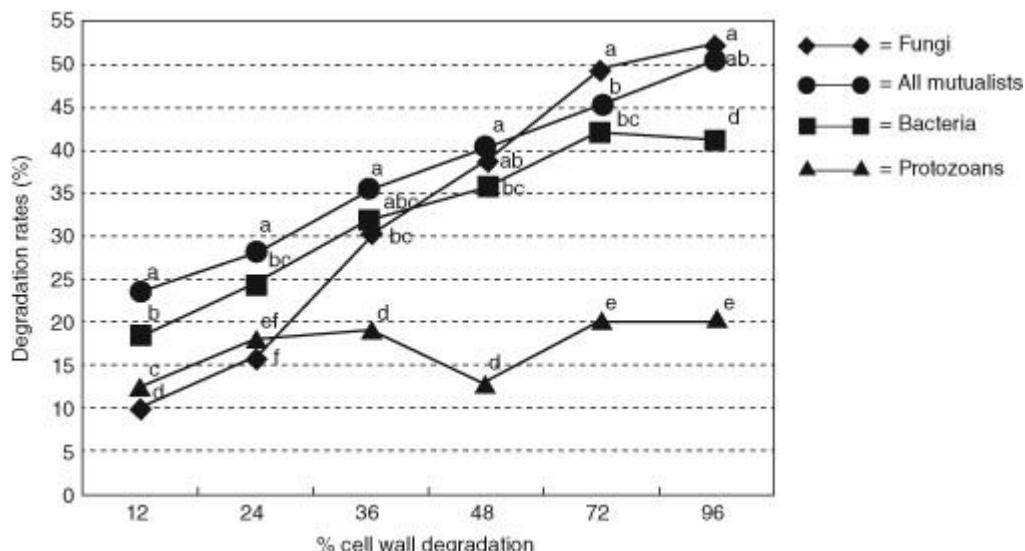
Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 31.4

54) Use the following information to answer the question.

Along with bacteria and protozoa, some chytrid fungi live in the digestive tracts of cattle and aid in the digestion of plant matter; thus, all three groups represent potential mutualists with cattle. In an experiment designed to test how much of a contribution to cell wall digestion was made by fungi in one part of the stomach (rumen), Lee et al. fed grain to cattle and then removed samples of the rumen contents. They took these samples to the laboratory and experimentally treated them with various chemicals to produce fractions that contained (A) only fungi, (B) only bacteria, (C) only protozoa, and (D) all of the potential mutualists. They then measured the percent of the cell wall that was degraded (see the figure).



Degradation rates of cell walls extracted from Orchard grass by the monoculture system to assess the relative contributions of digestion by bacterial (square), protozoan (triangle), and fungal (diamond) systems, and all components (closed circle) as a control. The lowercase letters above the spots indicate statistical significance; mean values with different letters are significantly different ($P < 0.05$).

Which of the following conclusions can be drawn correctly from the data?

- A) Of all three potential mutualists, protozoa contribute the most to cell wall digestion.
- B) Of all three potential mutualists, fungi contribute the least to cell wall digestion.
- C) Fungi contribute as much to cell wall degradation as all the potential mutualists together.
- D) The cattle did not benefit from the presence of fungi; therefore, the fungi are not mutualistic with the cattle.

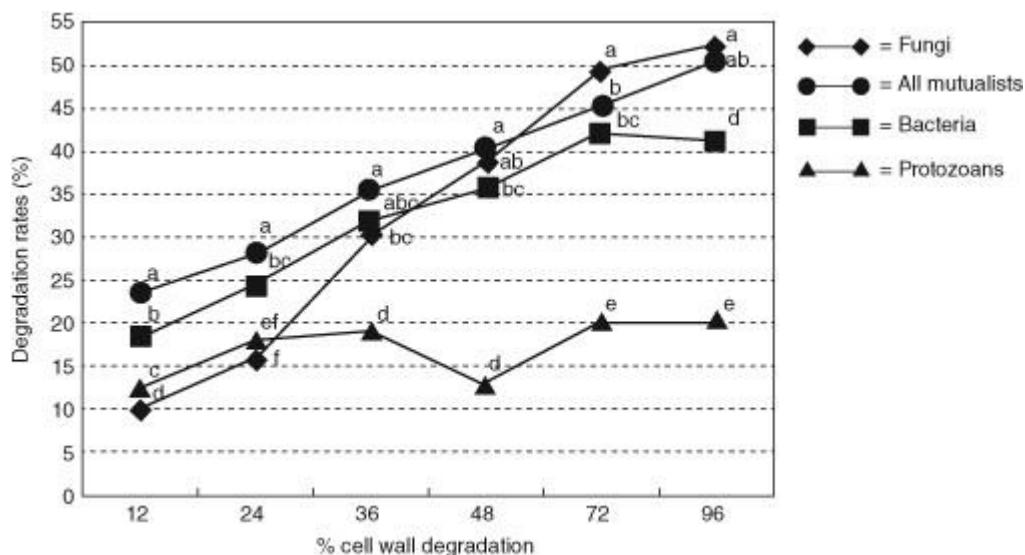
Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.4

55) Use the following information to answer the question.

Along with bacteria and protozoa, some chytrid fungi live in the digestive tracts of cattle and aid in the digestion of plant matter; thus, all three groups represent potential mutualists with cattle. In an experiment designed to test how much of a contribution to cell wall digestion was made by fungi in one part of the stomach (rumen), Lee et al. fed grain to cattle and then removed samples of the rumen contents. They took these samples to the laboratory and experimentally treated them with various chemicals to produce fractions that contained (A) only fungi, (B) only bacteria, (C) only protozoa, and (D) all of the potential mutualists. They then measured the percent of the cell wall that was degraded (see the figure).



Degradation rates of cell walls extracted from Orchard grass by the monoculture system to assess the relative contributions of digestion by bacterial (square), protozoan (triangle), and fungal (diamond) systems, and all components (closed circle) as a control. The lowercase letters above the spots indicate statistical significance; mean values with different letters are significantly different ($P < 0.05$).

Which of the following reasons provides the best explanation for the use of a control that contained all potential mutualists? Comparison to a fraction that contained all potential mutualists allowed the researchers to _____.

- A) demonstrate that their laboratory culture conditions allowed all potential mutualists to grow
- B) determine how much each potential mutualist contributed to cell wall degradation
- C) better mimic the conditions of the rumen
- D) demonstrate that the various potential mutualists did not compete with each other

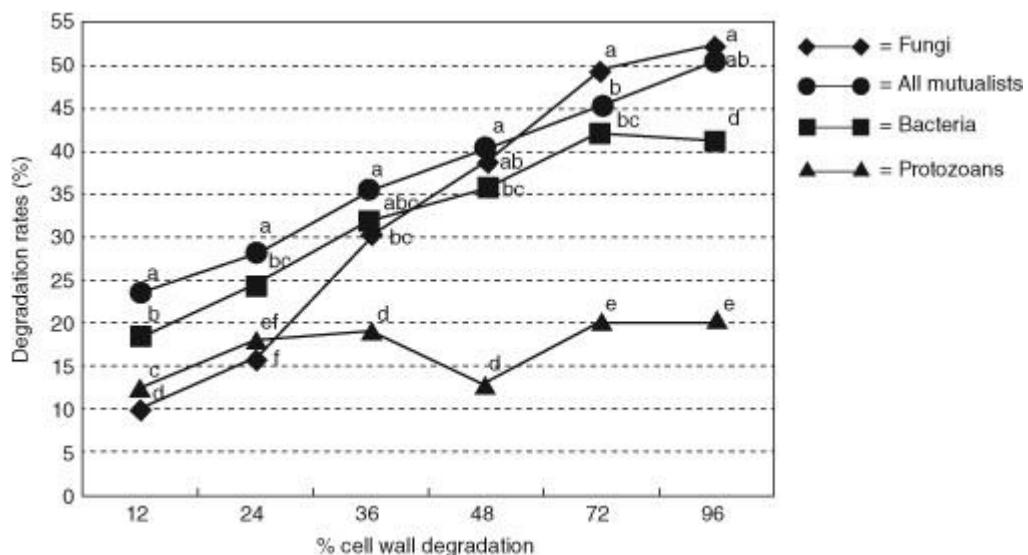
Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.4

56) Use the following information to answer the question.

Along with bacteria and protozoa, some chytrid fungi live in the digestive tracts of cattle and aid in the digestion of plant matter; thus, all three groups represent potential mutualists with cattle. In an experiment designed to test how much of a contribution to cell wall digestion was made by fungi in one part of the stomach (rumen), Lee et al. fed grain to cattle and then removed samples of the rumen contents. They took these samples to the laboratory and experimentally treated them with various chemicals to produce fractions that contained (A) only fungi, (B) only bacteria, (C) only protozoa, and (D) all of the potential mutualists. They then measured the percent of the cell wall that was degraded (see the figure).



Degradation rates of cell walls extracted from Orchard grass by the monoculture system to assess the relative contributions of digestion by bacterial (square), protozoan (triangle), and fungal (diamond) systems, and all components (closed circle) as a control. The lowercase letters above the spots indicate statistical significance; mean values with different letters are significantly different ($P < 0.05$).

Predict the results if the researchers had used a control that contained no potential mutualists (negative control).

- A) The negative control would have as much cell wall degradation as was shown by fungi alone.
- B) The negative control would have very little cell wall degradation.
- C) The negative control would have as much cell wall degradation as all three of the potential mutualists together.
- D) The negative control would have more cell wall digestion than protozoans alone.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.4

57) Use the following information to answer the question.

Heterobasidion is a basidiomycete that contributes to mortality of trees. Kuhlman isolated 23 strains of *Heterobasidion* and applied them to 16 seedlings of 10 different tree species. Partial results of this experiment are shown in the table. (From Kuhlman, E. G. 1970. Seedling inoculations with *Fomes annosus* show variation in virulence and in host susceptibility. *Phytopathology* 60:1743-1746.

https://www.apsnet.org/publications/phytopathology/backissues/Documents/1970Articles/Phyto6On12_1743.PDF)

% mortality of five host species from five *Heterobasidion* isolates

	Isolate	Isolate	Isolate	Isolate	Isolate
Host	63	117	195	126	118
Slash Pine	50	69	94	100	94
Shortleaf Pine	75	56	94	94	100
Red Cedar	38	32	19	50	25
Yellow-Poplar	0	0	6	6	6
Sycamore	0	0	0	0	6

Which of the following conclusions can best be drawn from these results?

- A) All tree species are susceptible to *Heterobasidion*.
- B) *Heterobasidion* strains are equally lethal to all tree species.
- C) *Heterobasidion* reduces mortality of some species.
- D) Tree species vary in their susceptibility to *Heterobasidion*.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.4

58) Use the following information to answer the question.

Heterobasidion is a basidiomycete that contributes to mortality of trees. Kuhlman isolated 23 strains of *Heterobasidion* and applied them to 16 seedlings of 10 different tree species. Partial results of this experiment are shown in the table. (From Kuhlman, E. G. 1970. Seedling inoculations with *Fomes annosus* show variation in virulence and in host susceptibility. *Phytopathology* 60:1743-1746.

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Which of the following conclusions can best be drawn from these results?

- A) All tree species are susceptible to *Heterobasidion*.
- B) *Heterobasidion* strains are equally lethal to all tree species.
- C) *Heterobasidion* strains vary in their effect on tree species.
- D) Some strains of *Heterobasidion* reduce tree mortality.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.4

59) The *Neurospora* genome is quite compact, lacking many of the noncoding DNA sequences that occur in humans and many other eukaryotes. Which of the following are probable benefits of the compactness of the genome?

- A) The organism saves energy during cell division because fewer DNA bases must be duplicated.
- B) It is more difficult for viruses to insert themselves into a compact genome.
- C) There is less genetic variation that can lead to mutation.
- D) The spores will be small and thus travel a greater distance.

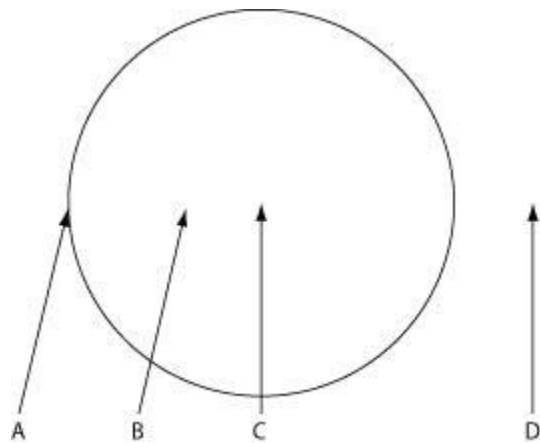
Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 31.4

60) Use the following information to answer the question.

The figure depicts the outline of a large fairy ring that has appeared overnight in an open meadow, as viewed from above. The fairy ring represents the furthest advance of this mycelium through the soil. Locations A-D are all 0.5 meters below the soil surface.



In which of the following human mycoses should one expect to find a growth pattern most similar to that of the mycelium that produced the fairy ring?

- A) skin mycoses
- B) coccidiomycosis (lung infection)
- C) systemic (bloodborne) *Candida* infection
- D) infection of lymphatic vessels

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 31.5

61) Use the following information to answer the question.

Rose-picker's disease is caused by the yeast *Sporothrix schenckii* (*S. schenckii*). The yeast grows on the exteriors of rose-bush thorns. If a human gets pricked by such a thorn, the yeasts can be introduced under the skin. The yeasts then assume a hyphal morphology and grow along the interiors of lymphatic vessels until they reach a lymph node. This often results in the accumulation of pus in the lymph node, which subsequently ulcerates through the skin surface and then drains.

Humans have immune systems in which lymph nodes are important, because many white blood cells (phagocytes and lymphocytes) reside there. Given that a successful infection by *S. schenckii* damages lymph nodes themselves, which of the following is most probable?

- A) The hyphae secrete antibiotics, which increases the ability of the infected human to tolerate the fungus.
- B) The fungal conversion from yeast to hyphal morphology allows such fast growth that the body's defenses are at least temporarily overwhelmed.
- C) Defensive cells of humans cannot detect foreign cells that are covered with cell walls composed of cellulose.
- D) Given that most fungal pathogens attack plants, human defenses are simply not adapted to seek out and destroy fungi.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 31.5

62) If haustoria from the fungal partner were to appear within the photosynthetic partner of a lichen, and if the growth rate of the photosynthetic partner consequently slowed substantially, then this would support the claim that _____.

- A) algae and cyanobacteria are autotrophic
- B) lichens are not purely mutualistic relationships
- C) algae require maximal contact with the fungal partner in order to grow at optimal rates
- D) soredia are asexual reproductive structures combining both the fungal and photosynthetic partners

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 31.5

63) A billionaire buys a sterile volcanic island that recently emerged from the sea. To speed the arrival of conditions necessary for plant growth, the billionaire might be advised to aerially sow what over the island?

- A) basidiospores
- B) spores of ectomycorrhizae
- C) soredia
- D) yeasts

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 31.5

64) Orchid seeds are tiny, with virtually no endosperm and with minuscule cotyledons. If such seeds are deposited in a dark, moist environment, then which of the following represents the most likely means by which fungi might assist in seed germination, given what the seeds lack?

- A) by transferring some chloroplasts to the embryo in each seed
- B) by providing the seeds with water and minerals
- C) by providing the embryos with some of the organic nutrients the fungi have absorbed
- D) by strengthening the seed coat that surrounds each seed

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 31.5

65) Use the following information to answer the question.

Rose-picker's disease is caused by the yeast *Sporothrix schenkii* (*S. schenkii*). The yeast grows on the exteriors of rose-bush thorns. If a human gets pricked by such a thorn, the yeasts can be introduced under the skin. The yeasts then assume a hyphal morphology and grow along the interiors of lymphatic vessels until they reach a lymph node. This often results in the accumulation of pus in the lymph node, which subsequently ulcerates through the skin surface and then drains.

Suppose that *S. schenkii* had initially been classified as a deuteromycete. Ascii were later discovered in the pus that oozed from an ulcerated lymph node, and the spores therein germinated, giving rise to *S. schenkii* yeasts. Which of these statements make sense on the basis of this information?

- A) *S. schenkii* produces asexual spores within lymph nodes; it continues to have no known sexual stage.
- B) *S. schenkii* produces asexual spores within lymph nodes; *S. schenkii* yeasts belonging to two different mating strains were introduced by the same thorn prick.
- C) *S. schenkii* should be reclassified; *S. schenkii* yeasts belonging to two different mating strains were introduced by the same thorn prick.
- D) The hyphae growing in lymphatic vessels probably belonged to a different fungal species; *S. schenkii* yeasts belonging to two different mating strains were introduced by the same thorn prick.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.5

66) Which of the following best describes the physical relationship of the partners involved in lichens?

- A) Fungal cells are enclosed within algal cells.
- B) Lichen cells are enclosed within fungal cells.
- C) Photosynthetic cells are surrounded by fungal hyphae.
- D) Fungi grow on rocks and trees and are covered by algae.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 31.5

67) Mycorrhizae are to the roots of vascular plants as endophytes are to the _____ of vascular plants.

- A) leaf mesophyll
- B) stem apical meristems
- C) root apical meristems
- D) xylem

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 31.5

68) Fungi interact with many organisms in mutualistic ways. Which of the following involves a fungus that is mutualistic with another organism?

- A) a fungus and a protozoan that live together as a lichen
- B) a fungus that is raised by ants on leaves that the ants collect from trees and shrubs
- C) a fungus that lives inside plant roots and produces toxins that kill neighboring plants
- D) a fungus that produces penicillin that is used by humans to kill infectious bacteria

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 31.5

69) Fungi produce many compounds that humans are able to use medically. How can you account for these compounds?

- A) Humans used artificial selection to develop fungi that produced specific compounds.
- B) The presence of the compounds in the fungi were accidentally produced and have no function.
- C) The compounds probably provide a benefit to the fungi.
- D) The compounds are produced as a result of sexual reproduction and recombination.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.5

70) Truffles are the fruiting bodies of certain fungi whose mycelium grows below ground. The truffle is also underground and can be detected by many mammals, which eat the truffle and expel the spores with their feces. Which of the following statements is likely accurate with respect to this interaction?

- A) The truffle spores are probably wind dispersed.
- B) Truffles produce an odor that mammals can detect and find attractive.
- C) Truffles probably produce toxins that can harm the mammals that eat them.
- D) Truffle fruiting bodies are important in decomposition of wood.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.5

- 71) If you wanted to use fungi to improve the environment, which of the following research goals would make the most sense?
- A) Discover the lignin-digesting enzymes of fungi, and use them to digest plant tissues left over from food-crop residues and produce a biofuel.
 - B) Discover the enzymes that the fungal partner in lichens uses to break down rock so that large rock expanses can be turned into agricultural lands.
 - C) Discover the enzymes that fungi use to break down plant matter and use them to increase decomposition rates in order to slow global warming.
 - D) Develop a strain of fungus that produces enzymes that absorb oxygen and will help slow global warming.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 31.5

31.2 Student Edition End-of-Chapter Questions

- 1) All fungi are
- A) symbiotic.
 - B) heterotrophic.
 - C) flagellated.
 - D) decomposers.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 2) Which of the following cells or structures are associated with *asexual* reproduction in fungi?
- A) ascospores
 - B) basidiospores
 - C) zygosporangia
 - D) conidiophores

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 3) The closest relatives of fungi are thought to be the
- A) animals.
 - B) vascular plants.
 - C) mosses.
 - D) slime molds.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

4) The most important adaptive advantage associated with the filamentous nature of fungal mycelia is

- A) the ability to form haustoria and parasitize other organisms.
- B) the potential to inhabit almost all terrestrial habitats.
- C) the increased chance of contact between mating types.
- D) an extensive surface area well suited for invasive growth and absorptive nutrition.

Answer: D

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 32 An Overview of Animal Diversity

32.1 Multiple-Choice Questions

1) A researcher is trying to construct a molecular-based phylogeny of the entire animal kingdom. Assuming that none of the following genes are absolutely conserved, which of the following would be the best choice on which to base the phylogeny?

- A) genes involved in chitin synthesis
- B) collagen genes
- C) genes involved in directing segmentation development
- D) genes involved in eye-lens synthesis

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 32.1

2) Which of the following is (are) unique to animals?

- A) the structural carbohydrate, chitin
- B) nervous system signal conduction and muscular movement
- C) heterotrophy
- D) flagellated gametes

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.1

3) The larvae of some insects are merely small versions of the adult, whereas the larvae of other insects look completely different from adults, eat different foods, and may live in different habitats. Which of the following is most directly involved in the evolution of these variations in metamorphosis?

- A) artificial selection of sexually immature forms of insects
- B) changes in the homeobox genes controlling early development
- C) the evolution of meiosis
- D) the origin of a brain

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.1

4) Use the table to answer the following question.

Organism	Appearance	Habitat/Activity	Nutrient Acquisition	Reproduction
A	Microscopic, unicellular, with a flagellum	Swims around in freshwater pools	Envelops and consumes other microscopic organisms	Mates with others; young bud off
B	Shaped like a basketball, covered with purple filaments, multicellular	Rolls slowly across grassy fields	Thrives with access to only freshwater and sunlight	Mates with others; young emerge from hardened spherical structures
C	Hard and branched, multicellular, covered in a sticky coating	Attached to rocky surfaces	Traps insects in sticky coating and dissolves them	No mating; releases winged young that fly off and affix to bare rocks
D	Multicellular with cell walls	Flies across fields	Constructs nets to trap flying organisms, and sucks out internal fluids	Mates with others, and disperses young ballistically

As you are on the way to Tahiti for a vacation, your plane crash lands on a previously undiscovered island. You soon find that the island is teeming with unfamiliar organisms, and you, as a student of biology, decide to survey them (with the aid of the Insta-Lab Portable Laboratory you brought along in your suitcase). You select four organisms and observe them in detail, making the notations found in the figure.

Which organism would you classify as an animal?

- A) organism A
- B) organism B
- C) organism C
- D) organism D

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.1

5) Use the table to answer the following question.

Organism	Appearance	Habitat/Activity	Nutrient Acquisition	Reproduction
A	Microscopic, unicellular, with a flagellum	Swims around in freshwater pools	Envelops and consumes other microscopic organisms	Mates with others; young bud off
B	Shaped like a basketball, covered with purple filaments, multicellular	Rolls slowly across grassy fields	Thrives with access to only freshwater and sunlight	Mates with others; young emerge from hardened spherical structures
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In which of the organisms listed would you search for photosynthetic genes?

- A) organism A
- B) organism B
- C) organism C
- D) organism D

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 32.1

6) Use the table to answer the following question.

Organism	Appearance	Habitat/Activity	Nutrient Acquisition	Reproduction
A	Microscopic, unicellular, with a flagellum	Swims around in freshwater pools	Envelops and consumes other microscopic organisms	Mates with others; young bud off
B	Shaped like a basketball, covered with purple filaments, multicellular	Rolls slowly across grassy fields	Thrives with access to only freshwater and sunlight	Mates with others; young emerge from hardened spherical structures
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As you are on the way to Tahiti for a vacation, your plane crash lands on a previously undiscovered island. You soon find that the island is teeming with unfamiliar organisms, and you, as a student of biology, decide to survey them (with the aid of the Insta-Lab Portable Laboratory you brought along in your suitcase). You select four organisms and observe them in detail, making the notations found in the figure.

In which of the organisms listed would you search for collagen?

- A) organism A
- B) organism B
- C) organism C
- D) organism D

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.1

7) Both animals and fungi are heterotrophic. What distinguishes animal heterotrophy from fungal heterotrophy is that most animals derive their nutrition by _____.

- A) preying on animals
- B) ingesting materials
- C) consuming living, rather than dead, prey
- D) using enzymes to digest their food

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.1

8) Use the information to answer the question.

Trichoplax adhaerens is the only living species in the phylum Placozoa. Individuals are about 1 mm wide and only 27 μm high, are irregularly shaped, and consist of a total of about 2,000 cells, which are diploid ($2n = 12$). There are four types of cells, none of which are nerve or muscle cells, and none of which have cell walls. Individual animals move using cilia, and any "edge" can lead. *T. adhaerens* feeds on marine microbes, mostly unicellular green algae, by crawling atop the algae and trapping it between its ventral surface and the substrate. Enzymes are then secreted onto the algae, and the resulting nutrients are absorbed. *T. adhaerens* sperm cells have never been observed, nor have embryos past the 64-cell (blastula) stage.

Which of the following *T. adhaerens* traits is different from all other known animals?

- A) *T. adhaerens* is multicellular.
- B) *T. adhaerens* lacks muscle and nerve cells.
- C) *T. adhaerens* has cilia.
- D) *T. adhaerens* lacks cell walls.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 32.1

9) What do animals ranging from corals to monkeys have in common?

- A) a mouth and an anus
- B) number of embryonic tissue layers
- C) some type of body symmetry
- D) presence of *Hox* genes

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.1

10) In individual insects of some species, whole chromosomes that carry larval genes are eliminated from the genomes of somatic cells at the time of metamorphosis. A consequence of this occurrence is that _____.

- A) we could not clone a larva from the somatic cells of such an adult insect
- B) such species must reproduce only asexually
- C) the descendants of these adults do not include a larval stage
- D) metamorphosis can no longer occur among the descendants of such adults

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 32.1

11) The fact that choanoflagellates and collar cells of sponges resemble each other supports the inference that _____.

- A) choanoflagellates are animals
- B) choanoflagellates are more closely related to sponges than they are to protists
- C) choanoflagellates and sponges are sister groups
- D) choanoflagellates and sponges evolved similar cell structures through convergent evolution

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.2

12) Which of the following would you classify as something other than an animal?

- A) sponge
- B) coral
- C) jellyfish
- D) choanoflagellate

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.2

13) The evolution of animal species has been prolific (current estimates of species numbers reach into the tens of millions). Much of this diversity is a result of the evolution of novel ways to _____.

- A) reproduce
- B) arrange cells into tissues
- C) sense, feed, and move
- D) form an embryo and establish a basic body plan

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.2

14) The last common ancestor of all animals was probably a _____.

- A) unicellular chytrid
- B) multicellular algae
- C) multicellular fungus
- D) flagellated protist

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.2

15) Evidence of which structure or characteristic would be most surprising to find among fossils of the Ediacaran fauna?

- A) true tissues
- B) hard parts
- C) bilateral symmetry
- D) embryos

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.2

16) One hypothesis suggests that the Cambrian explosion was caused by the rise of predator-prey relationships. This hypothesis is best supported by an increased incidence of which of the following fossil traces?

- A) worm burrows
- B) larger animals
- C) organic material
- D) hard parts

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 32.2

17) Which of the following genetic processes may be most helpful in accounting for the Cambrian explosion?

- A) binary fission
- B) random segregation
- C) gene duplication
- D) chromosomal condensation

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.2

18) Whatever its ultimate cause(s), the Cambrian explosion is a prime example of _____.

- A) mass extinction
- B) evolutionary stasis
- C) adaptive radiation
- D) a large meteor impact

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.2

19) Arthropods invaded land about 100 million years before vertebrates. This fact most clearly implies that _____.

- A) arthropods evolved before vertebrates did
- B) extant terrestrial arthropods are better adapted to terrestrial life than are extant terrestrial vertebrates
- C) vertebrates evolved from arthropods
- D) arthropods have had more time to coevolve with land plants than have vertebrates

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 32.2

20) Cadherin proteins help animal cells stick (adhere) to each other. Choose which statement about cadherin in cancer cells that are metastasizing (spreading) throughout a patient's body is most likely correct.

- A) Cadherin proteins in metastasizing cancer cells are likely to have mutations that make them less "sticky."
- B) Cadherin proteins in metastasizing cancer cells are likely to have mutations that make them more "sticky."
- C) Mutations in cadherin proteins are unlikely to affect the metastasizing of cancer cells.
- D) Mutations in cadherin proteins accumulate at a constant rate that can be measured by a molecular clock.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 32.2

21) Which of the following factors most likely contributed to the extinction of many Ediacaran life forms?

- A) predation by new species, poisoning from high carbon dioxide levels, and loss of developmental flexibility
- B) predation by new species, poisoning from high oxygen levels, and loss of habitat due to increased temperatures
- C) predation by new species, faster movement by new species, and increased developmental flexibility by new species
- D) loss of habitat due to increased temperatures, poisoning from high oxygen levels, and loss of developmental flexibility

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.2

22) Which tissue type or organ is *not* correctly matched with its germ layer tissue?

- A) nervous—mesoderm
- B) muscular—mesoderm
- C) stomach—endoderm
- D) skin—ectoderm

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.3

23) While looking at some seawater through your microscope, you spot the egg of an unknown animal. Which of the following tests could you use to determine whether the developing organism is a protostome or a deuterostome? See whether the embryo _____.

- A) develops germ layers
- B) exhibits spiral cleavage or radial cleavage
- C) develops a blastopore
- D) develops an archenteron

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 32.3

24) In examining an unknown animal species during its embryonic development, how can you be sure what you are looking at is a protostome and not a deuterostome?

- A) There is evidence of cephalization.
- B) The animal is triploblastic.
- C) The animal is clearly bilaterally symmetrical.
- D) You see a mouth, but not an anus.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 32.3

25) Which of the following is a feature of the "tube-within-a-tube" body plan in most animal phyla?

- A) The outer tube consists of a hard exoskeleton.
- B) The outer tube consists of digestive organs.
- C) The mouth and anus form the ends of the inner tube.
- D) The two "tubes" are separated by tissue that comes from embryonic endoderm.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.3

26) If you think of the earthworm body plan as a drinking straw within a pipe, where would you expect to find most of the tissues that developed from endoderm?

- A) lining the straw
- B) lining the space between the pipe and the straw
- C) forming the outside of the pipe
- D) forming the outside of the straw

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 32.3

27) Among protostomes, which morphological trait has shown the most variation?

- A) type of symmetry (bilateral versus radial versus none)
- B) type of body cavity (coelom versus pseudocoelom versus no coelom)
- C) number of embryonic tissue types (diploblasty versus triploblasty)
- D) type of development (protostome versus deuterostome)

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 32.3

28) What do all deuterostomes have in common?

- A) Adults are bilaterally symmetrical.
- B) Embryos have pharyngeal pouches that may or may not form gill slits.
- C) All have a spinal column.
- D) The pore (blastopore) formed during gastrulation becomes the anus.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.3

29) Soon after the coelom begins to form, a researcher injects a dye into the coelom of a deuterostome embryo. Initially, the dye should be able to flow directly into the _____.

- A) blastopore
- B) blastocoel
- C) archenteron
- D) pseudocoelom

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.3

30) You have before you a living organism, which you examine carefully. Which of the following should convince you that the organism is acoelomate?

- A) It is triploblastic.
- B) It has bilateral symmetry.
- C) It possesses sensory structures at its anterior end.
- D) Muscular activity of its digestive system distorts the body wall.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 32.3

31) Use the information to answer the question.

One small animal phylum (Placozoa) contains only two species, *Trichoplax adhaerens* (*T. adhaerens*) and *T. reptans*. *T. adhaerens* is the only species seen in over a century. Individuals are about 1 mm wide and only 27 μm high, are irregularly shaped, and consist of a total of about 2,000 cells, which are diploid ($2n = 12$). There are four types of cells, none of which are nerve or muscle cells, and none of which have cell walls. Individual animals move using cilia, and any "edge" can lead. *T. adhaerens* feeds on marine microbes, mostly unicellular green algae, by crawling atop the algae and trapping it between its ventral surface and the substrate. Enzymes are then secreted onto the algae, and the resulting nutrients are absorbed. *T. adhaerens* sperm cells have never been observed. Embryos up to, but not past, the 64-cell (blastula) stage have been observed.

On the basis of information in the paragraph, which of these should be able to be observed in *T. adhaerens*?

- A) a coelom
- B) the process of gastrulation
- C) eggs
- D) a radially symmetric larval form

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.3

32) A student encounters an animal embryo at the eight-cell stage. The four smaller cells that comprise 1 hemisphere of the embryo seem to be rotated 45° and to lie in the grooves between larger, underlying cells. This embryo may potentially develop into a(n) _____.

- A) turtle
- B) earthworm
- C) sea star
- D) sea urchin

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 32.3

33) A student encounters an animal embryo at the eight-cell stage. The four smaller cells that comprise 1 hemisphere of the embryo seem to be rotated 45° and to lie in the grooves between larger, underlying cells. If we were to separate these eight cells and attempt to culture them individually, then what is most likely to happen?

- A) All eight cells will die immediately.
- B) Each cell may continue development, but only into a nonviable embryo that lacks many parts.
- C) Each cell may develop into a full-sized, normal embryo.
- D) Each cell may develop into a smaller-than-average, but otherwise normal, embryo.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 32.3

- 34) What was an early selective advantage of a coelom in animals? A coelom _____.
- A) contributed to a hydrostatic skeleton, allowing greater range of motion
 - B) was a more efficient digestive system
 - C) allowed cephalization and the formation of a cerebral ganglion
 - D) allowed asexual and sexual reproduction

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 32.3

- 35) The protostome developmental sequence arose just once in evolutionary history, resulting in two main subgroups—Lophotrochozoa and Ecdysozoa. What does this finding suggest?
- A) These two subgroups have a common ancestor that was a deuterostome.
 - B) The protostomes are a polyphyletic group.
 - C) Division of these two groups occurred after the protostome developmental sequence appeared.
 - D) The lophotrochozoans are monophyletic.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.3

- 36) Which of these statements, if accurate, would support the claim that the ancestral cnidarians had bilateral symmetry?
- A) Cnidarian larvae possess anterior-posterior, left-right, and dorsal-ventral aspects.
 - B) Cnidarians have fewer *Hox* genes than bilaterians.
 - C) All cnidarians are acelomate.
 - D) The presence of collar cells.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 32.3

- 37) An organism that exhibits a head with sensory equipment and a brain probably also _____.
- A) is bilaterally symmetrical
 - B) has a coelom
 - C) is segmented
 - D) is diploblastic

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 32.3

38) Suppose a researcher for a pest-control company developed a chemical that inhibited the development of an embryonic mosquito's endodermal cells. Which of the following would be a likely mechanism by which this pesticide works?

- A) The mosquito would develop a weakened exoskeleton that would make it vulnerable to trauma.
- B) The mosquito would have trouble digesting food, due to impaired gut function.
- C) The mosquito would have trouble with respiration and circulation, due to impaired muscle function.
- D) The mosquito wouldn't be affected at all.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 32.3

39) Use the information to answer the question.

Trichoplax adhaerens is the only living species in the phylum Placozoa. Individuals are about 1 mm wide and only 27 μm high, are irregularly shaped, and consist of a total of about 2,000 cells, which are diploid ($2n = 12$). There are four types of cells, none of which are nerve or muscle cells, and none of which have cell walls. Individual animals move using cilia, and any "edge" can lead. *T. adhaerens* feeds on marine microbes, mostly unicellular green algae, by crawling atop the algae and trapping it between its ventral surface and the substrate. Enzymes are then secreted onto the algae, and the resulting nutrients are absorbed. *T. adhaerens* sperm cells have never been observed, nor have embryos past the 64-cell (blastula) stage.

T. adhaerens' body symmetry seems to be most like that of _____.

- A) most sponges
- B) cnidarians
- C) worms
- D) tetrapods

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 32.3

40) Use the information to answer the question.

Nudibranchs, a type of predatory sea slug, can have various protuberances (that is, extensions) on their dorsal surfaces. Rhinophores are paired structures, located close to the head, which bear many chemoreceptors. Dorsal plumules, usually located posteriorly, perform respiratory gas exchange. Cerata usually cover much of the dorsal surface and contain nematocysts at their tips.

If nudibranch rhinophores are located at the anterior ends of these sea slugs, then they contribute to the sea slugs' _____.

- A) segmentation
- B) lack of torsion
- C) development of a head
- D) identity as lophotrochozoans

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.3

41) What is the probable sequence in which the following animal clades originated, from earliest to most recent?

- A) bilaterians, deuterostomes, vertebrates, tetrapods, amniotes
- B) bilaterians, deuterostomes, amniotes, vertebrates, tetrapods
- C) deuterostomes, bilaterians, amniotes, vertebrates, tetrapods
- D) deuterostomes, bilaterians, vertebrates, tetrapods, amniotes

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.4

42) The most ancient branch point in animal phylogeny is the characteristic of having _____.

- A) radial or bilateral symmetry
- B) diploblastic or triploblastic embryos
- C) true tissues or no tissues
- D) a body cavity or no body cavity

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.3

43) When a scientist describes the "body plan" of a phylum, he or she is implying that _____.

- A) organisms direct their own evolution in order to maximize their success
- B) animals evolve according to a pre-ordained plan
- C) the body shapes we see now have been more successful than others in the past
- D) mutations have arisen that allow only some shapes to be produced

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.3

44) Which of the following statements comparing symmetry in sessile and swimming animals is most probable?

- A) Radial symmetry is more advantageous for active swimming than is bilateral symmetry.
- B) Radial symmetry occurs most frequently in animals that catch their prey by rapid swimming.
- C) Bilateral symmetry allowed animals to evolve nerves.
- D) Bilaterally symmetric animals can be streamlined for swimming, but radially symmetric animals cannot.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 32.3

45) The primary difference between a coelom and a pseudocoelom is _____.

- A) their developmental origin
- B) the manner in which they cushion the internal organs
- C) a coelom arises in the ectoderm, and a pseudocoelom arises in the endoderm
- D) a coelom occurs in triploblastic animals, and a pseudocoelom occurs in diploblastic animals

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.3

46) Nine-banded armadillos give birth to four offspring at a time. An amazing fact about these offspring is that they are genetically identical to each other. This fact suggests _____.

- A) the young undergo metamorphosis
- B) the embryo undergoes radial and indeterminate cleavage
- C) the first cell division of the fertilized egg is perpendicular to the vertical axis of the egg
- D) the species is pseudocoelomate

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 32.3

47) You find a new species of worm and want to classify it. Which of the following lines of evidence would allow you to classify the worm as a nematode and not an annelid?

- A) It is segmented.
- B) It is triploblastic.
- C) It has a coelom.
- D) It sheds its external skeleton to grow.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 32.4

- 48) The common ancestor of the protostomes had a coelom. What does this suggest?
- A) All lophotrochozoans have a coelom.
 - B) There are no pseudocoelomates within the protostomes.
 - C) There are no acoelomates within the protostomes.
 - D) The body cavity evolved before the lophophore.

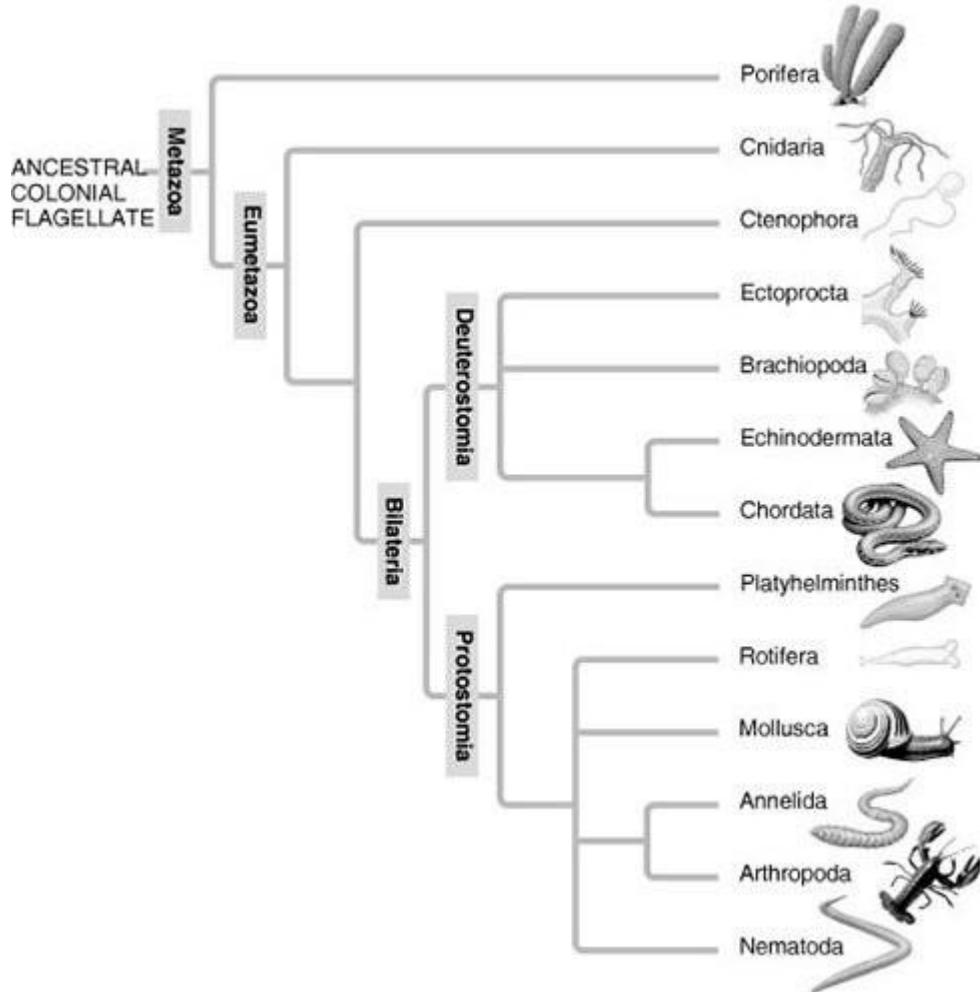
Answer: D

Bloom's Taxonomy: Application/Analysis

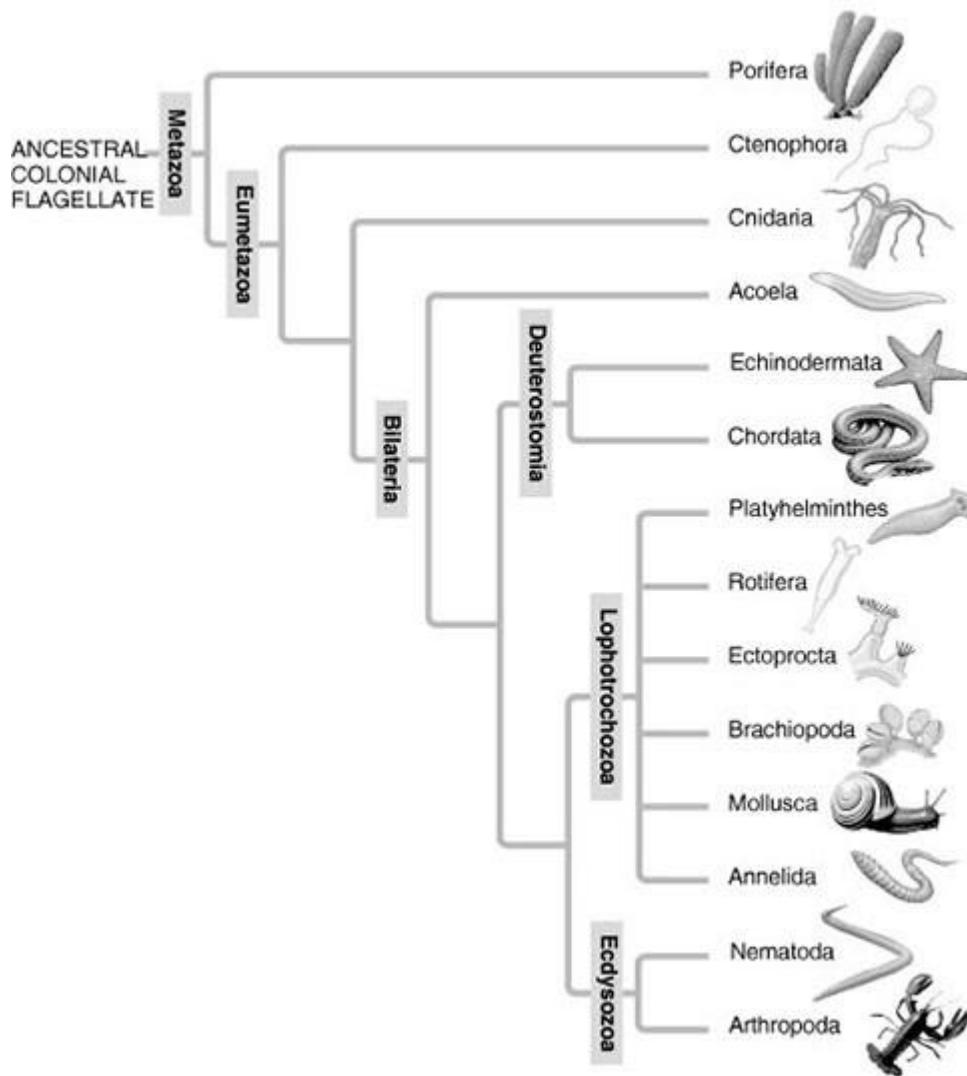
Section: 32.4

49) Use the figure to answer the question.

A: Morphological phylogeny.



B: Molecular phylogeny.



In the traditional phylogeny (A), the phylum Platyhelminthes is depicted as a sister taxon to the rest of the protostome phyla and as having diverged earlier from the lineage that led to the rest of the protostomes. In the molecular phylogeny (B), Platyhelminthes is depicted as a Lophotrochozoan phylum. What probably led to this change?

- A) Platyhelminthes ceased to be recognized as true protostomes.
- B) The removal of the acel flatworms (Acoela) from the Platyhelminthes allowed the remaining flatworms to be a monophyletic clade clearly tied to the Lophotrochozoa.
- C) All Platyhelminthes must have a well-developed lophophore as their feeding apparatus.
- D) Platyhelminthes' close genetic ties to the arthropods became clear as their *Hox* gene sequences were studied.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 32.4

50) The last common ancestor of all bilaterians is thought to have had four *Hox* genes. Most extant cnidarians have two *Hox* genes, though some have three *Hox* genes. On the basis of these observations, some have proposed that the ancestral cnidarian's were originally bilateral and, in stages, lost *Hox* genes from their genomes. If true, this would mean that _____.

- A) all radially symmetric animals should be grouped together in one clade
- B) the radial symmetry of extant cnidarians is secondarily derived, rather than being an ancestral trait
- C) *Hox* genes play little actual role in coding for an animal's "body plan"
- D) cnidaria may someday replace porifera as the basal bilaterians

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 32.4

51) Some researchers claim that sponge genomes have homeotic genes, but no *Hox* genes. If true, this finding would _____.

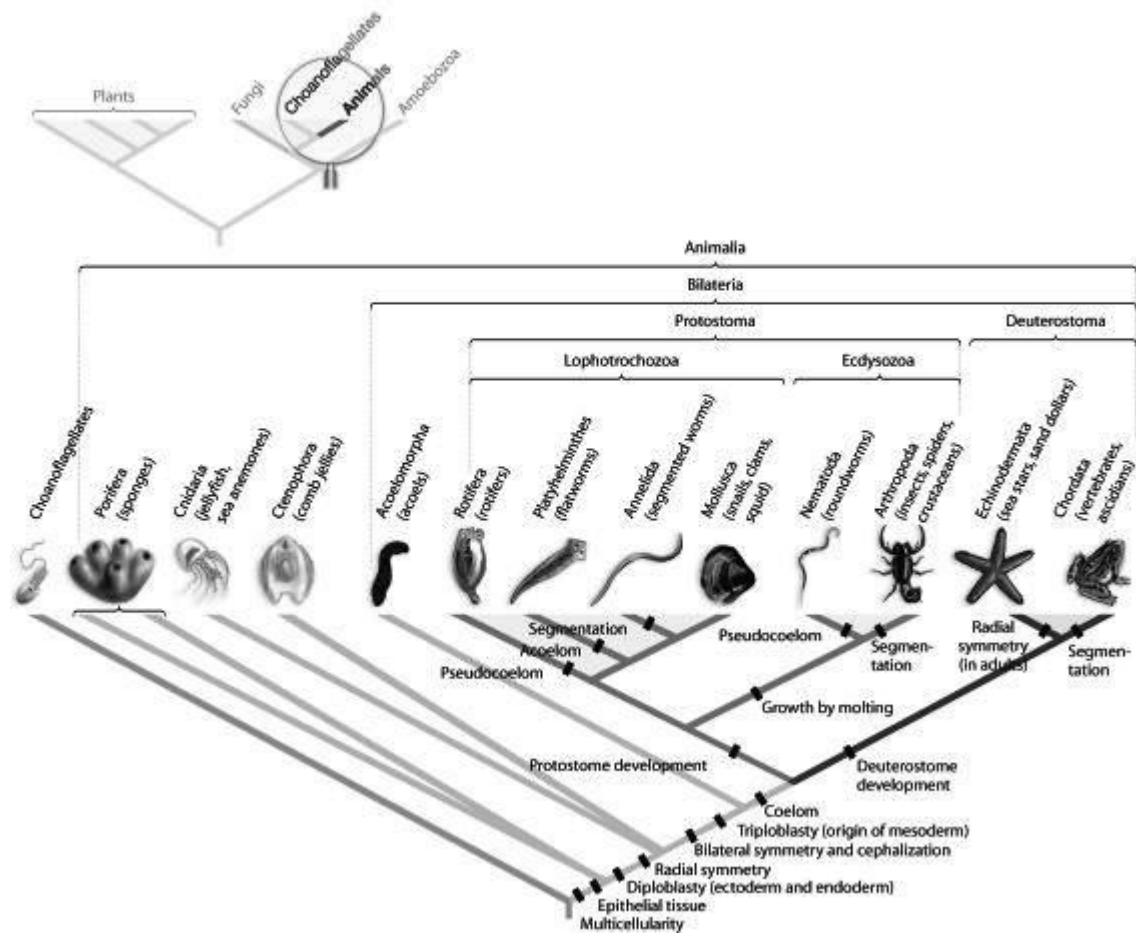
- A) mean that sponges must no longer be classified as animals
- B) confirm the identity of sponges as "basal animals"
- C) mean that extinct sponges must have been the last common ancestor of animals and fungi
- D) require sponges to be reclassified as choanoflagellates

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 32.4

52) Use the figure to answer the question.



Which morphological trait evolved more than once in animals, according to the phylogeny based on DNA sequence data found in the figure?

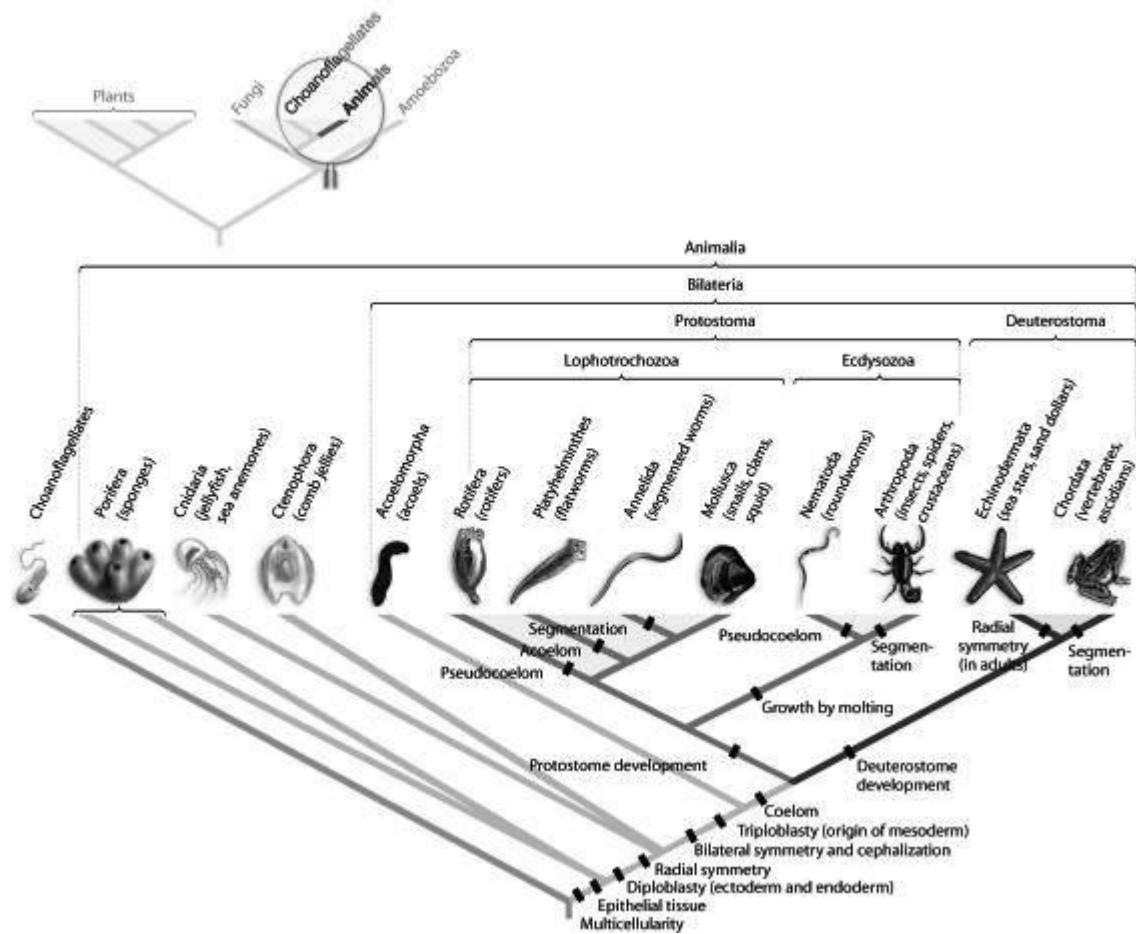
- A) coelom
- B) bilateral symmetry
- C) segmentation
- D) protostome development

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.4

53) Use the figure to answer the question.



Which of the following statements is supported by the phylogeny in the figure?

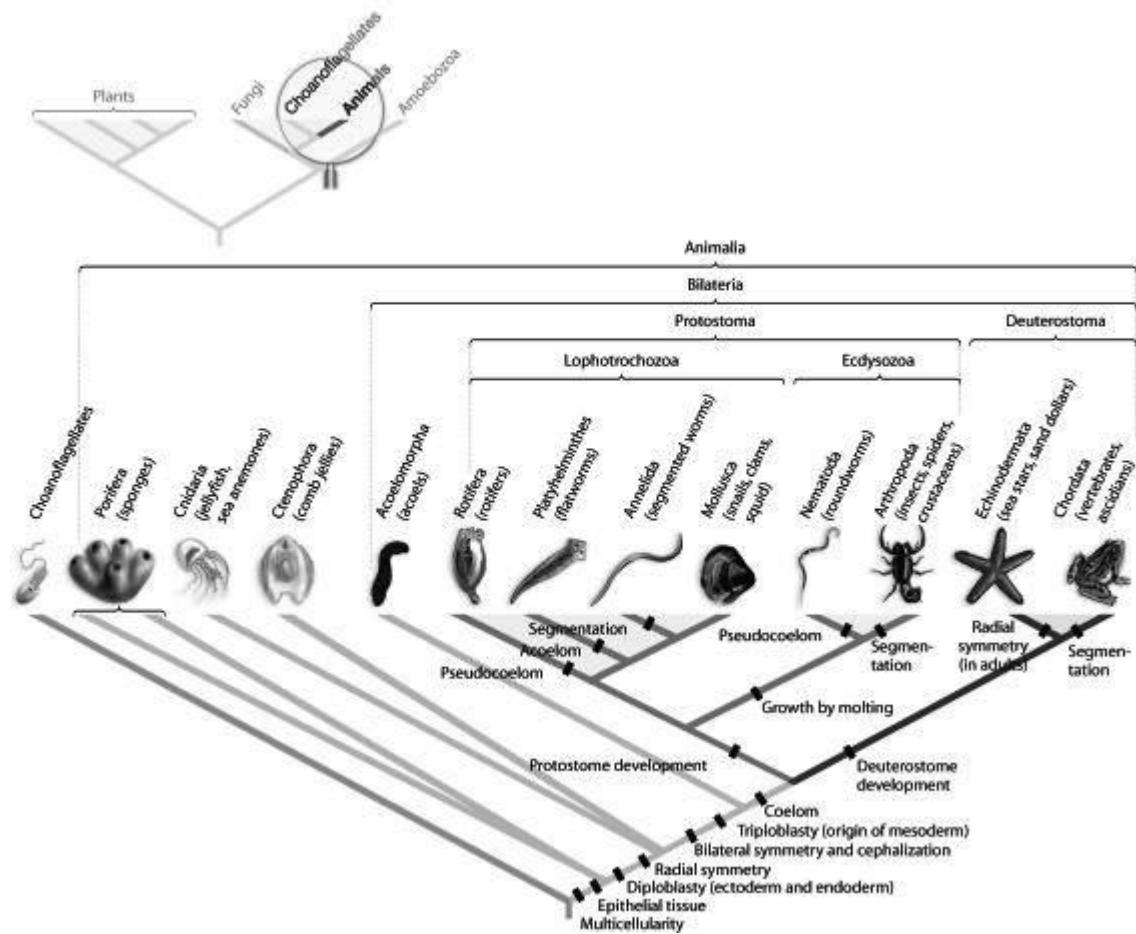
- A) Deuterostoma are more evolutionarily advanced than Porifera.
- B) Traits, once they evolve, are retained in later-evolving taxonomic groups.
- C) Animals show no evidence of convergent evolution in their traits.
- D) Animals with extremely different adult forms can be relatively closely related.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 32.4

54) Use the figure to answer the question.



Which of the following pairs of animals show that animals with widely different adult features can be each other's closest relatives?

- A) Annelida and Nematoda
- B) Chordata and Echinodermata
- C) Cnidemaria and Ctenophora
- D) Annelida and Rotifera

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 32.4

55) Why might researchers choose to use molecular data (such as ribosomal RNA sequences) rather than morphological data to study the evolutionary history of animals?

- A) Molecular data can be gathered in the lab, while morphological data must be gathered in the field.
- B) Molecular data can be used to give an estimate of the time since two groups split.
- C) Morphological changes usually do not result from molecular changes.
- D) Some phyla vary too widely in morphological characteristics to be classified accurately.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 32.4

56) If in the future the current molecular evidence regarding animal origins is further substantiated, which of the following statements would be correct with reference to fossil evidence that contradicts molecular evidence?

- A) The contrary fossil evidence will be seen as a hoax.
- B) The fossil evidence will be understood to have been interpreted incorrectly because it is incomplete.
- C) The fossil record will, henceforth, be ignored.
- D) Phylogenies involving even the smallest bit of fossil evidence will need to be discarded.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 32.4

57) Use the table to answer the question.

Proposed Number of *Hox* Genes in Various Extant and Extinct Animals

Last Common Ancestor of Bilateria	Last Common Ancestor of Insects and Vertebrates	Ancestral Vertebrates	Mammals
4	7	14	38-40

What conclusion can best be drawn from the data in the table?

- A) Land animals have more *Hox* genes than do those that live in water.
- B) All bilaterian phyla have had the same degree of expansion in their numbers of *Hox* genes.
- C) The expansion in number of *Hox* genes throughout vertebrate evolution cannot be explained merely by three duplications of the ancestral vertebrate *Hox* cluster.
- D) Extant insects all have seven *Hox* genes.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 32.4

- 58) Which of the following statements concerning animal taxonomy is accurate?
- A) Animals are thought to have evolved from flagellated protists similar to modern choanoflagellates.
 - B) Kingdom Animalia is polyphyletic.
 - C) Animals are more closely related to plants than to fungi.
 - D) In the kingdom Animalia, most clades based on body plan or fossils have been found to be incorrect.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.4

- 59) In the future, phylogenetic studies should be conducted to _____.
A) resolve the branching patterns (evolutionary history) of the Lophotrochozoa
B) discover the *Hox* genes in sponges
C) discover the relationships between nematodes and platyhelminthes
D) discover the larval stages of echinoderms
- Answer: A
- Bloom's Taxonomy: Synthesis/Evaluation
- Section: 32.4
- 60) At one time, sponges were lumped into one phylum. Then, they were separated into several different phyla. Now, they are considered one phylum again. These changes indicate which of the following?
A) Every phylogeny should be considered a hypothesis that must be revised in the light of new data.
B) We need more fossil evidence of sponges.
C) Molecular and morphological data often conflict when we try to reconstruct evolutionary history.
D) The goal of making all taxonomic groups monophyletic is unrealistic.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 32.4

- 61) Sponges and ctenophores have both been proposed as basal metazoans. Which of the following types of data support the idea that sponges are the basal group?
A) sequences of cadherin genes, cleavage type, structure of collar cells, and bilateral symmetry of adults
B) sequences of collagen genes, bilateral symmetry of adults, cleavage type, and fossil steroids
C) fossil steroids, molecular clock, lack of tissues in sponges, and structure of collar cells
D) structure of collar cells, bilateral symmetry of larvae, sequences of cadherin genes, and molecular clock

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 32.4

62) Sponges and ctenophores have both been proposed as basal metazoans. Imagine that you wanted to provide additional evidence to help resolve this question. Which of the following projects would be the best next step?

- A) more extensive study of DNA sequences in the bilateria
- B) ultrastructural (that is, electron microscope) comparisons of choanoflagellates and sperm cells from arthropods
- C) measurements of molecular clocks from the Lophotrochozoa
- D) more extensive studies of DNA sequences in both groups

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 32.4

63) Placing sponges as the basal metazoans on the basis of lack of tissues implies which of the following?

- A) Sponge ancestors never had tissues.
- B) Modern-day sponges have lost the ability to form tissues.
- C) Multicellular, modern-day choanoflagellates can form tissues.
- D) Sponges do not have nerve cells.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 32.4

32.2 Student Edition End-of-Chapter Questions

1) One of the characteristics unique to animals is

- A) gastrulation.
- B) multicellularity.
- C) sexual reproduction.
- D) flagellated sperm.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

2) The distinction between sponges and other animal phyla is based mainly on the absence versus the presence of

- A) a body cavity.
- B) a complete digestive tract.
- C) mesoderm.
- D) tissues.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

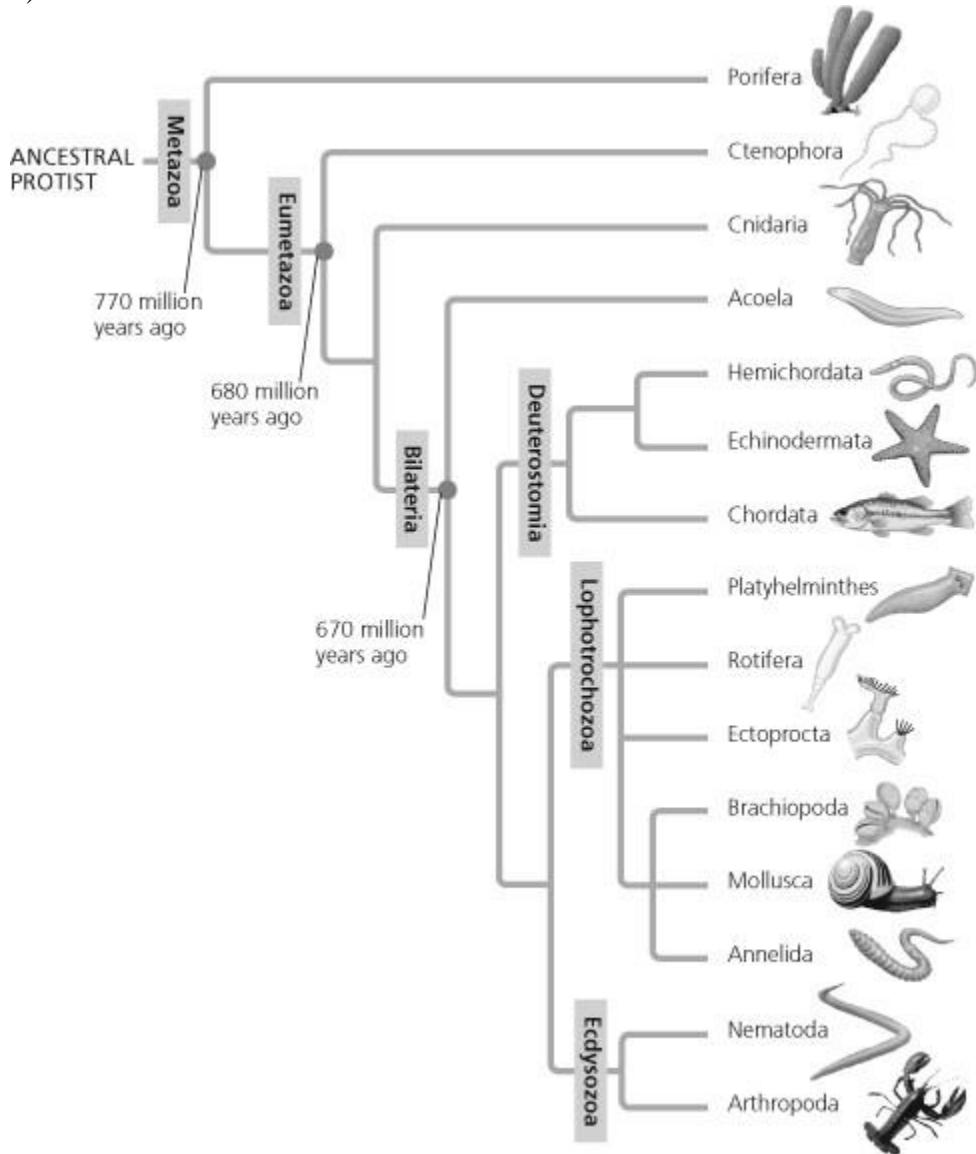
3) Which of the following was probably the *least* important factor in bringing about the Cambrian explosion?

- A) the emergence of predator-prey relationships
- B) an increase in the concentration of atmospheric oxygen
- C) the movement of animals onto land
- D) the origin of Hox genes

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

4)



Based on the tree shown, which statement is false?

- A) The animal kingdom is monophyletic.
- B) Acoelomate flatworms are more closely related to echinoderms than to annelids.
- C) Sponges are basal animals.
- D) Bilaterians form a clade.

Answer: B

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 33 An Introduction to Invertebrates

33.1 Multiple-Choice Questions

1) Use the following information to answer the question.

The phylum Cycliophora was discovered in 1995. They are tiny organisms that live in large numbers on the outsides of the mouthparts and appendages of lobsters. The feeding stage permanently attaches to the lobster via an adhesive disk and collects scraps of food from its host's feeding by capturing the scraps in a current created by a ring of cilia. The body is saclike and has a U-shaped intestine that brings the anus close to the mouth. Cycliophorans are coelomates, do not molt (though their host does), and their embryos undergo spiral cleavage.

Which of these features is *least* useful in assigning the phylum Cycliophora to a clade of animals?

- A) having a true coelom as a body cavity
- B) having a body symmetry that permits a U-shaped intestine
- C) having embryos with spiral cleavage
- D) lacking ecdysis (molting)

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 33.0

2) Use the following information to answer the question.

The phylum Cycliophora was discovered in 1995. They are tiny organisms that live in large numbers on the outsides of the mouthparts and appendages of lobsters. The feeding stage permanently attaches to the lobster via an adhesive disk and collects scraps of food from its host's feeding by capturing the scraps in a current created by a ring of cilia. The body is saclike and has a U-shaped intestine that brings the anus close to the mouth. Cycliophorans are coelomates, do not molt (though their host does), and their embryos undergo spiral cleavage.

Which of these, if discovered among cycliophorans, would cause the most confusion concerning our current understanding of cycliophoran taxonomy?

- A) if the ciliated feeding ring is a lophophore
- B) if embryos are diploblastic
- C) if the body cavity is actually a pseudocoelom
- D) if the organisms show little apparent cephalization

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 33.0

3) Use the following information to answer the question.

The phylum Cycliophora was discovered in 1995. They are tiny organisms that live in large numbers on the outsides of the mouthparts and appendages of lobsters. The feeding stage permanently attaches to the lobster via an adhesive disk and collects scraps of food from its host's feeding by capturing the scraps in a current created by a ring of cilia. The body is saclike and has a U-shaped intestine that brings the anus close to the mouth. Cycliophorans are coelomates, do not molt (though their host does), and their embryos undergo spiral cleavage.

The feeding stage of cycliophorans _____.

- A) is autotrophic and captures food in a manner similar to gastropods
- B) is sessile and captures food in a manner similar to that of animals with lophophores
- C) is sessile and radially symmetric
- D) is autotrophic and sessile

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 33.0

4) Use the following information to answer the question.

The phylum Cycliophora was discovered in 1995. They are tiny organisms that live in large numbers on the outsides of the mouthparts and appendages of lobsters. The feeding stage permanently attaches to the lobster via an adhesive disk and collects scraps of food from its host's feeding by capturing the scraps in a current created by a ring of cilia. The body is saclike and has a U-shaped intestine that brings the anus close to the mouth. Cycliophorans are coelomates, do not molt (though their host does), and their embryos undergo spiral cleavage.

Basing your inferences on information in the paragraph, to which clades should cycliophorans belong?

- A) Eumetazoa and Bilateria
- B) Eumetazoa and Lophotrochozoa
- C) Deuterostomia and Ecdysozoa
- D) Deuterostomia and Lophotrochozoa

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.0

5) One should expect to find cilia associated with the feeding apparatus of _____.

- A) annelids
- B) coral animals
- C) tapeworms
- D) sponges

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 33.1

6) Sponges _____.

- A) have larvae that are motile and move via the motion of cilia
- B) are the simplest diploblastic animals
- C) have a nerve net but not a central nervous system
- D) have feeding cells called dinoflagellates

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.1

7) Which of the following is most likely to be aquatic?

- A) filter feeder
- B) mass feeder
- C) deposit feeder
- D) fluid feeder

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 33.1

8) Which of the following can be found in the mesohyl of a sponge?

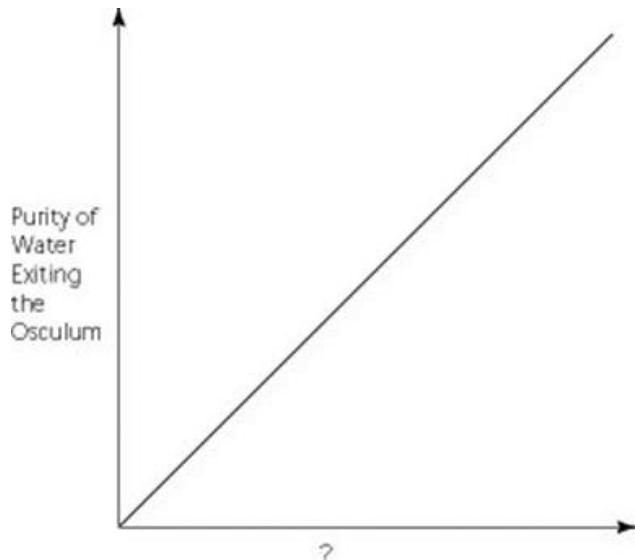
- A) amoebocytes and choanocytes
- B) spicules and choanocytes
- C) amoebocytes and spicules
- D) amoebocytes and polyps

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.1

9) Use the graph to answer the following question.



Which of the following factors, when used to label the horizontal axis of the graph, would account most directly for the shape of the plot?

- A) rate of cribrostatin synthesis (molecules/unit time)
- B) number of pores per sponge
- C) number of spicules per sponge
- D) number of choanocytes per sponge

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.1

10) Healthy corals are brightly colored because they _____.

- A) secrete colorful pigments to attract mates
- B) host symbionts with colorful photosynthetic pigments
- C) build their skeletons from colorful minerals
- D) secrete colorful pigments to protect themselves from ultraviolet light

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 33.2

11) In terms of food capture, which sponge cell is most similar to the cnidocyte of a cnidarian?

- A) amoebocyte
- B) choanocyte
- C) epidermal cell
- D) pore cell

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.2

12) The crown-of-thorns sea star, *Acanthaster planci*, preys on the flesh of live coral. If coral animals are attacked by these sea stars, then what actually provides nutrition to the sea star, and which chemical (besides the toxin within their nematocysts) do the corals rely on for protection?

- A) medusae; silica
- B) exoskeleton; calcium carbonate
- C) polyps; calcium carbonate
- D) polyps; silica

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 33.2

13) Use the following information to answer the question.

An elementary school science teacher decided to liven up the classroom with a saltwater aquarium. Knowing that saltwater aquaria can be quite a hassle, the teacher proceeded stepwise. First, the teacher conditioned the water. Next, the teacher decided to stock the tank with various marine invertebrates, including a polychaete, a siliceous sponge, several bivalves, a shrimp, several sea anemones of different types, a colonial hydra, a few coral species, an ectoproct, a sea star, and several herbivorous gastropod varieties. Lastly, she added some vertebrates—a parrot fish and a clown fish. She arranged for daily feedings of copepods and feeder fish.

One day, Tommy, a student in an undersupervised class of 40 fifth graders, got the urge to pet Nemo (the clown fish), who was swimming among the waving petals of a pretty underwater "flower" that had a big hole in the midst of the petals. Tommy giggled upon finding that these petals felt sticky. A few hours later, Tommy was in the nurse's office with nausea and cramps. Microscopic examination of his fingers would probably have revealed the presence of _____.

- A) teeth marks
- B) spines
- C) spicules
- D) nematocysts

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 33.2

14) Use the following information to answer the question.

An elementary school science teacher decided to liven up the classroom with a saltwater aquarium. Knowing that saltwater aquaria can be quite a hassle, the teacher proceeded stepwise. First, the teacher conditioned the water. Next, the teacher decided to stock the tank with various marine invertebrates, including a polychaete, a siliceous sponge, several bivalves, a shrimp, several sea anemones of different types, a colonial hydra, a few coral species, an ectoproct, a sea star, and several herbivorous gastropod varieties. Lastly, she added some vertebrates—a parrot fish and a clown fish. She arranged for daily feedings of copepods and feeder fish.

The teacher and class were especially saddened when the colonial hydrozoan died. They had watched it carefully, and the unfortunate creature never even got to produce offspring by budding. Yet, everyone was elated when one of the students noticed a small colonial hydrozoan growing in a part of the tank far from the location of the original colony. The teacher was apparently unaware that these hydrozoans exhibit _____.

- A) spontaneous generation
- B) abiogenesis
- C) alternation of generations
- D) a medusa stage

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 33.2

15) The sharp, inch-long thorns of the crown-of-thorns sea star are its spines. These spines, unlike those of most other sea stars, contain a potent toxin. If it were discovered that crown-of-thorns sea stars do not make this toxin themselves, then the most likely alternative would be that this toxin is _____.

- A) derived from the nematocysts of its prey
- B) absorbed from the surrounding seawater
- C) an endotoxin of cellulose-digesting bacteria that inhabit the sea star's digestive glands
- D) injected into individual thorns by mutualistic corals which live on the aboral surfaces of these sea stars

Answer: A

Bloom's Taxonomy: Application/Analysis

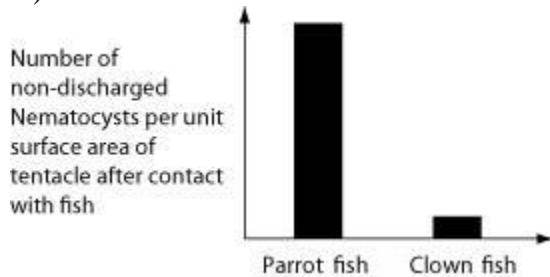
Section: 33.2

16) Use the following information to answer the question.

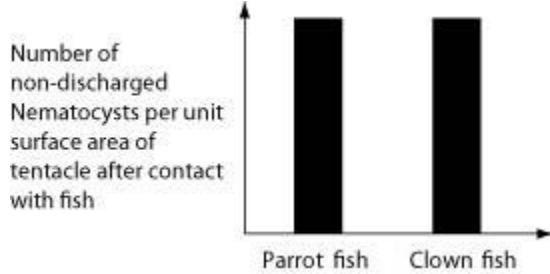
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Normally, the clown fish readily swims among the tentacles of the sea anemones; the parrot fish avoids them. One hypothesis for the clown fish's apparent immunity is that they slowly build a tolerance to the sea anemone's toxin. A second hypothesis is that a chemical in the mucus that coats the clown fish prevents the nematocysts from being triggered. Which of the following graphs supports the second, but not the first, of these hypotheses?

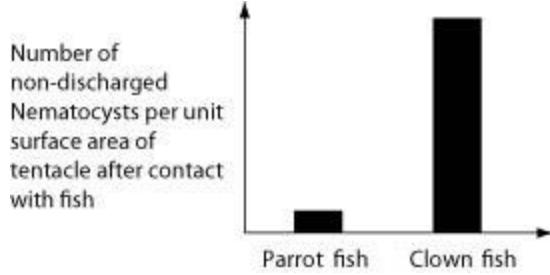
A)



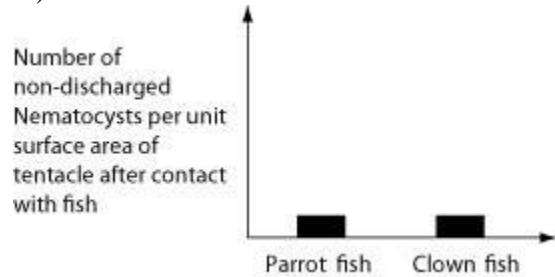
B)



C)



D)



Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

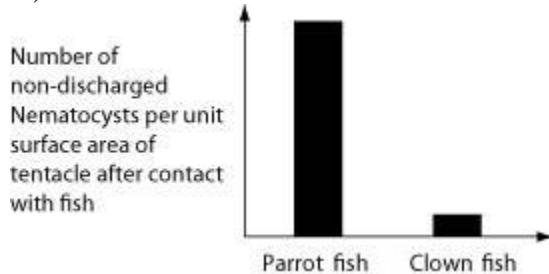
Section: 33.2

17) Use the following information to answer the question.

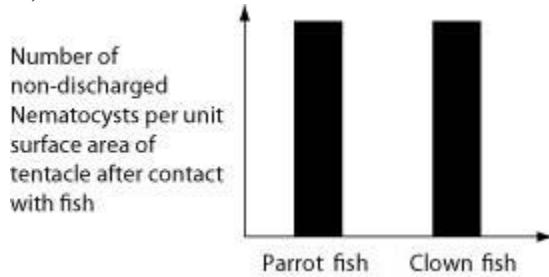
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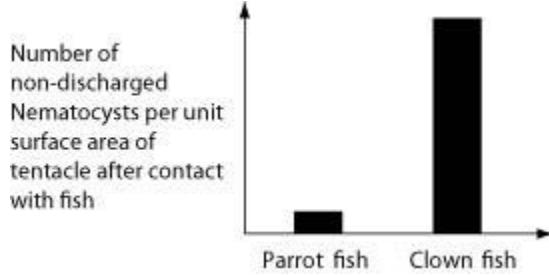
A)



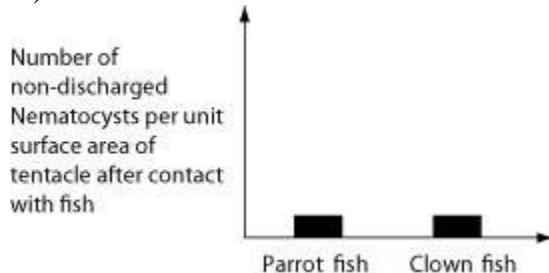
B)



C)



D)



Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.2

18) The presence of a lophophore in a newly discovered species would suggest that the species _____.

- A) has an exoskeleton
- B) grows by shedding its external covering
- C) is motile
- D) is a filter feeder

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.3

19) You find what you believe is a new species of animal. Which of the following characteristics would enable you to argue that it is more closely related to a flatworm than it is to a roundworm?

- A) It is a suspension feeder.
- B) It has no coelom.
- C) It is shaped like a worm.
- D) It has a mouth and an anus.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 33.3

20) What would be the best anatomical feature to look for to distinguish a gastropod from a chiton?

- A) presence of a muscular foot
- B) presence of a rasp-like feeding structure
- C) production of eggs
- D) dorsal plates

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.3

21) Which of the following organisms would you expect to have the largest surface-area-to-volume ratio? Assume that all of the following are the same total length.

- A) a mollusc
- B) an annelid
- C) an arthropod
- D) a platyhelminth

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 33.3

22) Against which hard structure do the circular and longitudinal muscles of annelids work?

- A) cuticle
- B) shell
- C) endoskeleton
- D) hydrostatic skeleton

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 33.3

23) While sampling marine plankton in a lab, a student encounters large numbers of fertilized eggs. The student rears some of the eggs in the laboratory for further study and finds that the blastopore becomes the mouth. The embryo develops into a trochophore larva and eventually has a true coelom. These eggs probably belonged to a(n) _____.

- A) echinoderm
- B) mollusc
- C) nematode
- D) arthropod

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.3

24) Use the information to answer the following question.

The nontaxonomic term *sea slug* encompasses a wide variety of marine gastropods. One feature they share as adults is the lack of a shell. One might think, therefore, that they represent defenseless morsels for predators. In fact, sea slugs have multiple defenses. Some sea slugs prey on sponges and concentrate sponge toxins in their tissues. Others feed on cnidarians, digesting everything except the nematocysts, which they then transfer to their own skins. Whereas the most brightly colored sea slugs are often highly toxic, others are nontoxic and mimic the coloration of the toxic species. Their colors are mostly derived from pigments in their prey. There are also sea slugs that use their coloration to blend into their environments.

This nudibranch, a type of sea slug, has many reddish cerata on its dorsal surface, as well as two white-tipped rhinophores located on the head.



Which structure do sea slugs use to feed on their prey?

- A) nematocysts
- B) an incurrent siphon
- C) a radula
- D) a mantle cavity

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.3

25) Use the information to answer the following question.

The nontaxonomic term *sea slug* encompasses a wide variety of marine gastropods. One feature they share as adults is the lack of a shell. One might think, therefore, that they represent defenseless morsels for predators. In fact, sea slugs have multiple defenses. Some sea slugs prey on sponges and concentrate sponge toxins in their tissues. Others feed on cnidarians, digesting everything except the nematocysts, which they then transfer to their own skins. Whereas the most brightly colored sea slugs are often highly toxic, others are nontoxic and mimic the coloration of the toxic species. Their colors are mostly derived from pigments in their prey. There are also sea slugs that use their coloration to blend into their environments.

This nudibranch, a type of sea slug, has many reddish cerata on its dorsal surface, as well as two white-tipped rhinophores located on the head.



The nematocysts most likely reach the skin of sea slugs through branches of the _____.

- A) intestine
- B) excurrent siphon
- C) nephridium
- D) pseudocoelom

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 33.3

26) Use the information to answer the following question.

The nontaxonomic term *sea slug* encompasses a wide variety of marine gastropods. One feature they share as adults is the lack of a shell. One might think, therefore, that they represent defenseless morsels for predators. In fact, sea slugs have multiple defenses. Some sea slugs prey on sponges and concentrate sponge toxins in their tissues. Others feed on cnidarians, digesting everything except the nematocysts, which they then transfer to their own skins. Whereas the most brightly colored sea slugs are often highly toxic, others are nontoxic and mimic the coloration of the toxic species. Their colors are mostly derived from pigments in their prey. There are also sea slugs that use their coloration to blend into their environments.

This nudibranch, a type of sea slug, has many reddish cerata on its dorsal surface, as well as two white-tipped rhinophores located on the head.



The nematocysts of sea slugs should be most effective at protecting individual sea slugs from predation if the predators _____.

- A) remove small bites of flesh from sea slugs and have long-term memory
- B) remove small bites of flesh from sea slugs and have no long-term memory
- C) consume entire sea slugs in one gulp and have no long-term memory
- D) consume entire sea slugs in one gulp and have long-term memory

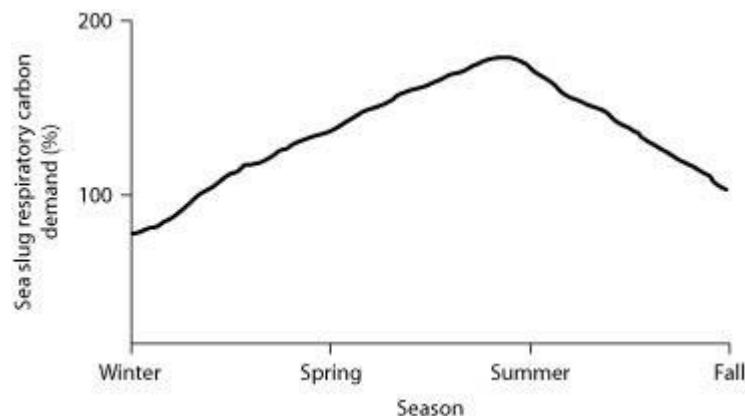
Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.3

27) Use the information and figure to answer the following question.

The sea slug *Pteraeolidia ianthina* can harbor living dinoflagellates (photosynthetic protists) in its skin. These endosymbiotic dinoflagellates reproduce quickly enough to maintain their populations. Low populations do not affect the sea slugs very much, but high populations ($> 5 \times 10^5$ cells/mg of sea slug protein) can promote sea slug survival.



Percent of sea slug respiratory carbon demand provided by indwelling dinoflagellates.

If the dinoflagellate-containing sea slug *P. ianthina* preys on coral animals, then it would be *most* surprising to find that _____.

- A) *P. ianthina* can tolerate the toxin in the nematocysts of its prey
- B) *P. ianthina* can locate its coral prey by chemicals released into the water by corals
- C) the coral prey harbor dinoflagellates in their tissues
- D) the coral prey transform themselves into medusas to flee from approaching *P. ianthina*

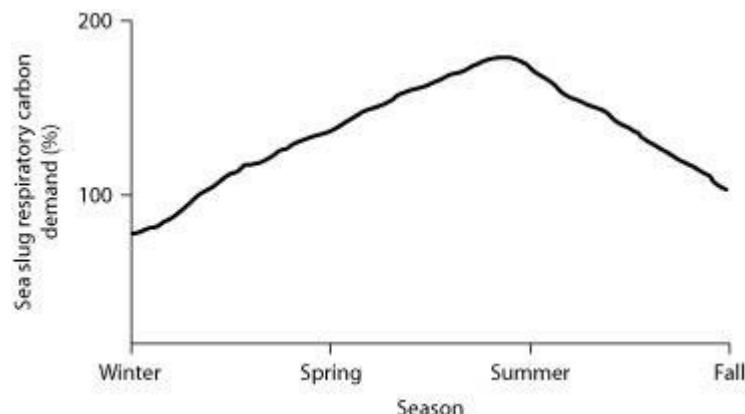
Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.3

28) Use the information and figure to answer the following question.

The sea slug *Pteraeolidia ianthina* can harbor living dinoflagellates (photosynthetic protists) in its skin. These endosymbiotic dinoflagellates reproduce quickly enough to maintain their populations. Low populations do not affect the sea slugs very much, but high populations ($> 5 \times 10^5$ cells/mg of sea slug protein) can promote sea slug survival.



Percent of sea slug respiratory carbon demand provided by indwelling dinoflagellates.

In the graph, the percent of the oxygen demand contributed by the dinoflagellates is greater than 100% during much of the year. What is the fate of this "excess" energy?

- A) It is dispersed as "entropy" (disorder in the system).
- B) It is saved for producing offspring by the sea slug.
- C) It is used to move around the sea bottom.
- D) It is used in evaporative cooling by the sea slug.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.3

29) The sea slug *Elysia chlorotica* has no nematocysts or dinoflagellates but, rather, has "naked" chloroplasts in its skin. The chloroplasts are all that remain of the seaweed (*Vaucheria* sp.) that *Elysia* feeds upon. The chloroplasts are transferred to the skin; consequently, this slug is green. It spends most of its time basking in shallow water on the surface of seaweeds. How should we expect its chloroplasts to benefit the *Elysia* sea slug?

- A) provide *Elysia* with fixed nitrogen
- B) provide *Elysia* with fixed carbon dioxide
- C) provide *Elysia* with fixed oxygen
- D) provide *Elysia* with a bright color that warns away potential predators

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 33.3

30) Use the following information to answer the question.

An elementary school science teacher decided to liven up the classroom with a saltwater aquarium. Knowing that saltwater aquaria can be quite a hassle, the teacher proceeded stepwise. First, the teacher conditioned the water. Next, the teacher decided to stock the tank with various marine invertebrates, including a polychaete, a siliceous sponge, several bivalves, a shrimp, several sea anemones of different types, a colonial hydra, a few coral species, an ectoproct, a sea star, and several herbivorous gastropod varieties. Lastly, she added some vertebrates—a parrot fish and a clown fish. She arranged for daily feedings of copepods and feeder fish.

If the teacher wanted to show the students what a lophophore is and how it works, the teacher would point out a feeding _____.

- A) hydra
- B) sponge
- C) gastropod
- D) ectoproct

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.3

31) What would be the most effective method of reducing the incidence of blood flukes in a human population?

- A) reduce the mosquito population
- B) reduce the population of the intermediate snail host
- C) avoid contact with rodent droppings
- D) carefully wash all raw fruits and vegetables

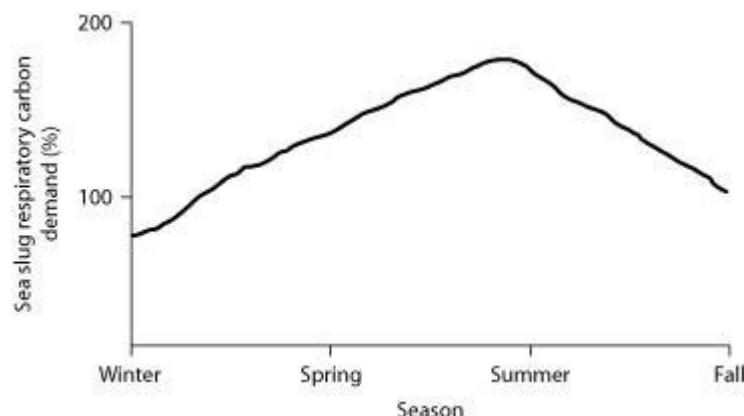
Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 33.3

32) Use the information and figure to answer the following question.

The sea slug *Pteraeolidia ianthina* can harbor living dinoflagellates (photosynthetic protists) in its skin. These endosymbiotic dinoflagellates reproduce quickly enough to maintain their populations. Low populations do not affect the sea slugs very much, but high populations ($> 5 \times 10^5$ cells/mg of sea slug protein) can promote sea slug survival.



Percent of sea slug respiratory carbon demand provided by indwelling dinoflagellates.

According to the graph, during which season(s) of the year is the relationship between the sea slug and its dinoflagellates closest to being commensal?

- A) winter
- B) spring
- C) summer
- D) spring and summer

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.3

33) Planarians lack dedicated respiratory and circulatory systems. This deficiency does not cause a problem because _____.

- A) none of their cells are far removed from the gastrovascular cavity or from the external environment
- B) they lack mesoderm as embryos and, therefore, lack the adult tissues derived from mesoderm
- C) their flame bulbs can carry out respiratory and circulatory functions
- D) their body cavity, a pseudocoelom, carries out these functions

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.3

34) Which one of these mollusc groups can be classified as suspension feeders?

- A) bivalves
- B) gastropods
- C) chitons
- D) cephalopods

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.3

35) Which characteristic is shared by cnidarians and flatworms?

- A) dorsoventrally flattened bodies
- B) radial symmetry
- C) a digestive system with a single opening
- D) a distinct head

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.3

36) If a lung were to be found in a mollusc, where would it be located?

- A) mantle cavity
- B) incurrent siphon
- C) visceral mass
- D) excurrent siphon

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 33.3

37) Parasitism is one of the most widespread lifestyles ever to evolve. Which of the following is consistent with this finding?

- A) Parasites almost always predigest their hosts' tissues and, therefore, spend less energy and require fewer structural adaptations.
- B) Parasites, unlike predators, feed on almost all the tissues of their host.
- C) Parasites do not generally kill their hosts; thus they can feed on the same host throughout the host's normal life span and do not have competition from decomposers.
- D) Parasites generally kill their host and can feed for a very long time because they are much smaller than their host.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 33.3

38) Molecular studies have changed many of the phylogenetic relationships previously identified by morphological studies. An example of such a change is _____.
A) *Lochotrophozora*
B) *Placozoa*
C) *Brachiopoda*
D) *Bivalvia*

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.3

39) Molecular studies have changed many of the phylogenetic relationships previously identified by morphological studies. These changes indicate that _____.
A) molecular and morphological studies rarely agree
B) molecular studies add additional information to morphological studies and improve our understanding of evolutionary history
C) molecular studies are less reliable than morphological studies
D) molecular studies are extremely time consuming and expensive and really don't add additional information to our understanding of evolutionary history

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.3

40) Large animals need specialized organs for gas exchange because _____.
A) they require more oxygen per unit of volume
B) surface area increases more rapidly than volume as size increases
C) volume increases more rapidly than surface area as size increases
D) they collect more energy and therefore have more energy to allocate to specialized tissues

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.3

41) Toilets are a modern convenience that people often take for granted. In fact, they are helpful in preventing spread of disease because _____.
A) disease-causing insects die quickly in fecal-contaminated water
B) toilets disinfect human feces
C) many diseases are transmitted by flying insects
D) many parasites release fertilized eggs in the feces of humans and other animals

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.3

42) Imagine that you are a graduate student seeking an idea for a research project that will help us understand the evolution of a parasitic lifestyle from a free-living lifestyle. Which of the following outcomes would you expect if you compare the genes of parasitic species to relatives that are free living?

- A) The parasitic species will have fewer functioning genes than the free-living species because loss of many genes will not be harmful.
- B) The free-living species will have more functioning genes because they evolved new traits.
- C) The genes will have changed in base sequence, but the number of functioning genes in parasitic and free-living species will be the same.
- D) More genes for sensing the environment will have evolved in the parasitic species as compared to the free-living species.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 33.3

43) Imagine that you are a research chemist who wishes to develop a chemical adhesive that will work under water. Which of the following organisms might give you a clue about where to start?

- A) sea wasps
- B) trematodes
- C) lobsters
- D) mussels

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 33.3

44) Which of the following changes would lead to an increase in surface-area-to-volume ratios?

- A) thickening of the body of earthworms
- B) increasing the number of layers in the chloroplasts of plants
- C) decreasing the projections of the choanocytes of sponges on the outer surface of the body
- D) reducing the branching of the mesoderm tissues of sponges

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 33.3

45) Without genetic variation, evolution cannot occur. Sexual reproduction leads to increased genetic variation, but male bdelloid rotifers have never been observed. Which of the following are correct statements with regard to evolution in bdelloid rotifers?

- A) As we learn more about bdelloid rotifers, we find males in more and more species.
- B) Bdelloid rotifers gain genetic variation by absorbing DNA from the external environment.
- C) Protists infect bdelloids and bring DNA from other rotifers with them.
- D) Bdelloid rotifers have lost the ability to reproduce sexually only recently.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.3

46) Which of the following statements about bryozoans (ectoprocts) is correct?

- A) Bryozoans are colonial, build reefs, and are related to corals.
- B) Bryozoans are colonial and live amongst mosses.
- C) Adult bryozoans are sessile, but their larvae make up much of marine plankton.
- D) Bryozoans build reefs and have lophophores that extend through a hard exoskeleton.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.3

47) Nematodes and arthropods both _____.

- A) develop an anus from the blastopore (pore) formed in the gastrula stage
- B) are parasites
- C) grow in conjunction with shedding of their exoskeleton
- D) have ciliated larvae

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.4

48) Arthropod exoskeletons and mollusc shells both _____.

- A) completely replace the hydrostatic skeleton
- B) are secreted by the mantle
- C) help retain moisture in terrestrial habitats
- D) are comprised of the polysaccharide chitin

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.4

49) You find a multi-legged animal in your garden and want to determine if it is a centipede or a millipede. You take the animal to a university where a myriapodologist quickly tells you that you have found a centipede. Which of the following traits may have allowed her to make this distinction?

- A) presence of body segments
- B) poisonous claws
- C) egg-laying
- D) molting

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.4

50) Whiteflies are common pest insects found on cotton, tomato, poinsettia, and many other plants. Nymphs are translucent and mostly sessile, feeding on their host plant's phloem (sap) from the undersides of leaves. They undergo incomplete metamorphosis into winged adults. Because whitefly nymphs cannot escape predation by moving, you hypothesize that their translucent bodies make them hard to spot by predators. How could you directly test this hypothesis?

- A) Compare rates of predation on whitefly nymphs on plant leaves of different colors (for example, red versus green poinsettia leaves).
- B) Compare rates of predation on whitefly nymphs coated with a nontoxic dye versus undyed whitefly nymphs.
- C) Compare rates of predation on whitefly nymphs versus whitefly adults.
- D) Compare rates of predation on whitefly nymphs by predators that are translucent versus predators that are not translucent.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.4

51) All insects _____.

- A) undergo complete metamorphosis and have segmented bodies
- B) have jointed appendages and a radula
- C) undergo complete metamorphosis and have an exoskeleton or cuticle
- D) have jointed appendages and spicules

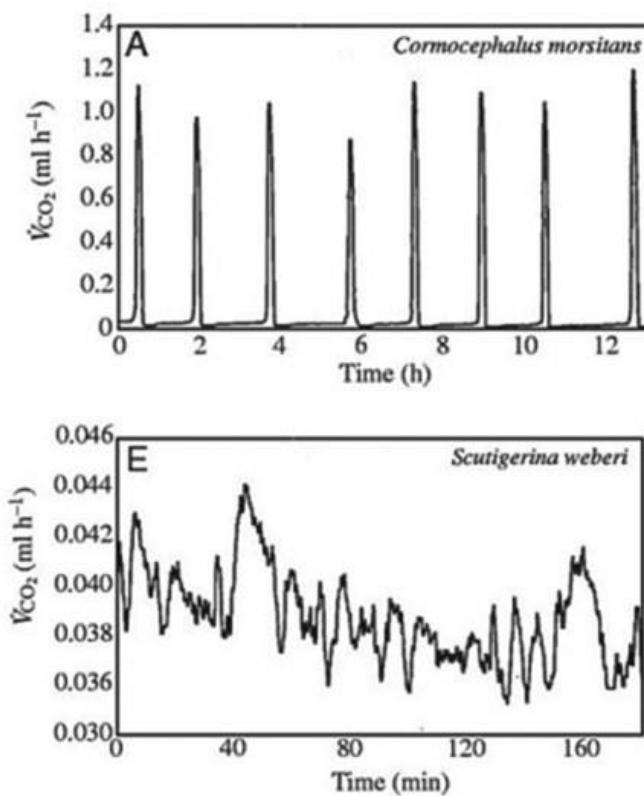
Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.4

52) Use the following information and figures to answer the question.

Many terrestrial arthropods exchange gases with their environments by using tracheae, tubes that lead from openings (called spiracles) in the animal's exoskeleton or cuticle directly to the animal's tissues. Some arthropods can control whether their spiracles are opened or closed; opening the spiracles allows the carbon dioxide produced in the tissues to travel down the tracheae and be released outside the animal. Klok et al. measured the carbon dioxide emitted over time (represented by V_{CO_2}) by several species of centipedes. The figures present graphs of their results for two species, *Cormocephalus morsitans* and *Scutigerina weberi*. (C. J. Klok, R. D. Mercer, and S. L. Chown. 2002. Discontinuous gas-exchange in centipedes and its convergent evolution in tracheated arthropods. *Journal of Experimental Biology* 205:1019-29.) Copyright 2002 The Company of Biologists and the Journal of Experimental Biology.



Look at the graph for *Cormocephalus morsitans* in the figure. What is the best interpretation of these results?

- A) The centipede had its spiracles open the entire time.
- B) The centipede had its spiracles closed the entire time.
- C) The centipede had its spiracles open when carbon dioxide (CO_2) emission peaked and closed when CO_2 emission was low.
- D) The centipede had its spiracles closed when carbon dioxide (CO_2) emission peaked and open when CO_2 emission was low.

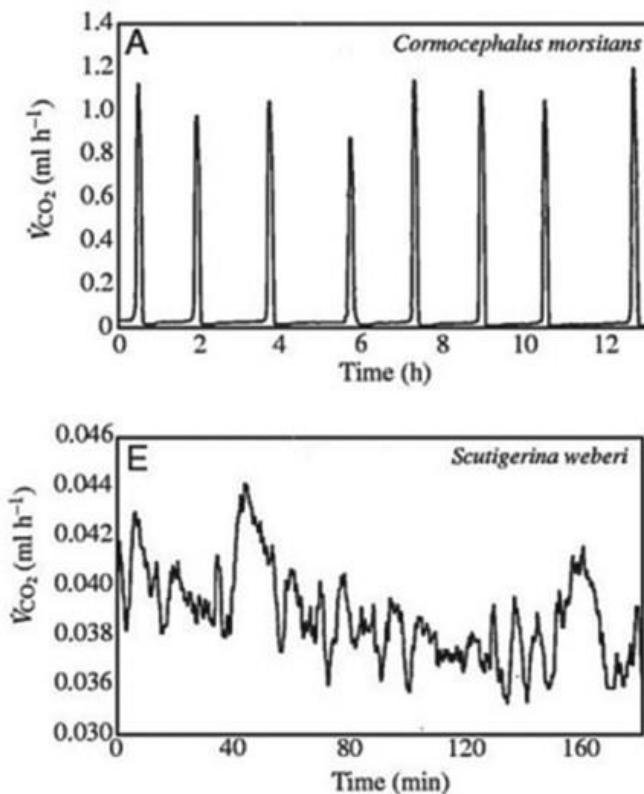
Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.4

53) Use the following information and figures to answer the question.

Many terrestrial arthropods exchange gases with their environments by using tracheae, tubes that lead from openings (called spiracles) in the animal's exoskeleton or cuticle directly to the animal's tissues. Some arthropods can control whether their spiracles are opened or closed; opening the spiracles allows the carbon dioxide produced in the tissues to travel down the tracheae and be released outside the animal. Klok et al. measured the carbon dioxide emitted over time (represented by $\dot{V}\text{CO}_2$) by several species of centipedes. The figures present graphs of their results for two species, *Cormocephalus morsitans* and *Scutigerina weberi*. (C. J. Klok, R. D. Mercer, and S. L. Chown. 2002. Discontinuous gas-exchange in centipedes and its convergent evolution in tracheated arthropods. *Journal of Experimental Biology* 205:1019-29.) Copyright 2002 The Company of Biologists and the Journal of Experimental Biology.



Look at the graph for *Scutigerina weberi* (note the scale of the y-axis) in the figure. What is the best interpretation of these results?

- A) The centipede had its spiracles open the entire time.
- B) The centipede had its spiracles closed the entire time.
- C) The centipede had its spiracles open when carbon dioxide (CO_2) emission peaked and closed when CO_2 emission was low.
- D) The centipede had its spiracles closed when carbon dioxide (CO_2) emission peaked and open when CO_2 emission was low.

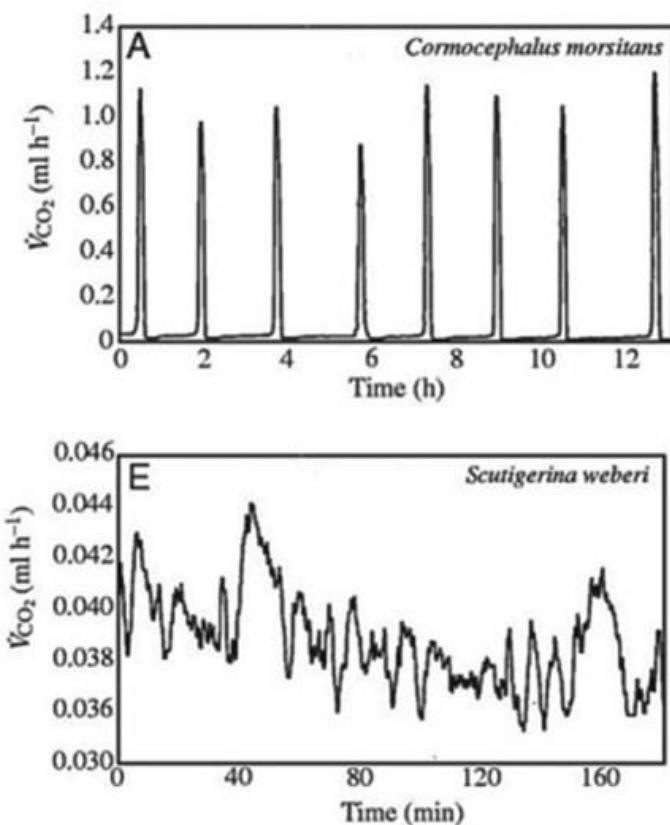
Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.4

54) Use the following information and figures to answer the question.

Many terrestrial arthropods exchange gases with their environments by using tracheae, tubes that lead from openings (called spiracles) in the animal's exoskeleton or cuticle directly to the animal's tissues. Some arthropods can control whether their spiracles are opened or closed; opening the spiracles allows the carbon dioxide produced in the tissues to travel down the tracheae and be released outside the animal. Klok et al. measured the carbon dioxide emitted over time (represented by $\dot{V}\text{CO}_2$) by several species of centipedes. The figures present graphs of their results for two species, *Cormocephalus morsitans* and *Scutigerina weberi*. (C. J. Klok, R. D. Mercer, and S. L. Chown. 2002. Discontinuous gas-exchange in centipedes and its convergent evolution in tracheated arthropods. *Journal of Experimental Biology* 205:1019-29.) Copyright 2002 The Company of Biologists and the Journal of Experimental Biology.



How would a terrestrial centipede most likely benefit from the ability to close its spiracles?
Closing spiracles would _____.

- A) allow the centipede to move more quickly
- B) allow the centipede to retain more moisture in its tissues
- C) allow the centipede to stay warmer
- D) allow more oxygen from the environment to reach the centipede's tissues

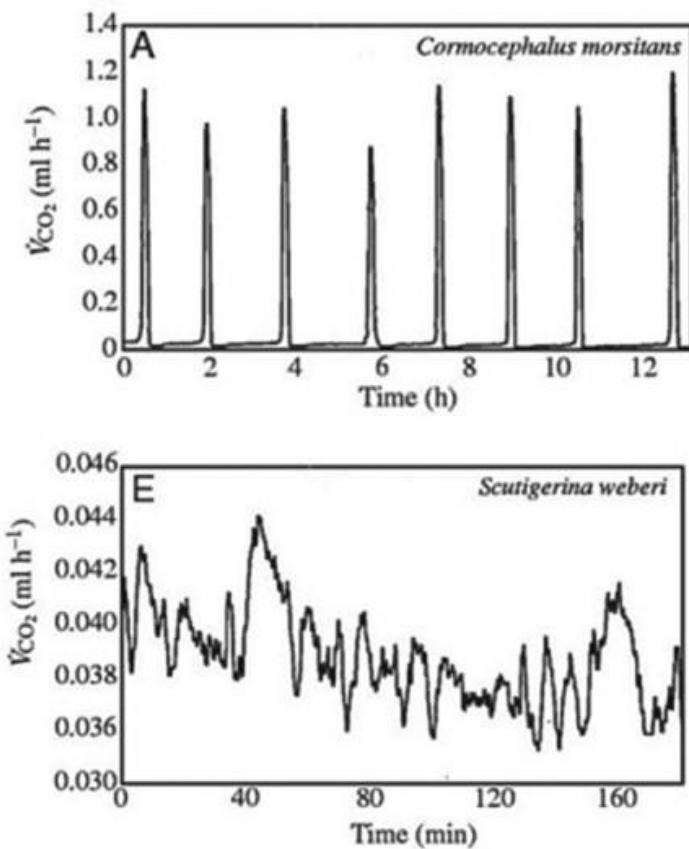
Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 33.4

55) Use the following information and figures to answer the question.

Many terrestrial arthropods exchange gases with their environments by using tracheae, tubes that lead from openings (called spiracles) in the animal's exoskeleton or cuticle directly to the animal's tissues. Some arthropods can control whether their spiracles are opened or closed; opening the spiracles allows the carbon dioxide produced in the tissues to travel down the tracheae and be released outside the animal. Klok et al. measured the carbon dioxide emitted over time (represented by V_{CO_2}) by several species of centipedes. The figures present graphs of their results for two species, *Cormocephalus morsitans* and *Scutigerina weberi*. (C. J. Klok, R. D. Mercer, and S. L. Chown. 2002. Discontinuous gas-exchange in centipedes and its convergent evolution in tracheated arthropods. *Journal of Experimental Biology* 205:1019-29.) Copyright 2002 The Company of Biologists and the Journal of Experimental Biology.



Compare the graphs in the figure of carbon dioxide (CO₂) emission for *Cormocephalus morsitans* and *Scutigerina weberi*. What hypothesis can you make about each centipede's habitat?

- A) *C. morsitans* lives in a habitat that provides more carbon dioxide than does *S. weberi*.
- B) *C. morsitans* lives in a habitat with more predators than does *S. weberi*.
- C) *C. morsitans* lives in a colder habitat than does *S. weberi*.
- D) *C. morsitans* lives in a drier habitat than does *S. weberi*.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 33.4

56) What would be the most direct effect of removing or damaging an insect's antennae? The insect would have trouble _____.

- A) hearing
- B) mating
- C) seeing
- D) smelling

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.4

57) The heartworms that can accumulate within the hearts of dogs and other mammals have a pseudocoelom, an alimentary canal, and an outer covering that is occasionally shed. To which phylum does the heartworm belong?

- A) Platyhelminthes
- B) Arthropoda
- C) Nematoda
- D) Annelida

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.4

58) A terrestrial animal species is discovered with the following larval characteristics: exoskeleton, system of tubes for gas exchange, and modified segmentation. A knowledgeable zoologist should predict that the adults of this species would also feature _____.

- A) eight legs
- B) two pairs of antennae
- C) a sessile lifestyle
- D) an open circulatory system

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.4

59) In a tide pool, a student encounters an organism with a hard outer covering that contains much calcium carbonate, an open circulatory system, and gills. The organism could potentially be a crab, a shrimp, a barnacle, or a bivalve. The presence of which of the following structures would allow for the most certain identification of the organism?

- A) a mantle
- B) a heart
- C) a body cavity
- D) a filter-feeding apparatus

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 33.3

60) Use the following information to answer the question.

Nudibranchs, a type of predatory sea slug, can have various protuberances (that is, extensions) on their dorsal surfaces. Rhinophores are paired structures, located close to the head, which bear many chemoreceptors. Dorsal plumules, usually located posteriorly, perform respiratory gas exchange. Cerata usually cover much of the dorsal surface and contain nematocysts at their tips.

The claws on the foremost trunk segment of centipedes have a function most similar to that of _____.

- A) rhinophores
- B) dorsal plumules
- C) cerata
- D) chemoreceptors

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 33.4

61) Use the following information to answer the question.

Nudibranchs, a type of predatory sea slug, can have various protuberances (that is, extensions) on their dorsal surfaces. Rhinophores are paired structures, located close to the head, which bear many chemoreceptors. Dorsal plumules, usually located posteriorly, perform respiratory gas exchange. Cerata usually cover much of the dorsal surface and contain nematocysts at their tips.

The stingers of honeybees have a function most similar to that of _____.

- A) rhinophores
- B) dorsal plumules
- C) cerata
- D) chemoreceptors

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 33.4

62) Use the following information to answer the question.

Nudibranchs, a type of predatory sea slug, can have various protuberances (that is, extensions) on their dorsal surfaces. Rhinophores are paired structures, located close to the head, which bear many chemoreceptors. Dorsal plumules, usually located posteriorly, perform respiratory gas exchange. Cerata usually cover much of the dorsal surface and contain nematocysts at their tips.

The spiracles and tracheae of insects have a function most similar to that of _____.

- A) rhinophores
- B) dorsal plumules
- C) cerata
- D) chemoreceptors

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 33.4

63) Use the following information to answer the question.

Nudibranchs, a type of predatory sea slug, can have various protuberances (that is, extensions) on their dorsal surfaces. Rhinophores are paired structures, located close to the head, which bear many chemoreceptors. Dorsal plumules, usually located posteriorly, perform respiratory gas exchange. Cerata usually cover much of the dorsal surface and contain nematocysts at their tips.

The antennae of insects have a function most similar to that of _____.

- A) rhinophores
- B) dorsal plumules
- C) cerata
- D) chemoreceptors

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 33.4

64) Use the following information to answer the question.

A farm pond, usually dry during winter, has plenty of water and aquatic pond life during the summer. One summer, Sarah returns to the family farm from college. Observing the pond, she is fascinated by some six-legged organisms that can crawl about on submerged surfaces or, when disturbed, seemingly "jet" through the water. Watching further, she is able to conclude that the "mystery organisms" are ambush predators, and their prey includes everything from insects to small fish and tadpoles.

If the pond organisms are larvae, rather than adults, Sarah should expect them to have all of the following structures, *except* _____.

- A) antennae
- B) an open circulatory system
- C) an exoskeleton of chitin
- D) sex organs

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 33.4

65) Use the following information to answer the question.

A farm pond, usually dry during winter, has plenty of water and aquatic pond life during the summer. One summer, Sarah returns to the family farm from college. Observing the pond, she is fascinated by some six-legged organisms that can crawl about on submerged surfaces or, when disturbed, seemingly "jet" through the water. Watching further, she is able to conclude that the "mystery organisms" are ambush predators, and their prey includes everything from insects to small fish and tadpoles.

Sarah observed that the mystery pond organisms never come up to the pond's surface. If she catches one of these organisms and observes closely, perhaps dissecting the organism, she should find _____.

- A) gills
- B) spiracles
- C) tracheae
- D) book lungs

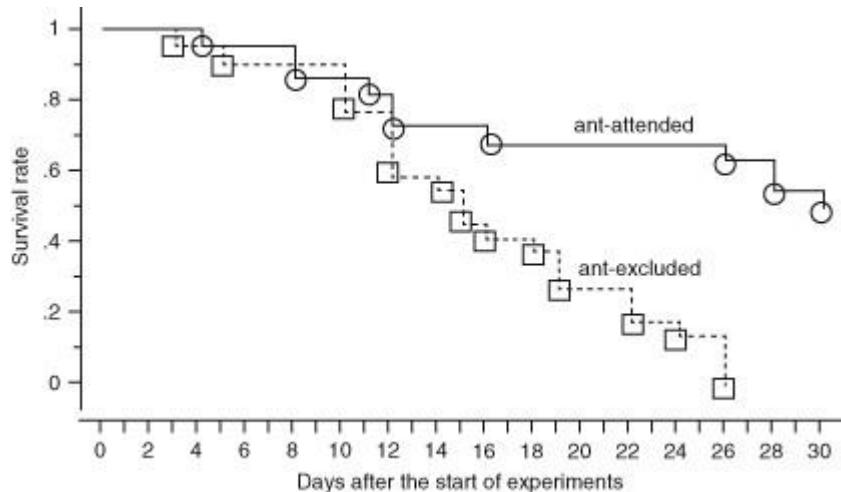
Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 33.4

66) Use the following information and figure to answer the question.

Aphids are Hemiptera that suck phloem liquid from plants. Ants are often seen tapping the posterior end of the aphid and collecting the liquid that is released from the aphid's digestive system. In an effort to understand this interaction, several researchers measure the survival rates of aphid populations when ants were present and when they were excluded. Their results are shown.



Which of the following conclusions is most likely correct?

- A) Ants derive nourishment from the aphids.
- B) Ants protect the aphids from predators.
- C) Ants parasitize the aphids.
- D) Ants feed the aphids.

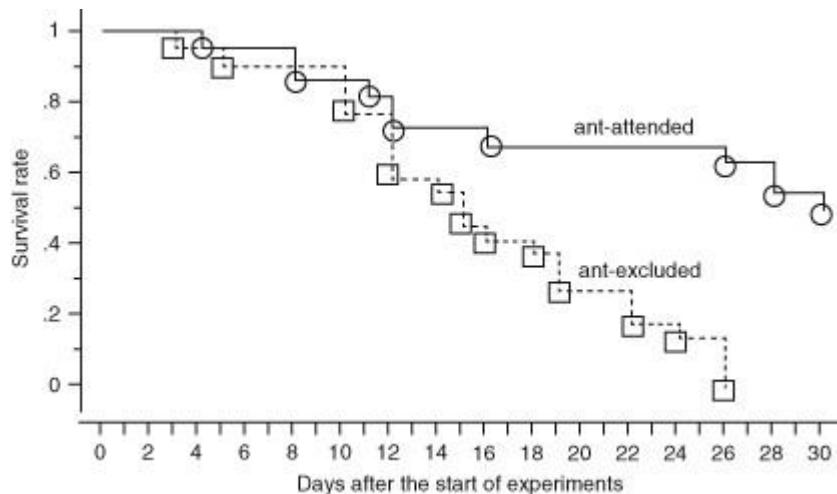
Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.4

67) Use the following information and figure to answer the question.

Aphids are Hemiptera that suck phloem liquid from plants. Ants are often seen tapping the posterior end of the aphid and collecting the liquid that is released from the aphid's digestive system. In an effort to understand this interaction, several researchers measure the survival rates of aphid populations when ants were present and when they were excluded. Their results are shown.



Imagine that you wished to discover if the ants protect the aphids from flying predators. You would exclude ants from the plants and count aphid population size under two conditions. Which of the following experiments would best help answer this question?

- A) plants covered by netting versus not covered by netting
- B) plants with stems coated at the base with a sticky substance versus not coated with a sticky substance
- C) plants with extra fertilizer and water versus no extra fertilizer and water
- D) plants sprayed with insecticide versus not sprayed with insecticide

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 33.4

68) Soft-shell crab is a prized dish in many ocean-side resorts. Why are the crabs' shells soft?

- A) The crab has just molted and the new exoskeleton has not yet hardened.
- B) These species of crabs live under rocks and therefore have lost the hard exoskeleton over evolutionary time.
- C) These species have evolved a light and soft exoskeleton so that gases can diffuse directly between body of the crab and the surrounding water.
- D) These species have evolved a light and soft exoskeleton so that they can float in the water column.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 33.4

69) Compared to insects with incomplete metamorphosis, insects with complete metamorphosis _____.

- A) grow more slowly in size
- B) use a greater variety of food resources
- C) have slower population growth rates
- D) have better abilities to escape from predators

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 33.4

70) The increase in plant species diversity allowed which of the following events?

- A) the evolution of complete metamorphosis in insects
- B) the evolution of flight in insects
- C) invasion of marine habitats by insects
- D) a massive increase in species diversity of insects

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.4

71) As you are walking along a beach, you find an animal and believe that it belongs to the class Asteroidea. Which of the following characteristics would support your hypothesis that the animal is a sea star and not another type of echinoderm?

- A) It is pentaradially symmetric.
- B) It feeds on other animals.
- C) It has a hydrostatic skeleton, formed from its water vascular system.
- D) Its central region is not well delineated from its appendages.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 33.5

72) The water vascular system of echinoderms _____.

- A) functions as a circulatory system that distributes nutrients to body cells
- B) functions in locomotion and feeding
- C) is bilateral in organization, even though the adult animal is not bilaterally symmetrical
- D) is analogous to the gastrovascular cavity of flatworms

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.5

73) Which of the following combinations correctly matches a phylum to its description?

- A) Echinodermata—bilateral symmetry as a larva, water vascular system
- B) Nematoda—segmented worms, closed circulatory system
- C) Cnidaria—flatworms, gastrovascular cavity, acelomate
- D) Platyhelminthes—radial symmetry, polyp and medusa body forms

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.5

74) Which of the following animal groups is entirely aquatic?

- A) Mollusca
- B) Crustacea
- C) Echinodermata
- D) Nematoda

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.5

75) Use the following information to answer the question.

An elementary school science teacher decided to liven up the classroom with a saltwater aquarium. Knowing that saltwater aquaria can be quite a hassle, the teacher proceeded stepwise. First, the teacher conditioned the water. Next, the teacher decided to stock the tank with various marine invertebrates, including a polychaete, a siliceous sponge, several bivalves, a shrimp, several sea anemones of different types, a colonial hydra, a few coral species, an ectoproct, a sea star, and several herbivorous gastropod varieties. Lastly, she added some vertebrates—a parrot fish and a clown fish. She arranged for daily feedings of copepods and feeder fish.

The bivalves started to die one by one; only the undamaged shells remained. To keep the remaining bivalves alive, the teacher would most likely need to remove the _____.

- A) sea anemones
- B) sea star
- C) gastropods
- D) ectoprocts

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 33.5

76) Which of the following statements is correct with respect to the evolutionary relationship between chordates and invertebrates?

- A) Chordates are most closely related to arthropods.
- B) Chordates evolved from echinoderms.
- C) Chordates are more closely related to echinoderms than to arthropods.
- D) Chordates are most closely related to the tunicate-type of echinoderms.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.5

77) Echinoderms show enormous diversity in which of the following traits?

- A) body shape and food habits
- B) food habits and body symmetry
- C) body symmetry and method of food digestion
- D) method of food digestion and body shape

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 33.5

33.2 Student Edition End-of-Chapter Questions

- 1) A land snail, a clam, and an octopus all share
A) a mantle.
B) a radula.
C) gills.
D) distinct cephalization.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 2) Which phylum is characterized by animals that have a segmented body?

- A) Cnidaria
B) Platyhelminthes
C) Arthropoda
D) Mollusca

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 3) The water vascular system of echinoderms

- A) functions as a circulatory system that distributes nutrients to body cells.
B) functions in locomotion and feeding.
C) is bilateral in organization, even though the adult animal is not bilaterally symmetrical.
D) moves water through the animal's body during filter feeding.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

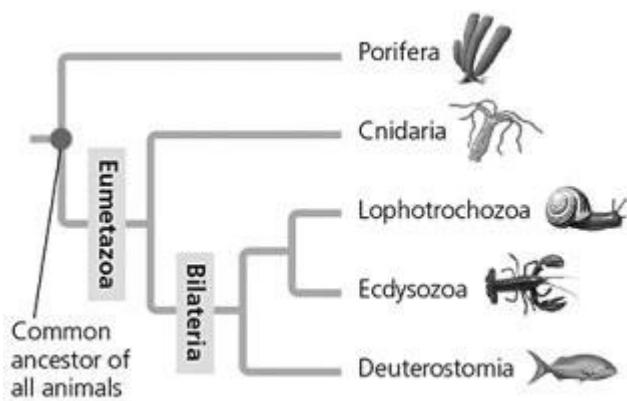
- 4) Which of the following combinations of phylum and description is *incorrect*?

- A) Echinodermata—bilateral symmetry as a larva, coelomate
B) Nematoda—roundworms, pseudocoelomate
C) Platyhelminthes—flatworms, gastrovascular cavity, acoelomate
D) Porifera—gastrovascular cavity, coelomate

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

5)



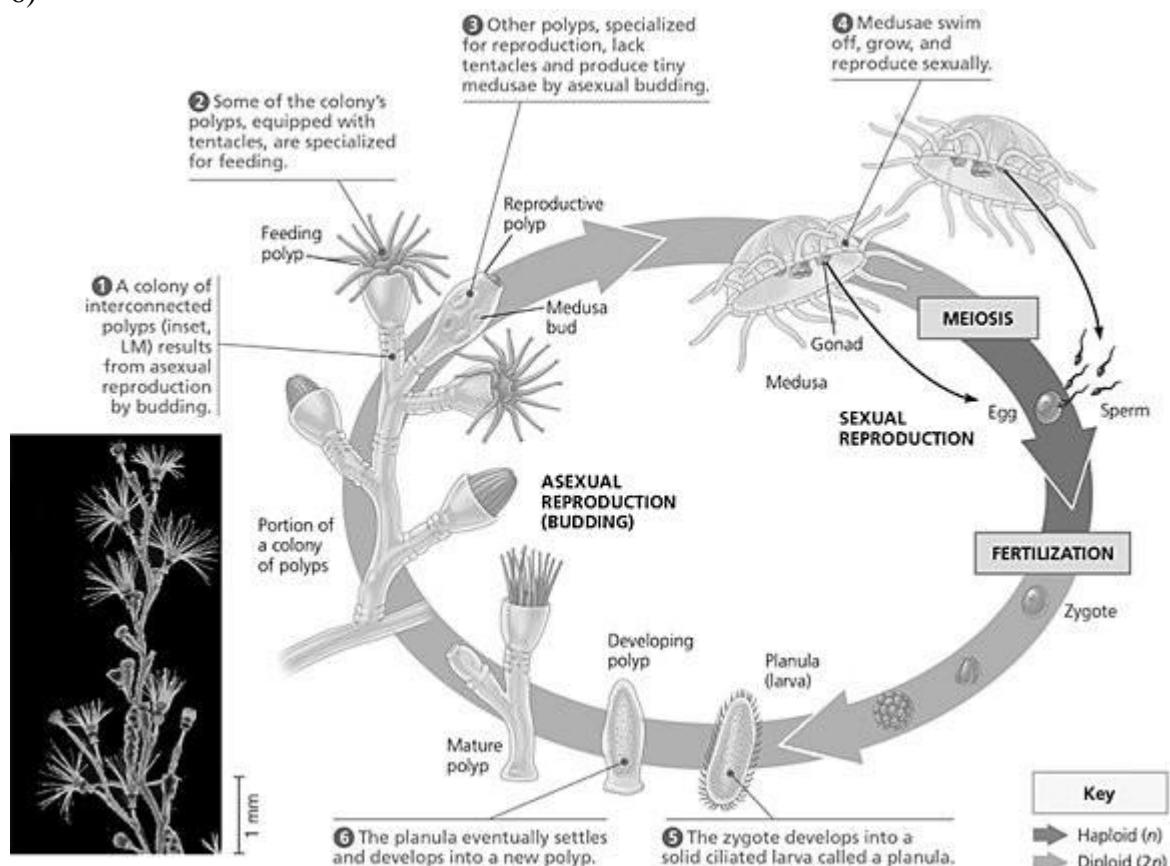
In Figure 33.2, which two main clades branch from the most recent common ancestor of the eumetazoans?

- A) Porifera and Cnidaria
- B) Lophotrochozoa and Ecdysozoa
- C) Cnidaria and Bilateria
- D) Deuterostomia and Bilateria

Answer: C

Bloom's Taxonomy: Application/Analysis

6)



In Figure 33.8, assume that the two medusae shown at step 4 were produced by one polyp colony. Review Concept 12.1 and Concept 13.3, and then use your understanding of mitosis and meiosis to evaluate whether the following sentence is true or false; if false, select the answer that provides the correct reason. *Although the two medusae are genetically identical, a sperm produced by one will differ genetically from an egg produced by the other.*

- A) False (both the medusae and the gametes are genetically identical)
 B) False (neither the medusae nor the gametes are genetically identical)
 C) False (the medusae are not identical but the gametes are)
 D) True

Answer: D

Bloom's Taxonomy: Application/Analysis

34.1 Multiple-Choice Questions

1) Which of the following is a characteristic of all chordates at some point during their life cycle?

- A) jaws
- B) post-anal tail
- C) four-chambered heart
- D) vertebrae

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.1

2) Why do adult urochordates (tunicates) lack notochords, even though larval urochordates have them? Larvae use notochords to _____.

- A) aid in swimming; adults are sessile and thus no longer propel themselves
- B) stiffen their bodies; in adults, the notochord is replaced by a column of bone
- C) induce tissue differentiation; in adults, tissue is already differentiated
- D) organize their nervous systems; adults' nervous systems are fully developed and do not change

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 34.1

3) If a tunicate's pharyngeal gill slits were suddenly blocked, the animal would have trouble _____.

- A) respiring
- B) feeding
- C) moving
- D) respiring and feeding

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 34.1

4) Chordate pharyngeal slits appear to have functioned first as _____.

- A) the digestive system's opening
- B) suspension-feeding devices
- C) components of the jaw
- D) sites of respiration

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.1

- 5) Which of the following statements would be *most* acceptable to most zoologists?
- A) The first fossils resembling lancelets appeared in the fossil record around 10 million years ago.
 - B) Recent work in molecular systematics supports the hypothesis that lancelets are the basal clade of chordates.
 - C) The extant lancelets are the immediate ancestors of the fishes.
 - D) Lancelets do not swim in the same way that fishes do.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.1

- 6) Which extant chordates are postulated to be most like the earliest chordates in appearance?
- A) lancelets
 - B) adult tunicates
 - C) amphibians
 - D) chondrichthyans

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.1

- 7) Vertebrates and tunicates share _____.
A) jaws adapted for feeding
B) a high degree of cephalization
C) the formation of structures from the neural crest
D) a notochord and a dorsal, hollow nerve cord

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.1

- 8) All chordates studied to date, except tunicates, share a set of _____.
A) 13 *Hox* genes
B) 5 *Dlx* genes
C) 9 *Otx* genes
D) 7 *FOXP2* genes

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.1

- 9) Which of the following characteristics is shared by a hagfish and a lamprey?
A) a rasping tongue
B) paired fins
C) jaws
D) a well-developed notochord

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 34.2

10) A new species of aquatic chordate is discovered that closely resembles an ancient form. It has the following characteristics: external armor of bony plates, no paired lateral fins, and a suspension-feeding mode of nutrition. In addition to these, it will probably have which of the following characteristics?

- A) legs
- B) no jaws
- C) an amniotic egg
- D) endothermy

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 34.2

11) The earliest known mineralized structures in vertebrates are associated with _____.

- A) feeding
- B) locomotion
- C) defense
- D) respiration

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.2

12) A team of researchers has developed a poison that has proven effective against lamprey larvae in freshwater cultures. The poison is ingested and causes paralysis by detaching segmental muscles from the skeletal structures. The team wants to test the poison's effectiveness in streams flowing into Lake Michigan, but one critic worries about potential effects on lancelets, which are similar to lampreys in many ways. Why is this concern misplaced?

- A) Lamprey larvae and lancelets have very different feeding mechanisms.
- B) Lancelets do not have segmental muscles.
- C) Lancelets live only in saltwater environments.
- D) Lancelets and lamprey larvae eat different kinds of food.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 34.2

13) To reproduce, many plants produce seeds—structures containing embryonic offspring along with nutrients inside a tough coat. These offspring develop after being released by the parent plant. To which animal reproductive "strategy" is seed production most comparable?

- A) oviparous reproduction
- B) ovoviviparous reproduction
- C) viviparous reproduction
- D) internal development and ballistic dispersal

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 34.3

- 14) Why do skates and rays have flattened bodies, while sharks are torpedo shaped?
- A) Sharks are more closely related to the tube-like lampreys than are skates and rays.
 - B) Skates and rays need enlarged pectoral fins to help them stay level in turbulent water, while sharks do not.
 - C) Skates and rays exchange gases across their skin and thus require a high surface-area-to-volume ratio, while sharks use gills to respire.
 - D) Sharks are streamlined for active swimming at mid-depths, while skates move about mostly on the ocean bed.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 34.3

- 15) Which of these statements accurately describes a similarity between sharks and ray-finned fishes?

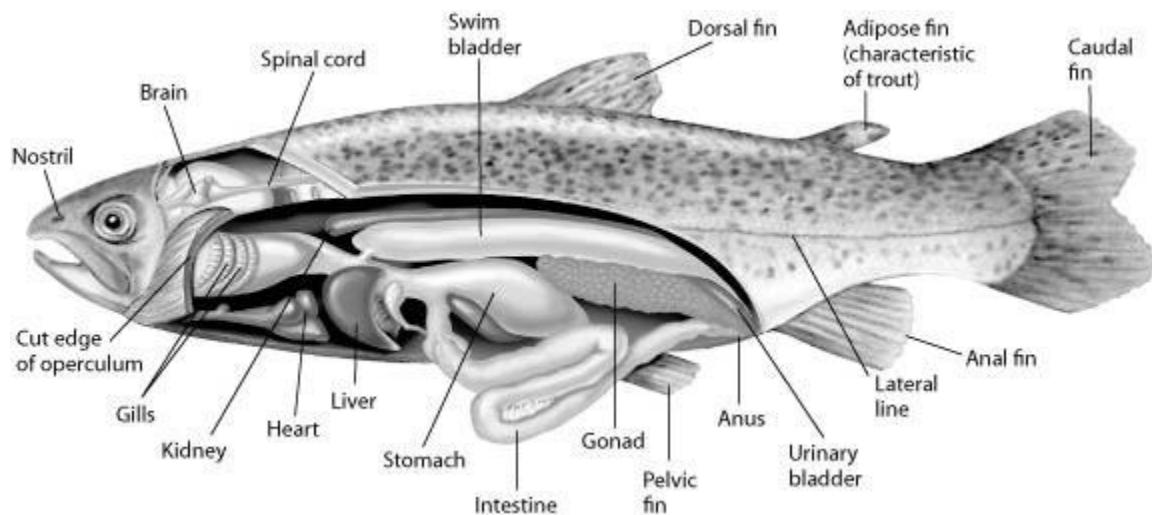
- A) They are equally able to exchange gases with the environment while stationary.
- B) They are highly maneuverable due to their flexibility.
- C) They have a lateral line that is sensitive to vibrations.
- D) A swim bladder helps control buoyancy.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.3

16) Use the following figure and information to answer the question.



Fishes that have swim bladders can regulate their density and, thus, their buoyancy. There are two types of swim bladder: physostomous and physoclistous. The ancestral version is the physostomous version, in which the swim bladder is connected to the esophagus via a short tube (see the figure). The fish fills this version by swimming to the surface, taking gulps of air, and directing them into the swim bladder. Air is removed from this version by "belching." The physoclistous version is more derived and has lost its connection to the esophagus. Instead, gas enters and leaves the swim bladder via special circulatory mechanisms within the wall of the swim bladder.

The presence of a swim bladder allows the typical ray-finned fish to stop swimming and still _____.

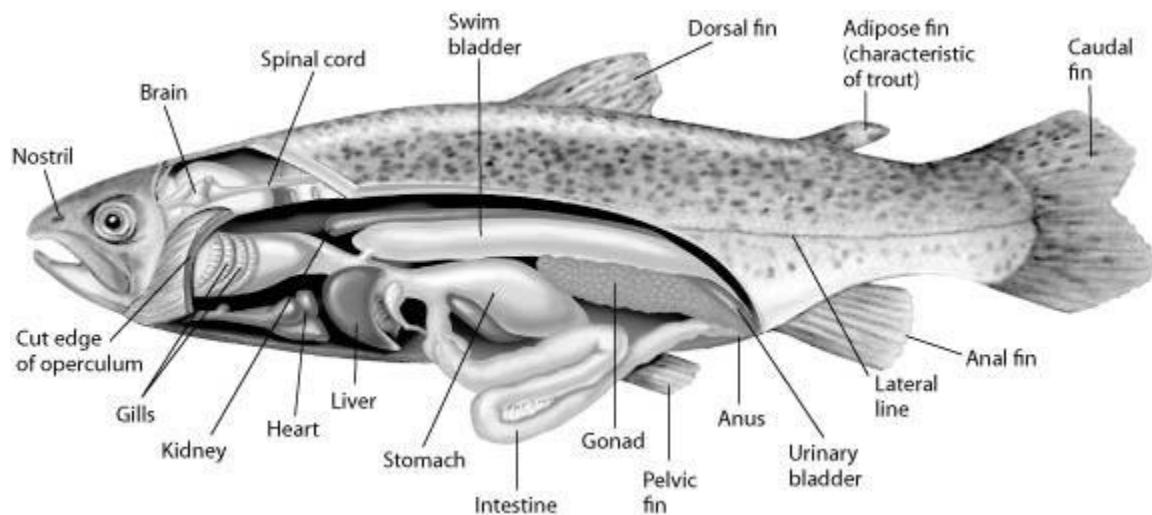
- A) effectively circulate its blood
- B) use its lateral line system
- C) use its swim bladder as a respiratory organ
- D) not sink

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.3

17) Use the following figure and information to answer the question.



Fishes that have swim bladders can regulate their density and, thus, their buoyancy. There are two types of swim bladder: physostomous and physoclistous. The ancestral version is the physostomous version, in which the swim bladder is connected to the esophagus via a short tube (see the figure). The fish fills this version by swimming to the surface, taking gulps of air, and directing them into the swim bladder. Air is removed from this version by "belching." The physoclistous version is more derived and has lost its connection to the esophagus. Instead, gas enters and leaves the swim bladder via special circulatory mechanisms within the wall of the swim bladder.

Which shark structure is closest in function to a swim bladder full of gas?

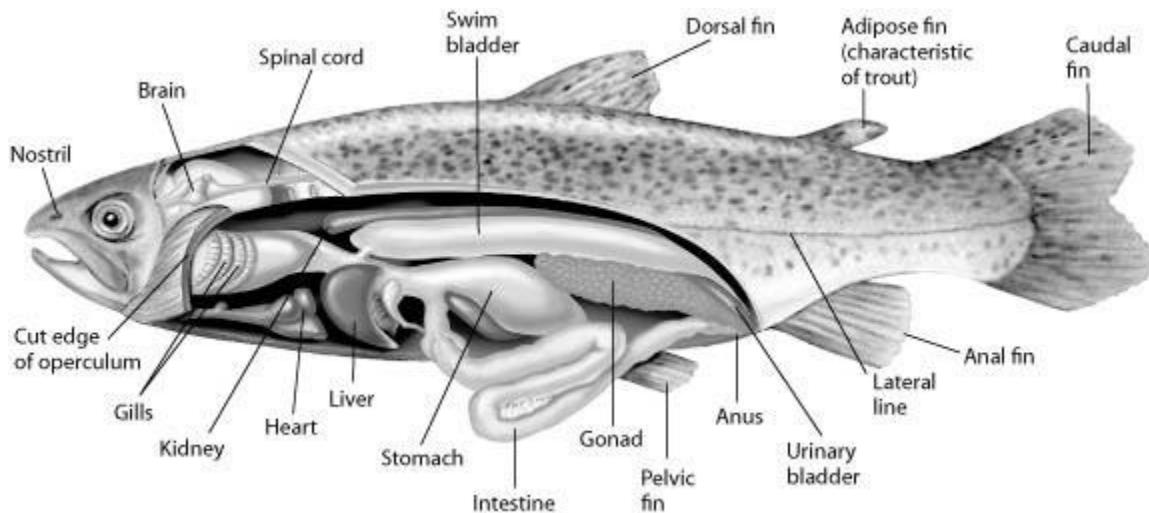
- A) its lateral line system
- B) its spiral valve
- C) its liver
- D) its gills

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 34.3

18) Use the following figure and information to answer the question.



Fishes that have swim bladders can regulate their density and, thus, their buoyancy. There are two types of swim bladder: physostomous and physoclistous. The ancestral version is the physostomous version, in which the swim bladder is connected to the esophagus via a short tube (see the figure). The fish fills this version by swimming to the surface, taking gulps of air, and directing them into the swim bladder. Air is removed from this version by "belching." The physoclistous version is more derived and has lost its connection to the esophagus. Instead, gas enters and leaves the swim bladder via special circulatory mechanisms within the wall of the swim bladder.

If a ray-finned fish is to both hover (remain stationary) in the water column and ventilate its gills effectively, then what other structure besides its swim bladder will it use?

- A) its pectoral fins
- B) its lateral line system
- C) its caudal (tail) fin
- D) its operculum

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.3

19) How did the evolution of the jaw contribute to diversification of early vertebrate lineages?

- A) It allowed for smaller body size.
- B) It was the first stage in the development of a bony skull.
- C) It made additional food sources available.
- D) It increased the surface area for respiration and feeding.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.3

20) It is believed that the coelacanths and lungfish represent a crucial link between other fishes and tetrapods. What is the major feature in these fish in support of this hypothesis?

- A) Like amphibians, they are tied to the water for reproduction.
- B) Their fins have skeletal and muscular structures similar to amphibian limbs.
- C) They have highly evolved nervous and circulatory systems.
- D) They have lungs and are able to breathe air when water is scarce.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 34.4

21) Jaws first occurred in which extant group of fishes?

- A) lampreys
- B) chondrichthyans
- C) ray-finned fishes
- D) placoderms

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.3

22) Which of these might have been observed in the common ancestor of chondrichthyans and osteichthyans?

- A) a mineralized, bony skeleton
- B) opercula
- C) a spiral valve intestine
- D) a swim bladder

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.3

23) Arrange these groups in order from most inclusive (most general) to least inclusive (most specific).

- A) osteichthyans, gnathostomes, lobe-fins, tetrapods, amphibians
- B) osteichthyans, gnathostomes, amphibians, tetrapods, lobe-fins
- C) gnathostomes, osteichthyans, lobe-fins, tetrapods, amphibians
- D) gnathostomes, osteichthyans, tetrapods, lobe-fins, amphibians

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.1

24) At one time, Chondrichthyes were thought to have split off from other vertebrates before the evolution of bone. Now we have concluded that the Chondrichthyes split off after the evolution of bone had started. This change demonstrates _____.

- A) characteristics can be lost in evolution
- B) evolution is one-way and straight line
- C) hagfishes and lampreys have ancestors with bone
- D) cartilage contributes to keeping sharks light so they do not sink

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 34.3

25) At one time, Chondrichthyes were thought to have split off from other vertebrates before the evolution of bone. Now we have concluded that the Chondrichthyes split off after the evolution of bone had started. This change demonstrates _____.

- A) as new evidence emerges, scientists revise their hypotheses
- B) scientists develop hypotheses and only accept data that confirm their hypotheses
- C) revisions of hypotheses take many years
- D) scientists accept the simplest hypotheses

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 34.3

26) Guppies are a common aquarium fish. They have internal fertilization, and females give birth to young that can swim immediately. Which of the following statements is correct?

- A) Most fish reproduce like guppies.
- B) Guppies reproduce by producing swimming young because they are related to marsupials.
- C) Most fish reproduce by laying eggs.
- D) Most fish produce amniote eggs.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.3

27) Scientific views are based on evidence rather than an appeal to authority. Which of the following statements demonstrates a conclusion based on evidence?

- A) We conclude that lungs evolved before swim bladders because a study of branching patterns shows that some of the oldest lineages of Osteichthyes have lungs.
- B) We conclude that lungs evolved before swim bladders because Darwin wrote that swim bladders evolved before lungs in *The Origin of Species*.
- C) We conclude that lungs evolved before swim bladders because the oldest osteichthyan fossils show lungs arising before swim bladders.
- D) We conclude that lungs evolved before swim bladders because *Hox* genes direct the evolution of swim bladders but not of lungs.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 34.3

- 28) Scientific views are based on evidence rather than an appeal to authority. Which of the following statements demonstrates a conclusion based on an appeal to authority?
- A) We conclude that lungs evolved before swim bladders because a study of branching patterns show that some of the oldest lineages of Osteichthyes have lungs.
 - B) We conclude that lungs evolved before swim bladders because Darwin wrote that swim bladders evolved before lungs in *The Origin of Species*.
 - C) We conclude that lungs evolved before swim bladders because the oldest osteichthyan fossils show lungs arising before swim bladders.
 - D) We conclude that lungs evolved before swim bladders because *Hox* genes direct the evolution of swim bladders but not of lungs.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 34.3

- 29) Which of the following characteristics allowed early gnathostomes to become successful predators?
- A) fins stiffened with bone that increased maneuverability and improved gas exchange through the skin
 - B) fins stiffened with bone that increased maneuverability and improved gas exchange in the gills
 - C) lobe fins that allowed temporary access to land and improved gas exchange through the skin
 - D) lobe fins that allowed temporary access to land and improved gas exchange in the gills

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.3

- 30) Suppose, while out camping in a forest, you found a chordate with a long, slender, limbless body slithering across the ground near your tent. This critter could be _____.
A) a lamprey
B) a mammal
C) an amphibian
D) a skate

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 34.4

31) Use the following information to answer the question.

While on an intersession course in tropical ecology, Kris pulls a large, snakelike organism from a burrow (the class was granted a collecting permit). The 1-meter-long organism has smooth skin, which appears to be segmented. It has two tiny eyes that are hard to see because they seem to be covered by skin. Kris brings it back to the lab at the field station, where it is a source of puzzlement to the class. Kris says that it is a giant oligochaete worm; Shaun suggests it is a legless amphibian; Kelly proposes it belongs to a snake species that is purely fossorial (lives in a burrow).

The class decided to humanely euthanize the organism and subsequently dissect it. Having decided that it was probably not a reptile, two of their original hypotheses regarding its identity remained. Which of the following, if observed, should help them arrive at a conclusive answer?

- A) presence of moist, highly vascularized skin
- B) presence of lungs
- C) presence of a nerve cord
- D) presence of a digestive system with two openings

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 34.4

32) Use the following information to answer the question.

While on an intersession course in tropical ecology, Kris pulls a large, snakelike organism from a burrow (the class was granted a collecting permit). The 1-meter-long organism has smooth skin, which appears to be segmented. It has two tiny eyes that are hard to see because they seem to be covered by skin. Kris brings it back to the lab at the field station, where it is a source of puzzlement to the class. Kris says that it is a giant oligochaete worm; Shaun suggests it is a legless amphibian; Kelly proposes it belongs to a snake species that is purely fossorial (lives in a burrow).

The organism was found to have two lungs, but the left lung was much smaller than the right lung. Kelly added that the herpetology instructor had said that in most snakes, the same condition exists. If the size difference between the lungs in this organism is *not* a shared ancestral characteristic with its occurrence in snakes, then its existence in this organism is explained as which of the following?

- A) a result of convergent evolution
- B) a result of convergent evolution and a similar adaptation to a shared lifestyle or body plan
- C) an example of homologous structures and a similar adaptation to a shared lifestyle or body plan
- D) a similar adaptation to a shared lifestyle or body plan and a result of having identical *Hox* genes

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 34.4

- 33) Which of the following could be considered the most recent common ancestor of living tetrapods?
- A) a sturdy-finned, shallow-water lobe-fin whose appendages had skeletal supports similar to those of terrestrial vertebrates
 - B) an armored, jawed placoderm with two pairs of appendages
 - C) an early ray-finned fish that developed bony skeletal supports in its paired fins
 - D) a salamander that had legs supported by a bony skeleton but moved with the side-to-side bending typical of fishes

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.4

- 34) A trend first observed in the evolution of the earliest tetrapods was _____.

- A) the appearance of jaws
- B) feet with digits
- C) the mineralization of the endoskeleton
- D) the amniotic egg

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.4

- 35) Ancient fossils that seem to be an intermediate stage in the evolution from fish to tetrapods had which of the following characteristics?

- A) fins and scales like a fish but ribs to support the body and a bone structure in the front limb like tetrapods
- B) a pelvis and rear limbs like a fish and gills like a tetrapod
- C) bones that allowed the head to move like a fish and both gills and lung like a tetrapod
- D) scales and a tail like a fish and a simple bone arrangement in the back limb like a tetrapod

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.4

- 36) Fossils of the earliest tetrapods should _____.

- A) show evidence of internal fertilization
- B) show evidence of having produced shelled eggs
- C) indicate limited adaptation to life on land
- D) feature the earliest indications of the appearance of jaws

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.4

37) Use the following information to answer the question.

Terry catches a ray-finned fish from the ocean and notices that attached to its flank is an equally long, snakelike organism. The attached organism has no external segmentation, no scales, a round mouth surrounded by a sucker, and two small eyes. Terry concludes it is a hagfish.

Terry saved some of the tooth-like objects within the hagfish's round mouth to analyze their composition in his mentor's biochemistry research lab. Terry will find that they are composed of the same protein found in tetrapod _____.

- A) scales
- B) teeth
- C) bones
- D) cartilage

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 34.5

38) What is believed to be the most significant result of the evolution of the amniotic egg?

- A) Tetrapods are no longer tied to the water for reproduction.
- B) Tetrapods can now function with just lungs.
- C) Newborns are much less dependent on their parents.
- D) Embryos are protected from predators.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 34.5

39) Which structure of the amniotic egg most closely surrounds the embryo?

- A) the chorion
- B) the yolk sac
- C) the allantois
- D) the amnion

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.5

40) The evolution of similar insulating skin coverings such as fur, hair, and feathers in mammals and birds is a result of _____.

- A) shared ancestry
- B) convergent evolution
- C) homology
- D) evolutionary divergence

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 34.5

41) Which of the following characteristics evolved independently in mammals and birds?

- A) amniotic eggs
- B) jaws
- C) bone
- D) endothermy

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 34.5

42) Suppose you traveled back in time and located the first animals to have evolved feathers. You found that these animals were tree-dwelling ectotherms, able to run quickly but unable to fly. You also noticed that only males had feathers. Which hypothesis of feather evolution would these data most support? Feathers initially evolved in a role associated with _____.

- A) flight
- B) insulation
- C) courtship behavior
- D) gliding

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 34.5

43) Mammals and birds eat more often than reptiles. Which of the following traits shared by mammals and birds best explains this habit?

- A) endothermy
- B) ectothermy
- C) amniotic egg
- D) terrestrial habitat

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 34.5

44) Which characteristic is common to all the modern representatives of all major reptilian lineages (turtles, lepidosaurs, crocodilians, and birds)?

- A) presence of teeth
- B) presence of four walking limbs
- C) ectothermy
- D) presence of a notochord

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 34.5

45) Which of these are amniotes?

- A) amphibians
- B) fishes
- C) turtles
- D) lungfish

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.5

46) Use the following information to answer the question.

Due to its system of air sacs connected to the lungs, the respiratory system of birds is arguably the most effective respiratory system of all air-breathers. Upon inhalation, air first flows into posterior air sacs, then into the lungs, and then into anterior air sacs on the way to being exhaled. Thus, there is one-way flow of air through the lungs, along thousands of tubules called parabronchi.

If the inner lining of the air sacs is neither thin nor highly vascularized, then what can be inferred about the air sacs?

- A) They must not belong to the respiratory system.
- B) They cannot be derived from endoderm.
- C) They are not efficient sites of gas exchange between air and blood.
- D) They cannot effectively moisturize the air before it reaches the lungs.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 34.5

47) Use the following information to answer the question.

Due to its system of air sacs connected to the lungs, the respiratory system of birds is arguably the most effective respiratory system of all air-breathers. Upon inhalation, air first flows into posterior air sacs, then into the lungs, and then into anterior air sacs on the way to being exhaled. Thus, there is one-way flow of air through the lungs, along thousands of tubules called parabronchi.

The one-way flow of air along parabronchi makes what type of gas exchange mechanism possible, at least theoretically?

- A) the same as that occurring in fish gills
- B) the same as that occurring in insect tracheae
- C) the same as that occurring in mammalian lungs
- D) the same as that occurring in echinoderm skin gills

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 34.5

48) Which of these characteristics contributed the most to vertebrate success in relatively dry environments?

- A) the shelled, amniotic egg
- B) the ability to maintain a constant body temperature
- C) two pairs of appendages
- D) a four-chambered heart

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.5

49) Which of the following are the only extant animals that descended directly from dinosaurs?

- A) lizards
- B) crocodiles
- C) birds
- D) tuataras

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.5

50) During chordate evolution, what is the sequence (from earliest to most recent) in which the following structures arose?

- A) paired fins, jaws, swim bladder, amniotic egg, four-chambered heart
- B) jaws, paired fins, swim bladder, four-chambered heart, amniotic egg
- C) jaws, paired fins, swim bladder, four-chambered heart
- D) paired fins, amniotic egg, four-chambered heart, jaws, swim bladder

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.5

51) Which clade does *not* include humans?

- A) lobe-fins
- B) diapsids
- C) amniotes
- D) osteichthyans

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.5

52) At one time, birds held the same taxonomic rank as Reptilia and Mammalia. Now, however, they are considered as part of the reptile clade. Without this change, _____.

- A) birds would be considered Mammalia because both groups are endothermic
- B) birds would be classified according to traits that were convergently evolved
- C) Reptilia would be paraphyletic
- D) Reptilia would be monophyletic

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 34.5

53) Birds are descended from species that laid eggs in water. It could be argued that embryos of birds still develop in water because _____.

- A) the shell keeps the embryo from drying out
- B) the amnion encases each embryo in water
- C) the chorion, allantois, and yolk sac provide embryos with nutrients and waste disposal
- D) the amnion protect the embryo in the same way that a seed coat protects plant embryos of flowering plants

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 34.5

54) Which of the following types of evidence would be useful in understanding if the impact of a comet caused the extinction of the dinosaurs?

- A) more DNA analyses
- B) more comparison of skeletal structures
- C) more phylogenetic studies
- D) more detailed collection of fossils

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 34.5

55) Primate evolution and behavior, such as hunting skills, have been directed in part by the development of depth perception. What anatomical change made depth perception possible?

- A) a larger brain
- B) the formation of compound eyes
- C) location of the eyes at the front of the head
- D) diurnal activity

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 34.6

56) What group of mammals have (a) embryos that spend more time feeding through the placenta than the mother's nipples, (b) young that feed on milk, and (c) a prolonged period of maternal care after leaving the placenta?

- A) Eutheria
- B) Marsupiala
- C) Monotremata
- D) Lagomorpha

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 34.6

- 57) Which of the following represents the strongest evidence that two of the three middle ear bones of mammals are homologous to certain reptilian jawbones?
- A) They are similar in size to the reptilian jawbones.
 - B) They are similar in shape to the reptilian jawbones.
 - C) The mammalian jaw has fewer bones than does the reptilian jaw.
 - D) These bones can be observed to move from the developing jaw to the developing middle ear in mammalian embryos.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 34.6

- 58) Which of the following is the most inclusive (most general) group in which all of the members have fully opposable thumbs?

- A) apes
- B) *Homo*
- C) anthropoids
- D) primates

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.6

- 59) Which of these would a paleontologist most likely do to determine if a fossil represents a reptile or a mammal?

- A) Look for the presence of milk-producing glands.
- B) Look for the mammalian characteristics of a four-chambered heart and a diaphragm.
- C) Use molecular analysis to look for the protein keratin.
- D) Examine the teeth.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 34.6

- 60) Female birds lay their eggs, thereby facilitating flight by reducing weight. Which "strategy" seems most likely for female bats to use to achieve the same goal?

- A) limit litters to a single embryo
- B) refrain from flying throughout pregnancy (about six weeks long)
- C) give birth to underdeveloped young, and subsequently carry them in a pouch that has teats
- D) feed multiple embryos internally using placentas

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 34.6

61) Unlike eutherians, *both* monotremes and marsupials _____.

- A) lack nipples
- B) have some embryonic development outside the uterus
- C) lay eggs
- D) are found in Australia and Africa

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.6

62) Which of the following statements about the geographic distribution of marsupials is accurate?

- A) they occur only in Australia and New Guinea
- B) they occur on all continents except Antarctica
- C) they occur in Australia and the Americas
- D) they occur only in Africa

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.6

63) Marsupials survived in Australia (as opposed to Asia) because _____.

- A) marsupials were better adapted to the climatic conditions of Australia than were eutherians
- B) marsupials were, and are, better competitors than eutherians
- C) Australia had separated from Pangea, and eutherians were not able to invade Australia
- D) continental drift, caused by plate tectonic processes, allowed eutherians to invade Asia and the Americas

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 34.6

64) On the back of your skull you can feel a small bump, below which is an opening where the spinal cord enters the skull. The location of this opening toward the bottom of the skull is significant in evolutionary biology for what reason?

- A) It allowed for the hominin brain to grow much larger than other primates.
- B) It provided greater protection for the spinal cord.
- C) It occurred as a result of the change to a bipedal stance.
- D) This change was necessary for the increase in size from prosimian forms to anthropoid forms.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 34.7

65) Use the following information to answer the question.

Brown et al. and Morwood et al. reported in 2004 that they had found skeletal remains of a previously unknown type of hominin, now dubbed *Homo floresiensis*, on the Indonesian island of Flores. These hominins were small (approximately 1 meter tall) with small braincases (approximately 380 cubic centimeters) as compared with other hominins. The remains of *H. floresiensis* were found alongside handmade stone tools and the remains of dwarf elephants that also inhabited the island, suggesting that *H. floresiensis* was able both to make tools and to coordinate the hunting of animals much larger than itself. *H. floresiensis* is estimated to have lived at the site where the remains were found from at least 38,000 years ago to 18,000 years ago.

Which would be the most feasible method of figuring out to which other hominin species *H. floresiensis* was most closely related?

- A) Compare the type of prey hunted by *H. floresiensis* to that hunted by each of the other hominin species.
- B) Compare the average body size of *H. floresiensis* to that of each of the other hominin species.
- C) Compare the skeletal morphology of *H. floresiensis* to that of each of the other hominin species.
- D) Compare the estimated life span of *H. floresiensis* to that of each of the other hominin species.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 34.7

66) In what respect do hominins differ from all other anthropoids?

- A) lack of a tail
- B) eyes on the front of the face
- C) bipedal posture
- D) opposable thumbs

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.7

67) Use the following information to answer the question.

Brown et al. and Morwood et al. reported in 2004 that they had found skeletal remains of a previously unknown type of hominin, now dubbed *Homo floresiensis*, on the Indonesian island of Flores. These hominins were small (approximately 1 meter tall) with small braincases (approximately 380 cubic centimeters) as compared with other hominins. The remains of *H. floresiensis* were found alongside handmade stone tools and the remains of dwarf elephants that also inhabited the island, suggesting that *H. floresiensis* was able both to make tools and to coordinate the hunting of animals much larger than itself. *H. floresiensis* is estimated to have lived at the site where the remains were found from at least 38,000 years ago to 18,000 years ago.

Species	Location of Fossils	Estimated Average Braincase Volume (cm ³)	Estimated Average Body Mass (kg)	Associated with Stone Tools?
<i>Australopithecus afarensis</i>	Africa	450	36	No
<i>A. africanus</i>	Africa	450	36	No
<i>Paranthropus boisei</i>	Africa	510	44	No?
<i>Homo habilis</i>	Africa	550	34	yes
<i>H. ergaster</i>	Africa	850	58	yes
<i>H. erectus</i>	Africa, Asia	1000	57	yes
<i>H. heidelbergensis</i>	Africa, Europe	1200	62	yes
<i>H. neanderthalensis</i>	Middle East, Europe, Asia	1500	76	yes
<i>H. floresiensis</i>	Asia	380	16-36	yes
<i>H. sapiens</i>	Middle East, Europe, Asia	1350	53	yes

The table is a comparison of several characteristics of *H. floresiensis* to those of nine other hominin species (arranged roughly from oldest to most recent). What do these data suggest?

- A) A large brain is not necessarily required for toolmaking.
- B) Body mass and braincase volume are completely unrelated.
- C) Hominins first evolved in and then radiated out from Asia.
- D) *Homo floresiensis* is most closely related to *Australopithecus afarensis* or *A. africanus*.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 34.7

68) Use the following information to answer the question.

Brown et al. and Morwood et al. reported in 2004 that they had found skeletal remains of a previously unknown type of hominin, now dubbed *Homo floresiensis*, on the Indonesian island of Flores. These hominins were small (approximately 1 meter tall) with small braincases (approximately 380 cubic centimeters) as compared with other hominins. The remains of *H. floresiensis* were found alongside handmade stone tools and the remains of dwarf elephants that also inhabited the island, suggesting that *H. floresiensis* was able both to make tools and to coordinate the hunting of animals much larger than itself. *H. floresiensis* is estimated to have lived at the site where the remains were found from at least 38,000 years ago to 18,000 years ago.

It is speculated that *H. floresiensis* and *H. sapiens* may have lived on Flores concurrently. Suppose researchers obtained mitochondrial DNA samples from the *H. floresiensis* remains, amplified a 1,000-base-pair sequence via PCR, and compared it to that of several currently living *H. sapiens* native to Indonesia, North Africa, and North America. Also suppose *H. floresiensis* were found to differ from the average Indonesian *H. sapiens* in 28 base pairs, from the average North African *H. sapiens* in 51 base pairs, and from the average North American *H. sapiens* in 53 base pairs, while two randomly selected *H. sapiens* differed from each other in an average of 21 base pairs. What would you surmise from these data?

- A) *H. floresiensis* and *H. sapiens* probably did not live on Flores concurrently.
- B) *H. floresiensis* and *H. sapiens* probably lived on Flores concurrently but did not interact.
- C) *H. floresiensis* and *H. sapiens* probably lived on Flores concurrently, and *H. sapiens* killed and consumed *H. floresiensis*.
- D) *H. floresiensis* and *H. sapiens* probably lived on Flores concurrently and interbred to some degree.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 34.7

69) Arrange the following taxonomic terms in order from most inclusive (most general) to least inclusive (most specific).

- A) primates, apes, anthropoids, hominins, *Homo*
- B) primates, anthropoids, apes, hominins, *Homo*
- C) primates, anthropoids, hominins, *Homo*
- D) primates, hominins, apes, anthropoids, *Homo*

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.7

70) Which of these traits is most strongly associated with the adoption of bipedalism?

- A) enhanced depth perception
- B) shortened hind limbs
- C) opposable big toe
- D) repositioning of foramen magnum

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.7

71) Which of the following statements about human evolution is correct?

- A) Modern humans are the only human species to have evolved on Earth.
- B) Human ancestors were virtually identical to extant chimpanzees.
- C) Human evolution has occurred within an unbranched lineage.
- D) The upright posture and enlarged brain of humans evolved separately.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.7

72) With which of the following statements would a biologist be most inclined to agree?

- A) Humans and other apes represent divergent lines of evolution from a common ancestor.
- B) Humans represent the pinnacle of evolution and have escaped from being affected by natural selection.
- C) Humans evolved from chimpanzees.
- D) Humans and other apes are the result of disruptive selection in a species of chimpanzee.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 34.7

73) Which of the following taxonomic groups is the most successful?

- A) Fungi are the most successful, based on their ability to digest cellulose, the most common organic compound on Earth.
- B) Bony fishes are the most successful, based on their high species diversity (almost as many as all other vertebrates combined).
- C) Mammals are the most successful, based on their complex mode of reproduction.
- D) All extant species are successful, based on their continuing existence.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.7

74) Which of the following characteristics occur in *Homo naledi*?

- A) large brain, feet that allowed bipedal walking, hands able to manipulate small objects
- B) large brain, feet that allowed occasional erect posture, hands able to manipulate small objects
- C) small brain, feet that allowed bipedal walking, hands able to manipulate small objects
- D) small brain, feet that allowed bipedal walking, hands able to swing from branch to branch

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 34.7

75) The history of hominin evolution demonstrates _____.

- A) unrelated traits (that is, characters of skulls and hips/feet) evolve together
- B) unrelated traits can evolve at different rates
- C) the decrease in rainfall favored maintaining the ability to climb trees
- D) the increase in rainfall favored the ability to walk upright

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 34.7

76) Many sentences in this chapter include the words "may suggest." This phrase indicates that _____.

- A) causality of a pattern is uncertain
- B) there is no cause-and-effect association
- C) the author is explaining a well-established relationship
- D) scientists agree on the cause of a pattern

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 34.7

34.2 Student Edition End-of-Chapter Questions

1) Vertebrates and tunicates share

- A) jaws adapted for feeding.
- B) a high degree of cephalization.
- C) an endoskeleton that includes a skull.
- D) a notochord and a dorsal, hollow nerve cord.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

2) Living vertebrates can be divided into two major clades. Select the appropriate pair.

- A) the chordates and the tetrapods
- B) the urochordates and the cephalochordates
- C) the cyclostomes and the gnathostomes
- D) the marsupials and the eutherians

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

3) Unlike eutherians, *both* monotremes and marsupials

- A) lack nipples.
- B) have some embryonic development outside the uterus.
- C) lay eggs.
- D) are found in Australia and Africa.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

4) Which clade does *not* include humans?

- A) synapsids
- B) lobe-fins
- C) diapsids
- D) osteichthyans

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

5) As hominins diverged from other primates, which of the following appeared first?

- A) reduced jawbones
- B) an enlarged brain
- C) the making of stone tools
- D) bipedal locomotion

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

6) Which of the following could be considered the most recent common ancestor of living tetrapods?

- A) a sturdy-finned, shallow-water lobe-fin whose appendages had skeletal supports similar to those of terrestrial vertebrates
- B) an armored, jawed placoderm with two pairs of appendages
- C) an early ray-finned fish that developed bony skeletal supports in its paired fins
- D) a salamander that had legs supported by a bony skeleton but moved with the side-to-side bending typical of fishes

Answer: A

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 35 Vascular Plant Structure, Growth, and Development

35.1 Multiple-Choice Questions

1) Which part of a plant absorbs most of the water and minerals taken up from the soil?

- A) root cap
- B) root hairs
- C) the thick parts of the roots near the base of the stem
- D) storage roots

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.1

2) Prop roots are the modified aerial adventitious roots of corn that _____.

- A) enable the root system to obtain oxygen
- B) support tall, top-heavy plants
- C) enable the root system to anchor
- D) wrap around other plants to support tall, top-heavy plants

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.1

3) Strawberries have modified horizontal shoots growing along the surface, which are referred to as _____.

- A) rhizomes
- B) tubers
- C) stolons
- D) rhizoids

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.1

4) An axillary bud in the stem can potentially form a _____ in a variety of plants based on evolutionary adaptations.

- A) lateral branch
- B) thorn
- C) flower
- D) lateral branch, thorn, and flower

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.1

5) Onion leaves have been modified for the purpose of _____.

- A) defense (protect from predators)
- B) storage
- C) support
- D) reproduction

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.1

6) _____ is a relatively indigestible strengthening polymer that accounts for more than a quarter of the dry mass of wood.

- A) Cellulose
- B) Starch
- C) Lignin
- D) None of these choices

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.1

7) When you eat Brussels sprouts, you are eating _____.

- A) immature flowers
- B) large axillary buds
- C) petioles
- D) storage leaves

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 35.1

8) Some of the largest leaves in the world can be found on plants near the floor of dense tropical rain forests. Which of the following precursors for photosynthesis is most likely limited in these large leaves?

- A) oxygen
- B) carbon dioxide
- C) glucose
- D) light

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 35.1

9) Leaf thickness represents a trade-off between _____.

- A) light collection and carbon dioxide absorption
- B) water retention and carbon dioxide absorption
- C) water retention and oxygen absorption
- D) light collection and oxygen absorption

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 35.1

10) One important difference between the anatomy of roots and the anatomy of leaves is that _____.

- A) only leaves have phloem and only roots have xylem
- B) root cells have cell walls and leaf cells do not
- C) a waxy cuticle covers leaves but is absent from roots
- D) vascular tissue is found in roots but is absent from leaves
- E) leaves have epidermal tissue but roots do not

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 35.1

11) Which structure is correctly paired with its tissue system?

- A) root hair—vascular tissue
- B) guard cell—vascular tissue
- C) companion cell—ground tissue
- D) tracheid—vascular tissue

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.1

12) The vascular bundle in the shape of a single central cylinder in a root is called the _____.

- A) cortex
- B) stele
- C) periderm
- D) pith

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.1

13) Which of the following cell types retains the ability to undergo cell division?

- A) a parenchyma cell near the root tip
- B) a functional sieve tube element
- C) a tracheid
- D) a stem fiber

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.1

14) Which of the following have unevenly thickened primary walls that support young, growing parts of the plant?

- A) parenchyma cells
- B) collenchyma cells
- C) sclerenchyma cells
- D) tracheids and vessel elements

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.1

15) Which of the following is correctly paired with its structure and function?

- A) sclerenchyma—supporting cells with thick secondary walls
- B) ground meristem—protective coat of woody stems and roots
- C) guard cells—waterproof ring of cells surrounding the central stele in roots
- D) periderm—parenchyma cells functioning in photosynthesis in leaves

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.1

16) Which of the following are water-conducting cells that are dead at functional maturity?

- A) parenchyma cells
- B) collenchyma cells
- C) tracheids and vessel elements
- D) sieve-tube elements

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.1

17) Which of the following cells transport sugars over long distances?

- A) parenchyma cells
- B) sclerenchyma cells
- C) tracheids and vessel elements
- D) sieve-tube elements

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.2

18) Which of the following plants are annuals?

- A) azaleas
- B) roses
- C) blueberries
- D) wheat

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.2

19) Plant meristematic cells _____.

- A) are distributed evenly in all tissues throughout the plant
- B) are undifferentiated cells that produce new cells
- C) increase the surface area of dermal tissue by developing root hairs
- D) subdivide into three distinct cell types named parenchyma, ground meristem, and procambium

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.2

20) Which of the following arise, directly or indirectly, from meristematic activity?

- A) secondary xylem
- B) leaves
- C) dermal tissue
- D) secondary xylem, leaves, dermal tissue, and tubers

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 35.2

21) Compared to most animals, the growth of most plant structure is best described as _____.

- A) perennial
- B) weedy
- C) indeterminate
- D) primary

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.2

22) What is present in a shoot apical meristem region?

- I) the region of cell division
- II) immature buds and leaves
- III) cells that will give rise to the protoderm, ground meristem, and procambium

- A) only I
- B) only II
- C) only III
- D) I, II, and III

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.2

- 23) Shoot elongation in a growing bud is due primarily to _____.
A) cell division at the shoot apical meristem
B) cell elongation directly below the shoot apical meristem
C) cell elongation localized in each internode
D) cell division at the shoot apical meristem and cell elongation directly below the shoot apical meristem

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.3

- 24) Apical meristems of dicots are at the tips of stems. Apical meristems of grasses are at ground level or slightly below, concealed by the leaves. What does this mean when considering care of a lawn or soccer field?

- A) If you mow right at ground level, the leaves can keep growing with no problem.
B) Grass mowed two inches above ground level grows at a slower rate compared to grass mowed three inches above the ground level.
C) If you mow two inches above ground level, most apical meristems will be cut down.
D) If you mow two inches above ground level, the apical meristem can keep producing new cells.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 35.2

- 25) In a meristematic region, the cell plate during mitosis is perpendicular to the side of the stem. In what direction will the stem grow?

- A) laterally in width
B) vertically in height
C) at a 45-degree angle from the ground
D) away from the sun

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 35.2

- 26) Which of the following cells or tissues arise from lateral meristem activity?

- A) secondary xylem
B) leaves
C) trichomes
D) tubers

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.2

27) Cells produced by lateral meristems are known as _____.

- A) dermal and ground tissue
- B) lateral tissues
- C) pith
- D) secondary tissues

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.4

28) Which of the following can be used to determine a twig's age?

- A) number of apical bud scar rings
- B) number of leaf scars
- C) number and arrangement of axillary buds
- D) length of internodes

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 35.2

29) A plant that grows one year, dies back, and then grows again the following year, produces flowers, and then dies would be considered _____.

- A) annual
- B) biennial
- C) perennial
- D) not very fit

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.2

30) Which of the following is the correct sequence of the zones in the primary growth of a root, moving from the root cap inward?

- A) zone of cell division, zone of elongation, zone of differentiation
- B) zone of differentiation, zone of elongation, zone of cell division
- C) zone of elongation, zone of cell division, zone of differentiation
- D) zone of cell division, zone of differentiation, zone of elongation

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.3

31) The driving force that pushes the root tip through the soil is primarily _____.

- A) continuous cell division in the root cap at the tip of the root
- B) continuous cell division just behind the root cap in the center of the apical meristem
- C) elongation of cells behind the root apical meristem
- D) continuous cell division of root cap cells

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.3

32) Mitotic activity by the apical meristem of a root makes which of the following more possible?

- A) increased delivery of water to the aboveground stem
- B) decreased absorption of mineral nutrients
- C) increased absorption of carbon dioxide.
- D) effective lateral growth of the stem

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 35.3

33) Which of the following root tissues gives rise to lateral roots?

- A) endodermis
- B) phloem
- C) epidermis
- D) pericycle

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.3

34) As a youngster, you drive a nail in the trunk of a young tree that is 3 meters tall. The nail is about 1.5 meters from the ground. Fifteen years later, you return and discover that the tree has grown to a height of 30 meters. About how many meters above the ground is the nail?

- A) 0.5
- B) 1.5
- C) 3.0
- D) 15.0

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 35.3

35) You find a plant unfamiliar to you and observe that it has vascular bundles scattered throughout the stem cross section. What do you conclude about the plant?

- A) It is probably an herbaceous eudicot.
- B) It will probably get annual rings of wood.
- C) It is probably a monocot.
- D) It could be either a young eudicot or a monocot.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 35.3

36) Monocot vascular bundles do not have a vascular cambium between the xylem and phloem. This means that monocots _____.

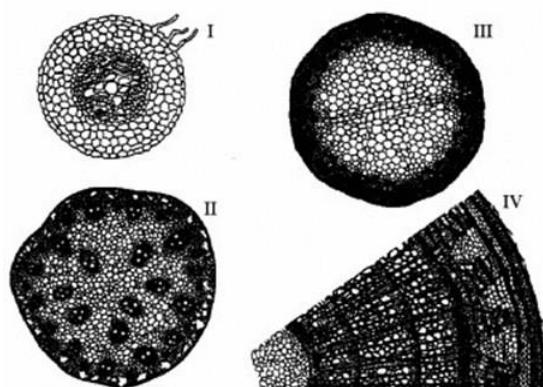
- A) are much less efficient at conducting water and sugars
- B) have very thin stems
- C) do not produce wood in annual rings
- D) cannot produce lateral shoots

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.3

37) The following question is based on the drawings of root or stem cross sections shown in the figure.



Refer to the figure. A monocot stem is represented by _____.

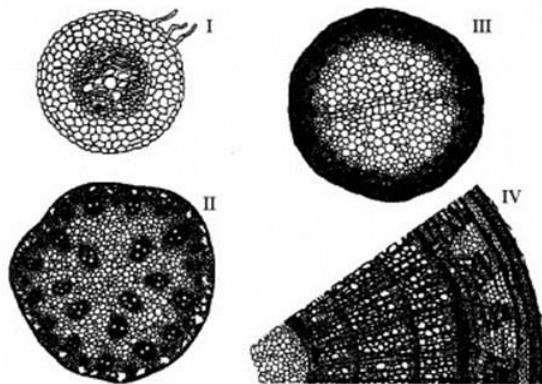
- A) I only
- B) II only
- C) III only
- D) IV only

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.3

38) The following question is based on the drawings of root or stem cross sections shown in the figure.



Refer to the figure. A woody eudicot is represented by _____.

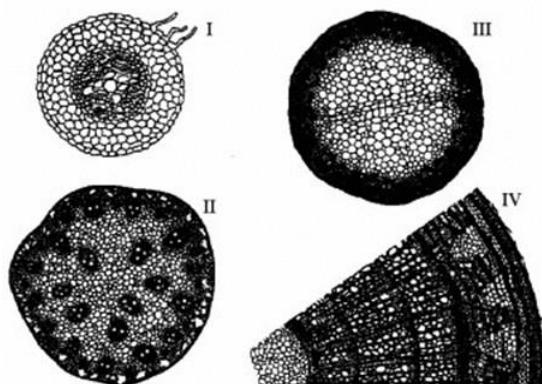
- A) II only
- B) III only
- C) IV only
- D) I and III

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.3

39) The following question is based on the drawings of root or stem cross sections shown in the figure.



Refer to the figure. A plant that is at least three years old is represented by _____.

- A) I only
- B) II only
- C) III only
- D) IV only

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.3

40) A student examining leaf cross sections under a microscope finds many loosely packed cells with relatively thin cell walls. The cells have numerous chloroplasts. What type of cells are they?

- A) parenchyma
- B) endodermis
- C) collenchyma
- D) sclerenchyma

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 35.3

41) The veins of leaves are _____.

- I) composed of xylem and phloem
- II) continuous, with vascular bundles in the stem and roots
- III) finely branched to be in close contact with photosynthesizing cells

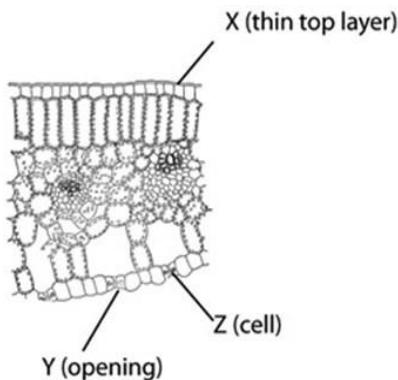
- A) only I
- B) only II
- C) only III
- D) I, II, and III

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.3

42) The following diagram is of a cross section of a plant leaf. Use the diagram to answer the question.



The main function associated with structure X is _____.

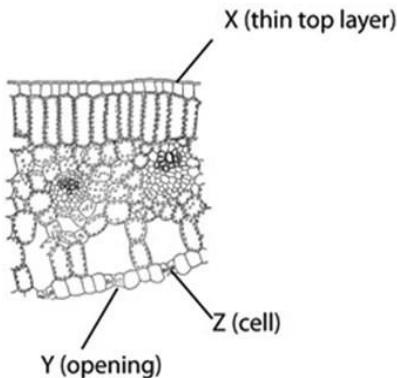
- A) absorption of carbon dioxide
- B) retention of water
- C) collection of light
- D) release of carbon dioxide

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 35.3

43) The following diagram is of a cross section of a plant leaf. Use the diagram to answer the question.



The main function associated with structure Y is _____.

- A) absorption of carbon dioxide
- B) retention of water
- C) collection of light
- D) release of carbon dioxide

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 35.3

44) Increasing the number of stomata per unit surface area of a leaf when atmospheric carbon dioxide levels decline is most analogous to a human _____.

- A) breathing faster as atmospheric carbon dioxide levels increase
- B) putting more red blood cells into circulation when atmospheric oxygen levels decline
- C) removing red blood cells from circulation when atmospheric oxygen levels increase
- D) increasing the volume of its lungs when atmospheric carbon dioxide levels increase

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 35.3

45) A lateral root originates in the _____.

- A) pericycle
- B) cortex
- C) endodermis
- D) epidermis

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.3

46) Of the following plants, which stem has scattered vascular bundles?

- A) corn
- B) magnolia
- C) chrysanthemum
- D) hibiscus

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.3

47) The secondary mesophyll of leaves is made up of _____.

- A) parenchyma tissue
- B) collenchyma tissue
- C) sclerenchyma tissue
- D) parenchyma and collenchyma tissues

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.3

48) Where is primary growth occurring in an old tree?

- A) closest to ground level at the base of the tree
- B) in young branches where leaves are forming
- C) where the vascular cambium and cork cambium are located
- D) Nowhere; trees more than a year old have only secondary growth.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.4

49) What tissue makes up most of the wood of a tree?

- A) primary xylem
- B) secondary xylem
- C) secondary phloem
- D) vascular cambium

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.4

50) A plant has the following characteristics: a taproot system, several growth rings evident in a cross section of the stem, and a layer of bark around the outside. Which of the following best describes the plant?

- A) herbaceous eudicot
- B) woody eudicot
- C) woody monocot
- D) herbaceous monocot

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 35.4

51) If you were able to walk into an opening cut into the center of a large redwood tree, when you exited from the middle of the trunk (stem) outward, you would cross, in order, _____.

- A) the annual rings, new xylem, vascular cambium, phloem, and bark
- B) the secondary xylem, cork cambium, phloem, and periderm
- C) the vascular cambium, oldest xylem, and newest xylem
- D) the secondary xylem, secondary phloem, and vascular cambium

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 35.4

52) Heartwood and sapwood consist of _____.

- A) periderm
- B) secondary xylem
- C) secondary phloem
- D) cork

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.4

53) Additional vascular tissue produced as secondary growth in a root originates from which cells?

- A) vascular cambium
- B) apical meristem
- C) endodermis
- D) xylem

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.4

54) The bark of a tree trunk is made up of _____.

- A) heart wood and sap wood
- B) heart wood
- C) secondary phloem
- D) secondary phloem and layers of periderm

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.4

55) The polarity of a plant is established when _____.

- A) cotyledons form at the shoot end of the embryo
- B) the shoot-root axis is established in the embryo
- C) the primary root breaks through the seed coat
- D) the shoot first breaks through the soil into the light as the seed germinates

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.5

56) Growth and development of plant parts involves _____.

- I) cell division to produce new cells
- II) enlargement and elongation of cells
- III) specialization of cells into tissues

- A) only I
- B) only II
- C) only III
- D) I, II, and III

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.5

57) Totipotency is a term used to describe a cell's ability to give rise to a complete new organism. In plants, this means that _____.

- A) plant development is *not* under genetic control
- B) the cells of shoots and the cells of roots have different genes
- C) cell differentiation depends largely on the control of gene expression
- D) a cell's environment has no effect on its differentiation

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 35.5

58) The phase change of an apical meristem from the juvenile to the mature vegetative phase is often revealed by _____.

- A) a change in the morphology of the leaves produced
- B) the initiation of secondary growth
- C) a change in the orientation of prophase bands and cytoplasmic microtubules in lateral meristems
- D) the activation of floral meristem identity genes

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 35.5

35.2 Student Edition End-of-Chapter Questions

1) Most of the growth of a plant body is the result of

- A) cell differentiation.
- B) morphogenesis.
- C) cell division.
- D) cell elongation.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

2) The innermost layer of the root cortex is the

- A) core.
- B) pericycle.
- C) endodermis.
- D) pith.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

3) Heartwood and sapwood consist of

- A) bark.
- B) periderm.
- C) secondary xylem.
- D) secondary phloem.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

4) The phase change of an apical meristem from the juvenile to the mature vegetative phase is often revealed by

- A) a change in the morphology of the leaves produced.
- B) the initiation of secondary growth.
- C) the formation of lateral roots.
- D) the activation of floral meristem identity genes.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

5) Suppose a flower had normal expression of genes *A* and *C* and expression of gene *B* in all four whorls. Based on the ABC hypothesis, what would be the structure of that flower, starting at the outermost whorl?

- A) carpel-petal-petal-carpel
- B) petal-petal-stamen-stamen
- C) sepal-carpel-carpel-sepal
- D) sepal-sepal-carpel-carpel

Answer: B

Bloom's Taxonomy: Application/Analysis

6) Which of the following arise(s), directly or indirectly, from meristematic activity?

- A) secondary xylem
- B) leaves
- C) dermal tissue
- D) all of the above

Answer: D

Bloom's Taxonomy: Application/Analysis

7) Which of the following would *not* be seen in a cross section through the woody part of a root?

- A) sclerenchyma cells
- B) parenchyma cells
- C) sieve-tube elements
- D) root hairs

Answer: D

Bloom's Taxonomy: Application/Analysis

36.1 Multiple-Choice Questions

1) Given that early land plants most likely share a common ancestor with green algae, the earliest land plants were most likely _____.

- A) nonvascular plants that grew leafless, photosynthetic shoots
- B) species that did not exhibit alternation of generations
- C) vascular plants with well-defined root systems
- D) plants with well-developed leaves

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.1

2) A fellow student brought in a leaf to be examined. The leaf was dark green, thin, had stoma on the lower surface only, and had a total surface area of ten square meters. Where is the most likely environment where this leaf was growing?

- A) a large, still pond
- B) a tropical rain forest
- C) an oasis within a grassland
- D) the floor of a deciduous forest

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 36.1

3) Phloem sap can flow _____.

- A) from leaves to shoots only
- B) from shoots to leaves only
- C) from sites of sugar production to storage units only
- D) both ways between production and storage sites

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.1

4) Why do most angiosperms have alternate phyllotaxy, with leaf emergence at an angle of 137.5° compared to leaves above and below?

- A) to allow maximum exposure to light
- B) to promote a leaf area index above 8
- C) to reduce shading of lower leaves
- D) to allow maximum exposure to light and to reduce shading of lower leaves

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 36.1

5) A plant developed a mineral deficiency after being treated with a fungicide. What is the most probable cause of the deficiency?

- A) Mineral receptor proteins in the plant membrane were not functioning.
- B) Mycorrhizal fungi were killed.
- C) Active transport of minerals was inhibited.
- D) The genes for the synthesis of transport proteins were destroyed.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 36.1

6) Which one of the following does *not* correctly match the form with its function?

- A) stem—water and minerals are transported upward
- B) xylem sap—transport water and nutrients from roots to shoots upward
- C) transpiration—loss of water mostly through stomata
- D) cork cambium—increase in stem thickness

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.1

7) The leaf area index is the ratio of the _____.

- A) upper leaf surface of a single plant divided by the surface area of the land on which the plant grows
- B) lower leaf surface of a single plant divided by the surface area of the land on which the plant grows
- C) upper leaf surface of a single plant multiplied by the surface area of the land on which the plant grows
- D) lower leaf surface of a single plant multiplied by the surface area of the land on which the plant grows

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 36.1

8) Which one of the following played a critical role in the successful colonization of land by plants?

- A) ground tissue
- B) bacterial association
- C) mycorrhizae
- D) cuticle on leaf surface

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.1

9) Which structure or compartment is separate from the apoplastic route?

- A) the lumen of a xylem vessel
- B) the lumen of a sieve tube
- C) the cell wall of a mesophyll cell
- D) the cell wall of a root hair

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.2

10) The apoplast in plant tissues consists of _____.

- A) cell walls, extracellular spaces, and plasmodesmata
- B) cell walls, extracellular spaces, and vessel elements
- C) vessel elements, plasmodesmata, and extracellular spaces
- D) cell walls, plasma membrane, and cytosol

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 36.2

11) Active transport of amino acids in plants at the cellular level requires _____.

- A) NADP and channel proteins
- B) xylem membranes and channel proteins
- C) sodium/potassium pumps and xylem membranes
- D) ATP, transport proteins, and a proton gradient

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 36.2

12) The physical property that predicts the direction of water flow is referred as _____.

- A) potassium pump
- B) water potential
- C) osmotic potential
- D) sodium pump

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.2

13) What is the function of proton pumps localized in the plant plasma membrane?

- A) to transfer phosphorus groups from ATP to proteins
- B) to transfer metal ions across the plasma membrane
- C) to transfer anions across the plasma membrane
- D) to create a membrane potential

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.2

14) Which of following ions play the primary role in basic transport processes in plant cells?

- A) H⁺
- B) Na⁺
- C) K⁺
- D) Ca⁺²

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 36.2

15) Which of the following would be *least* likely to affect osmosis in plants?

- A) a difference in solute concentrations
- B) receptor proteins in the membrane
- C) aquaporins
- D) a difference in water potential

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 36.2

16) The movement of water across biological membranes can best be predicted by _____.

- A) prevailing weather conditions
- B) aquaporins
- C) level of active transport
- D) water potentials

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 36.2

17) If isolated plant cells with a water potential averaging -0.5 MPa are placed into a solution with a water potential of -0.3 MPa, which of the following would be the most likely outcome?

- A) The pressure potential of the cells would increase.
- B) Water would move out of the cells.
- C) The cell walls would rupture, killing the cells.
- D) Solutes would move out of the cells.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.2

18) Solute potential in a cell is also called _____.

- A) water potential
- B) osmotic potential
- C) potential gradient
- D) pressure potential

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.4

19) The value for Ψ in root tissue was found to be -0.15 MPa. If you take the root tissue and place it in a 0.1 M solution of sucrose ($\Psi = -0.23$ MPa), the net water flow would _____.

- A) be from the tissue into the sucrose solution
- B) be from the sucrose solution into the tissue
- C) be in both directions, and the concentration of water would remain equal
- D) be impossible to determine from the values given here

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 36.2

20) In the transmembrane route for transport within plant tissue, _____.

- A) water and solutes move out of one cell, across the cell wall, and into the neighboring cell
- B) water and solutes move out of one cell, through the plasmodesmata, and into the neighboring cell
- C) water moves out of one cell, across the cell wall, and into the neighboring cell
- D) solutes move out of one cell, across the plasmodesmata, and into the neighboring cell

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.2

21) When an animal cell is placed in a hypotonic solution and water enters the cell via osmosis, the volume of the cell increases until it bursts. This does not happen to plant cells, because _____.

- A) they have large central vacuoles, which provide abundant space for storage of incoming water
- B) they have cell walls, which prevent the entry of water by osmosis
- C) they have cell walls, which provide pressure to counteract the pressure of the incoming water
- D) certain gated channel proteins embedded in their plasma membranes open as osmotic pressure decreases, allowing excess water to leave the cell

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 36.2

22) How does a flaccid cell differ from a turgid cell?

- A) A flaccid cell has higher pressure potential.
- B) A flaccid cell has lower pressure potential.
- C) A flaccid cell has higher solute potential.
- D) A flaccid cell has lower solute potential.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 36.2

23) The protoplast consists of _____.

- A) all cell components without a nucleus
- B) all cell components without a cell membrane
- C) only the cytoplasm and nucleus
- D) the living part of the cell, including the cell membrane

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.2

24) Compared to a cell with few aquaporins in its membrane, a cell containing many aquaporins will _____.

- A) have a faster rate of osmosis
- B) have a lower water potential
- C) have a higher water potential
- D) have a faster rate of active transport

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 36.2

25) If you place flaccid plant cells in pure water, water _____ into cell because it has _____.

- A) does not enter the cell; solutes and low water potential
- B) enter the cell; solutes and low water potential
- C) enter the cell; solutes and high water potential
- D) does not enter the cell; solutes and high water potential

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 36.2

26) If $\Psi_P = 0.3 \text{ MPa}$ and $\Psi_S = -0.45 \text{ MPa}$, the resulting Ψ is _____.

- A) +0.75 MPa
- B) -0.75 MPa
- C) -0.15 MPa
- D) +0.15 MPa

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 36.2

27) Which of the following are important components of the long-distance transport process in plants?

- I) the cohesion of water molecules
- II) a negative water potential
- III) the root parenchyma
- IV) the active transport of solutes
- V) bulk flow from source to sink

A) II, III, IV, and V

B) I, III, IV, and V

C) I, II, IV, and V

D) I, II, III, and V

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 36.2

28) The value for Ψ in root tissue was found to be -0.15 MPa. If you take the root tissue and place it in a 0.1 M solution of sucrose ($\Psi = -0.23$ MPa), the net water flow would _____.

A) be from the tissue into the sucrose solution

B) be from the sucrose solution into the tissue

C) be in both directions and the concentrations would remain equal

D) occur only as ATP was hydrolyzed in the tissue

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 36.2

29) Loss of water from the aerial parts of plants is called _____.

A) dehydration

B) respiration

C) gas exchange

D) transpiration

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.3

30) Which of the following contribute to the surface area available for water absorption from the soil by a plant root system?

- I) root hairs
- II) endodermis
- III) mycorrhizae
- IV) fibrous arrangement of the roots

- A) II and III
- B) I, III, and IV
- C) I, II, and IV
- D) I, II, III, and IV

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 36.3

31) What is the overall charge on the cytoplasmic side of a plant cell plasma membrane?

- A) positive
- B) negative
- C) neutral

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.2

32) A water molecule could move all the way through a plant from soil to root to leaf to air and pass through a living cell only once. This living cell would be a part of which structure?

- A) a guard cell
- B) the root epidermis
- C) the endodermis
- D) the root cortex

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 36.3

33) Bulk flow is much faster than diffusion or active transport. Peak velocities in the transport of xylem sap can range from _____ for trees with wide vessel elements.

- A) 10-20 m/hr
- B) 15-45 m hr
- C) 5-10 m hr
- D) >50 m hr

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.3

- 34) In plant roots, the Casparyan strip _____.
A) aids in the uptake of nutrients
B) provides energy for the active transport of minerals into the stele from the cortex
C) ensures that all minerals are absorbed from the soil in equal amounts
D) ensures that all water and dissolved substances must pass through a cell membrane before entering the stele

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 36.3

- 35) Which of the following observations provides the strongest evidence against root pressure being the principal mechanism of water transport in the xylem?
A) Not all soils have high concentrations of ions.
B) Root pressure requires movement of water into the xylem from surrounding cells in the roots.
C) Over long distances, the force of root pressure is not enough to overcome the force of gravity.
D) There is no water potential gradient between roots and shoots.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 36.3

- 36) One is most likely to see guttation in small plants when the _____.
A) transpiration rates are high
B) root pressure exceeds transpiration pull
C) preceding evening was hot, windy, and dry
D) roots are not absorbing minerals from the soil

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.3

- 37) Most of the water taken up by a plant is _____.
A) used as a solvent
B) used as a hydrogen source in photosynthesis
C) lost during transpiration
D) used to keep cells turgid

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.3

38) Transpiration in plants requires _____.

- I) adhesion of water molecules to cellulose
 - II) cohesion between water molecules
 - III) evaporation of water molecules
 - IV) active transport through xylem cells
 - V) transport through tracheids
- A) I, III, IV, and V
 - B) I, II, IV, and V
 - C) I, II, III, and V
 - D) I, II, III, and IV

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 36.3

39) During the nighttime, due to lack of transpiration, the water potential within the vascular cylinder _____.

- A) lowers due to accumulation of minerals
- B) increases due to accumulation of minerals
- C) lowers due to loss of minerals
- D) increases due to loss of minerals

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.3

40) What is the main force by which most of the water within xylem vessels moves toward the top of a tree?

- A) active transport of ions into the stele
- B) evaporation of water through stoma
- C) the force of root pressure
- D) osmosis in the root

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.3

41) Water potential is generally most negative in which of the following parts of a plant?

- A) mesophyll cells of the leaf
- B) xylem vessels in leaves
- C) xylem vessels in roots
- D) cells of the root cortex

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 36.3

- 42) Formation of the curved upper surface, such as occurs in a tube filled with water, is an important factor in plant water movement. A curved upper surface is created by _____.
A) the upward pull of gravity on the water column in the tube
B) downward pressure from the atmosphere on the topmost layer of water molecules
C) the water molecules being pulled upward by adhesion to the air
D) the topmost layer of water molecules being pulled downward by the hydrogen bonds to the water molecules below

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 36.3

- 43) Which one of the following ions plays a critical role in the opening and closing of stomata?
A) H⁺
B) Na⁺
C) K⁺
D) Ca⁺²

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 36.4

- 44) Which of the following primarily enters a plant somewhere other than through the roots?
A) carbon dioxide
B) nitrogen
C) potassium
D) water

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 36.4

- 45) The opening of stomata is thought to involve _____.
A) an increase in the solute concentration of the guard cells
B) active transport of water out of the guard cells
C) decreased turgor pressure in guard cells
D) movement of K⁺ from the guard cells

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.4

- 46) The high surface-to-volume ratio in leaves aids in _____.
A) more light absorption
B) less light absorption
C) CO₂ absorption
D) transpiration

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 36.4

47) Ignoring all other factors, what kind of day would result in the fastest delivery of water and minerals to the leaves of an oak tree?

- A) a cool, dry day
- B) a very hot, dry, windy day
- C) a warm, humid day
- D) a cool, humid day

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 36.4

48) Photosynthesis ceases when leaves wilt, mainly because _____.

- A) the chlorophyll in wilting leaves is degraded
- B) flaccid mesophyll cells are incapable of photosynthesis
- C) stomata close, preventing carbon dioxide from entering the leaf
- D) accumulation of carbon dioxide in the leaf inhibits enzymes

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 36.4

49) The water lost during transpiration is a side effect of the plant's exchange of gases. However, the plant derives some benefit from this water loss in the form of _____.

- A) increased turgor and increased growth
- B) mineral transport and increased growth
- C) evaporative cooling and increased turgor
- D) evaporative cooling and mineral transport

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.4

50) Which of the following experimental procedures would most likely reduce transpiration while allowing the normal growth of a plant?

- A) subjecting the leaves of the plant to a partial vacuum
- B) increasing the level of carbon dioxide around the plant
- C) putting the plant in drier soil
- D) decreasing the relative humidity around the plant

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 36.4

51) Several tomato plants are growing in a small garden plot. If soil water potential were to drop significantly on a hot, summer afternoon, which of the following would most likely occur?

- A) Size of stomatal openings would decrease.
- B) Transpiration would increase.
- C) The leaves would become more turgid.
- D) The uptake of carbon dioxide would be enhanced.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 36.4

52) What is the advantage of having small, needlelike leaves?

- A) increased transpiration rate
- B) decreased transpiration rate
- C) increased efficiency of light capture
- D) decreased efficiency of light capture

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.4

53) The plant hormone _____ causes stomatal closures in drought stress conditions.

- A) indole-3-acetic acid
- B) gibberellin
- C) abscisic acid (ABA)
- D) ethylene

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.4

54) Plants adapted to arid environments are referred to as _____.

- A) mesophytes
- B) xerophytes
- C) psilophytes
- D) halophytes

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 36.4

55) In xerophytes, _____ are referred to as crypts.

- A) stomata recessed in cavities
- B) guard cells
- C) hairs (trichomes)
- D) lower epidermal cells

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.4

56) Which of the following is a net sugar source for a deciduous angiosperm tree?

- A) new leaves in early spring
- B) fruits in summer
- C) roots in early spring
- D) roots in early autumn

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.5

57) Arrange the following five events in an order that explains the mass flow of materials in the phloem.

1. Water diffuses into the sieve tubes.
2. Leaf cells produce sugar by photosynthesis.
3. Solutes are actively transported into sieve tubes.
4. Sugar is transported from cell to cell in the leaf.
5. Sugar moves down the stem.

- A) 1, 2, 3, 4, 5
- B) 2, 4, 3, 1, 5
- C) 4, 2, 1, 3, 5
- D) 2, 4, 1, 3, 5

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 36.5

58) Water flows into the source end of a sieve tube because _____.

- A) sucrose has been actively transported into the sieve tube, making it hypertonic
- B) water pressure outside the sieve tube forces in water
- C) the companion cell of a sieve tube actively pumps in water
- D) sucrose has been transported out of the sieve tube by active transport

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 36.5

59) Which of the following supports the finding that sugar translocation in phloem is an active (energy-requiring) process?

- A) Sucrose occurs in higher concentrations in companion cells than in the mesophyll cells where it is produced.
- B) Movement of water occurs from xylem to phloem and back again.
- C) Strong pH differences exist between the cytoplasm of the companion cell and the mesophyll cell.
- D) ATPases are abundant in the plasma membranes of the mesophyll cells.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.5

- 60) Which one of the following statements about transport of nutrients in phloem is correct?
- A) Solute particles are actively transported from phloem at the source.
 - B) Companion cells control the rate and direction of movement of phloem sap.
 - C) Differences in osmotic concentration at the source and sink cause a hydrostatic pressure gradient to be formed.
 - D) A sink is the part of a plant where a particular solute is produced.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.5

- 61) In the pressure-flow mechanism, loading of sucrose from companion cells to sieve-tube elements takes place through _____.

- A) plasmodesmata
- B) facilitated diffusion
- C) sucrose-H⁺ symporters
- D) sucrose-H⁺ antiporters

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.5

- 62) Which of the following is a correct statement about sugar movement in phloem?

- A) Diffusion can account for the observed rates of transport.
- B) Movement can occur both upward and downward in the plant.
- C) Sugar is translocated from sinks to sources.
- D) Only phloem cells with nuclei can perform sugar movement.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.5

- 63) Plants do not have a circulatory system like that of some animals. If a water molecule in a plant did "circulate" (that is, go from one point in a plant to another and back in the same day), it would require the activity of _____.

- A) only the xylem
- B) only the phloem
- C) only the endodermis
- D) both the xylem and the phloem

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 36.5

64) Some botanists argue that the entire plant should be considered as a single unit rather than a composite of many individual cells. Which of the following cellular structures best supports this view?

- A) cell wall
- B) cell membrane
- C) vacuole
- D) plasmodesmata

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 36.6

65) Plasmodesmata can change in number, and when dilated can provide a passageway for _____.

- A) macromolecules
- B) ribosomes
- C) chloroplasts
- D) mitochondria

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 36.6

66) The symplastic route can transport _____.

- A) sugars, mRNA, and mitochondria
- B) mRNA, mitochondria, and proteins
- C) mitochondria, mRNA, and viruses
- D) viruses, sugars, and mRNA

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 36.6

36.2 Student Edition End-of-Chapter Questions

1) Which of the following is an adaptation that enhances the uptake of water and minerals by roots?

- A) mycorrhizae
- B) pumping through plasmodesmata
- C) active uptake by vessel elements
- D) rhythmic contractions by cells in the root cortex

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

2) Which structure or compartment is part of the symplast?

- A) the interior of a vessel element
- B) the interior of a sieve tube
- C) the cell wall of a mesophyll cell
- D) an extracellular air space

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

3) Movement of phloem sap from a source to a sink

- A) occurs through the apoplast of sieve-tube elements.
- B) depends ultimately on the activity of proton pumps.
- C) depends on tension, or negative pressure potential.
- D) results mainly from diffusion.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

4) Photosynthesis ceases when leaves wilt, mainly because

- A) the chlorophyll in wilting leaves is degraded.
- B) accumulation of CO₂ in the leaf inhibits enzymes.
- C) stomata close, preventing CO₂ from entering the leaf.
- D) photolysis, the water-splitting step of photosynthesis, cannot occur when there is a water deficiency.

Answer: C

Bloom's Taxonomy: Application/Analysis

5) What would enhance water uptake by a plant cell?

- A) decreasing the Ψ of the surrounding solution
- B) positive pressure on the surrounding solution
- C) the loss of solutes from the cell
- D) increasing the Ψ of the cytoplasm

Answer: B

Bloom's Taxonomy: Application/Analysis

6) A plant cell with a Ψ_S of -0.65 MPa maintains a constant volume when bathed in a solution that has a Ψ_S of -0.30 MPa and is in an open container. The cell has a

- A) Ψ_P of +0.65 MPa.
- B) Ψ of -0.65 MPa.
- C) Ψ_P of +0.35 MPa.
- D) Ψ_P of 0 MPa.

Answer: C

Bloom's Taxonomy: Application/Analysis

7) Compared with a cell with few aquaporin proteins in its membrane, a cell containing many aquaporin proteins will

- A) have a faster rate of osmosis.
- B) have a lower water potential.
- C) have a higher water potential.
- D) accumulate water by active transport.

Answer: A

Bloom's Taxonomy: Application/Analysis

8) Which of the following would tend to increase transpiration?

- A) spiny leaves
- B) sunken stomata
- C) a thicker cuticle
- D) higher stomatal density

Answer: D

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 37 Soil and Plant Nutrition

37.1 Multiple-Choice Questions

1) What soil composition would be best for availability of nutrients, water, and root development?

- A) equal amounts of sand, clay, and humus
- B) higher proportion of humus; lower amounts of clay and sand
- C) higher proportion of clay; lower amounts of humus and sand
- D) higher proportion of sand; lower amount of humus and clay

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 37.1

2) The highest amount of oxygen will be found in soils containing large amounts of _____.

- A) clay
- B) sand
- C) gravel
- D) silt

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 37.1

3) A group of ten tomato plants are germinated and maintained in a large tray with no drainage. After several weeks they all begin to wilt and die despite repeated watering and fertilization. The most likely cause of this die-off is _____.

- A) competition for resources
- B) a lack of oxygen for the roots
- C) organic nutrient depletion
- D) no room left for root growth

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 37.1

4) There are several properties that are characteristic of a soil in which typical plants would grow well. Of the following, which would be the *least* conducive to plant growth?

- A) abundant humus
- B) numerous soil organisms
- C) compacted soil
- D) high cation exchange capacity

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.1

5) Which of the following soil minerals is most likely leached away during a hard rain?

- A) Na⁺
- B) K⁺
- C) Ca⁺⁺
- D) NO₃⁻

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 37.1

6) Which of the following are problems associated with intensive irrigation?

- I) mineral runoff
- II) over fertilization
- III) aquifer depletion
- IV) soil salinization

- A) only I and II
- B) only I, III, and IV
- C) only III and IV
- D) I, II, III, and IV

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.1

7) A young farmer purchases some land in a relatively arid area and is interested in earning a reasonable profit for many years. Which of the following strategies would best allow the farmer to achieve such a goal?

- A) establishing an extensive irrigation system
- B) using plenty of the best fertilizers
- C) finding a way to sell all parts of crop plants
- D) selecting crops adapted to arid areas

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 37.1

8) The NPK percentages on a package of fertilizer refer to the _____.

- A) percentages of manure collected from different types of animals
- B) relative percentages of organic and inorganic nutrients in the fertilizer
- C) percentages of three important mineral nutrients
- D) proportions of three different nitrogen sources

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.1

9) Which of the following would inhibit the growth of most plants?

- A) abundant humus
- B) air spaces
- C) good drainage
- D) a pH above 10.0

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.1

10) The B horizon of soil has _____.

- A) living organisms and decaying organic matter
- B) a mixture of broken soil with a variety of texture
- C) much less organic matter than the A horizon
- D) partially broken-down rock

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.1

11) Roots acidify the soil solution by releasing _____ and pumping _____ into the soil.

- A) CO₂; K⁺
- B) CO₂; H⁺
- C) CO₂; Na⁺
- D) N; Na⁺

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.1

12) Soil pH is an important factor that influences _____.

- A) cation exchange
- B) the chemical form of minerals
- C) availability of minerals
- D) cation exchange and the chemical form of minerals

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.1

13) Soil erosion could be controlled by _____.

- A) planting rows of trees as windbreaks
- B) no-till agriculture
- C) terrace hillside crops
- D) all of the above

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.1

14) Which of the following would be the most effective strategy to remove toxic heavy metals from a soil?

- A) heavy irrigation to leach out the heavy metals
- B) application of sulfur to lower the soil pH and precipitate the heavy metals
- C) adding plant species that have the ability to take up and accumulate heavy metals
- D) inoculating soil with mycorrhizae to avoid heavy-metal uptake

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 37.1

15) How would you expect the root system of a plant grown by hydroponics to compare to the root system of a plant grown in soil? The root system of a plant grown by hydroponics would be _____.

- A) more developed
- B) less developed
- C) about the same
- D) absent

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 37.2

16) Deficiency of calcium in plants causes _____.

- A) wilting and poor growth
- B) chlorosis between veins and wilting
- C) crinkling of young leaves and death of terminal buds
- D) reduced internode length and crinkled leaves

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.2

17) Which one of the following elements plays a critical role in the formation of chlorophyll?

- A) magnesium
- B) manganese
- C) calcium
- D) zinc

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.2

18) Which of the following experiments is the best way to determine if an element is essential for plant growth?

- A) Measure the amount of the element stored in plant tissues.
- B) Measure the amount of the element in the soil after plant growth.
- C) Measure the weight of the plant and soil before and after plant growth.
- D) Grow a plant using hydroponics with and without the element.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 37.2

19) Which criteria allow biologists to divide chemicals into macronutrients and micronutrients?

- A) molecular weight of the element or compound
- B) the quantities of each required by plants
- C) how they are used in metabolism
- D) whether or not they are essential for plant growth

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.2

20) Which elements are most often the limiting nutrients for plant growth?

- A) nitrogen, potassium, phosphorus
- B) nitrogen, oxygen, hydrogen
- C) carbon, sodium, chlorine
- D) carbon, nitrogen, oxygen

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.2

21) Synthesis of which of the following compounds in a mature leaf would be least impacted by a temporary soil nitrogen deficiency?

- A) DNA
- B) RNA
- C) amino acids
- D) cellulose

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 37.2

22) A major function of magnesium in plants is to be _____.

- A) required to regenerate phosphoenolpyruvate in C₄ and CAM plants
- B) a component of DNA and RNA
- C) a component of chlorophyll
- D) active in amino acid formation

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.2

23) Micronutrients are needed in very small amounts because _____.

- A) most of them are mobile in the plant
- B) most serve mainly as cofactors of enzymes
- C) they play only a minor role in the growth and health of the plant
- D) only the most actively growing regions of the plants require micronutrients

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.2

24) Two groups of tomatoes were grown under laboratory conditions, one with humus added to the soil, and one a control without humus. The leaves of the plants grown without humus were yellowish (less green) compared with those of the plants grown in the humus-enriched soil. The best explanation for this difference is that _____.

- A) the healthy plants used the food in the decomposing leaves of the humus for energy to make chlorophyll
- B) the humus made the soil more loosely packed, so water penetrated more easily to the roots
- C) the humus contained minerals such as magnesium and iron, needed for the synthesis of chlorophyll
- D) the heat released by the decomposing leaves of the humus caused more rapid growth and chlorophyll synthesis

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 37.2

25) Soil leaching can cause nutrient deficiencies in the soil. Which of the following are symptoms of nutrient deficiency in plants?

- I) chlorosis
- II) death of meristems
- III) excess storage of chlorophyll
- IV) small internodes

- A) I, II, and III
- B) II, III, and IV
- C) I, II, and IV
- D) I, II, III, and IV

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 37.2

26) If an African violet has chlorosis, which of the following elements might be a useful addition to the soil?

- A) molybdenum
- B) copper
- C) iodine
- D) magnesium

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.2

27) Which one of the following micronutrients plays a critical role as a component of chlorophyll?

- A) nickel
- B) iron
- C) magnesium
- D) molybdenum

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.2

28) Nitrogen-fixing bacteria and nitrifying bacteria convert atmospheric nitrogen into different compounds of nitrogen such as: (a) ammonium ion, (b) ammonia, (c) nitrate ion, and (d) nitrite ion. Which of the following is the correct sequence of formation of the nitrogen compounds?

- A) a, b, c, and d
- B) b, a, d, and c
- C) b, a, c, and d
- D) a, b, d, and c

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.3

29) Which of the following plants is classified as an epiphyte?

- A) Venus flytrap
- B) pitcher plant
- C) staghorn fern
- D) mistletoe

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.2

30) Nitrogen fixation is a process that _____.

- A) recycles nitrogen compounds from dead and decaying materials
- B) converts ammonia to ammonium
- C) releases nitrate from the rock substrate
- D) converts nitrogen gas into ammonia

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.3

31) Why is nitrogen fixation an essential process?

- A) Nitrogen fixation can only be done by certain prokaryotes.
- B) Fixed nitrogen is often the limiting factor in plant growth.
- C) Nitrogen fixation is very expensive in terms of metabolic energy.
- D) Nitrogen fixers are sometimes symbiotic with legumes.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 37.3

32) You are weeding your garden when you accidentally expose some roots of your pea plants. You notice swellings (root nodules) on the roots, and there is a reddish tinge to the ones you accidentally damaged. Most likely your pea plants _____.

- A) suffer from a mineral deficiency
- B) are infected with a parasite
- C) are benefiting from a mutualistic bacterium
- D) are developing offshoots from the root

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 37.3

33) The specific relationship between a legume and its mutualistic *Rhizobium* strain probably depends on _____.

- A) each legume having a chemical dialogue with a fungus
- B) each *Rhizobium* strain having a form of nitrogenase that works only in the appropriate legume host
- C) each legume being found where the soil has only the *Rhizobium* specific to that legume
- D) specific recognition between the chemical signals and signal receptors of the *Rhizobium* strain and legume species

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 37.3

34) Rhizobia, actinomycetes, and cyanobacteria all share the common feature that they can _____.

- A) increase water uptake in plants
- B) kill parasites in the soil
- C) exist in extreme environments
- D) fix atmospheric nitrogen

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.3

35) The earliest vascular plants on land had underground stems (rhizomes), but no roots. Water and mineral nutrients were most likely obtained by _____.

- A) diffusion through stomata
- B) absorption by mycorrhizae
- C) osmosis through the root hairs
- D) diffusion across the cuticle of the rhizome

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 37.3

36) What major benefits do plants and mycorrhizal fungi receive from their symbiotic relationship?

- A) Plants receive enzymes, and fungi receive nitrogen and phosphorus.
- B) Plants receive increased root surface area, and fungi receive digestive enzymes.
- C) Fungi receive photosynthetic products in exchange for living in plant root nodules.
- D) Plants receive nitrogen and phosphorus, and fungi receive photosynthetic products.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.3

37) Hyphae form a covering over roots. These hyphae create a large surface area that helps to do which of the following?

- A) aid in absorbing minerals and ions
- B) maintain cell shape
- C) increase cellular respiration
- D) anchor a plant

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.3

38) A plant developed a mineral deficiency after being treated with a fungicide. What is the most probable cause of the deficiency?

- A) Mineral receptor proteins in the plant membrane were not functioning.
- B) Mycorrhizal fungi were killed.
- C) Active transport of minerals was inhibited.
- D) Proton pumps reversed the membrane potential.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 37.3

39) We would expect the greatest difference in plant health between two groups of plants of the same species, one group with mycorrhizae and one group without mycorrhizae, in an environment _____.

- A) where nitrogen-fixing bacteria are abundant
- B) that has soil with poor drainage
- C) in which the soil is relatively deficient in mineral nutrients
- D) that is near a body of water, such as a pond or river

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 37.3

40) Which of the following is a primary difference between ectomycorrhizae and endomycorrhizae?

- A) Endomycorrhizae have thicker, shorter hyphae than ectomycorrhizae.
- B) Ectomycorrhizae do not penetrate root cells, whereas endomycorrhizae grow into invaginations of the root cell membranes.
- C) Endomycorrhizae are more common than ectomycorrhizae.
- D) There are no significant differences between ectomycorrhizae and endomycorrhizae.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.3

41) Carnivorous plants have evolved mechanisms that trap and digest small animals. The products of this digestion are used to supplement the plant's supply of _____.

- A) energy
- B) carbohydrates
- C) lipids and steroids
- D) nitrogen and other minerals

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.3

42) Epiphytes are _____.

- A) aerial vines common in tropical regions
- B) plants that live in poor soil and digest insects to obtain nitrogen
- C) plants that grow on other plants but do not obtain nutrients from their hosts
- D) plants that have a symbiotic relationship with fungi

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 37.3

43) While hiking in a forest, you notice an unusual plant growing on the branches of a tree. What will help you to determine if this plant is epiphytic or parasitic?

- A) If the plant is green, it is epiphytic; if not, then it is parasitic.
- B) The root of an epiphytic plant will be in the soil, but a parasitic plant will grow from the trunk of a tree.
- C) The roots of a parasitic plant will penetrate under the bark into the tree xylem, and the roots of epiphytic plant will not.
- D) The epiphytic plant will have large water collecting leaves, and the parasitic plant will not.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 37.3

37.2 Student Edition End-of-Chapter Questions

1) The inorganic nutrient most often lacking in crops is

- A) carbon.
- B) nitrogen.
- C) phosphorus.
- D) potassium.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

2) Micronutrients are needed in very small amounts because

- A) most of them are mobile in the plant.
- B) most serve mainly as cofactors of enzymes.
- C) most are supplied in large enough quantities in seeds.
- D) they play only a minor role in the growth and health of the plant.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

3) Mycorrhizae enhance plant nutrition mainly by

- A) absorbing water and minerals through the fungal hyphae.
- B) providing sugar to root cells, which have no chloroplasts.
- C) converting atmospheric nitrogen to ammonia.
- D) enabling the roots to parasitize neighboring plants.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Epiphytes are
- A) fungi that attack plants.
 - B) fungi that form mutualistic associations with roots.
 - C) nonphotosynthetic parasitic plants.
 - D) plants that grow on other plants.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 5) Some of the problems associated with intensive irrigation include all of the following *except*
- A) soil salinization.
 - B) overfertilization.
 - C) land subsidence.
 - D) aquifer depletion.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 6) A mineral deficiency is likely to affect older leaves more than younger leaves if
- A) the mineral is a micronutrient.
 - B) the mineral is very mobile within the plant.
 - C) the mineral is required for chlorophyll synthesis.
 - D) the mineral is a macronutrient.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 7) The greatest difference in health between two groups of plants of the same species, one group with mycorrhizae and one group without mycorrhizae, would be in an environment
- A) where nitrogen-fixing bacteria are abundant.
 - B) that has soil with poor drainage.
 - C) that has hot summers and cold winters.
 - D) in which the soil is relatively deficient in mineral nutrients.

Answer: D

Bloom's Taxonomy: Application/Analysis

- 8) Two groups of tomatoes were grown under laboratory conditions, one with humus added to the soil and one a control without humus. The leaves of the plants grown without humus were yellowish (less green) compared with those of the plants grown in humus-enriched soil. The best explanation is that
- A) the healthy plants used the food in the decomposing leaves of the humus for energy to make chlorophyll.
 - B) the humus made the soil more loosely packed, so water penetrated more easily to the roots.
 - C) the humus contained minerals such as magnesium and iron needed for the synthesis of chlorophyll.
 - D) the heat released by the decomposing leaves of the humus caused more rapid growth and chlorophyll synthesis.

Answer: C

Bloom's Taxonomy: Application/Analysis

- 9) The specific relationship between a legume and its mutualistic *Rhizobium* strain probably depends on
- A) each legume having a chemical dialogue with a fungus.
 - B) each *Rhizobium* strain having a form of nitrogenase that works only in the appropriate legume host.
 - C) each legume being found where the soil has only the *Rhizobium* specific to that legume.
 - D) specific recognition between chemical signals and signal receptors of the *Rhizobium* strain and legume species.

Answer: D

Bloom's Taxonomy: Application/Analysis

38.1 Multiple-Choice Questions

1) Which of the following is the correct order of floral organs from the outside to the inside of a complete flower?

- A) petals → sepals → stamens → carpels
- B) sepals → stamens → petals → carpels
- C) spores → gametes → zygote → embryo
- D) sepals → petals → stamens → carpels

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 38.1

2) Arrange the following structures from largest to smallest, assuming that they belong to two generations of the same angiosperm.

1. ovary
2. ovule
3. egg
4. carpel
5. embryo sac

- A) 4, 2, 1, 5, 3
- B) 5, 4, 3, 1, 2
- C) 5, 1, 4, 2, 3
- D) 4, 1, 2, 5, 3

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 38.1

3) A summer occupation in the Corn Belt states is de-tasseling the corn: removing unwanted male flowers so that female flowers on the same plant are pollinated by the desired pollen for the hybrid corn. What does this tell you about corn? The flowers are _____.

- A) perfect and the plant is dioecious
- B) perfect and the plant is monoecious
- C) imperfect and the plant is dioecious
- D) imperfect and the plant is monoecious

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 38.1

- 4) During the alternation of generations in plants, _____.
A) meiosis produces gametes
B) mitosis produces gametes
C) fertilization produces spores
D) fertilization produces gametes

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.1

- 5) Which of these is a major trend in land plant evolution?
A) the trend toward smaller size
B) the trend toward a gametophyte-dominated life cycle
C) the trend toward a sporophyte-dominated life cycle
D) the trend toward larger gametophytes

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.1

- 6) Retaining the zygote on the living gametophyte of land plants _____.
A) protects the zygote from herbivores
B) evolved concurrently with pollen
C) helps in dispersal of the zygote
D) allows it to be nourished by the parent plant

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 38.1

- 7) Sperm cells are formed in plants by _____.
A) meiosis in pollen grains
B) meiosis in anthers
C) mitosis in male gametophyte
D) mitosis in the micropyle

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.1

- 8) A researcher has developed two stains for use with seed plants. One stains sporophyte tissue blue; the other stains gametophyte tissue red. If the researcher exposes pollen grains to both stains, and then rinses away the excess stain, what should occur?
A) The pollen grains will be pure red.
B) The pollen grains will be pure blue.
C) The pollen grains will have red interiors and blue exteriors.
D) The pollen grains will have blue interiors and red exteriors.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.1

9) In which of the following pairs are the two terms equivalent?

- A) ovule — egg
- B) embryo sac — female gametophyte
- C) seed — zygote
- D) microspore — pollen grain

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.1

10) The generative cell of male angiosperm gametophytes is haploid. This cell divides to produce two haploid sperm cells. What type of cell division does the generative cell undergo to produce these sperm cells?

- A) mitosis
- B) meiosis
- C) mitosis without subsequent cytokinesis
- D) meiosis without subsequent cytokinesis

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 38.1

11) Which of the following statements regarding flowering plants is correct?

- A) The gametophyte is the dominant generation.
- B) Female gametophytes develop from megasporangia within the anthers.
- C) Pollination is the delivery of pollen to the stigma of a carpel.
- D) The food-storing endosperm is derived from the cell that contains one polar nucleus and two sperm nuclei.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 38.1

12) In a typical angiosperm, what is the sequence of structures encountered by the tip of a growing pollen tube on its way to the egg?

1. micropyle
2. style
3. ovary
4. stigma

- A) 4 → 2 → 3 → 1
- B) 4 → 3 → 2 → 1
- C) 1 → 3 → 4 → 2
- D) 3 → 2 → 4 → 1

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 38.1

13) If an ovary contains 50 ovules, what is the minimum number of pollen grains that must land to form 50 mature seeds?

- A) 25
- B) 50
- C) 100
- D) 500

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 38.1

14) Double fertilization means that _____.

- A) flowers must be pollinated twice to yield fruits and seeds
- B) one sperm is needed to fertilize the egg, and a second sperm is needed to fertilize the polar nuclei
- C) the egg of the embryo sac is diploid
- D) every sperm has two nuclei

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.1

15) A typical angiosperm embryo sac (female gametophyte) has _____ cells.

- A) 2
- B) 1
- C) 8
- D) 4

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 38.1

16) Double fertilization in angiosperm embryo sac produces endosperm, a food-storing tissue of the seed. The genetic makeup of endosperm is _____.

- A) $2n$
- B) $3n$
- C) $4n$
- D) n

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.1

17) In a typical dicot ovule, a surviving megasporangium divided by _____ consecutive mitotic divisions without cytokinesis results in _____ nuclei.

- A) 2; 6
- B) 3; 8
- C) 3; 12
- D) 4; 16
- E) 1; 1

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 38.1

18) Which of the following is correctly paired with its life cycle generation?

- A) anther—sporophyte
- B) pollen—sporophyte
- C) embryo sac—gametophyte
- D) stamen—gametophyte

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.1

19) Which of the following pollinating agents is correctly matched with the type of plant it helps pollinate?

- A) Water—terrestrial plants
- B) Animals—aquatic plants
- C) Wind—grasses
- D) Sand—desert plants

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.1

20) Suppose that 100 pollen grains land on a stigma, and 50 mature seeds are formed in the fruit. What does this indicate about the pollination process and success?

- A) 50% success: 100 pollen grains grew to 50 ovules, and double fertilization occurred.
- B) 50% success: Evidently, only 50 sperm pollinated 50 anthers.
- C) 50% success: 50 sperm fertilized 50 eggs, and 50 sperm fused with 50 polar nuclei.
- D) 50% success: 50 sperm fertilized 50 eggs, and 50 sperm fused with 100 polar nuclei.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 38.1

21) Which of the following flower parts develops into a seed?

- A) ovule
- B) ovary
- C) stamen
- D) carpel

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.1

22) The vast number and variety of flower species is probably related to various kinds of _____.

- A) seed dispersal agents
- B) pollinators
- C) herbivores
- D) climatic conditions

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.1

23) Cottonwood, aspen, and willow trees have beige flowers, with no petals, that appear before the tree's leaves are out in the spring; and they are dioecious. What does this indicate about these trees?

- A) Their insect pollinators are specialists.
- B) Early emerging insects are probably the pollinators.
- C) Their pollen is dispersed by wind.
- D) The trees are self-pollinating.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 38.1

24) The egg of a plant has a haploid chromosome number of 12 ($n = 12$). What is true about the number of chromosomes in the cells of other tissues of this plant?

- A) The sperm has 6 chromosomes.
- B) The leaves and stems have 12 chromosomes.
- C) The zygote has 12 chromosomes.
- D) The endosperm has 36 chromosomes.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 38.1

25) What adaptations should one expect of the seed coats of angiosperm species whose seeds are dispersed by frugivorous (fruit-eating) animals, as opposed to angiosperm species whose seeds are dispersed by other means?

1. The exterior of the seed coat should have barbs or hooks.
2. The seed coat should contain secondary compounds that irritate the lining of the animal's mouth.
3. The seed coat should be able to withstand low pHs.
4. The seed coat, upon its complete digestion, should provide vitamins or nutrients to animals.
5. The seed coat should be resistant to the animals' digestive enzymes.

- A) 4 only
B) 1 and 2
C) 3 and 5
D) 3, 4, and 5

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 38.1

26) Which of these events occurs first in seed germination?

- A) Cell division occurs in the embryo and growth starts.
B) Mitochondria multiply and provide energy for growth processes.
C) Water is taken up.
D) Oxygen is produced and proteins are synthesized.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 38.1

27) Before plowing a field, a farmer thought the bare field looked weed-free. Three days after plowing and turning over the soil, he was amazed to see thousands of tiny seedlings. What is the most likely reason for the mass germination of seeds?

- A) large seeds that needed soil disturbance to germinate
B) small seeds that need light to germinate
C) small seeds that were scarified by exposure to plow
D) large seeds that needed exposure to higher levels of oxygen to germinate

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 38.1

28) Which of the following flower parts develops into the pulp of a fleshy fruit?

- A) stigma
B) style
C) ovule
D) ovary

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.1

29) Pineapple is a _____ fruit.

- A) simple
- B) multiple
- C) aggregate
- D) accessory

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.1

30) Among plants known as legumes (beans, peas, alfalfa, clover, for example), the seeds are contained in a fruit that is itself called a legume, better known as a pod. Upon opening such pods, it is commonly observed that some ovules have become mature seeds, whereas other ovules have not. Thus, which of the following statements is (are) true?

1. The flowers that gave rise to such pods were not pollinated.
2. Pollen tubes did not enter all of the ovules in such pods.
3. There was apparently not enough endosperm to distribute to all of the ovules in such pods.
4. The ovules that failed to develop into seeds were derived from sterile floral parts.
5. Fruit can develop, even if all ovules within have not been fertilized.

- A) 1 only
- B) 1 and 5
- C) 2 and 5
- D) 3 and 5

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 38.1

31) Use the following information to answer the question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, is a source of high-quality lumber, and is a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can now enter. The uneaten seeds may subsequently germinate.

Orchid bees are to Brazil nut trees as _____ are to pine trees.

- A) breezes
- B) rain droplets
- C) seed-eating birds
- D) squirrels

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 38.1

32) Use the following information to answer the question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, is a source of high-quality lumber, and is a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can now enter. The uneaten seeds may subsequently germinate.

The same bees that pollinate the flowers of the Brazil nut trees also pollinate orchids, which are epiphytes (in other words, plants that grow on other plants); however, orchids cannot grow on Brazil nut trees. These observations explain _____.

- A) the coevolution of Brazil nut trees and orchids
- B) why Brazil nut trees do not set fruit in monoculture plantations
- C) why male orchid bees do not pollinate Brazil nut tree flowers
- D) why male orchid bees are smaller than female orchid bees

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 38.1

33) Use the following information to answer the question.

The Brazil nut tree, *Bertholletia excels* ($n = 17$), is native to tropical rain forests of South America. It is a hardwood tree that can grow to over 50 meters tall, is a source of high-quality lumber, and is a favorite nesting site for harpy eagles. As the rainy season ends, tough-walled fruits, each containing 8-25 seeds (Brazil nuts), fall to the forest floor. Brazil nuts are composed primarily of endosperm. About \$50 million worth of nuts are harvested each year. Scientists have discovered that the pale yellow flowers of Brazil nut trees cannot fertilize themselves and admit only female orchid bees as pollinators. The agouti (*Dasyprocta* spp.), a cat-sized rodent, is the only animal with teeth strong enough to crack the hard wall of Brazil nut fruits. It typically eats some of the seeds, buries others, and leaves still others inside the fruit, which moisture can now enter. The uneaten seeds may subsequently germinate.

Animals that consume Brazil nuts derive nutrition mostly from tissue whose nuclei have how many chromosomes?

- A) 17
- B) 34
- C) 51
- D) 68

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 38.1

34) Which of the following could be considered an evolutionary advantage of asexual reproduction in plants?

- A) increased success of progeny in a stable environment
- B) increased agricultural productivity in a rapidly changing environment
- C) maintenance and expansion of a large genome
- D) increased ability to adapt to a change in the environment

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 38.2

35) Plants produce more seeds when they reproduce asexually than sexually. Yet most plants reproduce sexually in nature. What is the probable explanation for the prevalence of sexual reproduction? Sexual reproduction _____.

- A) is more energy efficient than asexual reproduction
- B) ensures genetic continuity from parents to offspring
- C) mixes up alleles, contributing to variation in a species
- D) is not dependent on other agents of pollination

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 38.2

36) Which of the following is a true statement about asexual reproduction in plants?

- A) Clones of plants do not occur naturally.
- B) Cloning, although achieved in animals, has not been demonstrated in plants.
- C) Making cuttings of ornamental plants is a form of fragmentation.
- D) Reproduction of plants by cloning may be either sexual or asexual.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 38.2

37) In a multicellular organism, any cell that can divide and generate a/an _____ of the original organism is called to be totipotent.

- A) organ
- B) clone
- C) tissue
- D) cell

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.2

38) While looking at a flower in your garden, you notice that it has carpels with very long styles, and stamens with very short filaments. This plant is most likely to reproduce by _____.

- A) cross-pollination
- B) selfing
- C) asexual reproduction
- D) vegetative reproduction

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 38.2

39) Which of the following types of plants are incapable of self-pollination?

- A) dioecious
- B) monoecious
- C) wind-pollinated
- D) insect-pollinated

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.2

40) Which of the following is a potential advantage of introducing apomixis into hybrid crop species?

- A) Cultivars would be better able to cope with a rapidly changing environment.
- B) They would have a larger potential genome than inbred crops.
- C) All of the desirable traits of the cultivar would be passed on to offspring.
- D) They would benefit from positive mutations in their DNA.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 38.2

41) Pollen from a plant with the S_1S_2 genotype is recognized and allowed to germinate on the stigma of the same plant with the S_1S_2 genotype. According to this, the plant is _____.

- A) self-compatible and can self-pollinate
- B) self-compatible and must cross-pollinate
- C) self-incompatible and can self-pollinate
- D) self-incompatible and must cross-pollinate

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 38.2

42) Which of the following is an effective method to produce plants exhibiting hybrid vigor?

- A) self-pollination
- B) cloning
- C) tissue culture
- D) genetic engineering

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 38.2

43) Over human history, which process has been most important in improving the features of plants that have long been used by humans as staple foods?

- A) genetic engineering
- B) artificial selection
- C) sexual selection
- D) pesticide and herbicide application

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.3

44) Which of these activities is part of the development of crop plants from wild relatives?

- I) people planting seeds of the plants with the characteristic wanted
- II) people making observations of desired plant characteristics
- III) people eating products from only the plants with desired characteristics
- IV) people developing several varieties of crops from a wild relative

- A) I and II
- B) I and IV
- C) I, III, and IV
- D) I, II, and IV

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 38.3

45) Regardless of where in the world a vineyard is located, for the winery to produce a Burgundy, it must use varietal grapes that originated in Burgundy, France. The most effective way for a new California grower to plant a vineyard to produce Burgundy is to _____.

- A) plant seeds obtained from French varietal Burgundy grapes
- B) transplant varietal Burgundy plants from France
- C) acquire a tissue culture of varietal Burgundy grapes from France
- D) graft varietal Burgundy grape scions onto native (Californian) root stocks

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 38.3

46) Plant biotechnology is an effective tool for _____.

- A) reducing world hunger
- B) increasing the import of oil
- C) decreasing genetic diversity
- D) increasing the incompatibility of fertilization

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 38.3

47) The most immediate potential benefits of introducing genetically modified crops include _____.

- I) creating crops that can grow on land previously unsuitable for agriculture
- II) creating crops with better potential for biofuel production
- III) creating crops with better nutritional attributes
- IV) increasing crop yield
- V) decreasing the mutation rate of certain genes

- A) only II, III, and IV
- B) only I, II, III, and IV
- C) only III, IV, and V
- D) I, II, III, IV, and V

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.3

48) "Golden Rice" _____.

- A) is resistant to various herbicides, making it practical to weed rice fields with those herbicides
- B) includes bacterial genes that produce a toxin that reduces damage from insect pests
- C) produces larger, golden grains that increase crop yields
- D) contains daffodil genes that increase vitamin A content

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 38.3

49) Which of the following is a scientific concern related to creating genetically modified crops?

- A) Herbicide resistance may spread to weedy species.
- B) Genetically modified crops cannot survive without the addition of great amounts of fertilizer to the soil.
- C) The monetary costs of growing genetically modified plants are significantly greater than traditional breeding techniques.
- D) Genetically modified plants are less stable and may revert back to parental genotypes.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 38.3

50) Which of the following would be the most problematic for the natural environment in the development of genetically engineered crops?

- A) the introduction of male sterility into crops
- B) the creation of transgenic crops with apomictic seeds
- C) the creation of crops with flowers that develop normally, but fail to open
- D) the creation of transgenic crops that hybridize more easily

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 38.3

51) Fruit ripening represents an example of positive feedback. Which one of the following statements accurately justifies why the process of fruit ripening involves positive feedback?

- A) Once seeds have reached maturity, chemical signals increase enzymatic activity in fruit to convert sugars into starches, thicken pulp, and maintain color in the fruit.
- B) Once seeds have reached maturity, chemical signals block enzymatic steps that normally convert sugars into starches, and sugars accumulate from photosynthetic activity within the fruit.
- C) Chemical signals initiate a process that triggers enzymatic activity, which involves converting starches into sugars, softening of pulp, and color change of fruit.
- D) Chemical signals shut down enzymatic activity within the fruit, which results in breakdown of starches into sugars, softening of pulp, and color change of fruit.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 38.1

52) In order for an ovule (egg cell) in a flower to be fertilized and form a viable seed, pollination must occur. In this process, a sperm cell is delivered to the ovule when the pollen grain lands on the stigma and grows a tube, which enters the ovary and discharges the sperm cell to form a diploid zygote when it fuses with the egg cell. Although it only takes one pollen grain to successfully deliver sperm to the egg, numerous pollen grains are generally transferred to the stigma during insect pollination of flowering plants. Which phenotypic traits of pollen would you predict to be selected upon to promote survival and fitness within an insect-pollinated flowering plant?

- A) high pollen tube growth rate and ability to detect chemicals from cells surrounding the egg
- B) ability to produce the most cells during mitotic growth of the pollen tube
- C) elaborate and striking UV "nectary guides" on the petals to guide an insect to the stigma
- D) larger pollen in order to carry the tube that is necessary for delivery of the sperm cells

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 38.1

53) Many flowering plants coevolve with specific pollinators. The Madagascar orchid has a 12-inch floral tube and is a reliable nectar source for the hawkmoth, which has a correspondingly long proboscis (tongue). Which statement most accurately describes how coevolution might have occurred for the hawkmoth and Madagascar orchid?

- A) The hawkmoths that expended the most effort to reach the nectar would be the most fit, and pass the longer tongue phenotype to their offspring.
- B) Natural selection would favor orchids with nectar tubes just long enough for an insect with pollen to make contact. Hawkmoths whose tongue could reach the deep tubes would be more fit.
- C) Hawkmoths whose tongue was just long enough to obtain nectar, but not able to pick up pollen would become the most fit in the population.
- D) It is most likely that mutations that resulted in both the length of the orchid floral tube and the length of the hawkmoth tongue occurred abruptly and simultaneously.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 38.1

38.2 Student Edition End-of-Chapter Questions

- 1) A fruit is
 - A) a mature ovary.
 - B) a mature ovule.
 - C) a seed plus its integuments.
 - D) an enlarged embryo sac.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 2) Double fertilization means that
 - A) flowers must be pollinated twice to yield fruits and seeds.
 - B) every egg must receive two sperm to produce an embryo.
 - C) one sperm is needed to fertilize the egg, and a second sperm is needed to fertilize the polar nuclei.
 - D) every sperm has two nuclei.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 3) "Bt maize"
 - A) is resistant to various herbicides, making it practical to weed rice fields with those herbicides.
 - B) contains transgenes that increase vitamin A content.
 - C) includes bacterial genes that produce a toxin that reduces damage from insect pests.
 - D) is a "boron (B)-tolerant" transgenic variety of maize.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Which statement concerning grafting is correct?
 - A) Stocks and scions refer to twigs of different species.
 - B) Stocks and scions must come from unrelated species.
 - C) Stocks provide root systems for grafting.
 - D) Grafting creates new species.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 5) Some dioecious species have the XY genotype for male and XX for female. After double fertilization, what would be the genotypes of the embryos and endosperm nuclei?
 - A) embryo XY/endosperm XXX or embryo XX/endosperm XXY
 - B) embryo XX/endosperm XX or embryo XY/endosperm XY
 - C) embryo XX/endosperm XXX or embryo XY/endosperm XYY
 - D) embryo XX/endosperm XXX or embryo XY/endosperm XXY

Answer: D

Bloom's Taxonomy: Application/Analysis

- 6) A small flower with green petals is most likely
- A) bee-pollinated.
 - B) bird-pollinated.
 - C) bat-pollinated.
 - D) wind-pollinated.

Answer: D

Bloom's Taxonomy: Application/Analysis

- 7) The black dots that cover strawberries are actually fruits formed from the separate carpels of a single flower. The fleshy and tasty portion of a strawberry derives from the receptacle of a flower with many separate carpels. Therefore, a strawberry is
- A) a simple fruit with many seeds.
 - B) both a multiple fruit and an accessory fruit.
 - C) both a simple fruit and an aggregate fruit.
 - D) both an aggregate fruit and an accessory fruit.

Answer: D

Bloom's Taxonomy: Application/Analysis

39.1 Multiple-Choice Questions

1) The detector of light during de-etiolation (greening) of a tomato plant is (are) _____.

- A) carotenoids
- B) xanthophylls
- C) phytochrome
- D) auxin

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.1

2) Plant hormones _____.

- A) in plant cells naturally exist in very large amounts
- B) change their shape in response to stimulus
- C) are unable to move from one cell to another
- D) affect only cells with the appropriate receptor

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.1

3) Which of the following mechanisms is the correct sequence of events that takes place during the plant responses to internal and external signals?

- A) transduction, reception, and response
- B) reception and transduction
- C) reception, transduction, and response
- D) reception and response

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.1

4) Which of the following mechanisms is in the correct sequence of steps (I-IV as listed below) that takes place during the formation of de-etiolation (greening) response proteins in plants?

- I. Detection of light signal
- II. Activation of phytochrome
- III. Activation of specific protein kinase1
- IV. Formation of de-etiolation response protein

A) I, III, II, and IV

B) I, II, III, and IV

C) II, I, III, and IV

D) III, I, II, and IV

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.1

5) Which of the following can function in signal transduction in plants?

- I. calcium ions
- II. nonrandom mutations
- III. receptor proteins
- IV. autochrome
- V. secondary messengers

A) only I, III, and IV

B) only I, II, and V

C) only I, III, and V

D) only II, III, and V

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.1

6) Plant hormones produce their effects by _____.

- I. altering the expression of genes
- II. modifying the permeability of the plasma membrane
- III. modifying the structure of the nuclear envelope membrane

A) only I

B) only II

C) only III

D) only I and II

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 39.2

- 7) Plant hormonal regulation differs from animal hormonal regulation in that _____.
A) there are no dedicated hormone-producing organs in plants as there are in animals
B) all production of hormones is local in plants with little long-distance transport
C) only animal hormone concentrations are developmentally regulated
D) only animal hormones may have either external or internal receptors

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 39.2

- 8) Auxins in plants are known to affect which of the following processes?

- I. gravitropism of shoots
- II. maintenance of seed dormancy
- III. phototropism of shoots
- IV. inhibition of lateral buds
- V. apical dominance

- A) only I and II
B) only I, III, and V
C) only I, III, IV, and V
D) only II, III, IV, and V

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.2

- 9) Experiments on the positive phototropic response of plants indicate that _____.
A) light destroys auxin
B) auxin moves down the plant apoplastically
C) auxin is synthesized in the area where the stem bends
D) auxin can move to the shady side of the stem

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.2

- 10) What are the primary sites of auxin (IAA) production in plants?

- A) shoot apical meristem and young leaves
- B) roots
- C) seeds
- D) ripening fruits

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.2

11) What are the primary sites of ethylene production in high concentrations in plants?

- A) shoot apical meristem and young leaves
- B) roots
- C) seeds
- D) ripening fruits

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.2

12) Which one of the following hormones regulates cell division in plants?

- A) auxin (IAA)
- B) ethylene
- C) gibberellins
- D) cytokinins

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.2

13) Which one of the following hormones stimulates stem elongation and pollen tube growth?

- A) auxin (IAA)
- B) ethylene
- C) gibberellins
- D) cytokinins

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.2

14) Generally, each hormone has multiple functions in plants depending on _____.

- I. site of action
- II. its concentration
- III. developmental stage
- IV. age

- A) I, II, III, and IV
- B) I, II, and III
- C) I and II
- D) II

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.2

15) Apical dominance in plants is under the control of _____.

- A) sugar
- B) various plant hormones
- C) cell division
- D) sugar and various plant hormones

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.2

16) Arrange the following steps that occur during drought tolerance in plants in a correct sequence.

- I. hormone ABA accumulation in the leaves
- II. causes stomata to close

III. reduction in transpiration

IV. preventing further water loss

- A) I, II, III, and IV
- B) I, III, II, and IV
- C) II, I, III, and IV
- D) III, I, II, and IV

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 39.2

17) Which of the following statements best summarizes the acid growth hypothesis in an actively growing shoot?

- A) Auxin stimulates proton pumps in the plasma membrane and tonoplast.
- B) Auxin-activated proton pumps lower the pH of the cell wall, which breaks bonds and makes the walls more flexible.
- C) Auxins and gibberellins together act as a lubricant to help stretch cellulose microfibrils.
- D) Auxins activate aquaporins that increase turgor pressure in the cells.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 39.2

18) Which of the following conclusions is supported by the research of both Peter Boysen-Jensen and Charles and Francis Darwin on shoot responses to light?

- A) When shoots are exposed to light, a chemical substance migrates toward the light.
- B) A chemical substance involved in shoot bending is produced in shoot tips.
- C) Once shoot tips have been cut, normal growth cannot be induced.
- D) Light stimulates the synthesis of a plant hormone that responds to light.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 39.2

19) An eccentric millionaire botanist has offered a \$25,000 scholarship to anyone who can successfully get a plant to grow through a vertical maze in complete darkness. The maze is not in a box; the maze is simply drawn on the wall, and the contestants must get their plant to grow in a pattern that matches the path through the maze. You need the money and feel confident that you can accomplish this task. Which of the following techniques will help you succeed?

- A) Apply auxin directly to the shoot tip on the side to which you want the tip to bend.
- B) Apply auxin directly to the part of the stem just below the tip opposite from the direction you want the stem to bend.
- C) Inject compounds that block auxin receptors into the part of the stem opposite from the direction you want the stem to bend.
- D) Plant the roots in two different pots, and apply auxin to the root bucket that is on the same side as the direction you want the plant to bend.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 39.2

20) You have a small tree in your yard that is the height that you want it, but does not have as many branches as you want. How can you prune it to trigger it to increase the number of branches?

- A) Cut off the leaves at the ends of several branches.
- B) Cut off the tips of the main shoots.
- C) Cut off lower branches.
- D) Cut off the leaves at the base of most of the branches.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 39.2

21) As cytokinins are primarily produced in roots, what route would they travel to influence lateral shoot formation in a recently topped tree?

- A) symplastic
- B) tracheids/vessels
- C) phloem
- D) apoplastic

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 39.2

22) Who might be interested in using cytokinins?

- A) grocers, to spray on fruit to enhance ripening in the store
- B) consumers, to spray on fruit before eating to enhance taste
- C) florists, to dip stems in to keep leaves green longer
- D) farmers, to spray on fruit after picking to stall ripening

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 39.2

23) If a farmer wanted more loosely packed clusters of grapes, he would most likely spray the immature bunches with _____.

- A) auxin
- B) gibberellins
- C) cytokinins
- D) abscisic acid

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.2

24) _____ prevents seeds from germinating until conditions are favorable for the growth of the plant.

- A) Ethylene
- B) Zeaxanthin
- C) Gibberellin
- D) Abscisic acid

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.2

25) A population of plants experiences several years of severe drought. Much of the population dies due to lack of water, but a few individuals survive. You set out to discover the physiological basis for their adaptation to such an extreme environmental change. You hypothesize that the survivors have the ability to synthesize higher levels of _____ than their siblings do.

- A) auxin
- B) gibberellin
- C) cytokinin
- D) abscisic acid

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 39.2

26) If you were shipping green bananas to a supermarket thousands of miles away, which of the following chemicals would you want to eliminate from the plants' environment?

- A) carbon dioxide
- B) cytokinins
- C) ethylene
- D) auxin

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 39.2

27) In the fall, the leaves of some trees change color. This happens because chlorophyll breaks down and the accessory pigments become visible. What hormone is responsible for this?

- A) phototropin
- B) abscisic acid
- C) cytokinin
- D) ethylene

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.2

28) Which type of mutant would be most likely to produce a bushier phenotype?

- A) auxin overproducer
- B) strigolactone overproducer
- C) cytokinin underproducer
- D) strigolactone underproducer

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 39.2

29) Vines in tropical rain forests must grow toward large trees before being able to grow toward the sun. To reach a large tree, the most useful kind of growth movement for a tropical vine presumably would be _____.

- A) negative thigmotropism
- B) negative phototropism
- C) negative gravitropism
- D) the opposite of circadian rhythms

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 39.2

30) Upon exposure to blue light, plants not only begin to grow toward the light, but move their chloroplasts to the sunny side of each cell. The adaptive advantage of moving chloroplasts to the sunny side of each cell _____.

- A) maximizes light absorption by the chloroplasts for photosynthesis
- B) increases production of phototropic hormones
- C) maximizes heat absorption by the chloroplasts for cellular respiration
- D) increases adenosine triphosphate (ATP) production during the light-independent reactions

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 39.3

31) Mammalian eyes sense light because the photoreceptor cells have molecules called opsins, which change structure when exposed to light. Which of the following plant molecules would be analogous to mammalian opsins in their light-sensing ability?

- A) auxin and phytochrome
- B) auxin and Pfr
- C) Pfr and phytochrome
- D) cytokinins and phototropins

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 39.3

32) Seed packets give a recommended planting depth for the enclosed seeds. The most likely reason some seeds are to be covered with only 1/4 inch of soil is that the _____.

- A) seedlings do not have an etiolation response
- B) seeds require light to germinate
- C) seeds require a higher temperature to germinate
- D) seeds are very sensitive to waterlogging

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 39.3

33) Suppose a plant had a photosynthetic pigment that absorbed far-red wavelengths of light. In which of the following environments could that plant thrive?

- A) on the surface of a lake
- B) on the forest floor, beneath a canopy of taller plants
- C) on the ocean floor, in very deep waters
- D) on mountaintops, closer to the Sun

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 39.3

34) The biological clock controlling circadian rhythms must ultimately _____.

- A) depend on environmental cues
- B) affect gene transcription
- C) stabilize on a 24-hour cycle
- D) speed up or slow down with increasing or decreasing temperature

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 39.3

35) Which of the colors of visible light induces curvature in coleoptile most effectively?

- A) red
- B) blue
- C) violet
- D) orange

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.3

36) Phytochrome plays a critical role in seed germination. Which of the colors maximizes the seed germination?

- A) red
- B) blue
- C) violet
- D) orange

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.3

37) Many plants flower in response to day-length cues. Which of the following statements best summarizes this phenomenon?

- A) As a rule, short-day plants flower in the summer.
- B) As a rule, long-day plants flower in the spring or fall.
- C) Long-day plants flower in response to long days, not short nights.
- D) Flowering in short-day and long-day plants is controlled by phytochrome.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.3

38) Plants often use changes in day length (photoperiod) to trigger events such as dormancy and flowering. It is logical that plants have evolved this mechanism because photoperiod changes _____.

- A) are more predictable than air temperature changes
- B) predict moisture availability
- C) are modified by soil temperature changes
- D) can reset the biological clock

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 39.3

39) A gardener in Canada wants to surprise his mother on her birthday and make her favorite hibiscus bush flower in May instead of at the end of June. The bush is growing in the greenhouse. Which of the following might make the hibiscus bush flower early?

- A) grafting leaves of a hibiscus that was exposed to long nights
- B) grafting leaves of a hibiscus that was exposed to short nights
- C) exposing flower buds of the hibiscus bush to long nights
- D) exposing flower buds of the hibiscus bush to short nights

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 39.3

40) Which of the following environmental factors can be sensed by plants?

- I) gravity
- II) pathogens
- III) wind
- IV) light

- A) only I and III
- B) only I, II, and IV
- C) only II, III, and IV
- D) I, II, III, and IV

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.4

41) Shoots that grow vertically toward the sun can be characterized as _____.

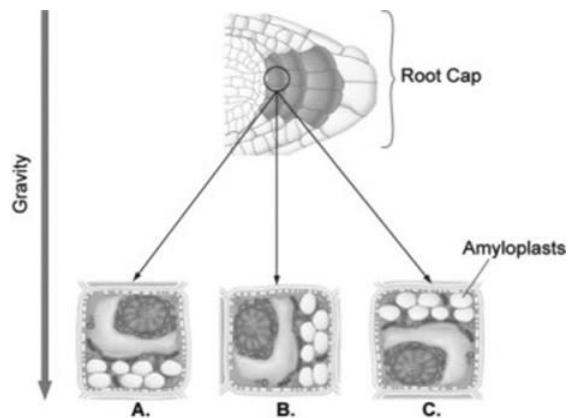
- A) positive for phototropism and negative for gravitropism
- B) neutral for phototropism and positive for gravitropism
- C) negative for phototropism and positive for gravitropism
- D) positive for phototropism and neutral for gravitropism

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.4

42) Use the figure to answer the following question.



Suppose you laid a seedling on its side so that the root was parallel to the ground as shown in the figure. Several hours after the change in position, where in the root cells, position A, B, or C in the figure, would you find the amyloplasts?

- A) A
- B) B
- C) C
- D) A and C

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 39.4

43) The rapid leaf movements resulting from a response to touch (thigmotropism) primarily involve _____.

- A) potassium channels
- B) nervous tissue
- C) aquaporins
- D) stress proteins

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.4

44) In extremely cold regions, woody species may survive freezing temperatures by _____.

- A) emptying water from the vacuoles to prevent freezing
- B) decreasing the numbers of phospholipids in cell membranes
- C) decreasing the fluidity of all cellular membranes
- D) increasing cytoplasmic levels of specific solute concentrations, such as sugars

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.4

45) Most scientists agree that global warming is underway; thus, it is important to know how plants respond to heat stress. Which of the following would be a useful line of inquiry to try and improve plant response and survival to heat stress?

- A) the production of heat-stable carbohydrates
- B) increased production of heat-shock proteins
- C) the opening of stomata to increase evaporational heat loss
- D) protoplast fusion experiments with xerophytic plants

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 39.4

46) When an arborist prunes a limb off a valuable tree, he or she may paint the cut surface. The primary purpose of the paint is to _____.

- A) minimize water loss by evaporation from the cut surface
- B) improve the appearance of the cut surface
- C) stimulate growth of the cork cambium to "heal" the wound
- D) block entry of pathogens through the wound

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 39.5

47) You are out working in your garden, and you notice that one of your favorite flowering plants has black, dead spots on the leaves. You immediately suspect that the plant has been invaded by a pathogen and has initiated a(n) _____.

- A) avirulence response
- B) hypersensitive response
- C) resistance response
- D) virulence response

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 39.5

48) Generalized defense responses in organs distant from the infection site are called _____.

- A) hyperactive responses
- B) systemic acquired resistance
- C) pleiotropy
- D) hyperplasia

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.5

49) A particular species of virus carries a gene for salicylate hydroxylase, an enzyme that breaks down salicylic acid. Will this virus be more or less virulent to plants than other viruses?

- A) more virulent
- B) less virulent
- C) same virulent
- D) faster virulent

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.5

50) Which event during the evolution of land plants favored the synthesis of secondary compounds?

- A) the greenhouse effect throughout the Devonian period
- B) the reverse-greenhouse effect during the Carboniferous period
- C) the association of the roots of land plants and fungi
- D) the rise of herbivory

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 39.5

51) For a plant to initiate chemical responses to herbivory, before it is directly affected by herbivores, _____.

- A) a plant must have already flowered at least once
- B) volatile "signal" compounds must be perceived
- C) gene-for-gene intraspecific recognition must occur
- D) phytoalexins must be released

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 39.5

52) You may have observed plants rotate towards a light source, thereby increasing the plant's ability to intercept light energy and increase photosynthesis. You, however, are given the task of preventing grass seedlings from rotating toward the light. Using your knowledge of phototropism, which of the following experimental procedures would you use to complete your task?

- A) Cover the growing tip of the grass seedling with black paper.
- B) Supply the seedlings with very dim light (red light does not induce a bend).
- C) Cover the portion of the seedling below the tip with a black shield.
- D) Supply the seedling with nutrient-rich fertilizer solution.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 39.2

53) A plant scientist was hired by a greenhouse operator to devise a way to force iris plants to bloom in the short days of winter. Iris normally blooms as a long-day (short-night) plant. Which of the following has the best chance of creating iris blooms in winter?

- A) Artificially increase the period of darkness in the greenhouse.
- B) Increase the temperature to more closely follow summer temperatures.
- C) Alternate four hours of darkness with four hours of light repeatedly over each 24-hour period.
- D) Interrupt the long winter nights with a brief period of light.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 39.3

54) An individual plant was discovered that could not grow towards light. After some research, it was determined that the reason was a defective gene that did not allow for the level of cell elongation necessary for a phototropic response. This mutation greatly reduces the fitness of the individual plant. Which reason best describes the reason for the loss of fitness?

- A) The plant was too short to attract insects for pollination.
- B) The plant could not adjust to directional light, which reduced photosynthetic activity and therefore energy available for reproduction.
- C) Because the plant grew much taller and straighter, resources that could be used for reproduction were used for growth.
- D) The loss of a phototropic response meant that the plant's seeds could not germinate, so reproduction would be unsuccessful.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 39.2

39.2 Student Edition End-of-Chapter Questions

1) The hormone that helps plants respond to drought is

- A) auxin.
- B) abscisic acid.
- C) cytokinin.
- D) ethylene.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

2) Auxin enhances cell elongation in all of these ways *except*

- A) increased uptake of solutes.
- B) gene activation.
- C) acid-induced denaturation of cell wall proteins.
- D) cell wall loosening.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 3) Charles and Francis Darwin discovered that
- A) auxin is responsible for phototropic curvature.
 - B) red light is most effective in shoot phototropism.
 - C) light destroys auxin.
 - D) light is perceived by the tips of coleoptiles.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 4) How may a plant respond to *severe* heat stress?
- A) by reorienting leaves to increase evaporative cooling
 - B) by creating air tubes for ventilation
 - C) by producing heat-shock proteins, which may protect the plant's proteins from denaturing
 - D) by increasing the proportion of unsaturated fatty acids in cell membranes, reducing their fluidity

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 5) The signaling molecule for flowering might be released earlier than usual in a long-day plant exposed to flashes of
- A) far-red light during the night.
 - B) red light during the night.
 - C) red light followed by far-red light during the night.
 - D) far-red light during the day.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 6) If a long-day plant has a critical night length of 9 hours, which 24-hour cycle would prevent flowering?
- A) 16 hours light/8 hours dark
 - B) 14 hours light/10 hours dark
 - C) 4 hours light/8 hours dark/4 hours light/8 hours dark
 - D) 8 hours light/8 hours dark/light flash/8 hours dark

Answer: B

Bloom's Taxonomy: Application/Analysis

- 7) A plant mutant that shows normal gravitropic bending but does not store starch in its plastids would require a reevaluation of the role of _____ in gravitropism.

- A) auxin
- B) calcium
- C) statoliths
- D) differential growth

Answer: C

Bloom's Taxonomy: Application/Analysis

40.1 Multiple-Choice Questions

1) Penguins, seals, and tuna have body forms that permit rapid swimming, because _____.

- A) all share a recent common ancestor
- B) all of their bodies have been compressed since birth by intensive underwater pressures
- C) the shape is a convergent evolutionary solution, which reduces drag while swimming
- D) this is the only shape that will allow them to maintain a constant body temperature in water

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 40.1

2) As animals have evolved large body size, they have also evolved adaptations to improve exchange of energy and materials with the environment. For example, in many larger organisms, evolution has favored lungs and a digestive tract with _____.

- A) more branching or folds
- B) increased thickness
- C) larger cells
- D) decreased blood supply

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.1

3) Much of the coordination of vertebrate body functions via chemical signals is accomplished by the _____.

- A) respiratory system
- B) endocrine system
- C) integumentary system
- D) excretory system

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.1

4) Compared with a smaller cell, a larger cell of the same shape has _____.

- A) less surface area
- B) less surface area per unit of volume
- C) a smaller average distance between its mitochondria and the external source of oxygen
- D) a smaller cytoplasm-to-nucleus ratio

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 40.1

5) Both the endocrine and nervous systems transmit information around an animal's body. Which of the following is a characteristic of nervous system signals?

- A) allow gradual changes to take place in the body
- B) travel quickly, allowing rapid transmission of signals
- C) usually impact the entire body
- D) a voltage change must occur

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 40.1

6) Some animals have no gills when young, but then develop gills that grow larger as the animal grows larger. What is the reason for this increase in gill size?

- A) The young of these animals are much more active than the adult, which leads to a higher BMR (basal metabolic rate) and, therefore, a higher need for oxygen.
- B) Relative to their volume, the young have more surface area across which they can transport all the oxygen they need.
- C) The young have a higher BMR.
- D) Relative to their surface area, the young have more body volume in which they can store oxygen for long periods of time.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 40.1

7) Evolutionary adaptations that help some animals *directly* exchange matter between the cells of their body and the environment include _____.

- A) a gastrovascular cavity, a two-layered body, and a torpedo-like body shape
- B) an external respiratory surface, a small body size, and a two-cell-layered body
- C) a large body volume, a long, tubular body, and a set of wings
- D) an unbranched internal surface, a small body size, and thick covering

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.1

8) All animals, whether large or small, have _____.

- A) an external body surface that is dry
- B) a basic body plan that resembles a two-layered sac
- C) a body surface covered with hair to keep them warm
- D) most of their cells in contact with an aqueous medium

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 40.1

9) Interstitial fluid is _____.

- A) the internal environment inside animal cells
- B) identical to blood in composition.
- C) a site of exchange between blood and body cells
- D) found only in the lumen of the small intestine

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.1

10) Generally, epithelial cell layers are responsible for separating two fluids. For example, the epithelium of blood vessels in animals separates the blood from the interstitial fluid. What characteristic would you expect to see in an epithelium that was specialized for passive diffusion of materials from one fluid to another?

- A) a single layer of flattened cells
- B) many layers of cells stacked together
- C) large, cube-shaped cells
- D) loosely connected cells surrounded by an extracellular matrix

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 40.1

11) Most of the exchange surfaces of multicellular animals are lined with _____.

- A) connective tissue
- B) smooth muscle cells
- C) neural tissue
- D) epithelial tissue

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.1

12) Connective tissues typically have _____.

- A) little space between the membranes of adjacent cells
- B) the ability to transmit electrochemical impulses
- C) the ability to shorten upon stimulation
- D) relatively few cells and a large amount of extracellular matrix

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.1

13) In mammals, GH (growth hormone) is an endocrine signal that stimulates repair and growth of various tissues. Which of the following would be required for a tissue to respond to growth hormone?

- A) the presence of a growth hormone receptor on the responding tissue
- B) the responding tissue must be muscle
- C) nerve cells must attach to the responding tissue for growth hormone to work
- D) a voltage change must occur

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 40.1

14) Blood is best classified as connective tissue because _____.

- A) its cells are separated from each other by an extracellular matrix
- B) it contains more than one type of cell
- C) its cells can move from place to place
- D) it is found within all the organs of the body

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 40.1

15) Most types of communication between cells utilize _____.

- A) the exchange of cytosol between the cells
- B) the movement of the cells
- C) chemical or electrical signals
- D) the exchange of DNA between the cells

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 40.1

16) All types of muscle tissue have _____.

- A) striated banding patterns seen under the microscope
- B) cells that lengthen when appropriately stimulated
- C) a response that can be consciously controlled
- D) interactions between actin and myosin

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 40.1

17) Cardiac muscle cells are both _____.

- A) striated and interconnected by intercalated disks
- B) smooth and under voluntary control
- C) striated and under voluntary control
- D) smooth and under involuntary control

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.1

18) Muscle cells are organized to perform specific types of contractions within a tissue. Which of the following is a characteristic of smooth muscle?

- A) many cells fused together
- B) intercalated discs
- C) spindle-shaped cells with a single nucleus
- D) striations with sarcomeres

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.1

19) Food moves along the digestive tract as the result of contractions by _____.

- A) cardiac muscle
- B) smooth muscle
- C) striated muscle
- D) skeletal muscle

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 40.1

20) In many animals, fat is stored in specialized cells in the _____.

- A) bone
- B) muscle
- C) adipose tissue
- D) blood

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.1

21) Bone consists of _____.

- A) a mixture of hardened collagen and minerals.
- B) chondroitin sulfate secreted by chondrocytes.
- C) many columnar epithelial cells packed together.
- D) hardened fibrous connective tissue.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.1

22) What is the name of the epithelial cell surface that faces the outside of an organ?

- A) apical
- B) basal
- C) interstitial
- D) lumen

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.1

- 23) Which organ system is responsible for protection against injury, infection, and dehydration?
- A) Reproductive system
 - B) Excretory system
 - C) Skeletal system
 - D) Integumentary system

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.1

- 24) Which of the following is a true statement about body size and physiology?
- A) The amount of food and oxygen an animal requires and the amount of heat and waste it produces are inversely proportional to its mass.
 - B) The rate at which an animal uses nutrients and produces waste products is independent of its volume.
 - C) Small and large animals face different physiological challenges because an animal's body mass increases cubically while its surface area increases as a squared function.
 - D) The wastes produced by an animal double as its volume doubles and triple as its surface area triples.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 40.1

- 25) An elephant and a mouse are running in full sunlight, and both overheat by the same amount above their normal body temperatures. When they move into the shade and rest, which animal will cool down faster?

- A) The elephant will because it has the higher surface-area-to-volume ratio.
- B) The elephant will because it has the lower surface-area-to-volume ratio.
- C) The mouse will because it has the higher surface-area-to-volume ratio.
- D) They will cool at the same rate because they overheated by the same amount.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 40.1

- 26) You have a cube of modeling clay in your hands. Which of the following changes to the shape of this cube of clay will decrease its surface area relative to its volume?

- A) Pinch the edges of the cube into small folds.
- B) Flatten the cube into a pancake shape.
- C) Round the clay up into a sphere.
- D) Stretch the cube into a long, shoebox shape.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 40.1

27) The metabolic rate of an animal is most accurately determined by _____.

- A) the amount of work done by an animal
- B) the amount of food consumed during a meal
- C) the amount of carbon dioxide produced by an animal in a given time.
- D) the amount of energy used by an animal in a given time

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.4

28) The migratory eel, *Anguilla rostrata*, is born and lives the juvenile (immature) part of its life in a freshwater environment, but then migrates thousands of miles through the ocean as an adult in order to breed. These eels are known to regulate their internal water and salt balance. What adaptations would you expect this eel to have in order to transition from fresh water to salt water at these two life stages?

- A) The juvenile eels would be better at removing salt from their bodies compared to adults.
- B) The adult eels would be better at removing salt from their bodies compared to juveniles.
- C) The juvenile eels would spend energy keeping water in their bodies.
- D) The adult eels would spend energy keeping salt in their bodies.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 40.1

29) The metamorphosis of a tadpole to an adult frog involves a thorough reconstruction of the animal's body. All of the structural and physiological changes must be complete or the frog will not survive this transformation. Which type of regulation would ensure that the animal completed its transformation?

- A) positive feedback
- B) negative feedback
- C) feedback inhibition
- D) enzymatic catalysis

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 40.2

30) When the body's blood glucose level rises, the pancreas secretes insulin and, as a result, the blood glucose level declines. When the blood glucose level is low, the pancreas secretes glucagon and, as a result, the blood glucose level rises. Such regulation of the blood glucose level is the result of _____.

- A) catalytic feedback
- B) positive feedback
- C) negative feedback
- D) protein-protein interactions

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 40.2

31) The body's automatic tendency to maintain a constant and optimal internal environment is termed as _____.

- A) balanced equilibrium
- B) physiological chance
- C) homeostasis
- D) static equilibrium

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.2

32) An example of a properly functioning homeostatic control system is seen when _____.

- A) the core body temperature of a runner rises gradually from 37°C to 45°C
- B) the kidneys excrete salt into the urine when dietary salt levels rise
- C) a blood cell shrinks when placed in a solution of salt and water
- D) the blood pressure increases in response to an increase in blood volume

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 40.2

33) If a person were to travel to a time zone that was several hours ahead of their own, they may experience tiredness known as jet lag. Jet lag is due to a disruption of _____.

- A) homeostasis
- B) circadian rhythm
- C) body temperature
- D) nerve impulses

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.2

34) What would be an advantage for an animal that conforms to a changing environmental condition, such as temperature?

- A) The animal's internal temperature would remain constant, even though the external temperature had changed.
- B) The animal's internal temperature would change opposite to the change in the external temperature.
- C) The animal would spend more time looking for food.
- D) The animal would spend less energy regulating its internal temperature.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 40.2

35) You discover a new species of bacteria that grows in aquatic environments with high salt levels. While studying these bacteria, you note that their internal environment is similar to the salt concentrations in their surroundings. You also discover that the internal salt concentrations of the bacteria change as the salt concentration in their environment changes. The new species can tolerate small changes in this way, but dies from large changes because it has no mechanism for altering its own internal salt levels. What type of homeostatic mechanism is this species using to regulate its internal salt levels?

- A) conformation
- B) regulation
- C) integration
- D) assimilation

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 40.2

36) Chum salmon (*Oncorhynchus keta*) are born in freshwater environments and then migrate to the sea. Near the end of their lives, they return to the freshwater stream where they were born to spawn. In fresh water, water constantly diffuses into the body and ions are lost from the body. In salt water, body water diffuses out of the body and excess ions are gained from the water. A salmon's gills have special cells to pump salt in or out of the body to maintain homeostasis. In response to the salmon's moves between fresh water and salt water, some cells in the gills are produced and others are destroyed. These changes made in the cells of the gills during the lifetime of an individual salmon are an example of which of the following?

- A) evolution
- B) trade-off
- C) acclimatization
- D) adaptation

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 40.2

37) To prepare flight muscles for use on a cool morning, hawkmoths _____.

- A) relax the muscles completely until after they launch themselves into the air
- B) decrease their standard metabolic rate
- C) rapidly contract and relax these muscles to generate metabolic warmth
- D) reduce the metabolic rate of the muscles to rest them before flight

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.3

38) In a cool environment, an ectotherm is more likely to survive an extended period of food deprivation than would an equally sized endotherm because the ectotherm _____.

- A) maintains a higher basal metabolic rate
- B) expends more energy per kilogram of body mass than does the endotherm
- C) invests little energy in temperature regulation
- D) has greater insulation on its body surface

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 40.3

39) Elephants can often be observed cooling off by spraying water over their bodies with their trunks. What type of heat exchange is occurring?

- A) conduction
- B) convection
- C) radiation
- D) evaporation

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 40.3

40) An example of an ectothermic organism that has few or no *behavioral* options when it comes to its ability to adjust its body temperature is a _____.

- A) sea star living deep in the ocean
- B) bass living in a farm pond
- C) hummingbird flying through a prairie
- D) honeybee in a hive on a rural farm

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 40.3

41) The panting responses observed in overheated birds and mammals dissipate excess heat by _____.

- A) countercurrent exchange
- B) acclimation
- C) vasoconstriction
- D) evaporation

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.3

- 42) Most land-dwelling invertebrates and all of the amphibians _____.
A) are ectothermic organisms with variable body temperatures
B) alter their metabolic rates to maintain a constant body temperature of 37°C
C) are endotherms but become thermo-conformers when they are in water
D) become more active when environmental temperatures drop below 15°C

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.3

- 43) The temperature-regulating center of vertebrate animals is located in the _____.
A) thyroid gland
B) hypothalamus
C) subcutaneous layer of the skin
D) liver

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.3

- 44) The metabolic breakdown of specialized brown fat deposits in certain animals is substantially increased during _____.
A) acclimatization
B) torpor
C) nonshivering thermogenesis
D) shivering thermogenesis

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.3

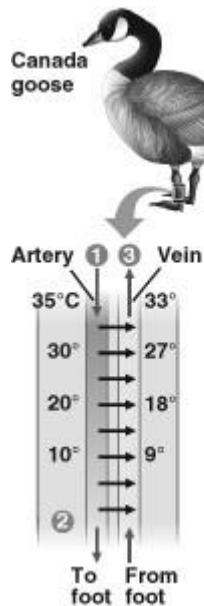
- 45) The use of brown fat to generate metabolic heat is mostly limited to small mammals. What is the basis of this adaptation?
A) Small mammals cannot grow enough fur to insulate their bodies.
B) Because of their large surface area to volume ratio, heat loss across the body surface is higher in small animals.
C) Small mammals do not have enough muscle to generate heat by shivering.
D) Large mammals have lost their brown fat through the course of their evolution.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 40.2 / 40.3

46) Use the figure to answer the following question.



The thin horizontal arrows in the figure above show that the _____.

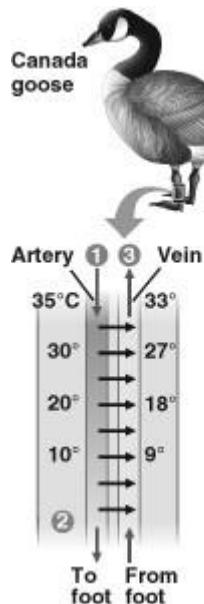
- A) warmer arterial blood can bypass the legs as needed, when the legs are too cold to function well
- B) warmer venous blood transfers heat to the cooler arterial blood
- C) warmer arterial blood transfers heat to the cooler venous blood
- D) arterial blood is always cooler in the abdomen, compared to the temperature of the venous blood in the feet of the goose

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 40.3

47) Use the figure to answer the following question.



The countercurrent arrangement of blood vessels is an adaptation that allows the goose to _____.

- A) minimize heat exchange between the feet and water
- B) generate heat using shivering thermogenesis
- C) more effectively cool off in the summer
- D) conserve heat in its core when the goose is swimming in cold water

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 40.3

48) Which of the following would increase the rate of heat exchange between an animal and its environment?

- A) feathers or fur
- B) vasoconstriction
- C) wind blowing across the body surface
- D) blubber or fat layer

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.3

- 49) You are studying a large tropical reptile that has a high and relatively stable body temperature. How would you determine whether this animal is an endotherm or an ectotherm?
- A) You know from its high and stable body temperature that it must be an endotherm.
 - B) You know that it is an ectotherm because it is not a bird or mammal.
 - C) You subject this reptile to various temperatures in the lab and find that its body temperature and metabolic rate change with the ambient temperature. You conclude that it is an ectotherm.
 - D) You note that its environment has a high and stable temperature. Because its body temperature matches the environmental temperature, you conclude that it is an ectotherm.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 40.3

- 50) A woman standing and watching the stars on a cool, calm night will lose most of her body heat by _____.

- A) radiation
- B) convection
- C) conduction
- D) evaporation

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 40.3

- 51) There are advantages and disadvantages to adaptations. Animals that are endothermic are likely to be at the greatest disadvantage in _____.

- A) very cold environments
- B) very hot environments
- C) environments with a constant food source
- D) environments with variable and limited food sources

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 40.3

- 52) Which principle of heat exchange is the most important explanation for why birds look larger in colder weather because they fluff their feathers?

- A) Fluffing feathers results in less cooling by radiation because feathers emit less infrared radiation than other tissues do.
- B) Fluffing decreases the amount of heat lost by conduction when the bird makes contact with cold objects in its environment.
- C) Fluffing creates a pocket of air near the bird that acts as insulation.
- D) Fluffing decreases the surface-area-to-volume ratio, thus decreasing the amount of heat lost to the environment.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 40.3

53) Snake behavior in Wisconsin changes throughout the year. For example, a snake is _____.

- A) less active in winter because the food supply is decreased
- B) less active in winter because it does not need to avoid predators
- C) more active in summer because that is the period for mating
- D) more active in summer because it can gain body heat by conduction

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 40.4

54) Standard metabolic rate (SMR) and basal metabolic rate (BMR) are _____.

- A) used differently: SMR is measured during exercise, whereas BMR is measured at rest
- B) used to compare metabolic rates during feeding and other active conditions
- C) both measured across a wide range of temperatures for a given species
- D) both measured in animals in a resting and fasting state

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 40.4

55) Independent of whether an organism is an endotherm or ectoderm, the *least* reliable indicator of an animal's metabolic rate is the amount of _____.

- A) food eaten in one day
- B) heat generated in one day
- C) oxygen used in mitochondria in one day
- D) water consumed in one day

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 40.4

56) Consider the energy budgets for a human, an elephant, a penguin, a mouse, and a snake. The _____ would have the highest total annual energy expenditure, and the _____ would have the highest energy expenditure per unit mass.

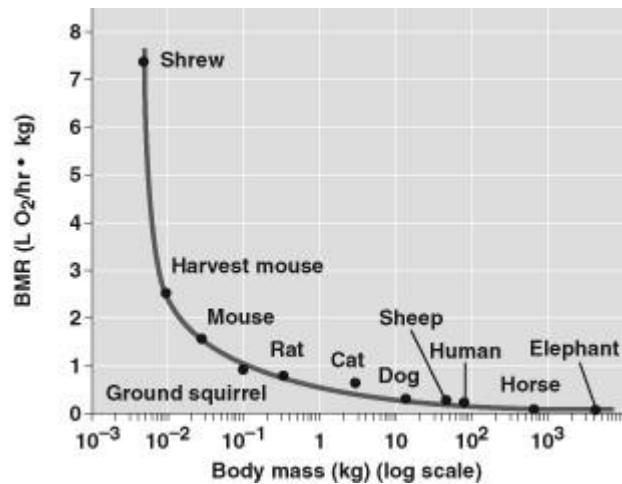
- A) elephant; mouse
- B) elephant; human
- C) human; penguin
- D) mouse; snake

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 40.4

57) Use the graph to answer the following question.



What can you determine from the graph?

- A) A smaller animal would consume less food per gram of tissue.
- B) An animal with a larger mass has a lower metabolic rate per gram of tissue relative to an animal with smaller mass.
- C) An elephant uses more energy than a shrew.
- D) A shrew uses more energy than an elephant.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 40.4

58) Which of the following animals most likely uses the largest percentage of its energy budget for homeostatic regulation?

- A) a marine jelly (an invertebrate) living deep in the ocean
- B) a snake in a tropical forest
- C) a shark swimming in the open ocean
- D) a bird living year-round in a desert

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 40.4

59) A researcher is setting up an experiment to measure basal metabolic rate in prairie voles (*Microtus ochrogaster*—a small rodent). Which of the following would be the best set of conditions for the voles immediately before and during the measurement?

- A) House the animals in a cage with plenty of food and water to avoid stress; conduct measurements in a warmer room than the room where housed.
- B) House the animals in a cage with plenty of food and water to avoid stress; conduct measurements in a room the same temperature as the room where housed.
- C) House the animals in a cage with no food for a few hours before measurement; conduct measurements in a colder room than the room where housed, and exercise the voles.
- D) House the animals in a cage with no food for a few hours before measurement; conduct measurements in a room the same temperature as the room where housed.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 40.4

60) Hummingbirds are small birds that require a regular food supply. When hummingbirds are faced with a situation that decreases their food supply, such as a storm, which of the following adaptations would be most useful for the bird to survive such an unpredictable and short-term absence of food resources?

- A) shivering
- B) torpor
- C) hibernation
- D) burrowing into soil

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 40.4

61) Organisms maintain dynamic homeostasis through behavioral and physiological mechanisms. Which of the following statements is an accurate explanation of a negative feedback mechanism used by animals to regulate body temperature?

- A) Squirrels are able to cool themselves during warmer months by producing more brown fat, which contains abundant mitochondria and a rich blood supply.
- B) Desert jackrabbits have unusually large ears that serve as solar heat collectors to enable them to maintain their body temperatures.
- C) A ground squirrel's hypothalamus detects changes in environmental temperatures and responds by activating or suppressing metabolic heat production.
- D) A goldfish slows its movements when the water temperature is lower.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 40.2

40.2 Student Edition End-of-Chapter Questions

- 1) The body tissue that consists largely of material located outside of cells is
A) epithelial tissue.
B) connective tissue.
C) muscle tissue.
D) nervous tissue.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 2) Which of the following would increase the rate of heat exchange between an animal and its environment?
A) feathers or fur
B) vasoconstriction
C) wind blowing across the body surface
D) countercurrent heat exchanger

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 3) Consider the energy budgets for a human, an elephant, a penguin, a mouse, and a snake. The _____ would have the highest total annual energy expenditure, and the _____ would have the highest energy expenditure per unit mass.
A) elephant; mouse
B) elephant; human
C) mouse; snake
D) penguin; mouse

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Compared with a smaller cell, a larger cell of the same shape has
A) less surface area.
B) less surface area per unit of volume.
C) the same surface-area-to-volume ratio.
D) a smaller cytoplasm-to-nucleus ratio.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 5) An animal's inputs of energy and materials would exceed its outputs
A) if the animal is an endotherm, which must always take in more energy because of its high metabolic rate.
B) if it is actively foraging for food.
C) if it is growing and increasing its mass.
D) never; due to homeostasis, these energy and material budgets always balance.

Answer: C

Bloom's Taxonomy: Application/Analysis

- 6) You are studying a large tropical reptile that has a high and relatively stable body temperature. How do you determine whether this animal is an endotherm or an ectotherm?
- A) You know from its high and stable body temperature that it must be an endotherm.
 - B) You subject this reptile to various temperatures in the lab and find that its body temperature and metabolic rate change with the ambient temperature. You conclude that it is an ectotherm.
 - C) You note that its environment has a high and stable temperature. Because its body temperature matches the environmental temperature, you conclude that it is an ectotherm.
 - D) You measure the metabolic rate of the reptile, and because it is higher than that of a related species that lives in temperate forests, you conclude that this reptile is an endotherm and its relative is an ectotherm.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 7) Which of the following animals uses the largest percentage of its energy budget for homeostatic regulation?

- A) marine jelly (an invertebrate)
- B) snake in a temperate forest
- C) desert insect
- D) desert bird

Answer: D

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 41 Animal Nutrition

41.1 Multiple-Choice Questions

- 1) The following table shows the contents of a multivitamin supplement and its percentage of recommended daily values (% DV).

Dietary Supplement	% DV
Vitamin A	70
Vitamin C	100
Vitamin D	100
Vitamin E	150
Vitamin K	13
Vitamin B ₁	100
Vitamin B ₂	100
Folic acid	100
Vitamin B ₁₂	41.7
Calcium	20
Phosphorus	5
Iodine	100
Magnesium	25
Zinc	100
Copper	100
Chromium	125
Molybdenum	100
Iron	0

The most likely reason that some of the vitamins and minerals in this supplement are found at less than 100% is that _____.

- A) it would be chemically impossible to add more
- B) these vitamins and minerals are too large in size to reach 100%
- C) it is too easy to overdose on minerals such as phosphorus and calcium
- D) it is dangerous to overdose on fat-soluble vitamins such as A and K

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 41.1

- 2) If a mammal did not obtain enough iodine in its diet, you might expect _____.

- A) a decreased ability to produce thyroid hormones
- B) a decrease in enzyme function
- C) the animal to have weak bones
- D) a decrease in muscle function

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.1

3) Animals that migrate great distances would obtain the greatest energetic benefit of storing chemical energy as _____.

- A) proteins
- B) minerals
- C) carbohydrates
- D) fats

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 41.5

4) Lysine is an essential amino acid for animals. If an animal did not consume lysine in its diet, you might expect that the animal _____.

- A) would make lysine from other amino acids
- B) could not effectively make many necessary proteins
- C) was a carnivore
- D) would be very healthy

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 41.1

5) Which of the following is a difference between vitamins and minerals?

- A) Vitamins are involved in regulating enzyme activity, but minerals are not.
- B) Vitamins are organic molecules, but minerals are inorganic molecules.
- C) Minerals are obtained by an animal through dietary sources, but vitamins are made by the animal.
- D) Vitamins and minerals are only obtained by digesting plants.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.1

6) Folic acid supplements have become especially important for pregnant women because _____.

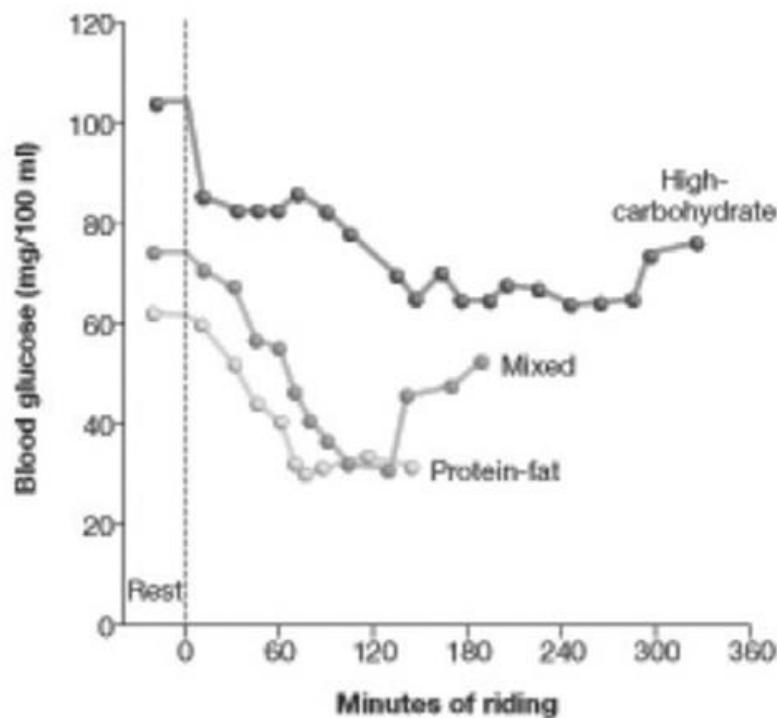
- A) folic acid supplies vitamins that only pregnant women can use
- B) the fetus makes high levels of folic acid
- C) folic acid deprivation is associated with neural tube defects in a fetus
- D) folic acid deprivation is a cause of heart abnormalities in a newborn

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.1

7)



Three groups of cyclists consumed three different types of diets: high-carbohydrate; a diet mixed in carbohydrates, fat, and protein; or a diet higher in protein and fat. The average time each group could spend cycling over a six-hour period is shown in the accompanying graph. What conclusion from the data would help an athlete or trainer improve performance?

- A) Endurance is entirely related to diet.
- B) Maintaining elevated blood sugar improves performance.
- C) An early 50 percent drop in blood glucose is associated with improved endurance.
- D) Diet is not at all related to endurance.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 41.1

8) Ticks are parasites that obtain nutrients by ingesting blood from a host animal. Ticks would be classified as _____.

- A) filter feeders
- B) substrate feeders
- C) fluid feeders
- D) bulk feeders

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 41.2

9) The process of obtaining food is known as _____ and requires specialized feeding mechanisms.

- A) ingestion
- B) digestion
- C) absorption
- D) excretion

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.2

10) In a hydra, digestion is completed _____.

- A) intracellularly
- B) extracellularly
- C) in the alimentary canal
- D) in the gastrovascular cavity

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.2

11) An advantage of a complete digestive system over a gastrovascular cavity is that the complete system _____.

- A) excludes the need for extracellular digestion
- B) allows for specialized regions with specialized functions
- C) allows extensive branching
- D) facilitates intracellular digestion

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.2

12) Because the foods eaten by animals are often composed largely of macromolecules, animals need to have mechanisms for _____.

- A) dehydration synthesis
- B) enzymatic hydrolysis
- C) regurgitation
- D) demineralization

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 41.2

13) Fat digestion yields fatty acids and glycerol, whereas protein digestion yields amino acids; both digestive processes _____.

- A) are catalyzed by the same enzyme
- B) use water molecules when breaking bonds (hydrolysis)
- C) require the presence of hydrochloric acid to lower the pH
- D) require adenosine triphosphate (ATP) as an energy source

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 41.2

14) The process by which digested dietary substances cross cell membranes to be used by the body is known as _____.

- A) ingestion
- B) digestion
- C) hydrolysis
- D) absorption

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.2

15) Mechanical digestion, the process of breaking down large chunks of food into smaller pieces, is important because smaller pieces of food _____.

- A) do not taste as good as larger pieces of food
- B) have more surface area for chemical digestion than do larger pieces of food
- C) are easier to excrete than are larger pieces of food
- D) are more easily stored in the stomach than are larger pieces of food

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 41.2

16) The large surface area in the gut directly facilitates _____.

- A) secretion
- B) absorption
- C) filtration
- D) temperature regulation

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

17) In the digestive system, peristalsis is _____.

- A) a process of fat emulsification in the small intestine
- B) voluntary control of the rectal sphincters regulating defecation
- C) the transport of nutrients to the liver through the hepatic portal vessel
- D) smooth muscle contractions that move food along the esophagus

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

18) Among mammals, it is generally true that _____.

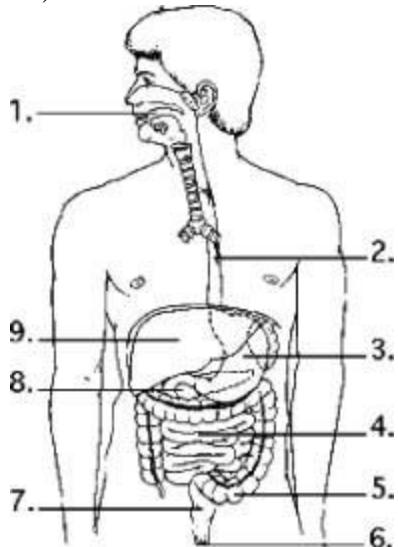
- A) all types of foods begin their enzymatic digestion in the mouth
- B) after leaving the oral cavity, the bolus enters the larynx
- C) the epiglottis prevents swallowed food from entering the trachea
- D) the trachea leads to the esophagus and then to the stomach

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

19)



Examine the digestive system structures in the figure. The agents that help emulsify fats are produced in location _____.

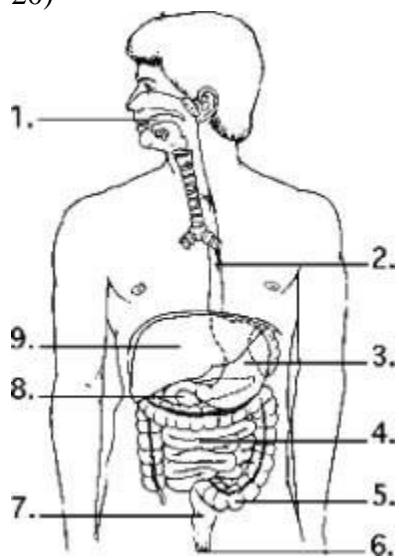
- A) 1
- B) 3
- C) 8
- D) 9

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

20)



Examine the digestive system structures in the figure. The highest rate of nutrient absorption occurs at location _____.

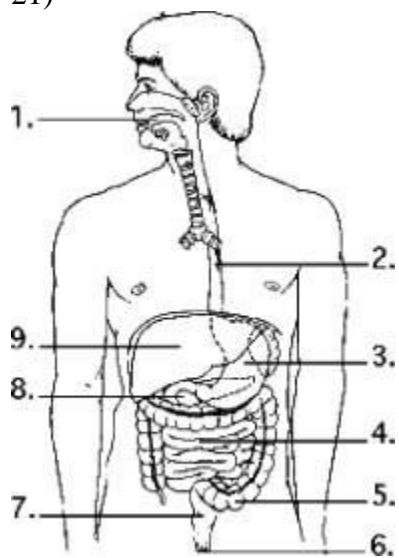
- A) 1
- B) 4
- C) 5
- D) 8

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

21)



Examine the digestive system structures in the figure. Most of the digestion of fats occurs in structure(s) _____.

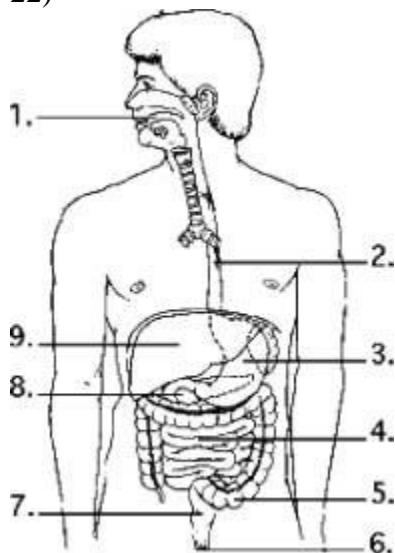
- A) 3 only
- B) 4 only
- C) 1 and 4
- D) 3 and 4

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

22)



Examine the digestive system structures in the figure. Bacteria that produce vitamins are found in the greatest concentration in location _____.

- A) 3
- B) 4
- C) 5
- D) 8

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

23) Animals cannot produce enzymes to digest cellulose, yet many termite species consume cellulose from plant material as a main part of their diet. How do termites access the nutrients contained in cellulose?

- A) Termites have specialized mouthparts to mechanically break down the cellulose.
- B) The ingested plant material also contains enzymes for cellulose digestion.
- C) Cellulose is digested intracellularly in the termite hindgut.
- D) Mutualistic bacteria in the hindgut of the termite digest the cellulose into sugars.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.4

24) Which of the following organs is correctly paired with its function?

- A) stomach—fat digestion
- B) large intestine—bile production
- C) small intestine—polysaccharide digestion
- D) pancreas—starch digestion

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

25) Stomach cells are moderately well adapted to the acidity and protein-digesting activities in the stomach by having _____.

- A) a sufficient colony of *H. pylori*
- B) a thick, mucous secretion and active mitosis of epithelial cells
- C) a high level of secretion of enzymes by chief cells
- D) a cell wall impermeable to acid

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 41.3

26) The function of chylomicrons is to _____.

- A) digest nucleic acids in the intestine
- B) break down carbohydrates in the mouth
- C) transport lipids from the intestine to other organs
- D) move proteins across plasma membranes of cells

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

27) Upon activation by stomach acidity, the secretions of the parietal cells _____.

- A) initiate the chemical digestion of protein in the stomach
- B) initiate the mechanical digestion of lipids in the stomach
- C) initiate the chemical digestion of lipids in the stomach
- D) delay digestion until the food arrives in the small intestine

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 41.3

28) What is the importance of the mucus that are released by salivary glands?

- A) They aid in degradation of triglycerides to fatty acids and monoglycerides.
- B) They are beginning the process of starch digestion.
- C) They are hormonal molecules that stimulate the release of gastric juice by the stomach in anticipation of receipt of the contents of the mouth.
- D) They are glycoproteins that make food slippery enough to slide easily through the esophagus.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

29) Jahasz-Pocsine and co-workers found a correlation between gastric bypass surgery and neurological complications. Surgeons performed gastric bypass surgery on 150 patients at the University of Arkansas for Medical Sciences Neurology Clinic. Of the 150 patients, 26 experienced neurological complications related to the surgery. What is the most likely cause for the neurological complications?

- A) sudden weight loss and caloric deficiency interfering with neurological function
- B) nutrient (for example, vitamin and mineral) deficiencies
- C) sloppy surgical technique of physicians performing the bypass surgery
- D) infections following surgical intervention

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 41.3

30) Why do the cells of the digestive system secrete proteolytic enzymes, such as pepsin, in their inactive forms?

- A) These proteolytic enzymes, in active form, would digest the very tissues that synthesize them.
- B) By secreting inactive enzymes, the catalytic activity of the enzymes is maintained for a longer time.
- C) The stomach is too acidic to maintain these enzymes in their active form.
- D) Inactive pepsin and trypsin are more easily transported across the cell membrane

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

31) Over-the-counter medications for acid reflux or heartburn block the production of stomach acid. Which of the following cells are directly affected by this medication?

- A) goblet cells
- B) chief cells
- C) parietal cells
- D) smooth muscle cells

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 41.3

32) The active ingredient *orlistat* acts to decrease the amount of fat that is absorbed by attaching to enzymes that digest fat. Which of the following are potential targets of orlistat?

- A) salivary amylase
- B) pepsidase
- C) pancreatic lipase
- D) secretin

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 41.3

33) The digestion of _____ begins in the stomach.

- A) protein
- B) fat
- C) nucleic acids
- D) carbohydrates

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

34) Nutrient-rich blood from the intestine is carried through the _____ to the liver.

- A) lacteal vessels
- B) hepatic portal artery
- C) hepatic portal vein
- D) lymphatic system

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

35) The bile salts _____.

- A) are enzymes
- B) are manufactured by the pancreas
- C) emulsify fats in the duodenum
- D) are normally an ingredient of gastric juice

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

36) The absorption of fats differs from that of carbohydrates in that _____.

- A) fat absorption primarily occurs in the stomach, whereas carbohydrates are absorbed from the small intestine
- B) carbohydrates need to be emulsified before they can be digested, whereas fats do not
- C) most absorbed fat first enters the lymphatic system, whereas carbohydrates directly enter the blood
- D) fats, but not carbohydrates, are digested by bacteria before absorption

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

37) Constipation can result from the consumption of a substance that _____.

- A) promotes water reabsorption in the large intestine
- B) speeds up movement of material in the large intestine
- C) decreases water reabsorption in the small intestine
- D) stimulates peristalsis

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

38) After surgical removal of an infected gallbladder, a person must be especially careful to restrict dietary intake of _____.

- A) protein
- B) sugar
- C) fat
- D) water

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 41.3

39) Pepsinogen is converted to its active form in the stomach by _____.

- A) HCl
- B) chief cells
- C) high pH conditions
- D) parietal cells

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

40) If you place a small piece of a cracker on your tongue, what would you expect to happen?

- A) The vitamins in the cracker are immediately absorbed.
- B) Salivary amylase degrades the starch from the cracker into glucose.
- C) The proteins in the cracker begin to be digested.
- D) The flavor becomes less noticeable because the sugars are digested.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.3

41) A relatively long cecum is characteristic of animals that are _____.

- A) carnivores
- B) herbivores
- C) autotrophs
- D) omnivores

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.4

42) Cattle are able to survive on a diet consisting almost entirely of plant material because cattle _____.

- A) are autotrophic
- B) re-ingest their feces
- C) manufacture all fifteen amino acids out of sugars in the liver
- D) have cellulose-digesting, symbiotic microorganisms in chambers of their stomachs

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 41.4

43) A zoologist analyzes the jawbones of an extinct mammal and concludes that it was an herbivore. The zoologist most likely came to this conclusion based upon the _____.

- A) position of muscle attachment sites
- B) shape of the teeth
- C) size of the mouth opening
- D) angle of the teeth in the mouth

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 41.4

44) Coprophagy is important for the nutritional balance of _____.

- A) ruminants such as cows
- B) insects and arthropods
- C) rabbits and their relatives
- D) squirrels and some rodents

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.4

45) If you found a vertebrate skull in the woods and the teeth were sharp and scissor-like, what type of food would you expect this animal to eat?

- A) grass
- B) flesh of another animal
- C) nectar
- D) blood

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 41.4

46) What benefit is gained by intestinal bacteria living in a mutualistic relationship with an animal?

- A) The bacteria are provided with a regular source of nutrients.
- B) Temperature is always regulated.
- C) The bacteria can easily infect the animal's intestinal cells.
- D) The bacteria can avoid the animal's immune system.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 41.4

47) When used appropriately, antibiotic treatment can effectively reduce bacteria populations and help fight infections. However, antibiotic treatments can have unintended effects. What is one concern when using antibiotics?

- A) Antibiotics also damage animal cells, so they can be more harmful than a bacterial infection.
- B) Antibiotics cause viruses to become more effective at infecting cells.
- C) Each antibiotic is only effective against one type of bacteria, so effects on infection are limited.
- D) Antibiotics may also kill the beneficial bacteria of the microbiome, thereby disrupting digestive health.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 41.4

48) A significant contribution of intestinal bacteria to human nutrition is the benefit of bacterial _____.

- A) production of vitamins A and C
- B) absorption of organic materials
- C) production of vitamin K
- D) recovery of water from fecal matter

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.4

49) Obesity in humans is most clearly linked to _____.

- A) type 1 diabetes and prostate cancer
- B) type 2 diabetes and muscle hypertrophy
- C) type 2 diabetes and cardiovascular disease
- D) type 2 diabetes and decreased appetite

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 41.5

50) If you were to jog one kilometer a few hours after lunch, which stored fuel would you probably tap?

- A) muscle proteins
- B) liver glycogen and muscle glycogen
- C) fat stored in adipose tissue
- D) blood proteins

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 41.5

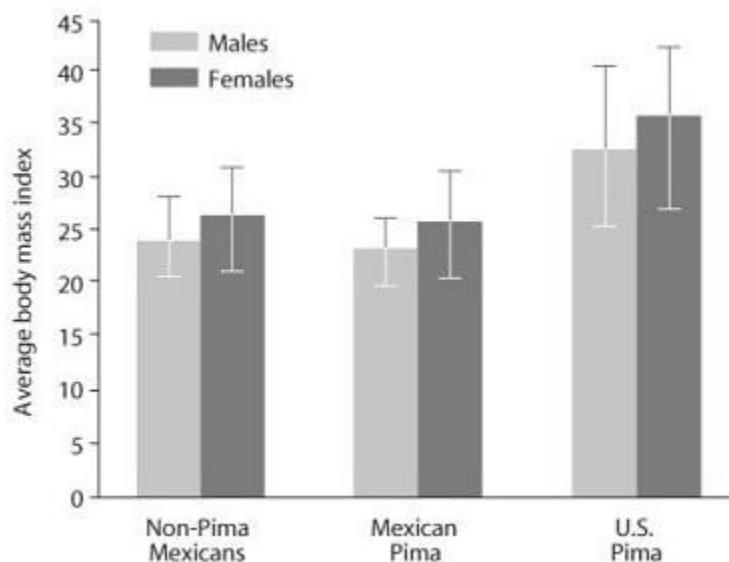
- 51) Food being digested in the stomach is in a highly acidic environment. When the food is released from the stomach into the small intestine, why is the environment no longer acidic?
- A) Secretin increases the flow of bicarbonate ions from the pancreas into the small intestine to neutralize the stomach acid.
 - B) Trypsinogen is activated, thus neutralizing the stomach acid.
 - C) Bile salts from the gallbladder neutralize the stomach acid.
 - D) When pepsinogen activates pepsin, one result is the neutralization of stomach acid in the stomach.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.5

52)



The Pimas are a group of people living in the southwestern United States and Mexico. Although Pima Indians living in the United States and Mexico have a similar genetic background, a five-fold increase in the incidence of type II diabetes mellitus among U.S. Pima has been reported. The body mass index of Mexicans of non-Pima descent, Mexicans of Pima descent, and Pimas living in the United States is shown in the figure. Based on this information and the graph, what can you infer about the incidence of type II diabetes mellitus?

- A) Obesity is a risk factor for development of type II diabetes mellitus.
- B) If you maintain a normal body weight (body mass index less than 25), you will not get type II diabetes mellitus.
- C) The incidence of type II diabetes mellitus has increased in the past ten years.
- D) People who develop type II diabetes mellitus are typically diagnosed in childhood or adolescence.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 41.5

53) In a healthy person, after a carbohydrate-rich meal, the production of _____ will increase, causing the uptake of _____ from the blood into liver cells.

- A) insulin; glucagon
- B) glucagon; protein
- C) glucagon; glucose
- D) insulin; glucose

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 41.5

54) If there is a strong genetic link for type II diabetes mellitus in your family, how might you minimize your risk of developing the disorder?

- A) monitor your blood glucose levels daily
- B) take oral insulin daily
- C) maintain a healthy weight, eat a balanced diet, and exercise
- D) eat complex carbohydrates like starch instead of sweets

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 41.5

55) When the digestion and absorption of organic carbohydrates results in more energy-rich molecules than are immediately required by an animal, the excess is _____.

- A) eliminated in the feces
- B) stored as starch in the liver
- C) stored as glycogen in the liver and muscles
- D) oxidized and converted to ATP

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.5

56) A fasting animal whose energy needs exceed those provided in its diet will draw on its stored resources in which order?

- A) fat, then glycogen, then protein
- B) glycogen, then protein, then fat
- C) liver glycogen, then muscle glycogen, then fat
- D) muscle glycogen, then fat, then liver glycogen

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.5

57) Feelings of hunger can be stimulated by the hormone _____, but suppressed by the hormone _____.

- A) insulin; glucagon
- B) secretin; gastrin
- C) pepsin; trypsin
- D) ghrelin; PYY

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 41.5

41.2 Student Edition End-of-Chapter Questions

1) Fat digestion yields fatty acids and glycerol. Protein digestion yields amino acids. Both digestive processes

- A) occur inside cells in most animals.
- B) add a water molecule to break bonds.
- C) require a low pH resulting from HCl production.
- D) consume ATP.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

2) The mammalian trachea and esophagus both connect to the

- A) pharynx.
- B) stomach.
- C) large intestine.
- D) rectum.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

3) Which of the following organs is *incorrectly* paired with its function?

- A) stomach—protein digestion
- B) large intestine—bile production
- C) small intestine—nutrient absorption
- D) pancreas—enzyme production

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

4) Which of the following is *not* a major activity of the stomach?

- A) storage
- B) HCl production
- C) nutrient absorption
- D) enzyme secretion

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

5) If you put the following events in the order they occur in the human digestive system, the third event in the series would be:

- A) Cells in gastric pits secrete protons.
- B) Pepsin activates pepsinogen.
- C) HCl activates pepsinogen.
- D) Partially digested food enters the small intestine.

Answer: B

Bloom's Taxonomy: Application/Analysis

6) After surgical removal of the gallbladder, a person might need to limit his or her dietary intake of

- A) starch.
- B) protein.
- C) sugar.
- D) fat.

Answer: D

Bloom's Taxonomy: Application/Analysis

7) If you were to jog 1 km a few hours after lunch, which stored fuel would you probably tap?

- A) muscle proteins
- B) muscle and liver glycogen
- C) fat in the liver
- D) fat in adipose tissue

Answer: B

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 42 Circulation and Gas Exchange

42.1 Multiple-Choice Questions

- 1) The circulatory systems of bony fishes, rays, and sharks are most similar to _____.
A) those of birds, with a four-chambered heart
B) the portal systems of mammals, where two capillary beds occur sequentially, without passage of blood through a pumping chamber
C) those of sponges, where gas exchange in all cells occurs directly with the external environment
D) those of humans, where there are four pumping chambers to drive blood flow

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 42.1

- 2) Organisms with a circulating body fluid that is distinct from the fluid that directly surrounds the body's cells are likely to have _____.
A) an open circulatory system
B) a closed circulatory system
C) a gastrovascular cavity
D) branched tracheae

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 42.1

- 3) In which of the following organisms does blood flow from the pulmocutaneous circulation to the heart before circulating through the rest of the body?
A) annelids
B) fishes
C) frogs
D) insects

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.1

- 4) The only vertebrates in which blood flows directly from respiratory organs to body tissues without first returning to the heart are the _____.
A) amphibians
B) fishes
C) mammals
D) reptiles

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.1

5) To adjust blood pressure independently in the capillaries of the gas-exchange surface and in the capillaries of the general body circulation, an organism would need a(n) _____.

- A) open circulatory system
- B) hemocoel
- C) two-chambered heart
- D) four-chambered heart

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 42.1

6) An anthropologist discovers the fossilized heart of an extinct animal. The evidence indicates that the organism's heart was large, was well-formed, and had four chambers, with no connection between the right and left sides. A reasonable conclusion supported by these observations is that the _____.

- A) animal had evolved from birds
- B) animal was endothermic and had a high metabolic rate
- C) animal was most closely related to alligators and crocodiles
- D) species had little to no need to regulate blood pressure

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 42.1

7) In an open circulatory system, blood is _____.

- A) always inside of vessels and is under higher pressure than in closed circulatory systems
- B) not always confined to blood vessels and is under higher pressure than in closed circulatory systems
- C) always inside of vessels and is under lower pressure than in closed circulatory systems
- D) not always confined to blood vessels and is under lower pressure than in closed circulatory systems

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.1

8) Circulatory systems compensate for _____.

- A) temperature differences between the lungs and the active tissue
- B) the slow rate at which diffusion occurs over large distances
- C) the problem of communication systems involving only the nervous system
- D) the need to cushion animals from trauma

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.1

- 9) Which of the following develops the greatest pressure on the blood in the mammalian aorta?
- A) systole of the left atrium
 - B) diastole of the right ventricle
 - C) systole of the left ventricle
 - D) diastole of the right atrium

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 42.2

- 10) Which of the following is the correct sequence of blood flow in birds and mammals?
- A) left ventricle → aorta → lungs → systemic circulation
 - B) vena cava → right atrium → right ventricle → pulmonary vein
 - C) pulmonary vein → left atrium → left ventricle → pulmonary circuit
 - D) vena cava → right atrium → right ventricle → pulmonary artery

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 42.2

- 11) A patient with a heart rate of 70 beats per minute and a stroke volume of 70 mL/beat will have a cardiac output of _____.
- A) 1,000 mL/minute
 - B) 1,400 mL/minute
 - C) 2,800 mL/minute
 - D) 4,900 mL/minute

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 42.2

- 12) Damage to the sinoatrial node in humans would _____.
- A) block conductance between the bundle branches and the Purkinje fibers
 - B) have a negative effect on peripheral resistance
 - C) disrupt the rate and timing of cardiac muscle contractions
 - D) have a direct effect on blood pressure monitors in the aorta

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 42.2

- 13) While jogging, a person has a stroke volume of 130 ml/beat and a heart rate of 120 beats per minute. If their resting stroke volume was 70 ml/beat and resting heart rate was 60 beats per minute, how did this person's cardiac output change?
- A) Their cardiac output did not change. Only their respiratory rate changed.
 - B) During exercise, their cardiac output decreased by 11,400 ml/minute.
 - C) During exercise, their cardiac output increased by 60 ml/beat.
 - D) Their cardiac output increased from 4,200 ml/minute to 15,600 ml/minute after jogging.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 42.2

14) Atrial systole _____.

- A) occurs at the same time as ventricular diastole
- B) pumps blood to the aorta
- C) refers to the relaxation of the cardiac muscle
- D) only occurs in the left heart chambers

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.2

15) The greatest difference in the concentration of respiratory gases is found in which of the following pairs of mammalian blood vessels?

- A) the pulmonary vein and the superior vena cava
- B) the veins from the right and left legs
- C) the pulmonary artery and the inferior vena cava
- D) the pulmonary vein and the aorta

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 42.2

16) A human red blood cell in an artery of the left arm is on its way to deliver oxygen to a cell in the thumb. To travel from the artery to the thumb and then back to the left ventricle, this red blood cell must pass through _____.

- A) one capillary bed
- B) two capillary beds
- C) three capillary beds
- D) four capillary beds

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 42.2

17) An electrocardiogram (ECG) provides information about _____.

- A) the pressure of blood in the heart chambers
- B) the rhythm of heart contractions
- C) the amount of oxygen in the blood as it leaves the heart
- D) the speed of blood flow through the blood vessels

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 42.2

18) Among the following choices, which organism likely has the highest systolic pressure?

- A) mouse
- B) human
- C) hippopotamus
- D) giraffe

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 42.3

19) The velocity of blood flow is the lowest in capillaries because _____.

- A) the capillaries have internal valves that slow the flow of blood
- B) the diastolic blood pressure is too low to deliver blood to the capillaries at a high flow rate
- C) the systemic capillaries are supplied by the left ventricle, which has a lower cardiac output than the right ventricle
- D) the total cross-sectional area of the capillaries is greater than the total cross-sectional area of the arteries or any other part of the circulatory system

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.3

20) Which of the following would you expect of a species that has a high resting cardiac output?

- A) The animal is likely small and compact, without the need to pump blood very far from the heart.
- B) The species likely has very wide-diameter veins.
- C) The animal likely has a very long distance between its heart and its brain.
- D) The animal likely has a relatively inactive lifestyle.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 42.3

21) Small swollen areas in the neck, groin, and axillary region are associated with _____.

- A) increased activity of the immune system
- B) blood sugar that is abnormally high
- C) dehydration
- D) sodium depletion

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 42.3

22) Humans infected with some types of parasitic worms develop a condition called *elephantiasis*, which is characterized by swelling of the limbs. Which of the following would be the most likely cause of elephantiasis?

- A) The infected human's immune system is fighting the worms.
- B) The worm infection is causing a decrease in cardiac output.
- C) The worms are blocking the lymph vessels.
- D) More blood is flowing through precapillary sphincters.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.3

23) Which of the following conditions would most likely be due to high blood pressure in a mammal?

- A) bursting of blood vessels in capillary beds
- B) inability of the right ventricle to contract
- C) reversal of normal blood flow direction in arteries
- D) destruction of red blood cells

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 42.3

24) Which of the following mechanisms are used to regulate blood pressure in the closed circulatory system of vertebrates?

- I) changing the force of heart contraction
- II) constricting and relaxing smooth muscle in the walls of arterioles
- III) opening or closing precapillary sphincters

- A) only I and II
- B) only I and III
- C) only II and III
- D) I, II, and III

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 42.3

25) Blood is pumped at high pressures in arteries from the heart to ensure that all parts of the body receive adequate blood flow. Capillary beds, however, would hemorrhage under direct arterial pressures. How does the design of the circulatory network contribute to reducing blood pressure to avoid this scenario?

- A) Blood flow through the capillaries is essentially frictionless, and this reduces the amount of pressure on their walls.
- B) The total cross-sectional diameter of the arterial circulation increases with progression from artery to arteriole to capillary, leading to a reduced blood pressure.
- C) Fluid loss from the arteries is high enough that pressure drops off significantly by the time blood reaches the capillaries.
- D) Capillary beds have the thickest walls of any blood vessel to resist these high pressures.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 42.3

26) In order for blood to always flow unidirectionally through a closed circulatory system, the _____.

- A) blood vessels farthest from the heart must have valves
- B) capillaries must have a thick endothelium
- C) arteries must be elastic
- D) pressure in all vessels must be equal

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.3

27) If the osmotic pressure on the venous side of capillary beds is lower than the hydrostatic pressure, then _____.

- A) hemoglobin will not release oxygen
- B) fluid will tend to accumulate in tissues
- C) the pH of the interstitial fluids will increase
- D) plasma proteins will escape through the endothelium of the capillaries

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 42.3

28) Large proteins such as albumin remain in capillaries rather than diffusing out, resulting in the _____.

- A) loss of osmotic pressure in the capillaries
- B) development of an osmotic pressure difference across capillary walls
- C) loss of fluid from capillaries
- D) increased diffusion of hemoglobin

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 42.3

29) Blood cells that function to fight infection are called _____.

- A) platelets
- B) leukocytes
- C) erythrocytes
- D) thrombi

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.4

30) To become bound to hemoglobin for transport in mammals, atmospheric molecules of oxygen must cross _____.

- A) one membrane—that of the lining in the lungs—and then bind directly to hemoglobin, a protein dissolved in the plasma of the blood
- B) two membranes—in and out of the cell lining the lung—and then bind directly to hemoglobin, a protein dissolved in the plasma of the blood
- C) four membranes—in and out of the cell lining the lung, in and out of the endothelial cell lining an alveolar capillary—and then bind directly to hemoglobin, a protein dissolved in the plasma of the blood
- D) five membranes—in and out of the cell lining the lung, in and out of the endothelial cell lining an alveolar capillary, and into the red blood cell—to bind with hemoglobin

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 42.4

31) The diagnosis of hypertension in adults is based on the _____.

- A) measurement of fatty deposits on the endothelium of arteries
- B) measurement of the LDL/HDL ratio in peripheral blood
- C) percentage of blood volume made up of platelets
- D) blood pressure being greater than 140 mm Hg systolic and/or greater than 90 mm Hg diastolic

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.4

32) Cyanide poisons mitochondria by blocking the final step in the electron transport chain.

Human red blood cells placed in an isotonic solution containing cyanide are likely to _____.

- A) retain the normal cell shape, but the mitochondria will be poisoned
- B) lyse as the cyanide concentration increases inside the cell
- C) switch to anaerobic metabolism
- D) be unaffected

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 42.4

33) A normal event in the process of blood clotting is the _____.

- A) production of erythropoietin
- B) conversion of fibrin to fibrinogen
- C) activation of prothrombin to thrombin
- D) synthesis of hemoglobin

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.4

34) You cut your finger, and after putting pressure on the wound for several minutes, you notice that it is still bleeding profusely. What may be the problem?

- A) Platelets are not functioning properly, or there are too few to be effective.
- B) Mast cells are not releasing their chemical messengers.
- C) There are too many antigens to allow clotting.
- D) Hemoglobin levels are too high to allow clotting.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 42.4

35) _____ is a hormone that is released from the _____ to stimulate the production of red blood cells.

- A) Growth hormone; pancreas
- B) Erythropoietin; kidney
- C) Cortisol; adrenal gland
- D) Acetylcholine; bone marrow

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.4

36) Countercurrent exchange is evident in the flow of _____.

- A) water across the gills of a fish and the blood within those gills
- B) blood in the dorsal vessel of an insect and that of air within its tracheae
- C) air within the primary bronchi of a human and the blood within the pulmonary veins
- D) water across the skin of a frog and the blood flow within the ventricle of its heart

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.5

37) Countercurrent exchange in the fish gill helps to maximize _____.

- A) blood pressure
- B) diffusion
- C) active transport
- D) osmosis

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.5

- 38) Which of the following statements comparing respiration in fish and in mammals is correct?
- A) The respiratory medium for fish carries more oxygen than the respiratory medium of mammals.
 - B) A countercurrent exchange mechanism between the respiratory medium and blood flow is seen in mammals but not in fish.
 - C) The movement of the respiratory medium in mammals is bidirectional, but in fish it is unidirectional.
 - D) In blood, oxygen is primarily transported by plasma in fish, but by red blood cells in mammals.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 42.5

- 39) Although having evolved independently, the tracheal tubes of mammals and insects are both supported by rigid tissues. The trachea of a mammal is supported by cartilage, and the tracheae of an insect are supported by chitin. What selective pressure most likely led to the convergent evolution of these respiratory structures?

- A) Both mammals and insects have similar oxygen needs.
- B) When air is the respiratory medium, there is a greater risk that the tracheal tubes will collapse.
- C) Insects and mammals both keep their internal temperature constant.
- D) A decrease in environmental carbon dioxide made structural support necessary.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 42.5

- 40) When the air in a testing chamber is specially mixed so that its oxygen content is 10% and its overall air pressure is 400 mm Hg, then PO_2 is _____.

- A) 400 mm Hg
- B) 82 mm Hg
- C) 40 mm Hg
- D) 4 mm Hg

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 42.5

- 41) The sun shining on a tidal pool during a hot day heats the water, causing some water to evaporate. Because the water has become warmer and saltier, _____.

- A) the carbon dioxide content will increase
- B) the oxygen content will decrease
- C) it will be better able to sustain aerobic organisms
- D) it will become more dense

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 42.5

42) An oil-water mixture works as an insecticidal spray against mosquitoes and other insects because it _____.

- A) blocks the openings into the tracheal system
- B) interferes with gas exchange across the capillaries
- C) clogs their bronchi
- D) prevents gases from leaving the atmosphere

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 42.5

43) Atmospheric pressure at the summit of Mount Everest is about one third the pressure at sea level, which is 760 mm Hg. If oxygen makes up 21% of the atmosphere by volume, the partial pressure of oxygen (PO_2) on Mount Everest is approximately _____.

- A) 53 mm Hg
- B) 157 mm Hg
- C) 255 mm Hg
- D) 760 mm Hg

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 42.5

44) Some human infants, especially those born prematurely, suffer serious respiratory failure because of _____.

- A) the sudden change from the uterine environment to the air
- B) the overproduction of surfactants
- C) lung collapse due to inadequate production of surfactant
- D) mutations in the genes involved in lung formation

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.5

45) Which of the following represents the correct flow of air into the lung of a mammal?

- A) trachea → bronchioles → bronchi → alveoli
- B) larynx → trachea → bronchi → bronchioles → alveoli
- C) trachea → tracheoles → bronchi → alveoli
- D) alveoli → tracheoles → bronchi → trachea

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.5

46) During aerobic exercise, the partial pressure of oxygen in muscle cells will _____, thus the rate of diffusion of oxygen into the muscle tissue from the blood will _____.

- A) decrease; increase
- B) increase; decrease
- C) not change; also not change
- D) decrease; decrease

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 42.5

47) A rabbit taken from a meadow near sea level and moved to a meadow high on a mountainside would have some trouble breathing. Why?

- A) The percentage of oxygen in the air at high elevations is lower than at sea level.
- B) The percentage of oxygen in the air at high elevations is higher than at sea level.
- C) The partial pressure of oxygen in the air at high elevations is lower than at sea level.
- D) The partial pressure of oxygen in the air at high elevations is higher than at sea level.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 42.5

48) What would be the consequence if we were to reverse the direction of water flow over the gills of a fish, moving water inward past the operculum, past the gills, then out the mouth? This reversal of water flow would _____.

- A) reduce efficiency of gas exchange
- B) change the exchange of gases in the body from carbon dioxide out and oxygen in to carbon dioxide in and oxygen out
- C) increase the efficiency of gas exchange

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 42.5

49) Under identical atmospheric conditions, freshwater _____.

- A) has more dissolved oxygen than seawater
- B) has less dissolved oxygen than seawater
- C) can hold 10-40 times more carbon dioxide than air
- D) can hold 10-40 times more oxygen than air

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 42.5

50) Consider the following reaction. If the pH of the blood was decreased, then the _____.



- A) amount of carbon dioxide would increase
- B) bicarbonate in the blood would increase
- C) amount of oxygen in the blood will decrease
- D) amount of protons in the blood will increase

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.6

51) How has the avian lung adapted to the metabolic demands of flight?

- A) Airflow through the avian lung is bidirectional like in mammals.
- B) There is more dead space within the avian lung so that oxygen can be stored for future use.
- C) Countercurrent circulation is present in the avian lung.
- D) Gas exchange occurs during both inhalation and exhalation.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 42.6

52) Carbon dioxide levels in the blood and cerebrospinal fluid affect pH. This enables the organism to sense a disturbance in gas levels as _____.

- A) the brain directly measures and monitors oxygen levels and causes breathing changes accordingly
- B) the medulla oblongata, which is in contact with cerebrospinal fluid, monitors pH and uses this measure to control breathing
- C) the brain alters the pH of the cerebrospinal fluid to force the animal to retain more or less carbon dioxide
- D) stretch receptors in the lungs cause the medulla oblongata to speed up or slow breathing

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 42.6

53) A person with a tidal volume of 450 mL (milliliters), a vital capacity of 4000 mL, and a residual volume of 1000 mL would have a potential total lung capacity of _____.

- A) 1450 mL
- B) 4000 mL
- C) 4450 mL
- D) 5000 mL

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 42.6

54) During most daily activities, the human respiration rate is most closely linked to the blood levels of _____.

- A) nitrogen
- B) oxygen
- C) carbon dioxide
- D) carbon monoxide

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.6

55) A decrease of blood pH from 7.4 to 7.2 causes hemoglobin to _____.

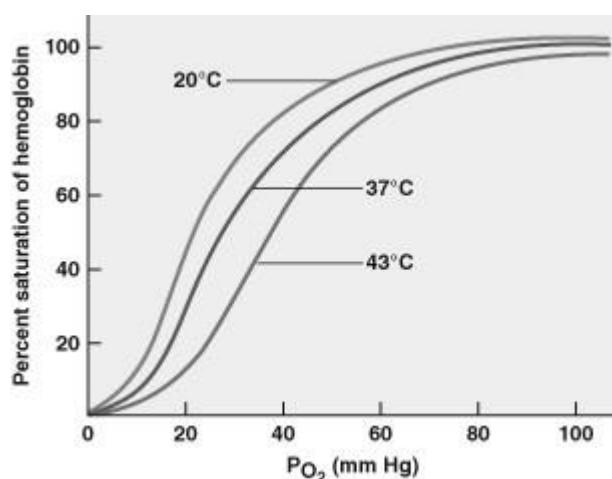
- A) release all bound carbon dioxide molecules
- B) bind more oxygen molecules
- C) decrease its binding of H⁺
- D) give up more of its oxygen molecules

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 42.7

56) Based on the graph, which of the following statements is correct?



- A) The greatest delivery of oxygen from the blood to the surrounding tissues occurs at 37°C.
- B) Increasing blood pH results in more oxygen unloading in tissues.
- C) Colder blood temperature results in greater dissociation of oxygen and hemoglobin.
- D) Hemoglobin has a lower affinity for oxygen under high temperature conditions.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.7

57) Most of the carbon dioxide produced by humans is _____.

- A) converted to bicarbonate ions
- B) bound to hemoglobin
- C) transported in the erythrocytes as carbonic acid
- D) simply dissolved in the plasma

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.7

58) Which of the following events would you predict as carbon dioxide is released from your muscles into the surrounding capillary bed?

- A) Oxygen delivery to muscle is increased when more carbon dioxide is produced by the muscle.
- B) Because of the change in blood pH, the blood can carry more oxygen.
- C) The amount of oxygen in venous blood will increase.
- D) Arterial blood entering the capillaries will carry more oxygen.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 42.7

59) Compared to mammals that are not adapted for diving, diving mammals _____.

- A) have larger lungs
- B) can store more oxygen in their muscles
- C) use gills for gas exchange
- D) always keep blood flowing to their lungs during a dive

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 42.7

60) Hyperventilation (rapid inhalation and exhalation) can result in respiratory alkalosis (increased blood pH). Why?

- A) Hyperventilation results in inefficient gas exchange, and not enough oxygen is absorbed by the blood.
- B) More metabolic waste is released into the blood, thus reducing the pH.
- C) Rapid breathing depletes the blood of carbon dioxide, thus the blood pH increases.
- D) Excess production of carbon dioxide decreases the affinity of hemoglobin for oxygen.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 42.7

42.2 Student Edition End-of-Chapter Questions

1) Which of the following respiratory systems is *not* closely associated with a blood supply?

- A) the lungs of a vertebrate
- B) the gills of a fish
- C) the tracheal system of an insect
- D) the skin of an earthworm

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

2) Blood returning to the mammalian heart in a pulmonary vein drains first into the

- A) left atrium.
- B) right atrium.
- C) left ventricle.
- D) right ventricle.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

3) Pulse is a direct measure of

- A) blood pressure.
- B) stroke volume.
- C) cardiac output.
- D) heart rate.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

4) When you hold your breath, which of the following blood gas changes first leads to the urge to breathe?

- A) rising O₂
- B) falling O₂
- C) rising CO₂
- D) falling CO₂

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

5) One feature that amphibians and humans have in common is

- A) the number of heart chambers.
- B) a complete separation of circuits for circulation.
- C) the number of circuits for circulation.
- D) a low blood pressure in the systemic circuit.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

6) If a molecule of CO₂ released into the blood in your left toe is exhaled from your nose, it must pass through all of the following *except*

- A) the pulmonary vein.
- B) the trachea.
- C) the right atrium.
- D) the right ventricle.

Answer: A

Bloom's Taxonomy: Application/Analysis

7) Compared with the interstitial fluid that bathes active muscle cells, blood reaching these cells in arterioles has a

- A) higher PO₂.
- B) higher PCO₂.
- C) greater bicarbonate concentration.
- D) lower pH.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Campbell Biology, 11e (Urry)
Chapter 43 The Immune System

43.1 Multiple-Choice Questions

1) Innate immunity _____.

- A) is the first, and most general, mechanism of protection against pathogens
- B) depends on an infected animal's previous exposure to a pathogen
- C) is based on recognition of antigens that are specific to a pathogen
- D) is found only in vertebrates

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.1

2) A strain of fruit fly lacks the ability to produce Dicer-2 protein. You might expect this strain to be more susceptible to _____ infections.

- A) viral
- B) bacterial
- C) fungal
- D) protozoan

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 43.1

3) Vertebrate immune cells, which are phagocytic, include _____.

- I) neutrophils
- II) macrophages
- III) dendritic cells
- IV) natural killer cells

- A) I and III
- B) II and IV
- C) I and IV
- D) I, II, and III

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.1

4) The cells and signaling molecules involved in the initial stages of the inflammatory response are _____.

- A) phagocytes and cytokines
- B) dendritic cells and interferons
- C) mast cells and histamines
- D) lymphocytes and interferons

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.1

5) Inflammatory responses typically include _____.

- A) increased activity of phagocytes in an inflamed area
- B) reduced permeability of blood vessels to conserve plasma
- C) release of substances to decrease the blood supply to an inflamed area
- D) inhibiting the release of white blood cells from bone marrow

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.1

6) _____ are receptor molecules on mammalian cells that recognize macromolecules that are present in or on certain groups of pathogens.

- A) Cytokines
- B) Toll-like receptors
- C) Interferons
- D) Complement proteins

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.1

7) Septic shock, a systemic response including high fever and low blood pressure, is a response to _____.

- A) certain bacterial infections
- B) specific forms of viruses
- C) the presence of natural killer cells
- D) increased production of neutrophils

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.1

8) _____ are cells of the mammalian innate immune response that help destroy tumors.

- A) Cytotoxic T cells
- B) Natural killer cells
- C) Macrophages
- D) B cells

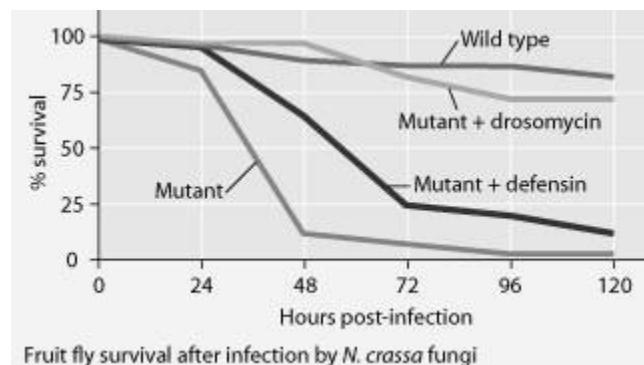
Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

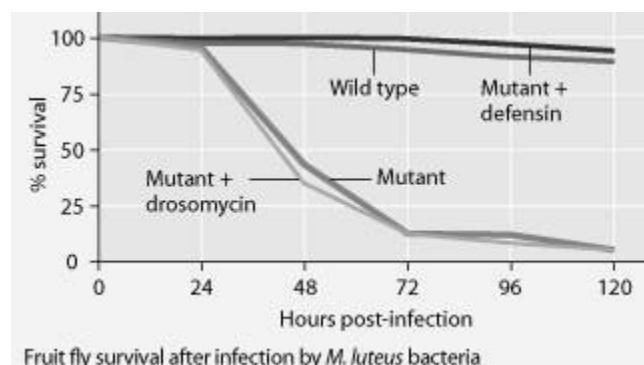
Section: 43.1

9) Use the graphs to answer the following question.

Mutant fruit flies that make only one antimicrobial peptide were tested for survival after infection with *Neurospora crassa* fungi or with *Micrococcus luteus* bacteria.



Fruit fly survival after infection by *N. crassa* fungi



The results shown in the graphs support the hypothesis that _____.

- A) adding the defensin gene to such mutants protects them from death by bacterial infection
- B) adding the drosomycin gene to such mutants protects them from death by bacterial infection
- C) wild-type flies with the full set of genes for antimicrobial peptides are highly susceptible to both fungal and bacterial pathogens
- D) the presence of any single antimicrobial peptide protects against both fungal and bacterial pathogens

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 43.1

10) A boy falls while riding his bike. A scrape on his hand almost immediately begins to bleed and becomes red, warm, and swollen. What response is occurring?

- A) inflammatory response
- B) lytic response
- C) adaptive immune response
- D) autoimmune response

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 43.1

11) Acidity in human sweat is an example of _____.

- A) cell-mediated immune responses
- B) acquired immunity
- C) adaptive immunity
- D) innate immunity

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.1

12) The eyes and the respiratory tract are both protected against infections by _____.

- A) interferons produced by immune cells
- B) the secretion of complement proteins
- C) the release of slightly alkaline secretions
- D) the secretion of lysozyme onto their surfaces

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.1

13) The complement system is _____.

- A) a set of proteins involved in innate but not acquired immunity
- B) a group of proteins that includes interferons and interleukins
- C) a group of proteins that act together in a cascade fashion
- D) a set of proteins that act individually to attack and lyse microbes

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.1

14) Bacteria entering the body through a small cut in the skin _____.

- A) inactivate the erythrocytes
- B) stimulate apoptosis of nearby body cells
- C) stimulate release of interferons
- D) activate a group of proteins called complement

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.1

15) Mucus occurs in both the respiratory and digestive tracts. What is its main immunological function?

- A) sweeping away debris
- B) physically trapping of pathogens
- C) destruction of pathogens because it is acidic
- D) increasing oxygen absorption

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.1

16) You and a friend were in line for a movie when you noticed the woman in front of you sneezing and coughing. Both of you were equally exposed to the woman's virus, but over the next few days, only your friend acquired flu-like symptoms and was ill for almost a week before recovering. Which one of the following is a logical explanation for this?

- A) Your friend had antibodies to that virus.
- B) You had an immunological memory of that virus.
- C) Your friend had an autoimmune disorder.
- D) Your friend had allergies.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 43.2

17) Within a differentiated B cell, the rearrangement of DNA sequences between variable regions and joining regions is accomplished by a(n)_____.

- A) RNA polymerase
- B) reverse transcriptase
- C) telomerase
- D) recombinase

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.2

18) Clonal selection and differentiation of B cells activated by antigen exposure leads to the production of _____.

- A) large quantities of the antigen initially recognized
- B) vast numbers of B cells with random antigen-recognition receptors
- C) long-lived erythrocytes that can later secrete antibodies for the antigen
- D) short-lived plasma cells that secrete antibodies for the antigen

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.2

19) A newborn who is accidentally given a drug that destroys the thymus would most likely _____.

- A) lack innate immunity
- B) be unable to genetically rearrange antigen receptors
- C) be unable to differentiate and mature T cells
- D) have a reduced number of B cells and be unable to form antibodies

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 43.2

20) Clonal selection is an explanation for how _____.

- A) *V*, *J*, and *C* gene segments are rearranged
- B) an antigen can provoke production of high amounts of specific antibodies
- C) HIV (human immunodeficiency virus) can disrupt the immune system
- D) macrophages can recognize specific T cells and B cells

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.2

21) An immunoglobulin (Ig) molecule, of any class, with regions symbolized as C or V, H or L, has a light chain made up of _____.

- A) one C region and one V region
- B) one H region and one L region
- C) three H regions and one L region
- D) two C regions and two V regions

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.2

22) Immunological memory accounts for _____.

- A) the human body's ability to distinguish self from non-self
- B) the observation that some strains of the pathogen that causes dengue fever cause more severe disease than others
- C) the ability of a helper T cell to signal B cells via cytokines
- D) the ancient observation that someone who had recovered from the plague could safely care for those newly diseased

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 43.2

23) Use the following information to answer the question(s) below.

An otherwise healthy student in your class was infected with EBV (the virus that causes infectious mononucleosis) when she was a child, at which time she had merely experienced a mild sore throat and swollen lymph nodes in her neck. When she is exposed to EBV again later in life, she does not get sick or have any symptoms of mononucleosis.

Which of the following statements explains why your class mate does not exhibit symptoms of EBV infection?

- A) She was likely infected with a weaker strain of EBV during her second exposure.
- B) Complement proteins effectively controlled the EBV during the second infection.
- C) Memory T cells quickly recognized the virus upon the second exposure and destroyed the virally infected cells.
- D) Her innate immune response was better at recognizing the EBV antigen during the second infection.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 43.2

24) How is a viral antigen, like EBV, recognized by T cells?

- A) An antigen fragment is presented within class I MHC to the T cell receptor.
- B) Interferon proteins stick to the surface of infected cells.
- C) T cells recognize antibodies that have bound to viral particles.
- D) The virus is engulfed by T cells using Toll-like receptors.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 43.2

25) Vaccination offers protection against future exposure to pathogens because it _____.

- A) stimulates the complement system
- B) triggers clonal expansion of lymphocytes
- C) promotes inflammation
- D) enhances the activity of macrophages

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 43.2

26) _____ is a characteristic of adaptive immunity but not innate immunity.

- A) Memory
- B) Inflammation
- C) Interferons
- D) Lysozyme

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 43.2

27) Lymphocytes mature in the _____.

- I) spleen
- II) thymus
- III) bone marrow

- A) only I and III
- B) only I and II
- C) only II and III
- D) I, II, and III

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.2

28) Which of the following statements are fundamental to the clonal selection theory of how the adaptive immune system functions?

- I) Each lymphocyte has a unique membrane receptor that recognizes one antigen.
- II) When the lymphocyte binds an antigen, it is activated and begins dividing to form many identical copies of itself.
- III) Cloned lymphocytes have slight differences and are selected by the spleen for removal if they do not bind an antigen.
- IV) Cloned cells descend from an activated lymphocyte and persist even after the pathogen is eliminated.

- A) only I and III
- B) only II and IV
- C) only I, II, and IV
- D) only II, III, and IV

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 43.2

29) What major advantage is conveyed by having a system of adaptive immunity?

- A) It enables a rapid defense against an antigen that has been previously encountered.
- B) It enables an animal to counter most pathogens almost instantly the first time they are encountered.
- C) It results in effector cells with specificity for a large number of antigens.
- D) It allows for the destruction of antibodies.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.2

30) Which of the following are similarities between B cells and T cells?

- I) They both recognize antigen using immunoglobulin receptors.
- II) Both B cells and T cells undergo clonal selection after encountering an antigen.
- III) B cells and T cells both maintain an immunological memory of previously encountered antigens.

- A) only III
- B) only II
- C) both II and III
- D) both I and II

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 43.2

31) A certain cell type has existed in the blood and tissue of its vertebrate host's immune system for over 20 years. One day, it recognizes a newly arrived antigen and binds to it, subsequently triggering a secondary immune response in the body. Which of the following cell types most accurately describes this cell?

- A) plasma cell
- B) thyroid cell
- C) memory cell
- D) macrophage

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 43.2

32) Which of the following statements about epitopes are correct?

- I) B cell receptors bind to epitopes.
- II) T cell receptors bind to epitopes.
- III) There can be 10 or more different epitopes on each antigen.
- IV) There is a one-to-one correspondence between antigen and epitope.

- A) only I and III
- B) only II and IV
- C) only I, II, and III
- D) only II, III, and IV

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 43.2

33) Which of the following proteins can be classified as immunoglobulins?

- I) T cell receptors
- II) B cell receptors
- III) Antigens

- A) only I
- B) only II
- C) both II and III
- D) both I and II

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 43.2

34) What type of immunity is associated with breast feeding?

- A) innate immunity
- B) active immunity
- C) passive immunity
- D) cell-mediated immunity

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.3

35) Select the pathway that would lead to the activation of cytotoxic T cells.

- A) B cell contact antigen → helper T cell is activated → clonal selection occurs
- B) body cell becomes infected with a virus → new viral proteins appear → class I MHC molecule-antigen complex displayed on cell surface
- C) complement is secreted → B cell contacts antigen → helper T cell activated → cytokines released
- D) cytotoxic T cells → class II MHC molecule-antigen complex displayed → cytokines released → cell lysis

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 43.3

36) Arrange in the correct sequence these components of the mammalian immune system as it first responds to a pathogen.

- I) Pathogen is destroyed.
- II) Lymphocytes secrete antibodies.
- III) Antigens from a pathogen bind to antigen receptors on lymphocytes.
- IV) Lymphocytes specific to antigens from a pathogen become numerous.
- V) Only memory cells remain.

- A) I → III → II → IV → V
- B) II → I → IV → III → V
- C) IV → II → III → I → V
- D) III → IV → II → I → V

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 43.3

37) A nonfunctional CD4 protein on a helper T cell would result in the helper T cell being unable to _____.

- A) respond to circulating viral antigens
- B) lyse tumor cells
- C) stimulate a cytotoxic T cell
- D) interact with a class II MHC-antigen complex

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 43.3

38) CD4 and CD8 are _____.

- A) proteins secreted by antigen-presenting cells
- B) receptors present on the surface of natural killer cells
- C) molecules present on the surface of T cells where they interact with major histocompatibility (MHC) molecules
- D) molecules on the surface of antigen-presenting cells where they enhance B cell activity

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.3

39) T cells of the immune system include _____.

- A) CD4, CD8, and plasma cells
- B) cytotoxic and helper cells
- C) plasma, antigen-presenting, and memory cells
- D) lymphocytes, macrophages, and dendritic cells

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.3

- 40) B cells interacting with helper T cells are stimulated to differentiate when _____.
A) B cells produce IgE antibodies
B) B cells release cytokines
C) cytotoxic T cells present the class II MHC molecule-antigen complex on their surface
D) helper T cells release cytokines

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.3

- 41) When antibodies bind antigens, the clumping of antigens results from _____.
A) the antibody having at least two binding regions
B) disulfide bridges between the antigens
C) bonds between class I and class II MHC molecules
D) denaturation of the antibodies

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.3

- 42) Phagocytosis of microbes by macrophages is enhanced by _____.
I) the binding of antibodies to the surface of microbes
II) antibody-mediated opsonization of microbes
III) the release of cytokines by activated B cells

- A) only I and II
B) only II and III
C) only I and III
D) I, II, and, III

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.3

- 43) Naturally acquired passive immunity can result from the _____.
A) injection of vaccine
B) ingestion of interferon
C) placental transfer of antibodies
D) absorption of pathogens through mucous membranes

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.3

44) Jenner's successful use of cowpox virus as a vaccine against the smallpox virus was due to the fact that _____.

- A) the immune system responds nonspecifically to antigens
- B) the cowpox virus made antibodies in response to the presence of smallpox
- C) there are some epitopes (antigenic determinants) common to both pox viruses
- D) cowpox and smallpox are caused by the same virus

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 43.3

45) An individual who has been bitten by a poisonous snake that has a fast-acting toxin would likely benefit from _____.

- A) vaccination with a weakened form of the toxin
- B) injection of antibodies to the toxin
- C) injection of interleukin-1
- D) injection of interferon

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 43.3

46) For the successful development of a vaccine to be used against a pathogen, it is necessary that _____.

- A) the surface antigens of the pathogen stay the same
- B) all of the surface antigens on the pathogen be identified
- C) the pathogen has only one epitope
- D) the major histocompatibility (MHC) molecules are heterozygous

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 43.3

47) The switch of one B cell from producing one class of antibody to another class of antibody that is responsive to the same antigen is due to _____.

- A) the rearrangement of V region genes in that clone of responsive B cells
- B) a switch in the kind of antigen-presenting cell that is involved in the immune response
- C) a patient's reaction to the first kind of antibody made by the plasma cells
- D) the rearrangement of immunoglobulin heavy-chain C region DNA

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 43.3

48) The number of major histocompatibility (MHC) protein combinations possible in a given population is enormous. However, an individual in that diverse population has a far more limited array of MHC molecules because _____.

- A) the MHC proteins are made from several different gene regions that are capable of rearranging in a number of ways
- B) MHC proteins from one individual can only be of class I or class II
- C) each of the MHC genes has a large number of alleles, but each individual only inherits two for each gene
- D) once a B cell has matured in the bone marrow, it is limited to two MHC response categories

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 43.3

49) A bone marrow transplant may not be appropriate from a given donor (Jane) to a given recipient (Jane's cousin, Bob), even though Jane has previously given blood for one of Bob's needed transfusions, because _____.

- A) even though Jane's blood type is a match to Bob's, her major histocompatibility (MHC) proteins may not be a match
- B) a blood type match is less stringent than a match required for transplant because blood is more tolerant of change
- C) for each gene, there is only one blood allele but many tissue alleles
- D) Jane's MHC class II genes are not expressed in bone marrow

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 43.3

50) An immune response to a tissue graft will differ from an immune response to a bacterium because _____.

- A) MHC molecules of the donor may stimulate rejection of the graft tissue, but bacteria lack MHC molecules
- B) the tissue graft, unlike the bacterium, is isolated from the circulation and will not enter into an immune response
- C) a bacterium cannot escape the immune system by replicating inside normal body cells
- D) the graft will stimulate an autoimmune response in the recipient

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 43.3

51) Which of the following components of the immune system destroys cancerous cells by punching holes in plasma membranes and triggering apoptosis?

- A) toll-like proteins
- B) macrophages
- C) plasma cells
- D) cytotoxic T cells

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.3

52) Which of the following should be the same in identical twins?

- A) the set of antibodies produced
- B) the set of major histocompatibility (MHC) molecules produced
- C) the set of T cell antigen receptors produced
- D) the susceptibility to a particular virus

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 43.3

53) Which of the following is crucial to activation of the adaptive immune response?

- A) memory cells
- B) presentation of MHC (major histocompatibility complex)-antigen complex on a cell surface
- C) activation of complement proteins
- D) phagocytosis of antibody-antigen complex by macrophages in the blood

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 43.3

54) Which of the following components of the immune system destroys bacteria by punching holes in the wall of the bacteria?

- A) complement protein
- B) macrophages
- C) plasma cells
- D) major histocompatibility complex proteins

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.3

55) Yearly vaccination of humans for influenza viruses is necessary because _____.

- A) of an increase in immunodeficiency diseases
- B) the flu can generate anaphylactic shock
- C) surviving the flu one year exhausts the immune system to nonresponsiveness the second year
- D) rapid mutation in flu viruses alters the surface proteins in infected host cells

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.4

56) A patient who has a high level of mast cell activity, dilation of blood vessels, and acute drop in blood pressure is likely suffering from _____.

- A) an autoimmune disease
- B) a typical skin allergy (contact dermatitis) that can be treated by antihistamines
- C) an organ transplant, such as a skin graft
- D) anaphylactic shock immediately following exposure to an allergen

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 43.4

57) The ability of some viruses to remain inactive (latent) for a period of time is exemplified by _____.

- A) influenza, a particular strain of which returns every 10-20 years
- B) herpes simplex viruses (oral or genital) whose reproduction is triggered by physiological or emotional stress in the host
- C) Kaposi's sarcoma, which causes a skin cancer in people with AIDS but rarely in those not infected by HIV
- D) the virus that causes a form of the common cold, which recurs in patients many times in their lives

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 43.4

58) A patient complaining of watery, itchy eyes and sneezing after being given a flower bouquet as a birthday gift should first be treated with _____.

- A) a vaccine
- B) sterile pollen
- C) antihistamines
- D) monoclonal antibodies

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 43.4

59) Which of the following would help a virus avoid triggering an effective adaptive immune response?

- I) having frequent mutations in genes for surface proteins
- II) building the viral shell from host proteins
- III) producing proteins very similar to those of other viruses
- IV) infecting and killing helper T cells

- A) only I and III
- B) only I, II, and IV
- C) only I, II, and III
- D) only II, III, and IV

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 43.4

60) Which of the following is the best definition of autoimmune disease?

- A) a condition in which B and T cells trigger anaphylactic shock in response to an antigen
- B) a condition in which the adaptive immune system fails to recognize the second infection by the same antigen
- C) a condition in which self molecules are treated as nonself (loss of self-tolerance)
- D) a condition in which the immune system creates random antibodies without being triggered by a specific antigen

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 43.4

61) If a person is prone to allergies, what treatment could redirect their immune response to help prevent future allergic reactions?

- A) stimulating activated B cells to switch antibody production from class IgE to class IgM
- B) blocking the antigen recognition sites of IgM antibodies
- C) reducing the number of helper T cells in the body
- D) reducing the number of cytotoxic cells

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 43.4

62) In a humoral or antibody-mediated immune response, specific B cells are stimulated by helper T cells to transform into plasma cells that secrete antibodies. What would be an important feature added to the plasma cells during this transition process that allows them to better perform their function?

- A) duplication of specific gene sequences for the appropriate antibody
- B) increased rough endoplasmic reticulum for greater antibody production
- C) duplication of lysosomes in order to store the antibodies before transport
- D) increased antigen presentation on the surface of the plasma cells

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 43.3

43.2 Student Edition End-of-Chapter Questions

- 1) Which of these is *not* part of insect immunity?
- A) enzyme activation of pathogen-killing chemicals
 - B) activation of natural killer cells
 - C) phagocytosis by hemocytes
 - D) production of antimicrobial peptides

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 2) An epitope associates with which part of an antigen receptor or antibody?

- A) the tail
- B) the heavy-chain constant regions only
- C) variable regions of a heavy chain and light chain combined
- D) the light-chain constant regions only

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 3) Which statement best describes the difference between responses of effector B cells (plasma cells) and those of cytotoxic T cells?

- A) B cells confer active immunity; cytotoxic T cells confer passive immunity.
- B) B cells respond the first time a pathogen is present; cytotoxic T cells respond subsequent times.
- C) B cells secrete antibodies against a pathogen; cytotoxic T cells kill pathogen-infected host cells.
- D) B cells carry out the cell-mediated response; cytotoxic T cells carry out the humoral response.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Which of the following statements is *not* true?

- A) An antibody has more than one antigen-binding site.
- B) A lymphocyte has receptors for multiple different antigens.
- C) An antigen can have different epitopes.
- D) A liver or muscle cell makes one class of MHC molecule.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 5) Which of the following should be the same in identical twins?

- A) the set of antibodies produced
- B) the set of MHC molecules produced
- C) the set of T cell antigen receptors produced
- D) the set of immune cells eliminated as self-reactive

Answer: B

Bloom's Taxonomy: Application/Analysis

- 6) Vaccination increases the number of
- A) different receptors that recognize a pathogen.
 - B) lymphocytes with receptors that can bind to the pathogen.
 - C) epitopes that the immune system can recognize.
 - D) MHC molecules that can present an antigen.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

- 7) Which of the following would *not* help a virus avoid triggering an adaptive immune response?
- A) having frequent mutations in genes for surface proteins
 - B) infecting cells that produce very few MHC molecules
 - C) producing proteins very similar to those of other viruses
 - D) infecting and killing helper T cells

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

44.1 Multiple-Choice Questions

1) The force driving simple diffusion is _____, while the energy source for active transport is _____.

- A) the concentration gradient; ADP
- B) the concentration gradient; ATP
- C) transmembrane pumps; electron transport
- D) phosphorylated protein carriers; ATP

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.1

2) To maintain homeostasis, freshwater fish must _____.

- A) excrete large quantities of electrolytes
- B) consume large quantities of water
- C) excrete large quantities of water
- D) take in electrolytes through simple diffusion

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.1

3) Single-celled *Paramecium* live in pond water (a hypotonic environment relative to the cytosol). They have a structural feature, a contractile vacuole, which enables them to osmoregulate. If sucrose or saline was added to the pond water in different concentrations (in millimolars, mM), under which conditions would you expect the contractile vacuole to be most active?

- A) 0.0 mM sucrose
- B) 0.05 mM saline
- C) 0.08 mM sucrose
- D) 1.0 mM saline

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 44.1

- 4) Like other osmoregulatory animals that live in marine environments, sharks maintain tissue concentrations of sodium, potassium, and chloride that are hypoosmotic to the seawater. In contrast to the bony marine fishes, however, sharks do not need to drink seawater. Why?
- A) High urea and trimethylamine oxide concentrations keep shark tissues slightly hyperosmotic relative to seawater, so water is absorbed passively.
 - B) Sodium, chloride, and potassium do not influence water balance in shark tissues.
 - C) Shark blood is hypotonic to the surrounding tissues, so water always moves passively into the tissue from the blood.
 - D) Sharks excrete large quantities of salt through their gills in exchange for water

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.1

- 5) What role do transport epithelia play in osmoregulation of marine fish with bony skeletons?
- A) They actively transport salt into the animal through the gills.
 - B) They mediate the movement of water from seawater through the gills.
 - C) They are involved in excretion of excess salt.
 - D) They allow the fish to produce dilute urine.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.1

- 6) Salmon eggs hatch in fresh water. The fish then migrate to the ocean (a hypertonic solution) and, after several years of feeding and growing, return to fresh water to breed. How can these organisms make the transition from fresh water to ocean water and back to fresh water?
- A) The rectal gland functions in the ocean water, and chloride cells function in fresh water.
 - B) The salt transport mechanisms of the gill epithelia change during migration.
 - C) Salmon in fresh water excrete concentrated urine, and salmon in salt water secrete dilute urine.
 - D) Their metabolism changes in salt water to degrade electrolytes.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.1

- 7) Terrestrial organisms lose water through evaporation. In what ecosystem might an entomologist find a good study organism to examine the prevention of water loss?

- A) wet rain forest
- B) desert
- C) prairie
- D) chaparral

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 44.1

8) An examination of a marine sea star that had died after it was mistakenly placed in fresh water would likely show that it died because _____.

- A) it was stressed and needed more time to acclimate to the new conditions
- B) it was so hypertonic to the fresh water that it could not osmoregulate
- C) its kidney had ruptured
- D) its cells dehydrated and lost the ability to metabolize

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 44.1

9) The body fluids of an osmoconformer would be _____ with its _____ environment

- A) hyperosmotic; freshwater
- B) hyperosmotic; seawater
- C) isoosmotic; seawater
- D) hypoosmotic; seawater

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 44.1

10) Compared to the seawater around them, most marine invertebrates are _____.

- A) hyperosmotic
- B) hypoosmotic
- C) isoosmotic
- D) both hyperosmotic and isoosmotic

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.1

11) The fluid with the highest osmolarity is _____.

- A) distilled water
- B) blood in birds
- C) blood in mammals
- D) seawater in a tidal pool

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.1

12) Unlike most bony fishes, sharks maintain body fluids that are isoosmotic to seawater, so they are considered by many to be osmoconformers. Nonetheless, these sharks osmoregulate at least partially by _____.

- A) using their gills and kidneys to rid themselves of sea salts
- B) monitoring dehydration at the cellular level with special gated aquaporins
- C) tolerating high urea concentrations that are balanced with internal salt concentrations to seawater osmolarity
- D) synthesizing trimethylamine oxide, a chemical that binds and precipitates salts inside cells

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 44.1

13) An examination of a freshwater fish that died after being placed accidentally in saltwater would likely show that _____.

- A) loss of water by osmosis from cells in vital organs resulted in cell death and organ failure
- B) high amounts of salt had diffused into the fish's cells, causing them to swell and lyse
- C) the kidneys were not able to keep up with the water removal necessary in this hyperosmotic environment, creating an irrevocable loss of homeostasis
- D) the gills became encrusted with salt, resulting in inadequate gas exchange and a resulting asphyxiation

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 44.1

14) Animals have adapted different mechanisms for excreting nitrogenous waste products.

Which of the following are selective pressures that likely influence which mechanism an animal uses?

- I) the amount of water available in the animal's habitat
- II) the energy needs of the animal
- III) the temperature of the animal's environment

- A) only I and III
- B) only II and III
- C) only I and II
- D) I, II, and III

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 44.2

15) Urea is produced in the _____.

- A) liver from NH₃ and carbon dioxide
- B) liver from glycogen
- C) kidneys from glycerol and fatty acids
- D) bladder from uric acid and water

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.2

16) Urea is _____.

- A) insoluble in water
- B) the primary nitrogenous waste product of humans
- C) the primary nitrogenous waste product of most birds
- D) the primary nitrogenous waste product of most aquatic invertebrates

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.2

17) Which nitrogenous waste has the greatest number of nitrogen atoms?

- A) ammonia
- B) ammonium ions
- C) urea
- D) uric acid

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.2

18) Ammonia is likely to be the primary nitrogenous waste in living conditions that include _____.

- A) lots of fresh water flowing across the gills of a fish
- B) lots of seawater, such as a bird living in a marine environment
- C) a terrestrial environment, such as that supporting crickets
- D) a moist system of burrows, such as those of naked mole rats

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 44.2

19) Excessive formation of uric acid crystals in humans leads to _____.

- A) a condition called diabetes, where excessive urine formation occurs
- B) a condition of insatiable thirst and excessive urine formation
- C) gout, a painful inflammatory disease that primarily affects the joints
- D) osteoarthritis, an inevitable consequence of aging

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.2

20) Developing bird embryos excrete most of their nitrogenous waste as uric acid because _____.

- A) it is less metabolically expensive to produce compared to other waste products
- B) it has a low solubility in water and is less toxic to the embryo than other forms of waste
- C) it requires less energy to transport across the egg shell
- D) it can be recycled by the embryo to make new protein

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.2

21) The advantage of excreting nitrogenous wastes as urea rather than as ammonia is that _____.

- A) urea can be removed as a semi-solid paste
- B) urea is less toxic than ammonia
- C) urea does not affect the osmotic gradient
- D) less nitrogen is removed from the body

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.2

22) In animals, nitrogenous wastes are produced mostly from the catabolism of _____.

- A) starch and cellulose
- B) triglycerides and steroids
- C) proteins and nucleic acids
- D) phospholipids and glycolipids

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.2

23) Birds secrete uric acid as their nitrogenous waste because uric acid _____.

- A) is readily soluble in water
- B) is metabolically less expensive to synthesize than other excretory products
- C) requires little water for nitrogenous waste disposal, thus reducing body mass
- D) can be reused by birds as a protein source

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.2

24) Among the following choices, the most concentrated urine is excreted by _____.

- A) frogs
- B) kangaroo rats
- C) humans
- D) freshwater bass

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 44.2

25) African lungfish, which are often found in small, stagnant pools of fresh water, produce urea as a nitrogenous waste. What is the advantage of this adaptation?

- A) Urea takes less energy to synthesize than ammonia.
- B) Small, stagnant pools do not provide enough water to dilute the toxic ammonia.
- C) The highly toxic urea makes the pool uninhabitable to potential competitors.
- D) Urea makes lungfish tissue hypoosmotic to the pool.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 44.2

26) Studies of cricket Malpighian tubules revealed that potassium ions accumulated inside the tubule, moving against the potassium concentration gradient. Based on the information, what can you infer about the mechanism of potassium transport?

- A) Potassium transport is a passive process.
- B) Movement of potassium into the lumen of the Malpighian tubules is an energy-requiring process.
- C) Potassium moves out of the tubules at a faster rate than it moves into the lumen of the tubules.
- D) Sodium ions will follow potassium ions.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 44.3

27) Studies of cricket Malpighian tubules revealed that potassium ions accumulated inside the tubule, moving against the potassium concentration gradient. How would you expect the movement of water to be influenced by the distribution of potassium ions?

- A) Water would be forced out of the lumen of the Malpighian tubules through an osmotic gradient.
- B) The potassium gradient would have no effect on water movement.
- C) There would be a net movement of water into the lumen of the tubules.
- D) Water would be conserved, forming a hypertonic solution in the Malpighian tubules.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 44.3

28) Why are the renal artery and vein critical to the process of osmoregulation in vertebrates?

- A) The kidneys require constant and abnormally high oxygen supply to function.
- B) The renal artery delivers blood with nitrogenous waste to the kidney and the renal vein brings blood with less nitrogenous wastes away from the kidneys.
- C) The kidneys require higher than normal levels of hormones.
- D) The renal artery and vein are the main pathways regulating how much is produced by the kidneys.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 44.3

29) The osmoregulatory/excretory system of a freshwater flatworm is based on the operation of _____.

- A) protonephridia
- B) metanephridia
- C) Malpighian tubules
- D) nephrons

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.3

30) Materials are returned to the blood from the filtrate by which of the following processes?

- A) filtration
- B) reabsorption
- C) secretion
- D) excretion

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.3

31) Excretory organs known as Malpighian tubules are present in _____.

- A) flatworms
- B) insects
- C) jellyfish
- D) sea stars

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.3

32) The osmoregulatory process called secretion refers to the _____.

- A) reabsorption of nutrients from a filtrate
- B) selective elimination of excess ions and toxins from body fluids
- C) formation of an osmotic gradient along an excretory structure
- D) expulsion of urine from the body

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.3

33) Which of the following is characteristic of juxtamedullary nephrons?

- A) large Bowman's capsule
- B) absence of proximal tubule
- C) limited branching of vasa recta
- D) long loop of Henle

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.3

34) Choose a pair that correctly associates the mechanism for osmoregulation or nitrogen removal with the appropriate animal.

- A) protonephridium—earthworm
- B) Malpighian tubule—frog
- C) flame bulb—flat worm
- D) exchange across the body surface—snake

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.3

35) An excretory system that is partly based on the filtration of fluid under high hydrostatic pressure is the _____.

- A) flame-bulb system of flatworms
- B) protonephridia of rotifers
- C) Malpighian tubules of insects
- D) kidneys of vertebrates

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.3

36) The transfer of fluid from the glomerulus to Bowman's capsule _____.

- A) results from active transport
- B) transfers large molecules as easily as small ones
- C) is very selective as to which sub-protein-sized molecules are transferred
- D) is mainly a consequence of blood pressure in the capillaries of the glomerulus

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 44.3

37) Within a normally functioning kidney, red blood cells can be found in _____.

- A) the vasa recta
- B) Bowman's capsule
- C) the proximal tubule
- D) the collecting duct

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.3

38) A primary reason that the kidneys have one of the highest metabolic rates of all body organs is that _____.

- A) they have membranes of varying permeability to water
- B) they operate an extensive set of active-transport ion pumps
- C) they are the body's only means of shedding excess nutrients
- D) they have an abundance of myogenic smooth muscle

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.4

39) Which process in the nephron is *least* selective?

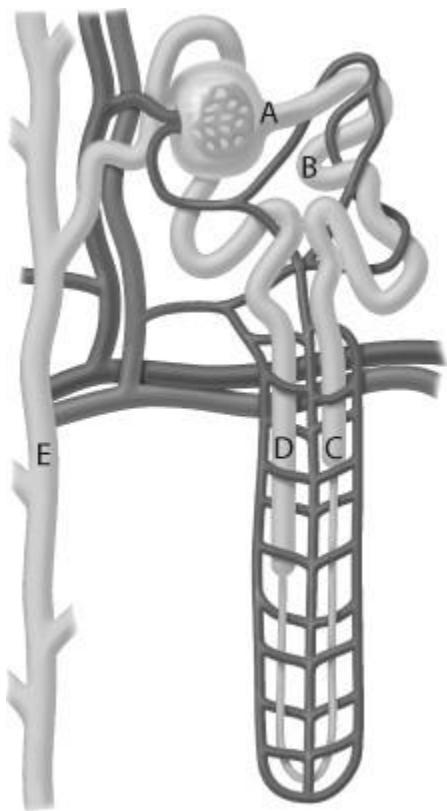
- A) filtration
- B) reabsorption
- C) active transport
- D) secretion

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.4

40) Use the following figure to answer the question.



Filtration takes place in the structure labeled _____.

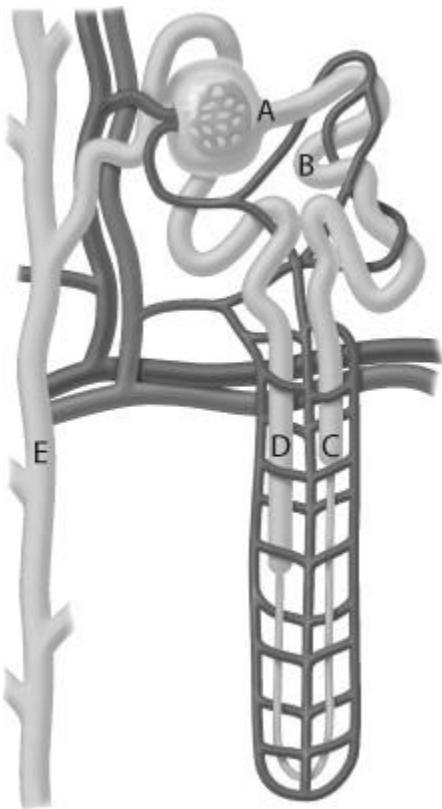
- A) A
- B) B
- C) C
- D) E

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.3

41) Use the following figure to answer the question.



In which of the labeled structures does passive water reabsorption take place?

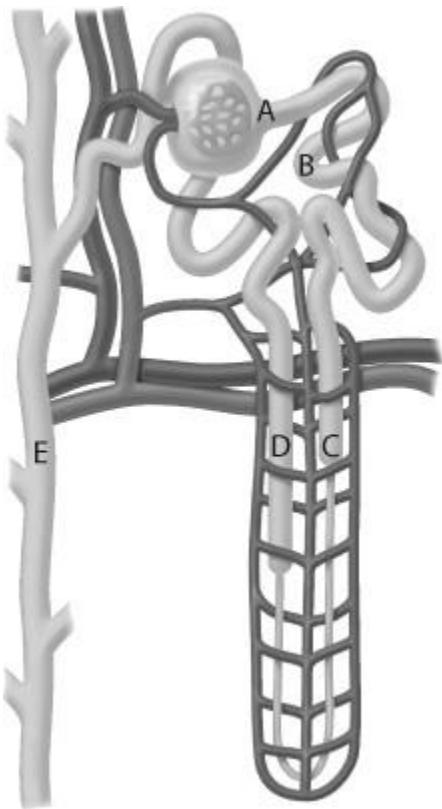
- A) only in B
- B) only in B and D
- C) in B, C, and E
- D) Passive water reabsorption occurs throughout all of the nephron.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.4

42) Use the following figure to answer the question.



Selective secretion of toxins and drugs takes place in the structure labeled _____.

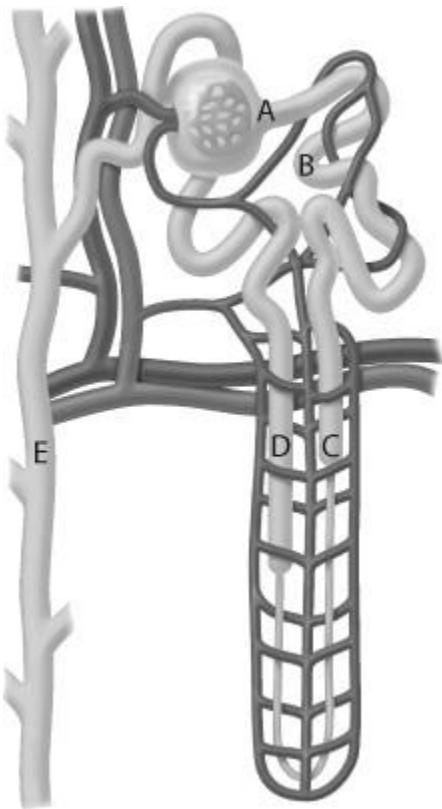
- A) A
- B) B
- C) C
- D) D

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.3

43) Use the following figure to answer the question.



The structure labeled _____ can be influenced by hormones to change the concentration of the urine.

- A) B
- B) C
- C) D
- D) E

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.4

44) The loop of Henle dips into the renal cortex. This is an important feature of osmoregulation in terrestrial vertebrates because _____.

- A) absorptive processes taking place in the loop of Henle are hormonally regulated
- B) differential permeabilities of ascending and descending limbs of the loop of Henle are important in establishing an osmotic gradient
- C) the loop of Henle plays an important role in detoxification
- D) additional filtration takes place along the loop of Henle

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 44.4

45) Low selectivity of solute movement is a characteristic of _____.

- A) H⁺ pumping to control pH
- B) reabsorption mechanisms along the proximal tubule
- C) filtration from the glomerular capillaries
- D) secretion along the distal tubule

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 44.4

46) If ATP production in a human kidney was suddenly halted, urine production would _____.

- A) decrease, and the urine would be hypoosmotic compared to plasma
- B) increase, and the urine would be isoosmotic compared to plasma
- C) increase, and the urine would be hyperosmotic compared to plasma
- D) decrease, and the urine would be isoosmotic compared to plasma

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 44.4

47) Compared to wetland mammals, water conservation in mammals of arid regions is enhanced by having more _____.

- A) juxamedullary nephrons
- B) urinary bladders
- C) ureters
- D) podocytes

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 44.4

48) Processing of filtrate in the proximal and distal tubules _____.

- A) achieves the conversion of toxic ammonia to less toxic urea
- B) maintains homeostasis of pH in body fluids
- C) regulates the speed of blood flow through the nephrons
- D) reabsorbs urea to maintain osmotic balance

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 44.4

49) In humans, the transport epithelial cells in the ascending loop of Henle _____.

- A) are the largest epithelial cells in the body
- B) are not in contact with interstitial fluid
- C) have plasma membranes of low permeability to water
- D) are not affected by high levels of nitrogenous wastes

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 44.4

50) Which of the following contribute to maintaining the high osmolarity of the renal medulla?

- I) active transport of salt from the upper region of the ascending limb
- II) the spatial arrangement of juxtamedullary nephrons
- III) diffusion of urea from the collecting duct
- IV) diffusion of salt from the descending limb of the loop of Henle

A) All of these conditions contribute to the osmolarity of the medulla.

B) I, II, and III

C) I and IV

D) I, II, and IV

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 44.4

51) Natural selection should favor the highest proportion of juxtamedullary nephrons in which of the following species?

A) a river otter

B) a mouse species living in a tropical rain forest

C) a mouse species living in a temperate broadleaf forest

D) a mouse species living in a desert

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 44.4

52) If you are hiking through the desert for several days, one would pack which of the following to ensure proper hydration?

A) a drink with a combination of water and electrolytes

B) caffeinated beverages

C) bottled water kept at room temperature

D) bottled water that had been frozen to ensure that it would be as cold as possible

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 44.5

53) Increased antidiuretic hormone (ADH) secretion is likely after _____.

A) drinking lots of pure water

B) sweating-induced dehydration increases plasma osmolarity

C) eating a small sugary snack

D) blood pressure becomes abnormally high

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.5

54) After blood flow is artificially reduced at one kidney, you would expect that kidney to secrete more of the hormone known as _____.

- A) angiotensinogen
- B) renin
- C) antidiuretic hormone
- D) atrial natriuretic peptide

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 44.5

55) After drinking alcoholic beverages, increased urine excretion is the result of _____.

- A) increased aldosterone production
- B) increased blood pressure
- C) inhibited secretion of antidiuretic hormone (ADH)
- D) increased reabsorption of water in the proximal tubule

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 44.5

56) Osmoregulatory adjustment via the atrial natriuretic peptide system can be triggered by _____.

- A) sleeping for one hour
- B) severe sweating on a hot day
- C) eating a pizza with olives and pepperoni
- D) drinking several glasses of water

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 44.5

57) Antidiuretic hormone (ADH) and the renin-angiotensin-aldosterone system (RAAS) work together in maintaining osmoregulatory homeostasis through which of the following ways?

- A) ADH regulates the osmolarity of the blood by altering renal reabsorption of water, and the RAAS maintains the osmolarity of the blood by stimulating both Na^+ and water reabsorption.
- B) ADH and the RAAS work antagonistically; ADH stimulates water reabsorption during dehydration, and the RAAS causes increased excretion of water when it is in excess in body fluids.
- C) Both stimulate the adrenal gland to secrete aldosterone, which increases both blood volume and pressure via its receptors in the urinary bladder.
- D) ADH and the RAAS combine at the receptor sites of proximal tubule cells, where reabsorption of essential nutrients takes place.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 44.5

58) A human who has no access to fresh water but is forced to drink seawater instead will _____.

- A) produce excessive antidiuretic hormone to remove more water but hold back salts
- B) passively excrete excess water in order to remove the high concentration of ingested salt
- C) release atrial natriuretic peptide to decrease blood pressure
- D) risk becoming overhydrated within twelve hours

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 44.5

44.2 Student Edition End-of-Chapter Questions

1) *Unlike* an earthworm's metanephridia, a mammalian nephron

- A) is intimately associated with a capillary network.
- B) functions in both osmoregulation and excretion.
- C) receives filtrate from blood instead of coelomic fluid.
- D) has a transport epithelium.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

2) Which process in the nephron is *least* selective?

- A) filtration
- B) reabsorption
- C) active transport
- D) secretion

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

3) Which of the following animals generally has the lowest volume of urine production?

- A) vampire bat
- B) salmon in fresh water
- C) marine bony fish
- D) freshwater flatworm

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

4) The high osmolarity of the renal medulla is maintained by all of the following *except*

- A) active transport of salt from the upper region of the ascending limb.
- B) the spatial arrangement of juxtamedullary nephrons.
- C) diffusion of urea from the collecting duct.
- D) diffusion of salt from the descending limb of the loop of Henle.

Answer: D

Bloom's Taxonomy: Application/Analysis

5) In which of the following species should natural selection favor the highest proportion of juxtamedullary nephrons?

- A) a river otter
- B) a mouse species living in a temperate broadleaf forest
- C) a mouse species living in a desert
- D) a beaver

Answer: C

Bloom's Taxonomy: Application/Analysis

6) African lungfish, which are often found in small stagnant pools of fresh water, produce urea as a nitrogenous waste. What is the advantage of this adaptation?

- A) Urea takes less energy to synthesize than ammonia.
- B) Small stagnant pools do not provide enough water to dilute ammonia, which is toxic.
- C) Urea forms an insoluble precipitate.
- D) Urea makes lungfish tissue hypoosmotic to the pool.

Answer: B

Bloom's Taxonomy: Application/Analysis

45.1 Multiple-Choice Questions

1) You are dissecting a fish in your biology laboratory section. Your teaching assistant points out a long oval structure and tells you it is an endocrine gland. Which of the following would you then know is a true statement about this structure?

- A) It secretes a product that is released through a series of ducts.
- B) The gland's product will only interact with receptors on the cell membrane.
- C) The gland's product is lipid soluble.
- D) The gland produces and secretes its product into the blood.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 45.1

2) In experiments where researchers suspect that a hormone may be responsible for a certain physiological effect, they may cut the neurons leading to the organ where the effect being studied occurs. What is the purpose of cutting these neurons?

- A) to make sure that the effect is not occurring through actions in the nervous system
- B) to make sure that the organ being affected cannot function unless the researchers stimulate it with an external electrical probe
- C) to impair the normal functions of the organ so that the hormonal effect can be more easily studied
- D) to numb the organ so that it can be probed without inducing pain in the lab animal

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 45.1

3) What is the only type of chemical signal that does not alter the physiology of the animal producing that signal?

- A) neural
- B) paracrine
- C) neuroendocrine
- D) pheromones

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.1

4) Testosterone is an example of a chemical signal that affects the very cells that synthesize it, the neighboring cells in the testis, along with distant cells outside the gonads. Thus, testosterone is an example of _____.

- I) an autocrine signal
- II) a paracrine signal
- III) an endocrine signal

A) only I and II

B) only II and III

C) only I and III

D) I, II, and III

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 45.1

5) Prostaglandins are local regulators whose chemical structure is derived from _____.

A) oligosaccharides

B) fatty acids

C) steroids

D) amino acids

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.1

6) Aspirin and ibuprofen both _____.

A) inhibit the synthesis of prostaglandins

B) inhibit the release of nitric oxide, a potent vasodilator

C) activate the paracrine signaling pathways that form blood clots

D) stimulate vasoconstriction in the kidneys

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.1

7) A cell with membrane-bound proteins that selectively bind a specific hormone is called that hormone's _____.

A) secretory cell

B) endocrine cell

C) target cell

D) regulatory cell

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.1

8) The steroid hormone aldosterone affects only a small number of cells in the body because _____.

- A) only target cells are exposed to aldosterone
- B) only target cells contain aldosterone receptors
- C) aldosterone is unable to enter nontarget cells
- D) nontarget cells destroy aldosterone before it can produce any effect

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 45.1

9) Different body cells can respond differently to the same polypeptide hormones because _____.

- A) different target cells have different sets of genes
- B) a target cell's response is determined by the components of its signal transduction pathways
- C) the circulatory system regulates responses to hormones by routing the hormones to specific targets
- D) the hormone is chemically altered in different ways as it travels through the circulatory system

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

10) Hormone X activates the cAMP second messenger system in its target cells. The greatest response by a target cell would come from _____.

- A) applying a molecule of hormone X to the extracellular fluid surrounding the cell
- B) injecting a molecule of hormone X into the cytoplasm of the cell
- C) applying a molecule of cAMP to the extracellular fluid surrounding the cell
- D) injecting a molecule of activated, cAMP-dependent protein kinase into the cytoplasm of the cell

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 45.1

11) When a steroid hormone and a polypeptide hormone exert similar effects on a population of target cells, then _____.

- A) the steroid and polypeptide hormones must use the same biochemical mechanisms
- B) the steroid and polypeptide hormones must bind to the same receptor protein
- C) the steroid hormones affect the synthesis of effector proteins, whereas polypeptide hormones activate effector proteins already present in the cell
- D) the steroid hormones affect the activity of certain proteins within the cell, whereas polypeptide hormones directly affect the processing of mRNA

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

- 12) Growth factors are local regulators that _____.
A) are modified fatty acids that stimulate bone and cartilage growth
B) are found on the surface of cancer cells and stimulate abnormal cell division
C) bind to cell-surface receptors and stimulate growth and development of target cells
D) convey messages between nerve cells
Answer: C
Bloom's Taxonomy: Knowledge/Comprehension
Section: 45.1
- 13) Steroid and polypeptide hormones typically have in common _____.
A) the building blocks from which they are synthesized
B) their solubility in cell membranes
C) their requirement for travel through the bloodstream
D) their reliance on signal transduction in the cell
Answer: C
Bloom's Taxonomy: Application/Analysis
Section: 45.1
- 14) A cluster of tumor cells that produces and secretes growth factors to induce surrounding cells to grow and divide is showing which type of cell-to-cell signaling?
A) autocrine
B) paracrine
C) endocrine
D) neuroendocrine
Answer: B
Bloom's Taxonomy: Knowledge/Comprehension
Section: 45.1
- 15) If a portion of the pancreas is surgically removed from a rat and the rat subsequently loses its appetite, one explanation is that the removed portion contains cells that secrete a chemical signal that somehow stimulates appetite. Given this scenario, what type of chemical signaling is occurring?
A) autocrine
B) paracrine
C) endocrine
D) neuroendocrine
Answer: C
Bloom's Taxonomy: Application/Analysis
Section: 45.1

16) If a biochemist discovers a new molecule, which of the following pieces of data would allow her to draw the conclusion that the molecule is a steroid hormone?

- I) The molecule is lipid soluble.
- II) The molecule is derived from a series of steps beginning with cholesterol.
- III) The molecule acts at a target tissue some distance from where it is produced.
- IV) The molecule uses a transport protein when in an aqueous solution such as blood.

- A) only I and III
- B) only II and IV
- C) only I, III, and IV
- D) I, II, III, and IV

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 45.1

17) Which of the following are similar in structure to cholesterol?

- I) estradiol
- II) insulin
- III) glucocorticoids
- IV) testosterone
- V) antidiuretic hormone

- A) I and II
- B) I, II, and III
- C) I, III, and IV
- D) II and V

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

18) Polypeptides can have which of the following types of effects?

- I) autocrine
- II) paracrine
- III) endocrine

- A) only I and III
- B) only II and III
- C) only I and II
- D) I, II, and III

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.1

19) Which of the following are properties of steroid hormones?

- I) Steroid hormones are lipid soluble and easily cross the phospholipid bilayer.
- II) Steroid hormones usually exert their effects on target cells through membrane receptor proteins.
- III) Steroid hormones act on cells close to where they were produced.
- IV) Steroid hormones regulate gene transcription by binding to intracellular receptor proteins.

- A) I and IV
- B) I and II
- C) II and III
- D) I, II, III, and IV

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 45.1

20) Tadpoles must undergo a major metamorphosis to become frogs. This change includes reabsorption of the tail, growth of limbs, calcification of the skeleton, increase in rhodopsin in the eye, development of lungs, change in hemoglobin structure, and reformation of the gut from the long gut of an herbivore to the short gut of a carnivore. Amazingly, all of these changes are induced by thyroxine. What is the most likely explanation for such a wide array of effects of thyroxine?

- A) There are many different forms of thyroxine, each specific to a different tissue.
- B) Different tissues have thyroxine receptors that activate different signal transduction pathways.
- C) Some tissues have membrane receptors for thyroxine, while other tissues have thyroxine receptors within the nucleus.
- D) Different releasing hormones release thyroxine to different tissues.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 45.1

21) What happens in a cell when adenylyl cyclase is activated?

- A) cAMP is created
- B) cAMP is destroyed
- C) G proteins bind to cAMP
- D) steroid hormones pass through the lipid bilayer

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.1

22) Nitric oxide and epinephrine _____.

- A) both regulate blood flow
- B) both function as steroid hormones
- C) bind the same receptors
- D) both cause a reduction in the blood levels of glucose

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.1

23) Insect hormones and their receptors _____.

- A) act independently of each other
- B) are a focus in pest control research
- C) utilize cell-surface receptors only
- D) are active independently of environmental cues

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.2

24) During mammalian labor and delivery, the contraction of uterine muscles is enhanced by oxytocin. This is an example of _____.

- A) a negative feedback system
- B) a hormone that acts in an antagonistic way with another hormone
- C) a hormone that is involved in a positive feedback loop
- D) signal transduction immediately changing gene expression in its target cells

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.2

25) Which of the following has both endocrine and exocrine activity?

- A) the pituitary gland
- B) parathyroid glands
- C) salivary glands
- D) the pancreas

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.1

26) Analysis of a blood sample from a fasting individual who had not eaten for 24 hours would be expected to reveal high levels of _____.

- A) insulin
- B) glucagon
- C) gastrin
- D) glucose

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 45.1

27) The steroid hormone that coordinates molting in arthropods is _____.

- A) ecdysteroid
- B) glucagon
- C) thyroxine
- D) growth hormone

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.2

28) Which of the following statements are correct?

- I) Hormones often regulate homeostasis through antagonistic functions.
- II) Hormones of the same chemical class usually have the same function.
- III) Hormones are secreted by specialized cells usually located in exocrine glands.
- IV) Hormones are often regulated through feedback loops.

- A) only II and III
- B) only I and III
- C) only III and IV
- D) only I and IV

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.2

29) An example of antagonistic hormones controlling homeostasis is _____.

- A) thyroxine and parathyroid hormone in calcium balance
- B) insulin and glucagon in glucose metabolism
- C) progestins and estrogens in sexual differentiation
- D) epinephrine and norepinephrine in fight-or-flight responses

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.2

30) The relationship between the insect hormones ecdysteroid and PTTH is an example of _____.

- A) an interaction of the endocrine and nervous systems
- B) competitive inhibition of a hormone receptor
- C) how polypeptide-derived hormones have more widespread effects than steroid hormones
- D) homeostasis maintained by antagonistic hormones

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 45.2

31) Hormones secreted by the posterior pituitary gland are made in the _____.
A) cerebellum
B) thalamus
C) hypothalamus
D) anterior pituitary gland

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.2

32) Injury localized to the hypothalamus would most likely disrupt _____.
A) short-term memory
B) coordination during locomotion
C) executive functions, such as decision making
D) regulation of water balance

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 45.2

33) Which of the following is an example of a *simple endocrine pathway*?
A) control of metabolism by thyroid hormones
B) release of secretin by cells of the duodenum in response to acid
C) release of antidiuretic hormone from the posterior pituitary gland to regulate water balance
D) regulation of growth by the production of growth hormone

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.2

34) Portal blood vessels connect two capillary beds found in the _____.
A) hypothalamus and thalamus
B) anterior pituitary and posterior pituitary
C) hypothalamus and anterior pituitary
D) posterior pituitary and thyroid gland

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.2

35) If a person loses a large amount of water in a short period of time, he or she may die from dehydration. Antidiuretic hormone (ADH) can help reduce water loss through its interaction with its target cells in the _____.
A) anterior pituitary
B) posterior pituitary
C) bladder
D) kidney

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.2

36) A product of the anterior pituitary gland that causes color changes in its target cells is _____.

- A) follicle-stimulating hormone (FSH)
- B) luteinizing hormone (LH)
- C) thyroid-stimulating hormone (TSH)
- D) melanocyte-stimulating hormone (MSH)

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

37) In a lactating mammal, the two hormones that promote milk synthesis and milk release, respectively, are _____.

- A) prolactin and calcitonin
- B) prolactin and oxytocin
- C) follicle-stimulating hormone and luteinizing hormone
- D) luteinizing hormone and oxytocin

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.2

38) Oxytocin and antidiuretic hormone (ADH) are synthesized in the _____ but released from the _____.

- A) hypothalamus; posterior pituitary
- B) adenohypophysis; posterior pituitary
- C) posterior pituitary; anterior pituitary
- D) hypothalamus; anterior pituitary

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.2

39) What would be a likely outcome of a person not consuming enough iodine in their diet?

- A) high body temperature
- B) high levels of circulating blood glucose
- C) reduced cellular metabolism
- D) stronger muscle contractions

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 45.2

40) Which of the following is the most likely explanation for hypothyroidism in a patient whose iodine level is normal?

- A) greater production of T₃ than of T₄
- B) hyposecretion of thyroid-stimulating hormone (TSH)
- C) hypersecretion of thyrotropin-releasing hormone (TRH)
- D) a decrease in the thyroid secretion of calcitonin

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 45.2

41) When a person drinks alcohol, the rate of urination increases. Which of the following best accounts for the increase in urination above normal rates?

- A) Alcohol stimulates the release of thyroid hormones.
- B) Alcohol inhibits the release of ADH.
- C) Alcohol inhibits the actions of calcitonin.
- D) Alcohol stimulates the release of oxytocin which causes more water secretion.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 45.2

42) Removing which of the following glands would have the most wide-reaching effect on bodily functions of an adult human?

- A) adrenal glands
- B) pituitary gland
- C) thyroid gland
- D) ovaries (in female) or testes (in male)

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 45.2

43) Glucocorticoids do which of the following?

- A) promote the immune response
- B) promote the release of fatty acids
- C) increase blood glucose levels
- D) increase insulin production

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

44) Fight-or-flight reactions include activation of the _____.

- A) parathyroid glands, leading to increased metabolic rate
- B) anterior pituitary gland, leading to cessation of gonadal function
- C) adrenal medulla, leading to increased secretion of epinephrine
- D) pancreas, leading to a reduction in the blood sugar concentration

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

45) The amino acid tyrosine is a starting substrate for the synthesis of _____.

- A) epinephrine
- B) steroid hormones
- C) parathyroid hormone
- D) acetylcholine

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

46) If the adrenal cortex were surgically removed, an increase in the plasma levels of _____ would likely be observed.

- A) glucocorticoid hormones
- B) epinephrine
- C) adrenocorticotrophic hormone (ACTH)
- D) acetylcholine

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 45.3

47) During a stressful interval, _____.

- A) thyroid-stimulating hormone (TSH) stimulates the adrenal cortex and medulla to secrete acetylcholine
- B) increased acid in the duodenum stimulates the S cells to release secretin
- C) adrenocorticotrophic hormone (ACTH) stimulates the adrenal cortex, and neurons of the sympathetic nervous system stimulate the adrenal medulla
- D) the calcium levels in the blood are increased due to actions of two antagonistic hormones, epinephrine and norepinephrine

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

48) In response to stress, the adrenal gland promotes the synthesis of glucose from noncarbohydrate substrates via the action of the steroid hormone _____.

- A) estradiol
- B) cortisol
- C) thyroxine
- D) adrenocorticotrophic hormone (ACTH)

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

49) Melatonin is secreted by the _____.

- A) hypothalamus during the day
- B) pineal gland during the night
- C) autonomic nervous system during the winter
- D) posterior pituitary gland during the day

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

50) DES is called an "endocrine disrupting chemical" because it interferes with the endocrine secretions of the _____.

- A) thyroid gland
- B) adrenal medulla
- C) ovaries
- D) hypothalamus

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

51) Following a stressful stimulus, the fight-or-flight response will cause _____.

- A) glucose to be stored in liver cells
- B) epinephrine to be released from the anterior pituitary
- C) an increase release of thyroid hormones
- D) the breakdown of glycogen into glucose

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

52) Use the figure to answer the following question.

	Group 1	Group 2
Daily injections of progesterone (milligrams)	0.25	20
Percentage of rats that carried fetus to birth	0	100

In an experiment, rats' ovaries were removed immediately after impregnation, and then the rats were divided into two groups. Treatments and results are summarized in the table. The results most likely occurred because progesterone exerts an effect on the _____.

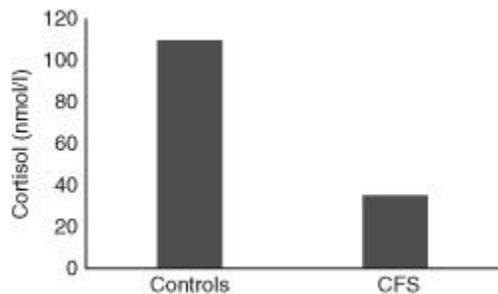
- A) general health of the rat
- B) metabolism of the uterus
- C) gestation period of rats
- D) number of eggs fertilized

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 45.3

53) Use the bar graph to answer the following question.



People who suffer from chronic fatigue syndrome (CFS) experience ongoing, debilitating fatigue. In one study, cortisol levels in the saliva during the first hour after waking were measured and compared between CFS patients and people without CFS (controls). The data is summarized in the graph. What can you infer from the data?

- A) A disruption to thyroid hormone production likely results in decreased cortisol in the saliva.
- B) Cortisol is lower in CFS patients because they were just woken up.
- C) The normal elevation in adrenocorticotropic hormone level in waking people is reduced in CFS patients.
- D) CFS patients are generally more relaxed as demonstrated by their decreased stress response.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 45.3

54) Osteoporosis is a condition in which the density of bones is decreased so much that the individual is at a higher risk of fractures. The more calcium in the bones, the better the bone density. Which of the following would produce the greatest increase in bone calcium levels?

- A) calcitonin injection
- B) calcitonin receptor blocker
- C) parathyroid hormone injection
- D) glucagon receptor blocker

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 45.3

55) Predict the effects of a drug that increases adrenocorticotropic hormone (ACTH) synthesis.

- A) increase in glucocorticoid production
- B) increase in release of corticotropin-releasing hormone (CRH)
- C) decrease in cortisol release
- D) decrease in release of corticotropin-releasing hormone (CRH)

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 45.3

- 56) People experiencing chronic stress may be more likely to become sick because _____.
A) too much thyroid hormone is being produced
B) elevated epinephrine concentrations deplete all of the available glucose in the body
C) high circulating glucocorticoid can suppress the immune response
D) their blood glucose is not being regulated appropriately

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 45.3

57) Correct and appropriate signal transduction processes are generally under strong selective pressure and are determined by the properties of the molecules involved, the concentrations of signal and receptor molecules, and the binding affinities between signal and receptor. Therefore, a hormone action is very specific in a species at any one point in time. However, there are examples of very diverse functions of a specific hormone between groups of organisms. For example, thyroxin, which is produced in all vertebrates and many invertebrates, can trigger growth, differentiation, metamorphosis, maturation, reproduction, behavior, temperature tolerance, osmoregulation, or seasonal adaptation depending on the organism in which it is produced. What is the most logical explanation for such different responses triggered by thyroxin in organisms?

- A) The concentration of thyroxin varies in different organisms. Invertebrate organisms do not have as much thyroxin as vertebrate organisms.
B) Thyroxin and its receptor molecules have a different binding affinity in different organisms.
C) Receptor molecules for thyroxin are located on different tissues in different organisms.
D) The function of thyroxine in a particular tissue is determined by the genes that are transcribed by the activated thyroxine receptor.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 45.3

58) The body's reaction to parathyroid hormone (PTH), raising plasma levels of calcium, can be opposed by _____.

- A) thyroxine
B) epinephrine
C) growth hormone
D) calcitonin

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

59) Rapid changes to skin color in many vertebrates is under the control of _____.

- A) melanocyte-stimulating hormone
B) adrenocorticotrophic hormone
C) thyroxine
D) melatonin

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 45.3

45.2 Student Edition End-of-Chapter Questions

- 1) Which of the following is *not* an accurate statement?
- A) Hormones are chemical messengers that travel to target cells through the circulatory system.
 - B) Hormones often regulate homeostasis through antagonistic functions.
 - C) Hormones of the same chemical class usually have the same function.
 - D) Hormones are often regulated through feedback loops.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 2) The hypothalamus
- A) synthesizes all of the hormones produced by the pituitary gland.
 - B) influences the function of only one lobe of the pituitary gland.
 - C) produces only inhibitory hormones.
 - D) regulates both reproduction and body temperature.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 3) Growth factors are local regulators that
- A) are produced by the anterior pituitary.
 - B) are modified fatty acids that stimulate bone and cartilage growth.
 - C) are found on the surface of cancer cells and stimulate abnormal cell division.
 - D) bind to cell-surface receptors and stimulate growth and development of target cells.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Which hormone is *incorrectly* paired with its action?
- A) oxytocin—stimulates uterine contractions during childbirth
 - B) thyroxine—inhibits metabolic processes
 - C) ACTH—stimulates the release of glucocorticoids by the adrenal cortex
 - D) melatonin—affects biological rhythms and seasonal reproduction

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 5) What do steroid and peptide hormones typically have in common?
- A) their solubility in cell membranes
 - B) their requirement for travel through the bloodstream
 - C) the location of their receptors
 - D) their reliance on signal transduction in the cell

Answer: B

Bloom's Taxonomy: Application/Analysis

6) Which of the following is the most likely explanation for hypothyroidism in a patient whose iodine level is normal?

- A) greater production of T₃ than of T₄
- B) hyposecretion of TSH
- C) hypersecretion of MSH
- D) a decrease in the thyroid secretion of calcitonin

Answer: B

Bloom's Taxonomy: Application/Analysis

7) The relationship between the insect hormones ecdysteroid and PTTH is an example of

- A) an interaction of the endocrine and nervous systems.
- B) homeostasis achieved by positive feedback.
- C) homeostasis maintained by antagonistic hormones.
- D) competitive inhibition of a hormone receptor.

Answer: A

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 46 Animal Reproduction

46.1 Multiple-Choice Questions

1) Regeneration, the regrowth of lost body parts, normally follows _____.

- A) all types of asexual reproduction
- B) fission
- C) fragmentation
- D) parthenogenesis

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.1

2) Asexual reproduction results in offspring that are genetically identical to their parent. What type of cell process occurs to generate this type of offspring?

- A) mitosis
- B) meiosis
- C) cell fusion
- D) fertilization

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.1

3) What makes sexually reproduced offspring genetically different from their parents?

- A) genetic recombination during meiosis
- B) genetic recombination during mitosis
- C) crossing over during mitosis
- D) Sexual reproduction does not produce genetically different offspring.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.1

4) Which of the following organisms reproduces by fission?

- A) lamprey
- B) bluefin tuna
- C) whiptail lizards
- D) stony corals

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.1

5) On a submarine expedition to the ocean bottom, you discover a population of fish that are only female. What type of reproduction does this fish most likely use?

- A) sexual
- B) budding
- C) cloning
- D) parthenogenesis

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 46.1

6) Sexual reproduction _____.

- A) results in over half of the offspring being female
- B) produces offspring of greater genetic variety compared to offspring resulting from asexual reproduction
- C) is completed more rapidly than asexual reproduction
- D) is better suited to environments with relatively constant conditions

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 46.1

7) Environmental cues that influence the timing of reproduction generally do so by _____.

- A) increasing the body temperature
- B) providing access to water for external fertilization
- C) increasing ambient temperature most favorable for sex
- D) direct effects on hormonal control mechanisms

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 46.1

8) Evidence that parthenogenic whiptail lizards are derived from sexually reproducing ancestors includes _____.

- A) the requirement for male-like behaviors in some females before their partners will ovulate
- B) the development and then regression of testes prior to sexual maturation
- C) the observation that all of the offspring are haploid
- D) the persistence of a vestigial penis among some of the females

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.1

9) In an animal that switches between sexual and asexual reproduction, when is sexual reproduction more likely to occur?

- A) when conditions for survival are favorable
- B) when conditions for survival are unfavorable
- C) when males and females find each other
- D) What conditions favor sexual over asexual remains a complete mystery.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 46.1

10) Genetic mutations in asexually reproducing organisms lead to more evolutionary changes than do genetic mutations in sexually reproducing ones because _____.

- A) asexually reproducing organisms, but not sexually reproducing organisms, pass all mutations on to their offspring
- B) sexually reproducing organisms can produce more offspring in a given time than can asexually reproducing organisms
- C) more genetic variation is present in organisms that reproduce asexually than is present in those that reproduce sexually
- D) asexually reproducing organisms have more dominant genes than organisms that reproduce sexually

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 46.1

11) Asexual reproduction results in greater reproductive success than does sexual reproduction when _____.

- A) pathogens are rapidly diversifying
- B) there is some potential for rapid overpopulation
- C) a species is expanding into diverse geographic settings
- D) a species is in a stable and favorable environment

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 46.1

12) Sexual reproduction _____.

- A) allows animals to conserve resources and reproduce only during optimal conditions
- B) can produce diverse phenotypes that may enhance survival of a population in a changing environment
- C) enables males and females to remain isolated from each other while rapidly colonizing habitats
- D) guarantees that both parents will provide care for each offspring

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 46.1

13) For water fleas of the genus *Daphnia*, switching from a pattern of asexual reproduction to sexual reproduction coincides with _____.

- A) environmental conditions becoming more favorable for offspring
- B) greater abundance of food resources for offspring
- C) periods of temperature or food stresses on adults
- D) exhaustion of an individual's supply of eggs

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.1

14) Among nonmammalian vertebrates, the cloaca is an anatomical structure that functions as _____.

- A) a specialized sperm-transfer device produced only by males
- B) a shared pathway for the digestive, excretory, and reproductive systems
- C) a source of nutrients for developing sperm in the testes
- D) a gland that secretes mucus to lubricate the vaginal opening

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.2

15) Females of many insect species, including honeybee queens, can store gametes shed by their mating partners in _____.

- A) their nests
- B) the abdominal tract
- C) the uterus
- D) the spermatheca

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.2

16) Animals that have external fertilization are most likely to reproduce in which of the following areas?

- A) sand dune
- B) polar ice sheet
- C) shallow lake
- D) tallgrass prairie

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 46.2

17) In close comparisons, external fertilization often yields more offspring than does internal fertilization. However, internal fertilization typically offers the advantage that _____.

- A) it requires less time and energy to be devoted to reproduction
- B) the smaller number of offspring produced often receive a greater amount of parental investment
- C) it permits the most rapid population increase
- D) it requires expression of fewer genes and maximizes genetic stability

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 46.2

18) You decide to study two species of birds, both of which form monogamous pairs (one male and one female). In species 1, you find that the eggs in a pair's nest are in fact almost always the offspring of that pair. In species 2, you are surprised to find that many of the eggs in a nest were actually fathered by males of neighboring pairs. Apparently, mating outside of monogamous pairings is widespread in species 2. Given this information, what would be the logical prediction to make before comparing testes size of males of the two species?

- A) Testes of species 1 are larger than testes of species 2.
- B) Testes of species 2 are larger than testes of species 1.
- C) There is no relationship between this observation and the size of the testes.
- D) The testes of the individual within each species would be exactly the same size.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 46.2

19) You decide to study two species of birds, both of which form monogamous pairs (one male and one female). In species 1, you find that the eggs in a pair's nest are in fact almost always the offspring of that pair. In species 2, you are surprised to find that many of the eggs in a nest were actually fathered by males of neighboring pairs. Apparently, mating outside of monogamous pairings is widespread in species 2. What would you expect to observe if you examined the reproductive tracts of the female birds in the species?

- A) Females of species 2 would have sperm from multiple males in their reproductive tracts.
- B) Females of species 1 would have sperm from multiple males in their reproductive tracts, but would only use their partners' sperm to fertilize eggs.
- C) Ovaries of species 1 are larger than those of species 2.
- D) Females of species 1 would produce more oocytes.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 46.2

20) Egg laying in fruit flies can be triggered (induced) when males deposit their sperm in the spermathecae of the females. What is the selective advantage of induced egg laying for the male flies?

- A) Because egg laying is induced upon mating, the males do not have to produce as much sperm.
- B) More eggs can be fertilized at once when egg laying is induced.
- C) Induced egg laying ensures that a male fly's sperm is used for fertilization.
- D) Mating takes less time, so less energy is expended by the males.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 46.2

21) Which of the following structures in females is analogous in function to the vas deferens in males?

- A) urethra
- B) oviduct
- C) uterus
- D) vagina

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 46.3

22) In humans, the follicular cells that remain behind in the ovary following ovulation become _____.

- A) the ovarian endometrium that is shed at the time of the menses
- B) a steroid-hormone synthesizing structure called the corpus luteum
- C) the thickened portion of the uterine wall
- D) the placenta, which secretes cervical mucus

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.3

23) At the time of fertilization, the maturation of the human oogonium has resulted in _____.

- A) one secondary oocyte
- B) two primary oocytes
- C) four secondary oocytes
- D) four zygotes

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.3

24) Which of the following are similar between spermatogenesis and oogenesis in vertebrate animals? Both oogenesis and spermatogenesis _____.

- I) begin at the onset of sexual maturity
- II) result in the production of four functional haploid cells from one diploid cell
- III) lead to the production of gametes from germ cells
- IV) are complete at the time of birth

- A) Both I and II
- B) Both III and IV
- C) Both II and III
- D) Only III

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 46.3

25) Mature human sperm and ova are similar in that they _____.

- A) both have the same number of chromosomes
- B) are approximately the same size
- C) each have a flagellum that provides motility
- D) are produced from puberty until death

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 46.3

26) Among mammals, the male and female genital structures that consist mostly of erectile tissue include the _____.

- A) penis and clitoris
- B) vas deferens and oviduct
- C) testes and ovaries
- D) prostate and ovaries

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.3

27) Among human males, both semen and urine normally travel along the _____.

- A) vas deferens
- B) seminal vesicle
- C) urethra
- D) ureter

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.3

28) Human sperm cells first arise in the _____.

- A) prostate gland
- B) vas deferens
- C) seminiferous tubules
- D) epididymis

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.3

29) The surgical removal of the seminal vesicles would likely _____.

- A) cause sterility because sperm would not be produced
- B) cause sterility because sperm would not be able to exit the body
- C) greatly reduce the volume of semen
- D) cause the testes to migrate back into the abdominal cavity

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 46.3

30) Increasing the temperature of the human scrotum by 2°C (that is, near the normal body core temperature) and holding it there would most likely _____.

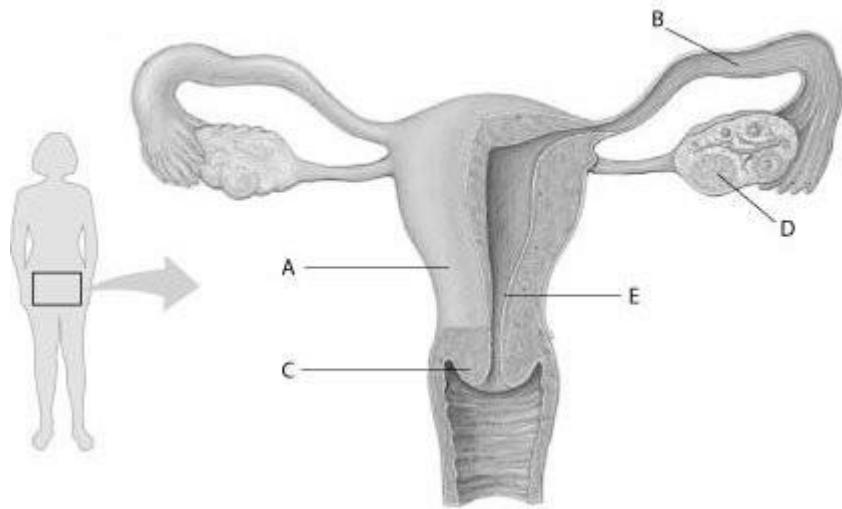
- A) reduce the fertility of the man by impairing the production of gonadal steroid hormones
- B) reduce the fertility of the man by impairing spermatogenesis
- C) reduce the man's sexual interest
- D) increase the fertility of the affected man by enhancing the rate of steroidogenesis

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 46.3

31) Refer to the following figure, which diagrams the reproductive anatomy of the human female, to answer the question.



In the figure, which letter points to the corpus luteum?

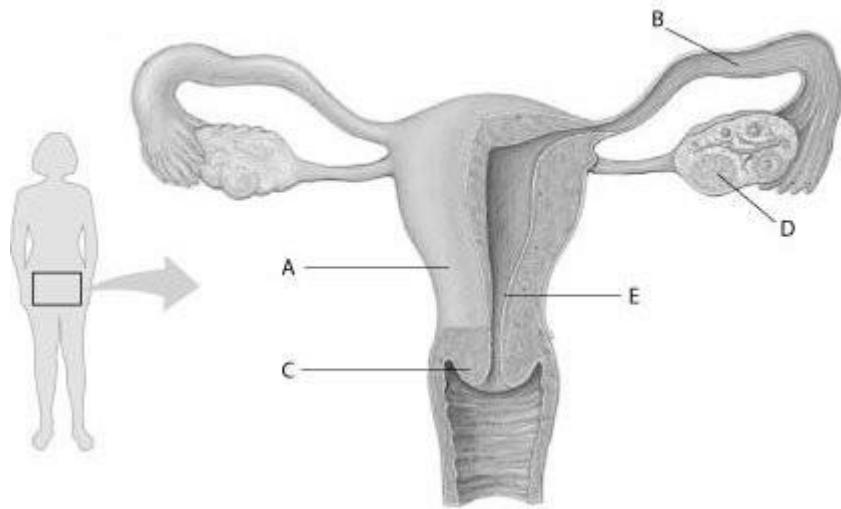
- A) A
- B) B
- C) C
- D) D

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.3

32) Refer to the following figure, which diagrams the reproductive anatomy of the human female, to answer the question.



In the figure, which letter points to the cervix?

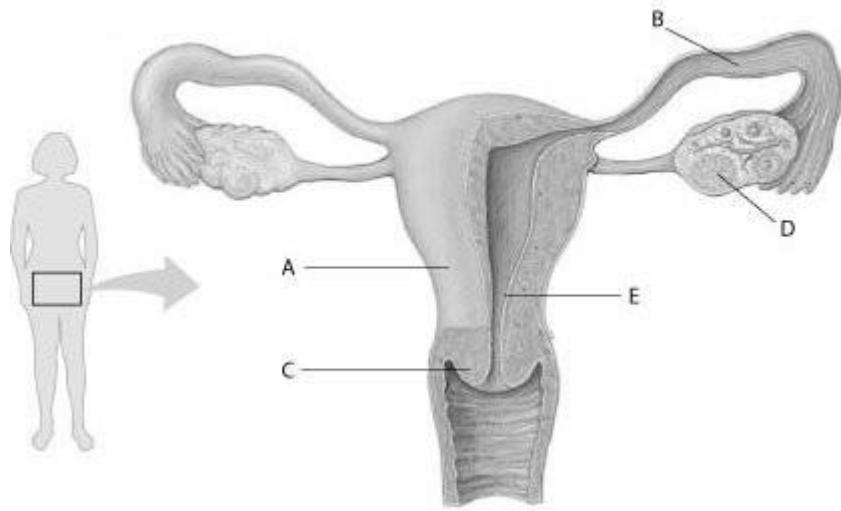
- A) A
- B) C
- C) D
- D) E

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.3

33) Refer to the following figure, which diagrams the reproductive anatomy of the human female, to answer the question.



In the figure, which structure is the site of embryo implantation?

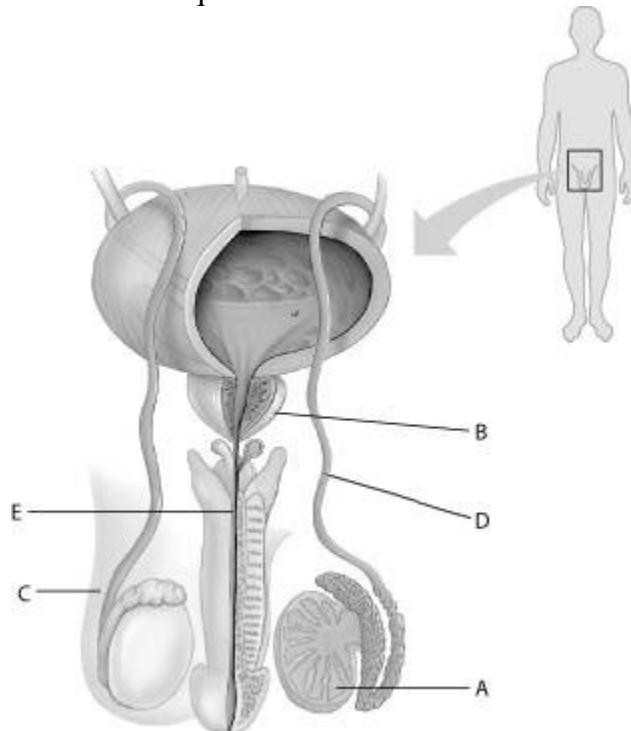
- A) B
- B) C
- C) D
- D) E

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.5

34) Refer to the following figure, which diagrams the reproductive anatomy of the human male, to answer the question.



In the figure, which letter points to the prostate gland?

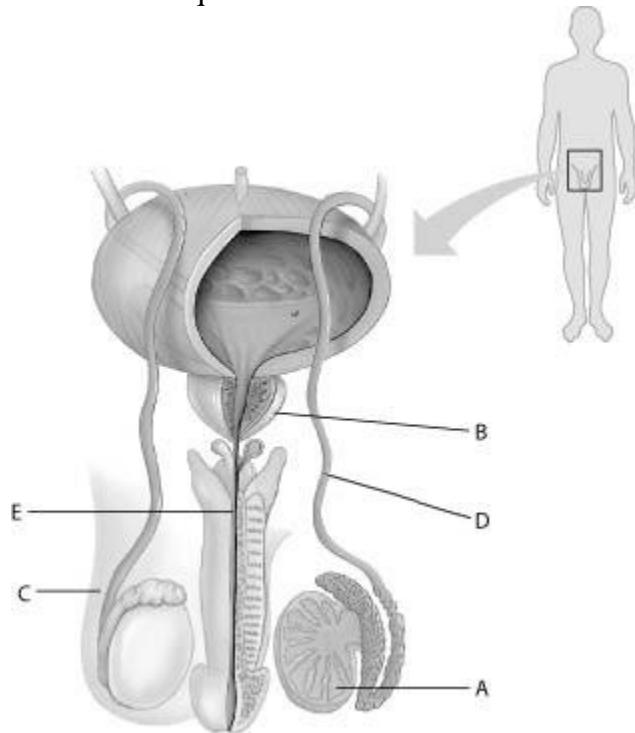
- A) A
- B) B
- C) C
- D) D

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.3

35) Refer to the following figure, which diagrams the reproductive anatomy of the human male, to answer the question.



In the figure, which letter points to the vas deferens?

- A) A
- B) B
- C) C
- D) D

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.3

36) For which of the following is the number the same in spermatogenesis and oogenesis?

- A) timing of meiotic divisions
- B) functional gametes produced by meiosis
- C) meiotic divisions required to produce each gamete
- D) different cell types produced by meiosis

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 46.3

- 37) Which statement about human reproduction is correct?
- A) Spermatogonia and oogonia are haploid cells.
 - B) In humans, spermatogenesis and oogenesis both function best at normal, core body temperatures.
 - C) A human oocyte only completes meiosis II after a sperm penetrates it.
 - D) The earliest stages of spermatogenesis occur closest to the lumen of the seminiferous tubules.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 46.3

- 38) A physician finds that a nine-year-old male patient is entering puberty much earlier than usual. Such a condition is most likely the result of a tumor in the _____.
A) hypothalamus, producing elevated levels of testosterone
B) anterior pituitary, producing elevated levels of testosterone
C) testes, producing elevated levels of estrogen
D) anterior pituitary, producing elevated levels of gonadotropins

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 46.4

- 39) A male's "primary" sex characteristics include _____.
A) deepening of the voice at puberty
B) development of the seminal vesicles and associated ducts
C) elongation of the skeleton prior to puberty
D) onset of growth of facial hair at puberty
- Answer: B
- Bloom's Taxonomy: Knowledge/Comprehension
- Section: 46.4
- 40) The primary difference between estrous and menstrual cycles is that _____.
A) the endometrium shed by the uterus during the estrous cycle is reabsorbed with no extensive fluid flow out of the body, whereas the shed endometrium of menstrual cycles is excreted from the body
B) behavioral changes during estrous cycles are much less apparent than those of menstrual cycles
C) season and climate have less pronounced effects on estrous cycles than they do on menstrual cycles
D) copulation normally occurs across the estrous cycle, whereas in menstrual cycles copulation only occurs during the period surrounding ovulation

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.4

41) In correct chronological order, the three phases of the human ovarian cycle that gives rise to a mature oocyte are _____.

- A) follicular → luteal → secretory
- B) menstrual → proliferative → secretory
- C) follicular → ovulation → luteal
- D) proliferative → luteal → ovulation

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.4

42) In correct chronological order, the three phases of the human uterine cycle are _____.

- A) follicular → luteal → secretory
- B) menstrual → proliferative → secretory
- C) follicular → ovulation → luteal
- D) proliferative → luteal → ovulation

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.4

43) An inactivating mutation in the progesterone receptor gene would likely result in _____.

- A) the absence of secondary sex characteristics
- B) the inability of the uterus to support pregnancy
- C) enlarged and hyperactive uterine endometrium
- D) the absence of mammary gland development

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 46.3

44) A primary response by the Leydig cells in the testes to the presence of luteinizing hormone is an increase in the synthesis and secretion of _____.

- A) inhibin
- B) testosterone
- C) oxytocin
- D) progesterone

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.4

45) Which hormone is released from the Sertoli cells that inhibits the release of follicle stimulating hormone?

- A) inhibin
- B) luteinizing hormone (LH)
- C) follicle-stimulating hormone (FSH)
- D) gonadotropin-releasing hormone (GnRH)

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.4

46) The primary function of the corpus luteum is to _____.

- A) nourish and protect the egg cell
- B) maintain progesterone and estrogen synthesis after ovulation has occurred
- C) stimulate the development of the mammary glands
- D) support pregnancy in the second and third trimesters

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.4

47) Menopause is characterized by _____.

- A) the loss of responsiveness by the ovaries to follicle-stimulating hormone (FSH) and luteinizing hormone (LH)
- B) a decline in production of the gonadotropin hormones by the anterior pituitary gland
- C) wearing away of the uterine endometrium
- D) a halt in the synthesis of gonadotropin-releasing hormone by the brain

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.4

48) Use the following information to answer the question.

For your internship at the local zoo, you have been assigned to help with the new orangutan-breeding program. Little is known about orangutan reproductive hormones, but hormone feedback cycles are often the same in closely related animals. You have been asked to use your knowledge of the interactions of human reproductive hormones to recommend injections to promote ovulation in a female orangutan when a visiting male arrives for a brief breeding visit.

Which of the following hormones would you use if you want to induce ovulation right away?

- A) estradiol (estrogen)
- B) progesterone
- C) luteinizing hormone (LH)
- D) follicle-stimulating hormone (FSH)

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 46.4

49) Use the following information to answer the question.

For your internship at the local zoo, you have been assigned to help with the new orangutan-breeding program. Little is known about orangutan reproductive hormones, but hormone feedback cycles are often the same in closely related animals. You have been asked to use your knowledge of the interactions of human reproductive hormones to recommend injections to promote ovulation in a female orangutan when a visiting male arrives for a brief breeding visit.

Which of the following hormones would you use if you want to induce ovulation in a few days?

- A) estradiol (estrogen)
- B) progesterone
- C) luteinizing hormone (LH)
- D) follicle-stimulating hormone (FSH)

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 46.4

50) Labor contractions can be increased by the medical use of a synthetic drug that mimics the action of _____.

- A) inhibin
- B) luteinizing hormone
- C) oxytocin
- D) prolactin

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 46.5

51) In excreted urine, a reliable "marker" that a pregnancy has initiated is _____.

- A) progesterone
- B) estrogen
- C) follicle-stimulating hormone
- D) human chorionic gonadotropin (hCG)

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.5

52) Two contraceptive methods that are considered permanent and that block the gametes from moving to a site where fertilization can occur are _____.

- A) the male condom and female condom
- B) the male condom and oral contraceptives
- C) vasectomy and tubal ligation
- D) the diaphragm and subcutaneous progesterone implant

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.5

53) _____ is a medical procedure that prevents oocytes from reaching the uterus.

- A) Vasectomy
- B) Endometriosis
- C) Tubal ligation
- D) Coitus interruptus

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.5

54) A vasectomy _____.

- A) eliminates spermatogenesis
- B) eliminates testosterone synthesis
- C) prevents implantation of an embryo
- D) prevents sperm from entering the male urethra

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 46.5

55) Once uterine contractions have begun, the female body releases several hormones that act in a positive feedback loop. The purpose of this feedback loop is _____.

- A) to promote the development of a new follicle
- B) to ensure continued contractions until labor is complete
- C) inhibit the release of prostaglandins
- D) decrease the number of oxytocin receptors in the uterus

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 46.5

56) A pregnant woman comes into the hospital past her due date. The doctor decides it is time for the baby to be delivered. Before performing a cesarean section, the doctor wants to try to induce labor. Which of the following would she most likely inject?

- A) progesterone
- B) luteinizing hormone (LH)
- C) follicle-stimulating hormone (FSH)
- D) oxytocin

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 46.5

57) An ectopic pregnancy occurs when a fertilized egg implants somewhere other than in the lining of the uterus. Usually it implants in the oviduct. Which of the following would be the most likely explanation for such a pregnancy being unsuccessful?

- A) The orientation of the baby would be sideways.
- B) Human chorionic gonadotropin (hCG) cannot be produced in the oviduct.
- C) The lining of the oviduct is unable to support the developing fetus.
- D) The necessary hormones cannot reach the developing fetus in the oviduct.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 46.5

58) Use the following information to answer the question.

Estrogens found in the environment have raised concerns about effects on reproductive health of animals. Researchers studied the effects that estrogens in the water have on sexual differentiation in zebrafish. They exposed embryo-larval (0-21 days post-hatching), juvenile (21-42 days post-hatching), and adult (over 200 days post-hatching) fish to three concentrations of 17 β -estradiol (5, 25, and 100 nanograms/liter) that are within the range of concentrations found in water leaving sewage treatment plants in different countries. They then examined the proportion of males and females when the fish exposed at embryo-larval and juvenile stages reached adulthood. Embryo-larval stage fish that had been exposed to 100 ng/l 17 β -estradiol resulted in adult populations that had substantially more females than males compared to control groups. Embryo-larval fish that had been exposed to 5 and 25 ng/l of 17 β -estradiol did not show a statistically significant shift in the proportion of females. (Brion, F., C. R. Tyler, X. Palazzi, B. Laillet, J. M. Porcher, J. Garric, and P. Flammarion. 2004. Impacts of 17 β -estradiol, including environmentally relevant concentrations, on reproduction after exposure during embryo-larval-, juvenile-, and adult-life stages in zebrafish (*Danio rerio*). *Aquatic Toxicology* 68:193-217.)

What is the significance of using the concentrations of 5, 25, and 100 ng/l of 17 β -estradiol in this experiment?

- A) These concentrations are similar to those found in many animals.
- B) These concentrations are found in the environment.
- C) These concentrations are effective, yet not lethal to the fish.
- D) These concentrations are standard in toxicology assays.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 46.5

59) Use the following information to answer the question.

Estrogens found in the environment have raised concerns about effects on reproductive health of animals. Researchers studied the effects that estrogens in the water have on sexual differentiation in zebrafish. They exposed embryo-larval (0-21 days post-hatching), juvenile (21-42 days post-hatching), and adult (over 200 days post-hatching) fish to three concentrations of 17 β -estradiol (5, 25, and 100 nanograms/liter) that are within the range of concentrations found in water leaving sewage treatment plants in different countries. They then examined the proportion of males and females when the fish exposed at embryo-larval and juvenile stages reached adulthood. Embryo-larval stage fish that had been exposed to 100 ng/l 17 β -estradiol resulted in adult populations that had substantially more females than males compared to control groups. Embryo-larval fish that had been exposed to 5 and 25 ng/l of 17 β -estradiol did not show a statistically significant shift in the proportion of females. (Brion, F., C. R. Tyler, X. Palazzi, B. Laillet, J. M. Porcher, J. Garric, and P. Flammarion. 2004. Impacts of 17 β -estradiol, including environmentally relevant concentrations, on reproduction after exposure during embryo-larval-, juvenile-, and adult-life stages in zebrafish (*Danio rerio*). *Aquatic Toxicology* 68:193-217.)

You are assigned to write the report to the Environmental Protection Agency that needs to decide what level of 17 β -estradiol to permit in sewage output. You do not want to make the level any lower than necessary, because it requires substantial additional money for the extra treatment of sewage. Given the data presented, what concentration of 17 β -estradiol would you suggest is safe to prevent feminization of fish?

- A) 2.5 ng/l
- B) 12.5 ng/l
- C) 25 ng/l
- D) 100 ng/l

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 46.5

60) Which of the following is the most likely explanation for the absence of a protective filter blocking the passage of alcohol between the maternal and fetal circulations in humans?

- A) There has not been enough time to evolve such a barrier.
- B) Such a barrier would probably also block important molecules that need to be passed to the fetus.
- C) The maternal and fetal blood mix directly together in an area with many villi, so a barrier is impossible.
- D) Alcohol has some positive effects on the fetus, so evolution has resulted in an intermediate level of filtering that blocks all but the worst abuses of alcohol.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 46.5

46.2 Student Edition End-of-Chapter Questions

- 1) Which of the following characterizes parthenogenesis?
- A) An individual may change its sex during its lifetime.
 - B) Specialized groups of cells grow into new individuals.
 - C) An organism is first a male and then a female.
 - D) An egg develops without being fertilized.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 2) In male mammals, excretory and reproductive systems share
- A) the vas deferens.
 - B) the urethra.
 - C) the seminal vesicle.
 - D) the prostate.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 3) Which of the following is *not* properly paired?
- A) seminiferous tubule—cervix
 - B) vas deferens—oviduct
 - C) testosterone—estradiol
 - D) scrotum—labia majora

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Peaks of LH and FSH production occur during
- A) the menstrual flow phase of the uterine cycle.
 - B) the beginning of the follicular phase of the ovarian cycle.
 - C) the period just before ovulation.
 - D) the secretory phase of the uterine cycle.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 5) During human gestation, rudiments of all organs develop
- A) in the first trimester.
 - B) in the second trimester.
 - C) in the third trimester.
 - D) during the blastocyst stage.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 6) Which of the following is a true statement?
- A) All mammals have menstrual cycles.
 - B) The endometrial lining is shed in menstrual cycles but reabsorbed in estrous cycles.
 - C) Estrous cycles are more frequent than menstrual cycles.
 - D) Ovulation occurs before the endometrium thickens in estrous cycles.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 7) For which of the following is the number the same in human males and females?

- A) interruptions in meiotic divisions
- B) functional gametes produced by meiosis
- C) meiotic divisions required to produce each gamete
- D) different cell types produced by meiosis

Answer: C

Bloom's Taxonomy: Application/Analysis

- 8) Which statement about human reproduction is false?

- A) Fertilization occurs in the oviduct.
- B) Spermatogenesis and oogenesis require different temperatures.
- C) An oocyte completes meiosis after a sperm penetrates it.
- D) The earliest stages of spermatogenesis occur closest to the lumen of the seminiferous tubules.

Answer: D

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 47 Animal Development

47.1 Multiple-Choice Questions

1) Even in the absence of sperm, metabolic activity in an egg can be artificially activated by _____.

- A) abnormally high levels of carbonic acid in the cytosol
- B) abnormally low levels of extracellular oxygen
- C) injection of calcium ions into the cytosol
- D) depletion of its ATP supplies

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

2) The formation of the fertilization envelope requires an increase in the cytosolic concentration of _____.

- A) calcium ions
- B) hydrogen ions
- C) potassium ions
- D) sodium ions

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

3) Contact of a sea urchin egg with signal molecules on sperm causes the egg to undergo a brief _____.

- A) mitosis
- B) membrane depolarization
- C) vitellogenesis
- D) acrosomal reaction

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

4) The plasma membrane of the sea urchin egg _____.

- A) is outside of the fertilization membrane
- B) releases calcium, which initiates the cortical reaction
- C) has receptor molecules that are specific for binding acrosomal proteins
- D) is a mesh of proteins crossing through the cytosol of the egg

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

5) Fertilization of an egg without activation is most like _____.

- A) placing the key in the ignition of a car but not starting the engine
- B) resting during halftime of a basketball game
- C) preparing a pie from scratch and baking it in the oven
- D) walking to the cafeteria and eating lunch

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 47.1

6) A reproductive difference between sea urchins and humans is _____.

- A) the sea urchin egg completes meiosis prior to fertilization, but meiosis in humans is completed after fertilization
- B) sea urchin eggs and sperm are of equal size, but human eggs are much bigger than human sperm
- C) sea urchins, but not humans, have a need to block polyspermy, because only in sea urchins can there be more than one source of sperm to fertilize the eggs
- D) sea urchin zygotes get their mitochondria from the sperm, but human zygotes get their mitochondria from the egg

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

7) During fertilization, the acrosomal contents _____.

- A) block polyspermy
- B) help propel more sperm toward the egg
- C) digest the protective jelly coat on the surface of the egg
- D) trigger the completion of meiosis by the sperm

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

8) In a newly fertilized egg, the vitelline layer _____.

- A) lifts away from the egg and hardens to form a fertilization envelope
- B) secretes hormones that enhance steroidogenesis by the ovary
- C) reduces the loss of water from the egg and prevents desiccation
- D) provides most of the nutrients used by the zygote

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

9) In sea urchins, the "fast block" and the longer lasting "slow block" to polyspermy, respectively, are _____.

- A) the acrosomal reaction and the formation of egg white
- B) the cortical reaction and the formation of yolk protein
- C) the jelly coat of the egg and the vitelline membrane
- D) membrane depolarization and the cortical reaction

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

10) In an egg cell treated with a chemical that binds calcium and magnesium ions, the _____.

- A) acrosomal reaction would be blocked
- B) fusion of sperm and egg nuclei would be blocked
- C) fast block to polyspermy would not occur
- D) fertilization envelope would not be formed

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 47.1

11) In mammalian eggs, the receptors for sperm are found in the _____.

- A) fertilization membrane
- B) egg plasma membrane
- C) cytosol of the egg
- D) mitochondria of the egg

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

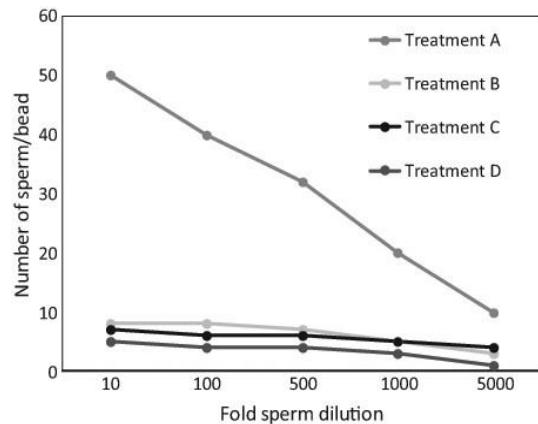
Section: 47.1

12) Use the following information to answer the question.

In order to test how sea urchin sperm bind to eggs, scientists isolated the egg receptor protein that binds to the sperm acrosomal protein called *bindin*. Plastic beads were coated with egg receptor for bindin (ERB1) from eggs of the sea urchin *Strongylocentrotus purpuratus*, and then the beads mixed with sperm from *S. purpuratus* or from the related species, *S. franciscanus*. The researchers counted how many sperm were bound to each bead. The results are shown in the graph below. (Adapted from Kamei and Glabe 2003)

Treatments:

- A: *S. purpuratus* sperm mixed with *S. purpuratus* ERB1 beads
- B: *S. purpuratus* sperm mixed with beads containing no ERB1 protein
- C: *S. franciscanus* sperm mixed with *S. purpuratus* ERB1 beads
- D: *S. franciscanus* sperm mixed with beads containing no ERB1 protein



Based on the description of the experiment, which of the treatments would be considered a "control" treatment for *S. purpuratus* sperm binding?

- A) Treatment A
- B) Treatment B
- C) Treatment C
- D) Treatment D

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

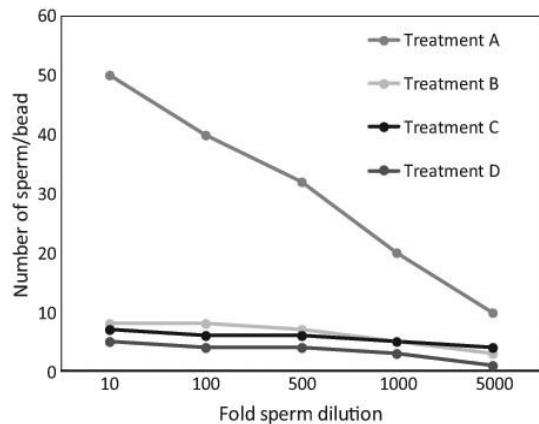
Section: 47.1

13) Use the following information to answer the question.

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- C: *S. franciscanus* sperm mixed with *S. purpuratus* ERB1 beads
- D: *S. franciscanus* sperm mixed with beads containing no ERB1 protein



Based on the data in the graph, which of the following conclusions is supported?

- A) Plastic beads will bind to sperm from both species of sea urchin.
- B) ERB1 prevents *S. franciscanus* sperm from binding the beads.
- C) Sperm from *S. purpuratus* bind to beads only if ERB1 is present.
- D) *S. franciscanus* and *S. purpuratus* are actually the same species.

Answer: C

Bloom's Taxonomy: Application/Analysis

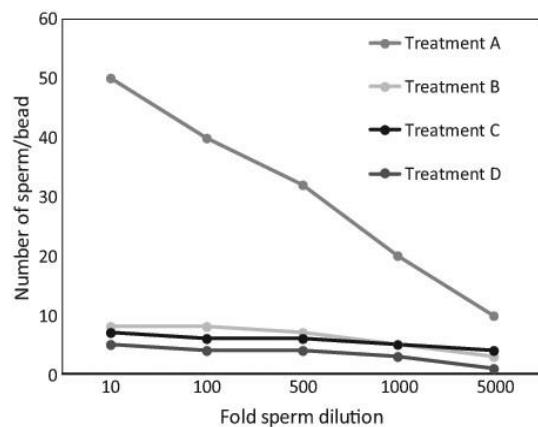
Section: 47.1

14) Use the following information to answer the question.

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- C: *S. franciscanus* sperm mixed with *S. purpuratus* ERB1 beads
- D: *S. franciscanus* sperm mixed with beads containing no ERB1 protein



What is a broader implication from the observations of the experiment?

- A) In sea urchins, fertilization of eggs by sperm is dependent upon species-specific protein interactions.
- B) Only some species of sea urchins use receptor proteins on their eggs to bind sperm.
- C) Protein-coated plastic beads should not be used to test sperm binding to eggs.
- D) *S. franciscanus* is probably not a sea urchin, but must be some other type of organism.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 47.1

15) A human blastomere is _____.

- A) an embryonic cell that is smaller than the ovum
- B) an embryonic structure that includes a fluid-filled cavity
- C) that part of the acrosome that opens the egg's membrane
- D) a cell that contains a (degenerating) second polar body

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

- 16) At the moment of sperm penetration, human eggs _____.
A) have used flagellar propulsion to move from the ovary to the oviduct
B) are still located within the ovary
C) have a paper-thin cell of calcium carbonate that prevents desiccation
D) are still surrounded by follicular cells

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 47.1

- 17) Among these choices, the largest cell involved in frog reproduction is _____.
A) an egg
B) a blastomere in the vegetal pole
C) a blastomere in the animal pole
D) one of the products of the first cleavage

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 47.1

- 18) The pattern of embryonic development in which only the cells lacking yolk subsequently undergo cleavage is called _____.
A) holoblastic development, which is typical of marsupial mammals
B) meroblastic development, which is typical of humans
C) holoblastic development, which is typical of amphibians
D) meroblastic development, which is typical of birds

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 47.1

- 19) As cleavage continues during frog development, the size of the blastomeres _____.
A) increases as the number of the blastomeres decreases
B) increases as the number of the blastomeres increases
C) decreases as the number of the blastomeres increases
D) decreases as the number of the blastomeres decreases

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

- 20) The vegetal pole of a frog zygote differs from the animal pole in that _____.
A) the vegetal pole has a higher concentration of yolk
B) the blastomeres originate only in the vegetal pole
C) the vegetal pole cells undergo mitosis, but not cytokinesis
D) the polar bodies bud from this region

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

21) In which of the following organisms does holoblastic cleavage typically occur?

- I) sea urchins
- II) humans
- III) birds
- IV) fish

- A) both II and IV
- B) both I and III
- C) both I and II
- D) I only

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 47.1

22) Which of the following correctly displays the sequence of developmental milestones?

- A) blastula → gastrula → cleavage
- B) cleavage → gastrula → blastula
- C) cleavage → blastula → gastrula
- D) gastrula → blastula → cleavage

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

23) The first cavity formed during frog development is the _____.

- A) blastopore
- B) mouth
- C) blastocoel
- D) anus

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

24) In some rare salamander species, all individuals are females. Reproduction relies on those females having access to sperm from males of another species. However, the resulting embryos receive no genetic contribution from the males. Why do you think sperm are necessary for reproduction?

- A) The sperm allow morphogenesis to proceed.
- B) Sperm trigger egg activation.
- C) Cell differentiation is initiated by the sperm.
- D) Sperm are necessary to produce a diploid zygote.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 47.1

25) The cortical reaction of sea urchin eggs functions directly in _____.
A) the formation of a fertilization envelope
B) the production of a fast block to polyspermy
C) the release of hydrolytic enzymes from the sperm
D) the generation of an electrical impulse by the egg

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.1

26) From earliest to latest, the overall sequence of early development proceeds in which of the following sequences?

- A) first cell division → synthesis of embryo's DNA begins → acrosomal reaction → cortical reaction
- B) cortical reaction → synthesis of embryo's DNA begins → acrosomal reaction → first cell division
- C) cortical reaction → acrosomal reaction → first cell division → synthesis of embryo's DNA begins
- D) acrosomal reaction → cortical reaction → synthesis of embryo's DNA begins → first cell division

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 47.1

27) An embryo with meroblastic cleavage, extraembryonic membranes, and a primitive streak must be that of _____.
A) an insect
B) an amphibian
C) a bird
D) a sea urchin

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 47.2

28) Cells move to new positions as an embryo establishes its three germ tissue layers during _____.

- A) determination
- B) cleavage
- C) induction
- D) gastrulation

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

29) The outer-to-inner sequence of tissue layers in a post-gastrulation vertebrate embryo is _____.

- A) endoderm → ectoderm → mesoderm
- B) mesoderm → endoderm → ectoderm
- C) ectoderm → mesoderm → endoderm
- D) ectoderm → endoderm → mesoderm

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

30) If gastrulation was blocked by an environmental toxin, then _____.

- A) cleavage would not occur in the zygote
- B) embryonic germ layers would not form
- C) the blastula would not be formed
- D) the blastopore would form above the gray crescent in the animal pole

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 47.2

31) The archenteron of the developing sea urchin eventually develops into the _____.

- A) blastocoel
- B) heart and lungs
- C) digestive tract
- D) brain and spinal cord

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

32) In a frog embryo, gastrulation _____.

- A) produces a blastocoel displaced into the animal hemisphere
- B) occurs along the primitive streak in the animal hemisphere
- C) proceeds by involution as cells roll over the lip of the blastopore
- D) occurs within the inner cell mass that is embedded in the large amount of yolk

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

33) Which of the following is a correct description of the fate of the germ layers?

- A) The mesoderm gives rise to the notochord.
- B) The endoderm gives rise to the hair follicles.
- C) The ectoderm gives rise to the liver.
- D) The mesoderm gives rise to the lungs.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

34) The primitive streak in a bird is the functional equivalent of _____.
A) the lip of the blastopore in the frog
B) the archenteron in a frog
C) the notochord in a mammal
D) neural crest cells in a mammal

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 47.2

35) In all vertebrate animals, development requires _____.
A) a large supply of yolk
B) an aqueous environment
C) extraembryonic membranes
D) a primitive streak

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

36) The least amount of yolk would be found in the egg of a _____.
A) bird
B) frog
C) eutherian mammal
D) reptile

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

37) At the time of implantation, the human embryo is called a _____.
A) blastocyst
B) gastrula
C) fetus
D) zygote

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

38) Uterine implantation due to enzymatic digestion of the endometrium is initiated by the _____.

- A) inner cell mass
- B) endoderm
- C) mesoderm
- D) trophoblast

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

39) Thalidomide, now banned for use as a sedative during pregnancy, was used in the early 1960s by many women in their first trimester of pregnancy. Some of these women gave birth to children with limb and organ deformities, suggesting that the drug most likely influenced _____.

- A) early cleavage divisions
- B) differentiation of bone tissue
- C) morphogenesis
- D) gastrulation

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 47.2

40) The migratory neural crest cells _____.

- A) form most of the central nervous system
- B) form the spinal cord in the frog
- C) form a variety of neural and non-neural structures
- D) form the lining of the lungs and of the digestive tract

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

41) Which of the following is a result of gastrulation in animals?

- I) The archenteron is formed.
- II) The body axes are established.
- III) The germ layers are formed.

- A) I
- B) III
- C) I and II
- D) I, II, and III

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 47.2

42) Cell migration occurs extensively during _____.

- A) organogenesis, but not during gastrulation or cleavage
- B) cleavage, but not during gastrulation or organogenesis
- C) gastrulation and cleavage
- D) both gastrulation and organogenesis

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 47.2

43) Changes in the shape of a cell usually involve a reorganization of the _____.

- A) nucleus
- B) cytoskeleton
- C) extracellular matrix
- D) transport proteins

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

44) Select the choice that correctly matches the organ with its embryonic sources.

- A) adrenal medulla—endoderm
- B) nervous system—mesoderm
- C) kidney—mesoderm
- D) skin—endoderm and mesoderm

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

45) The embryonic precursor to the human spinal cord is the _____.

- A) notochord
- B) neural tube
- C) mesoderm
- D) archenteron

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

46) During metamorphosis, a tadpole's tail is reduced in size by the process of _____.

- A) regeneration
- B) apoptosis
- C) oxidative phosphorylation
- D) redifferentiation

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

47) The term applied to a morphogenetic process whereby cells extend themselves, making the mass of the cells narrower and wider, is _____.

- A) convergent extension
- B) induction
- C) invagination
- D) involution

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

48) Which of the following is common to the development of birds and mammals?

- A) the formation of an embryonic epiblast and hypoblast
- B) the formation of an embryonic trophoblast
- C) the formation of an embryonic yolk plug
- D) the formation of an embryonic gray crescent

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

49) During frog development, the blastocoel _____.

- A) becomes the archenteron
- B) gives rise to the endoderm
- C) gives rise to the placenta
- D) is replaced by the expanding archenteron

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

50) Which of the following correctly matches the extraembryonic membrane with its function?

- A) amnion—waste disposal
- B) chorion—nutrient storage
- C) allantois—waste storage
- D) yolk sac—gas exchange

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.2

51) Why was the evolution of the extraembryonic membranes crucial for colonization of land by the vertebrates? Extraembryonic membranes _____.

- A) provide an aqueous environment for embryo development
- B) provide nutrients that produce energy for development
- C) direct morphogenesis within the embryo
- D) give rise to crucial organ systems, like the heart and brain

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 47.2

52) If an amphibian zygote is manipulated so that the first cleavage plane fails to divide the gray crescent, then _____.

- A) the daughter cell with the entire gray crescent will die
- B) both daughter cells will develop normally, because amphibians are totipotent at this stage
- C) only the daughter cell with the gray crescent will develop normally
- D) both daughter cells will develop abnormally

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.3

53) Hans Spemann and colleagues developed the concept of the "organizer" in amphibian embryos while studying the _____.

- A) medial cells between the optic cups
- B) anterior terminus of the notochord
- C) lateral margins of the neural tube
- D) dorsal lip of the blastopore

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.3

54) Which of the following is an adult organism that has fewer than 1,000 cells?

- A) chickens, *Gallus domesticus*
- B) African clawed frogs, *Xenopus laevis*
- C) fruit flies, *Drosophila melanogaster*
- D) nematodes, *Caenorhabditis elegans*

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 47.3

55) The developmental precursors to the gonadal tissues of *Caenorhabditis elegans* uniquely contain _____.

- A) proteins of maternal origin
- B) high concentrations of potassium ions
- C) T tubules for the propagation of action potentials
- D) P granules of mRNA and protein

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.3

56) One primary factor in shaping the polarity of the body axes in chick embryos is _____.

- A) light
- B) membrane potential
- C) gravity
- D) moisture

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.3

57) The arrangement of organs and tissues in their characteristic places in 3-D space defines _____.

- A) pattern formation
- B) differentiation
- C) determination
- D) organogenesis

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.3

- 58) If the apical ectodermal ridge is surgically removed from an embryo, it will lose _____.
A) positional information for limb-bud pattern formation
B) guidance signals needed for correct gastrulation
C) unequal cytokinesis of blastomeres
D) the developmental substrate for the kidneys

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.3

- 59) The nematode *Caenorhabditis elegans* _____.
A) is composed of about 1,000 cells, in which the developmental origin of each cell has been mapped
B) has only a single chromosome, which has been fully sequenced
C) has about 1,000 genes, each of which has been fully sequenced
D) uniquely, among animals, utilizes programmed cell death during normal development

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 47.3

- 60) In humans, identical twins are possible because _____.
A) cytoplasmic determinants are distributed unevenly in unfertilized eggs
B) extraembryonic cells interact with the zygote nucleus
C) early blastomeres can form a complete embryo if isolated
D) the gray crescent divides the dorsal-ventral axis into new cells

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 47.3

- 61) Cells transplanted from the neural tube of a frog embryo to the ventral part of another embryo develop into nervous system tissues. This result indicates that the transplanted cells were _____.
A) totipotent
B) determined
C) differentiated
D) mesenchymal

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 47.3

62) Embryonic induction, the influence of one group of cells on another group of cells, plays a critical role in embryonic development. In 1924, Hans Spemann and Hilde Mangold transplanted a piece of tissue that influences the formation of the notochord and neural tube, from the dorsal lip of an amphibian embryo to the ventral side of another amphibian embryo. If embryonic induction occurred, which of the following observations justifies the claim of embryonic induction?

- A) The transplanted tissue induced multiple limbs to develop on the ventral side of the recipient embryo.
- B) The transplanted tissue inhibited normal cell division on the dorsal side of the recipient embryo that lead to its death.
- C) The transplanted tissue had no effect on either the ventral or dorsal side of the recipient embryo so it continued to develop normally.
- D) The transplanted tissue induced the formation of a second notochord and neural tube on the ventral side of the developing embryo.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 47.3

63) Just prior to the onset of gastrulation in an embryo, the "organizer" cells are specified. If you were to experimentally block the specification of these cells, what would you expect the result to be in the developing embryo?

- A) There would be no effect on development.
- B) Gastrulation would not occur, and normal development would cease.
- C) The body axes would develop normally, but the embryo would not grow appendages.
- D) The embryo would not develop an intestine, but all other organs and tissues would develop normally.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 47.3

47.2 Student Edition End-of-Chapter Questions

1) The cortical reaction of sea urchin eggs functions directly in

- A) the formation of a fertilization envelope.
- B) the production of a fast block to polyspermy.
- C) the generation of an electrical impulse by the egg.
- D) the fusion of egg and sperm nuclei.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

2) Which of the following is common to the development of both birds and mammals?

- A) holoblastic cleavage
- B) epiblast and hypoblast
- C) trophoblast
- D) gray crescent

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 3) The archenteron develops into
- A) the mesoderm.
 - B) the endoderm.
 - C) the placenta.
 - D) the lumen of the digestive tract.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 4) What structural adaptation in chickens allows them to lay their eggs in arid environments rather than in water?

- A) extraembryonic membranes
- B) yolk
- C) cleavage
- D) gastrulation

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 5) If an egg cell were treated with EDTA, a chemical that binds calcium and magnesium ions,
- A) the acrosomal reaction would be blocked.

- B) the fusion of sperm and egg nuclei would be blocked.

- C) the fast block to polyspermy would not occur.

- D) the fertilization envelope would not form.

Answer: D

Bloom's Taxonomy: Application/Analysis

- 6) In humans, identical twins are possible because

- A) extraembryonic cells interact with the zygote nucleus.

- B) convergent extension occurs.

- C) early blastomeres can form a complete embryo if isolated.

- D) the gray crescent divides the dorsal-ventral axis into new cells.

Answer: C

Bloom's Taxonomy: Application/Analysis

- 7) Cells transplanted from the neural tube of a frog embryo to the ventral part of another embryo develop into nervous system tissues. This result indicates that the transplanted cells were

- A) totipotent.

- B) determined.

- C) differentiated.

- D) mesenchymal.

Answer: B

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 48 Neurons, Synapses, and Signaling

48.1 Multiple-Choice Questions

- 1) The three stages of information processing in animals include _____.
A) chemical senses, mechanoreception, and vision
B) dendrites, a cell body, and an axon
C) a presynaptic cell, neurotransmitters, and a postsynaptic cell
D) sensory reception, an integrating center, and effectors (motor neurons)

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.1

- 2) Most of the neurons in the human central nervous system are _____.
A) sensory neurons
B) motor neurons
C) interneurons
D) peripheral neurons

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 48.1

- 3) The motor (somatic nervous) system can alter the activities of its targets, the skeletal muscle fibers, because _____.
A) it is electrically coupled by gap junctions to the muscles
B) its signals bind to receptor proteins on the muscles
C) its signals reach the muscles via the blood
D) it is connected to the internal neural network of the muscles

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 48.4

- 4) The point of connection between two communicating neurons is called the _____.
A) axon hillock
B) dendrite
C) synapse
D) cell body

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.1

5) In a simple synapse, neurotransmitter chemicals are released by _____.

- A) the presynaptic membrane
- B) axon hillocks
- C) cell bodies
- D) ducts on the smooth endoplasmic reticulum

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.4

6) In a simple synapse, neurotransmitter chemicals are received by _____.

- A) the presynaptic membrane
- B) dendrites
- C) axon hillocks
- D) cell bodies

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.1

7) Although the membrane of a "resting" neuron is highly permeable to potassium ions, its membrane potential does not exactly match the equilibrium potential for potassium because the neuronal membrane is also _____.

- A) slightly permeable to sodium ions
- B) fully permeable to calcium ions
- C) impermeable to sodium ions
- D) highly permeable to chloride ions

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.2

8) The operation of the sodium-potassium pump moves _____.

- A) sodium and potassium ions into the cell
- B) sodium and potassium ions out of the cell
- C) sodium ions into the cell and potassium ions out of the cell
- D) sodium ions out of the cell and potassium ions into the cell

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.2

9) A researcher uses the chemical inhibitor cyanide to reduce ATP production in a neuron. What would be one effect of preventing ATP production?

- A) The sodium and potassium channels would all be closed.
- B) The membrane would become more permeable to sodium.
- C) Disruption to the normal "resting" distribution of potassium and sodium ions.
- D) A physical breakdown of the plasma membrane would occur.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 48.2

10) In a resting potential, an example of a cation that is more abundant as a solute in the cytosol of a neuron than it is in the interstitial fluid outside the neuron is _____.

- A) Cl⁻
- B) Ca⁺⁺
- C) Na⁺
- D) K⁺

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.2

11) The membrane potential in which there is no net movement of the ion across the membrane is called the _____.

- A) graded potential
- B) threshold potential
- C) equilibrium potential
- D) action potential

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.2

12) Two fundamental concepts about the ion channels of a "resting" neuron are that the channels _____.

- A) are always open, but the concentration gradients of ions frequently change
- B) are always closed, but ions move closer to the channels during excitation
- C) are open or closed depending on their type, and are specific as to which ion can traverse them
- D) open in response to stimuli, and then close simultaneously, in unison

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.2

13) If you experimentally increase the concentration of Na⁺ outside a cell while maintaining other ion concentrations as they were, what would happen to the cell's membrane potential?

- A) The membrane potential would become more negative.
- B) The membrane potential would become more positive.
- C) The membrane potential would be unaffected.
- D) The answer depends on the thermodynamic potential.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 48.2

- 14) The concentrations of ions are very different inside and outside a nerve cell due to _____.
A) osmosis
B) diffusion
C) sodium-potassium pumps
D) symports and antiports

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.2

- 15) Which of the following ions is most likely to cross the plasma membrane of a resting neuron?

- A) K⁺
B) Na⁺
C) Ca²⁺
D) Cl⁻

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.2

- 16) The Nernst equation specifies the equilibrium potential for a particular ion. This equilibrium potential is a function of _____.

- A) hydrostatic pressure
B) ion concentration gradient
C) osmotic gradient
D) temperature (thermal) gradient

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.2

- 17) Use the information in the table to answer the question.

Ion	Extracellular concentration (mM)	Intracellular concentration (mM)
Na ⁺	300	50
K ⁺	40	350

Calculate the equilibrium potential for potassium. Assume a temperature of 37°C.

- A) +48.2 mV
B) 0.0 mV
C) -58.4 mV
D) -80.0 mV

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 48.2

18) Use the information in the table to answer the question.

Ion	Extracellular concentration (mM)	Intracellular concentration (mM)
Na⁺	300	50
K⁺	40	350

Calculate the equilibrium potential for sodium. Assume a temperature of 37°C.

A) +48.2 mV

B) 0.0 mV

C) -58.4 mV

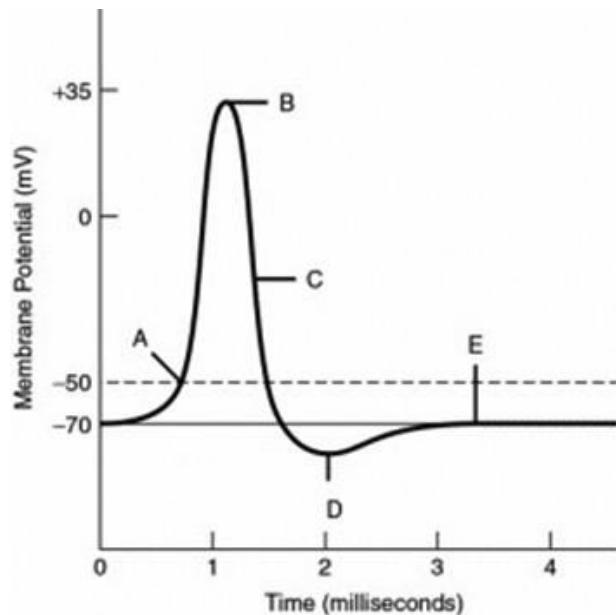
D) -80.0 mV

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 48.2

19) Refer to the following graph of an action potential to answer the question.



The membrane potential is closest to the equilibrium potential for potassium at label _____.

A) A

B) B

C) C

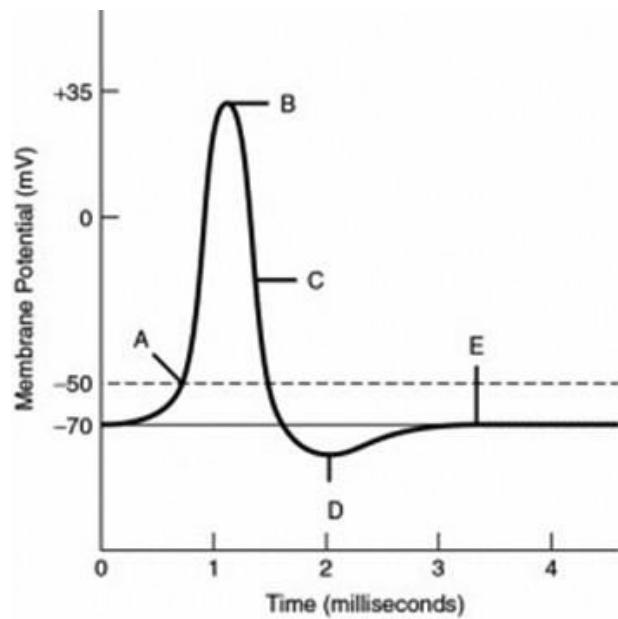
D) D

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 48.3

20) Refer to the following graph of an action potential to answer the question.



The membrane's permeability to sodium ions is greatest at label _____.

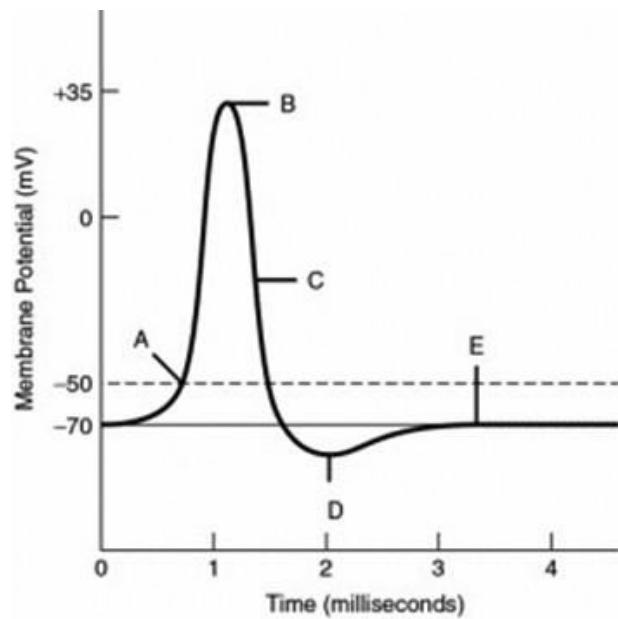
- A) A
- B) B
- C) C
- D) D

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 48.3

21) Refer to the following graph of an action potential to answer the question.



The minimum graded depolarization needed to operate the voltage-gated sodium and potassium channels is indicated by the label _____.

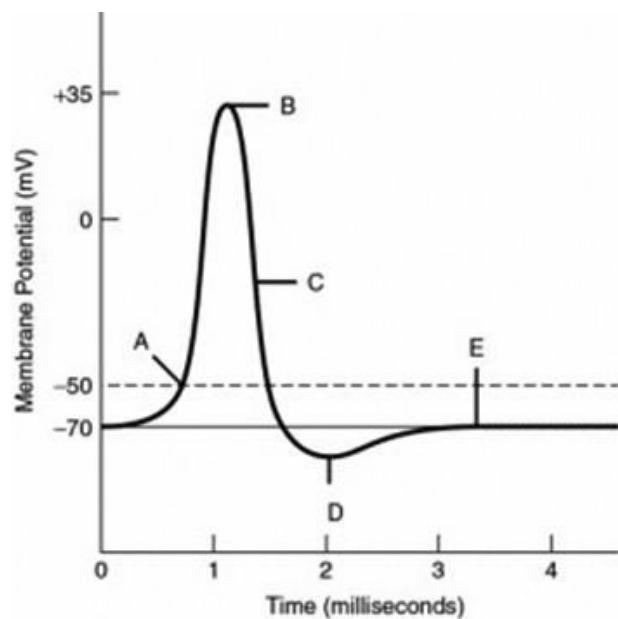
- A) A
- B) B
- C) D
- D) E

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 48.3

22) Refer to the following graph of an action potential to answer the question.



At label _____, the cell is not hyperpolarized; however, repolarization is in progress, as the sodium channels are inactivated or becoming inactivated, and many potassium channels have opened.

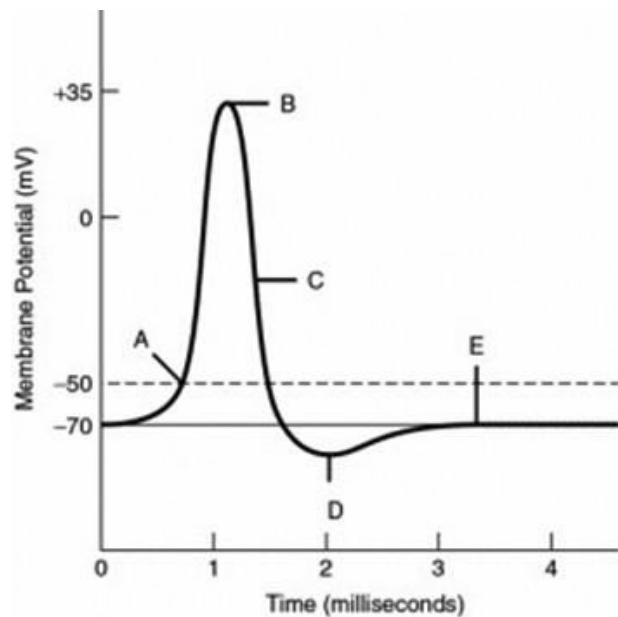
- A) B
- B) C
- C) D
- D) E

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 48.3

23) Refer to the following graph of an action potential to answer the question.



The neuronal membrane is at its resting potential at label _____.

- A) A
- B) B
- C) D
- D) E

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 48.3

24) For a neuron with an initial membrane potential at -70 mV, an increase in the movement of potassium ions out of that neuron's cytoplasm would result in the _____.

- A) depolarization of the neuron
- B) hyperpolarization of the neuron
- C) replacement of potassium ions with sodium ions
- D) replacement of potassium ions with calcium ions

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 48.3

25) Opening all of the sodium channels on an otherwise typical neuron, with all other ion channels closed (which is an admittedly artificial setting), should move its membrane potential to _____.

- A) -90 mV
- B) 0 mV
- C) equilibrium potential for sodium
- D) The membrane potential would not change, only the ion concentrations would change.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 48.3

26) A graded hyperpolarization of a membrane can be induced by _____.

- A) increasing its membrane's permeability to Na⁺
- B) decreasing its membrane's permeability to Cl⁻
- C) increasing its membrane's permeability to Ca⁺⁺
- D) increasing its membrane's permeability to K⁺

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.3

27) Conduction and refractory periods (states) are typical of _____.

- A) action potentials
- B) graded hyperpolarizations
- C) excitatory postsynaptic potentials
- D) threshold potentials

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.3

28) The "threshold" potential of a membrane is the _____.

- A) lowest frequency of action potentials a neuron can produce
- B) minimum hyperpolarization needed to prevent the occurrence of action potentials
- C) minimum depolarization needed to operate the voltage-gated sodium and potassium channels
- D) peak amount of depolarization seen in an action potential

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.3

29) Action potentials move along axons _____.

- A) more slowly in axons of large than in small diameter
- B) by activating the sodium-potassium "pump" at each point along the axonal membrane
- C) more rapidly in myelinated than in unmyelinated axons
- D) by reversing the concentration gradients for sodium and potassium ions

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.3

30) Pyrethroid insecticides prevent the voltage-gated sodium channels of insects from inactivating. Neurons that were exposed to pyrethroids would _____.
A) become hyperpolarized during an action potential
B) not repolarize during an action potential
C) not be able to open potassium channels
D) not release neurotransmitter molecules

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 48.3

31) After the depolarization phase of an action potential, the resting potential is restored by _____.
A) the opening of voltage-gated potassium channels and the inactivation of sodium channels
B) a decrease in the membrane's permeability to potassium and chloride ions
C) a brief inhibition of the sodium-potassium pump
D) the opening of more voltage-gated sodium channels

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.3

32) The "undershoot" phase of hyperpolarization is due to _____.
A) slow opening of voltage-gated sodium channels
B) sustained opening of voltage-gated potassium channels
C) rapid opening of voltage-gated calcium channels
D) slow restorative actions of the sodium-potassium ATPase

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.3

33) The fastest possible conduction velocity of action potentials is observed in _____.
A) thin, unmyelinated neurons
B) thin, myelinated neurons
C) thick, unmyelinated neurons
D) thick, myelinated neurons

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.3

- 34) Action potentials are normally carried in only one direction: from the axon hillock toward the axon terminals. If you experimentally depolarize the middle of the axon to threshold, using an electronic probe, then _____.
A) no action potential will be initiated
B) an action potential will be initiated and proceed only in the normal direction toward the axon terminal
C) an action potential will be initiated and proceed only back toward the axon hillock
D) two action potentials will be initiated, one going toward the axon terminal and one going back toward the hillock

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 48.3

- 35) Why are action potentials usually conducted in one direction?
A) The nodes of Ranvier conduct potentials in one direction.
B) The brief refractory period prevents reopening of voltage-gated sodium channels.
C) The axon hillock has a higher membrane potential than the terminals of the axon.
D) Voltage-gated channels for both Na^+ and K^+ open in only one direction.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 48.3

- 36) If you experimentally increase the concentration of K^+ inside a cell while maintaining other ion concentrations as they were, what would happen to the cell's membrane potential?
A) The membrane potential would become more negative.
B) The membrane potential would become less negative.
C) The membrane potential would remain the same.
D) The membrane potential would first become more negative and then less negative.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 48.3

- 37) Which of the following statements about action potentials is correct?
A) Action potentials for a given neuron vary in magnitude.
B) Action potentials for a given neuron vary in duration.
C) Action potentials are propagated down the length of the axon.
D) Movement of ions during the action potential occurs mostly through the sodium pump.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 48.3

- 38) Why do Na^+ ions enter the cell when voltage-gated Na^+ channels are opened in neurons?
- A) because the Na^+ concentration is much lower outside the cell than it is inside
 - B) because the Na^+ ions are actively transported by the sodium-potassium pump into the cell
 - C) because the Na^+ concentration is much higher outside the cell than it is inside, and the Na^+ ions are attracted to the negatively charged interior
 - D) because the Na^+ concentration is much higher outside the cell than it is inside, and the Na^+ ions are actively transported by the sodium-potassium pump into the cell

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 48.3

- 39) What would probably happen if a long neuron had one continuous myelin sheath down the length of the axon with no nodes of Ranvier?

- A) The action potential would be propagated nearly instantaneously to the synapse.
- B) There could be no action potential generated at the axon hillock.
- C) The signal would fade because it is not renewed by the opening of more sodium channels.
- D) Only potassium could move across the membrane, but not sodium.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 48.3

- 40) A neurophysiologist is investigating nerve reflexes in two different animals: a crab and a fish. Action potentials are found to pass more rapidly along the fish's neurons. What is the most likely explanation?

- A) The fish's axons are smaller in diameter; small axons transmit action potentials faster than large axons do.
- B) Unlike the crab, the fish's axons are wrapped in myelin.
- C) There are more ion channels in the axons of the crab compared with fish axons.
- D) Unlike the crab, the fish's axons are wrapped in myelin, and the fish's axons are smaller in diameter; small axons transmit action potentials faster than large axons do.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 48.3

- 41) Tetrodotoxin blocks voltage-gated sodium channels, and ouabain blocks sodium-potassium pumps. If you added both tetrodotoxin and ouabain to a solution containing neural tissue, what responses would you expect?

- A) immediate loss of resting potential
- B) immediate loss of action potential with gradual shift of resting potential
- C) slow decrease of resting potential and action potential amplitudes
- D) No effect; the substances counteract each other.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 48.3

42) Which of the following will increase the speed of an action potential moving down an axon?

- I) Action potentials move faster in wider axons.
- II) Action potentials move faster in axons lacking potassium ion channels.
- III) Action potentials move faster in myelinated axons.

- A) only I and II
- B) only II and III
- C) only I and III
- D) I, II, and III

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.3

43) In multiple sclerosis, the myelin sheaths around the axons of the brain and spinal cord are damaged and demyelination results. How does this disease manifest at the level of the action potential?

- I) Action potentials move in the opposite direction on the axon.
- II) Action potentials move more slowly along the axon.
- III) No action potentials are transmitted.

- A) only I
- B) only II
- C) only III
- D) only II and III

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 48.3

44) Neurotransmitters are released from axon terminals via _____.

- A) osmosis
- B) active transport
- C) diffusion
- D) exocytosis

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 48.4

45) Acetylcholine released into the junction between a motor neuron and a skeletal muscle binds to a sodium/potassium channel and opens it. This is an example of _____.

- A) a voltage-gated channel
- B) a ligand-gated channel
- C) a second-messenger-gated channel
- D) a chemical that inhibits action potentials

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.4

46) An inhibitory postsynaptic potential (IPSP) occurs in a membrane made more permeable to _____.

- A) potassium ions
- B) sodium ions
- C) ATP
- D) all neurotransmitter molecules

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.4

47) The following steps refer to various stages in transmission at a chemical synapse.

1. Neurotransmitter binds with receptors associated with the postsynaptic membrane.
2. Calcium ions rush into neuron's cytoplasm.
3. An action potential depolarizes the membrane of the presynaptic axon terminal.
4. The ligand-gated ion channels open.
5. The synaptic vesicles release neurotransmitter into the synaptic cleft.

Which sequence of events is correct?

- A) 1 → 2 → 3 → 4 → 5
- B) 2 → 3 → 5 → 4 → 1
- C) 3 → 2 → 5 → 1 → 4
- D) 4 → 3 → 1 → 2 → 5

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 48.4

48) The activity of acetylcholine in a synapse is terminated by its _____.

- A) diffusion across the presynaptic membrane
- B) active transport across the postsynaptic membrane
- C) diffusion across the postsynaptic membrane
- D) degradation on the postsynaptic membrane

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.4

49) An example of ligand-gated ion channels is _____.

- A) the spreading of action potentials in the heart
- B) acetylcholine receptors at the neuromuscular junction
- C) cAMP-dependent protein kinases
- D) action potentials on the axon

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.4

50) Neurotransmitters categorized as inhibitory are expected to _____.

- A) act independently of their receptor proteins
- B) close potassium channels
- C) open sodium channels
- D) hyperpolarize the membrane

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 48.4

51) If excitatory postsynaptic potentials (EPSPs) are produced nearly simultaneously through two different synapses on the same postsynaptic neuron, the EPSPs can also add together creating _____.

- A) a temporal summation
- B) a spatial summation
- C) a tetanus
- D) the refractory state

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.4

52) When two excitatory postsynaptic potentials (EPSPs) occur at a single synapse so rapidly in succession that the postsynaptic neuron's membrane potential has not returned to the resting potential before the second EPSP arrives, the EPSPs add together producing _____.

- A) temporal summation
- B) spatial summation
- C) tetanus
- D) the refractory state

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.4

53) One-way synaptic transmission occurs because _____.

- A) only dendrites can respond to electrical signals
- B) the postsynaptic cell contains most of the synaptic vesicles.
- C) receptors for neurotransmitters are mostly found on the postsynaptic membrane
- D) more receptors for neurotransmitters are found on the presynaptic membrane

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 48.4

54) Neurotransmitters can affect postsynaptic cells by _____.

- I) initiating signal transduction pathways in the cells
- II) causing molecular changes in the cells
- III) altering ion channel proteins
- IV) altering the permeability of the cells

- A) I and III
- B) II and IV
- C) III and IV
- D) I, II, III, and IV

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.4

55) The amino acid that operates at most inhibitory synapses in the brain is _____.

- A) acetylcholine
- B) endorphin
- C) nitric oxide
- D) gamma-aminobutyric acid (GABA)

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.4

56) The botulinum toxin, which causes botulism, reduces the synaptic release of _____.

- A) acetylcholine
- B) endorphin
- C) nitric oxide
- D) gamma-aminobutyric acid (GABA)

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.4

57) The heart rate of a vertebrate will decrease in response to the arrival of _____.

- A) acetylcholine
- B) endorphin
- C) nitric oxide
- D) gamma-aminobutyric acid (GABA)

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.4

58) A chemical that affects neuronal function but is not stored in presynaptic vesicles is _____.

- A) acetylcholine
- B) epinephrine
- C) nitric oxide
- D) gamma-aminobutyric acid (GABA)

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.4

59) Of those listed, which event occurs *first* following a depolarizing stimulus applied to the presynaptic membrane of an axon terminal?

- A) Voltage-gated calcium channels in the membrane open.
- B) Synaptic vesicles fuse with the membrane.
- C) The postsynaptic cell produces an action potential.
- D) Ligand-gated channels open, allowing neurotransmitters to enter the synaptic cleft.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 48.4

60) How could you increase the magnitude of excitatory postsynaptic potentials (EPSPs) generated at a synapse?

- A) Increase sodium-potassium pump activity.
- B) Increase K⁺ permeability.
- C) Increase Na⁺ permeability.
- D) All of the listed responses are correct.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 48.4

61) What happens if twice as many inhibitory postsynaptic potentials (IPSPs) as excitatory postsynaptic potentials (EPSPs) arrive in close proximity at a postsynaptic neuron?

- A) A stronger action potential results.
- B) A weaker action potential results.
- C) No action potential results.
- D) Many action potentials result.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 48.4

62) At the neuromuscular junction, the neurotransmitter acetylcholine (ACh) is degraded by acetylcholinesterase. If a neurophysiologist applies the naturally occurring acetylcholinesterase inhibitor, onchidial (produced by the mollusc *Onchidella binneyi*), to a synapse, what would you expect to happen?

- A) paralysis of muscle tissue
- B) convulsions due to constant muscle stimulation
- C) decrease in the frequency of action potentials
- D) no effect

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 48.4

48.2 Student Edition End-of-Chapter Questions

1) What happens when a resting neuron's membrane depolarizes?

- A) There is a net diffusion of Na^+ out of the cell.
- B) The equilibrium potential for K^+ (E_K) becomes more positive.
- C) The neuron's membrane voltage becomes more positive.
- D) The cell's inside is more negative than the outside.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

2) A common feature of action potentials is that they

- A) cause the membrane to hyperpolarize and then depolarize.
- B) can undergo temporal and spatial summation.
- C) are triggered by a depolarization that reaches threshold.
- D) move at the same speed along all axons.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

3) Where are neurotransmitter receptors located?

- A) the nuclear membrane
- B) the nodes of Ranvier
- C) the postsynaptic membrane
- D) synaptic vesicle membranes

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

4) Why are action potentials usually conducted in one direction?

- A) Ions can flow along the axon in only one direction.
- B) The brief refractory period prevents reopening of voltage-gated Na⁺ channels.
- C) The axon hillock has a higher membrane potential than the terminals of the axon.
- D) Voltage-gated channels for both Na⁺ and K⁺ open in only one direction.

Answer: B

Bloom's Taxonomy: Application/Analysis

5) Which of the following is the most *direct* result of depolarizing the presynaptic membrane of an axon terminal?

- A) Voltage-gated calcium channels in the membrane open.
- B) Synaptic vesicles fuse with the membrane.
- C) Ligand-gated channels open, allowing neurotransmitters to enter the synaptic cleft.
- D) An EPSP or IPSP is generated in the postsynaptic cell.

Answer: A

Bloom's Taxonomy: Application/Analysis

6) Suppose a particular neurotransmitter causes an IPSP in postsynaptic cell X and an EPSP in postsynaptic cell Y. A likely explanation is that

- A) the threshold value in the postsynaptic membrane is different for cell X and cell Y.
- B) the axon of cell X is myelinated, but that of cell Y is not.
- C) only cell Y produces an enzyme that terminates the activity of the neurotransmitter.
- D) cells X and Y express different receptor molecules for this particular neurotransmitter.

Answer: D

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 49 Nervous Systems

49.1 Multiple-Choice Questions

1) In the human knee-jerk reflex of a seated individual, as the calf is raised from a vertical position to a horizontal position, the muscles of the quadriceps (on the front of the thighs) and the muscles of the hamstring (on the back side of the thighs) are _____.

- A) both excited and contracting
- B) both inhibited and relaxed
- C) excited and inhibited, respectively
- D) inhibited and excited, respectively

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 49.1

2) The stretch sensors of the sensory neurons in the human knee-jerk reflex are located in the _____.

- A) cartilage of the knee
- B) quadriceps muscles on the front side of the thighs
- C) hamstring muscles on the back side of the thighs
- D) brain, the sensorimotor relay

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.1

3) Choose the correct match of glial cell type and function.

- A) astrocytes—promote blood flow and regulate ion concentrations
- B) oligodendrocytes—produce the myelin sheaths of myelinated neurons in the peripheral nervous system
- C) radial glia—the source of immunoprotection against pathogens
- D) Schwann cells—provide nutritional support to non-myelinated neurons

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.1

4) The human knee-jerk reflex requires an intact _____.

- A) spinal cord
- B) corpus callosum
- C) cerebellum
- D) medulla

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.1

5) Axons are especially abundant in the _____.

- A) gray matter of the brain and the white matter of the spinal cord
- B) white matter of the brain and the gray matter of the spinal cord
- C) gray matter of the brain and the gray matter of the spinal cord
- D) white matter in the brain and the white matter in the spinal cord

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.1

6) Cerebrospinal fluid can be described as which of the following?

- I) functioning in transport of nutrients and hormones through the brain
- II) a product of the filtration of blood in the brain
- III) functioning to cushion the brain
- IV) filling spaces between glial cells and neurons in the gray matter

- A) only I and III
- B) only II and IV
- C) only I, II, and III
- D) only II, III, and IV

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.1

7) The divisions of the nervous system that have antagonistic, or opposing, actions are _____.

- A) motor and sensory systems
- B) sympathetic and parasympathetic systems
- C) presynaptic and postsynaptic membranes
- D) central nervous system and peripheral nervous system

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.1

8) Preparation for the fight-or-flight response includes activation of the _____ nervous system

- A) sympathetic
- B) somatic
- C) central
- D) parasympathetic

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.1

9) Exercise and reactions to exciting stimuli include _____.

- A) increased activity in all parts of the peripheral nervous system
- B) increased activity in the sympathetic, and decreased activity in the parasympathetic divisions
- C) decreased activity in the sympathetic, and increased activity in the parasympathetic divisions
- D) increased activity in the enteric nervous system

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.1

10) Increased activity in the sympathetic nervous system leads to _____.

- A) decreased heart rate
- B) increased secretion by the pancreas
- C) increased contractions of the stomach
- D) relaxation of the airways in the lungs

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.1

11) The activation of the parasympathetic branch of the autonomic nervous system is associated with _____.

- A) resting and digesting
- B) release of epinephrine into the blood
- C) increased metabolic rate
- D) intensive aerobic exercise

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.1

12) In a cephalized invertebrate, the system that transmits "efferent" impulses from the anterior ganglion to distal segments is the _____.

- A) central nervous system
- B) peripheral nervous system
- C) autonomic nervous system
- D) parasympathetic nervous system

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 49.1

13) Imagine you are resting comfortably on a sofa after dinner. This could be described as a state with _____.

- A) increased activity in the sympathetic, parasympathetic, and enteric nervous systems
- B) decreased activity in the sympathetic, parasympathetic, and enteric nervous systems
- C) decreased activity in the sympathetic nervous system, and increased activity in the parasympathetic and enteric nervous systems
- D) increased activity in the sympathetic nervous system, and decreased activity in the parasympathetic and enteric nervous systems

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 49.1

14) If a doctor attempts to trigger the patellar tendon reflex and a lack of response occurs, what are potential regions where pathology might exist?

- I) the brain
- II) the knee
- III) the spinal cord

- A) only I
- B) only II
- C) only III
- D) only II and III

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 49.1

15) After narrowly escaping a mountain lion attack, which of the following reactions would your nervous system initiate?

- A) increased heartbeat
- B) constriction of airways
- C) constriction of pupils
- D) decreased heartbeat

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 49.1

16) After eating a large meal, which branch of your nervous system is activated?

- A) sensory
- B) somatic (motor)
- C) sympathetic
- D) enteric

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 49.1

17) The central nervous system is lacking in animals that have _____.

- A) a complete gut
- B) bilateral symmetry
- C) radial symmetry
- D) a closed circulatory system

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 49.1

18) Cephalization, the clustering of neurons and interneurons in the anterior part of the animal, is apparent in _____.

- I) mammals
- II) cnidarians
- III) *Planaria*
- IV) sea stars

- A) I and II
- B) III and IV
- C) I and III
- D) II and IV

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 49.1

19) Which of the following structures or regions is correctly paired with its function?

- A) limbic system—motor control of speech
- B) medulla oblongata—emotional memory
- C) cerebellum—homeostatic control
- D) corpus callosum—communication between the left and right cerebral cortices

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

20) In humans, control of balance and coordinated movements are associated with increased activity in the _____.

- A) hypothalamus
- B) cerebrum
- C) cerebellum
- D) spinal cord

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

21) Central coordination of vertebrate biological rhythms in physiology and behavior reside in the _____.

- A) pituitary gland
- B) hypothalamus
- C) cerebrum
- D) thalamus

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

22) Biological rhythms in animals isolated from light and dark cues _____.

- A) continue to have cycles of exactly 24 hours' duration
- B) continue to have cycles of approximately 24 hours' duration; some more rapid, some slower
- C) synchronize activity with whatever lighting cycle is imposed on them
- D) cease having any rhythms

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

23) Bottlenose dolphins breathe air but can sleep in the ocean because _____.

- A) they sleep for only 30 minutes at a time, which is the maximum interval they can cease breathing
- B) they fill their swim bladder with air to keep their blowholes above the surface of the water while they sleep
- C) they move to shallow water to sleep, so they do not need to swim to keep their blowholes above the surface of the water
- D) they alternate which half of their brain is asleep and which half is awake

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

24) Emotional responses and memories are linked in which part of the brain?

- A) amygdala
- B) cerebellum
- C) cerebrum
- D) pons

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

25) Increases and decreases of the heart rate result from changes in the activity of the _____.

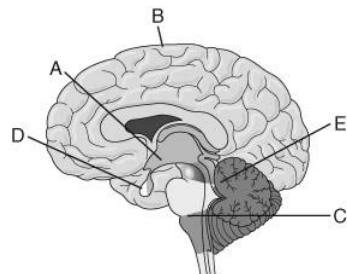
- A) medulla oblongata
- B) thalamus
- C) pituitary
- D) cerebellum

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

26) Use the figure to answer the following question.



Control of respiration and circulation are associated with the _____.

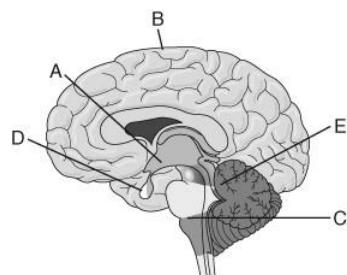
- A) A
- B) B
- C) C
- D) E

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

27) Use the figure to answer the following question.



Which of the following region(s) arose developmentally from the hindbrain?

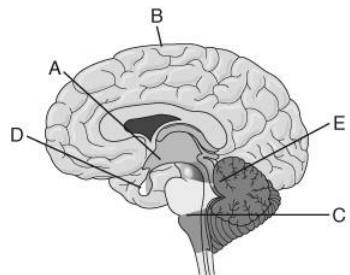
- A) only A
- B) both A and D
- C) only C
- D) both C and E

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

28) Use the figure to answer the following question.



Which part of the brain, if damaged, would lead to a decrease in the release of brain derived hormones, such as oxytocin?

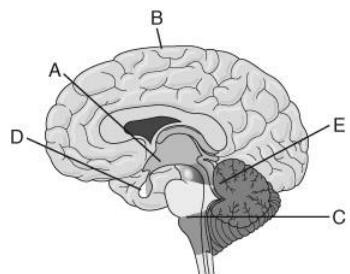
- A) both A and D
- B) only B
- C) only E
- D) both B and E

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 49.2

29) Use the figure to answer the following question.



If a person suffered a stroke which damaged brain region B, what might be the expected outcome?

- A) The person would suffer an inability to perform basic physiological functions, such as breathing.
- B) Higher-level integration of sensory inputs and motor outputs would be impaired.
- C) The person would not be able to see.
- D) Emotional response would be impaired.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 49.3

30) Movement and balance are monitored by activity in the _____.

- A) cerebrum
- B) cerebellum
- C) thalamus
- D) medulla oblongata

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

31) The regulation of body temperature derives from the activity of the _____.

- A) cerebrum
- B) cerebellum
- C) thalamus
- D) hypothalamus

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

32) Food and water appetites are under the regulatory influence of the _____.

- A) cerebrum
- B) thalamus
- C) hypothalamus
- D) medulla oblongata

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

33) The suprachiasmatic nuclei are found in the _____.

- A) hypothalamus
- B) epithalamus
- C) amygdala
- D) Broca's area

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

34) Wakefulness is regulated by the reticular formation, which is present in the _____.

- A) basal nuclei
- B) cerebral cortex
- C) brainstem
- D) limbic system

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

- 35) If a patient has an injury in the brainstem, which of the following would be observed?
- A) auditory hallucinations
 - B) visual hallucinations
 - C) an inability to regulate body temperature
 - D) an inability to regulate heart function

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 49.2

- 36) The telencephalon region of the developing brain of a mammal _____.
A) divides further into the metencephalon and myelencephalon
B) develops from the midbrain
C) is the brain region most like that of ancestral vertebrates
D) gives rise to the cerebrum

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.2

- 37) The motor cortex is part of the _____.
A) cerebrum
B) cerebellum
C) spinal cord
D) medulla oblongata

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.3

- 38) In mammals, advanced cognition is usually correlated with a large and very convoluted cerebral cortex, but birds are capable of sophisticated cognition because they have _____.
A) a more advanced cerebellum
B) a cerebellum with several flat layers
C) a pallium with neurons clustered into nuclei
D) microvilli to increase the brain's surface area

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.3

- 39) Wernicke's and Broca's regions of the brain affect _____.
A) olfaction
B) vision
C) speech
D) hearing

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.3

40) Which of the following shows a brain structure correctly paired with one of its primary functions?

- A) frontal lobe—decision making
- B) occipital lobe—control of skeletal muscles
- C) temporal lobe—visual processing
- D) occipital lobe—speech production

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.3

41) If you were writing an essay, the part(s) of your brain that would be actively involved in this task is/are the _____.

- A) frontal lobes
- B) parietal lobe
- C) Broca's area
- D) occipital lobe

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 49.3

42) Wernicke's area _____.

- A) is active when speech is heard and comprehended
- B) is active during the generation of speech
- C) coordinates the response to olfactory sensation
- D) is found on the left side of the brain

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.3

43) When Phineas Gage had a metal rod driven into his frontal lobe, or when someone had a frontal lobotomy, they would _____.

- A) lose their sense of balance
- B) lose all short-term memory
- C) have greatly altered emotional responses
- D) have greatly increased long-term memory

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.3

44) Patients with damage to Broca's area have difficulty _____.

- A) generating speech
- B) recognizing faces
- C) understanding language
- D) experiencing emotion

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.3

45) After suffering a stroke, a patient can see objects anywhere in front of him, but pays attention only to objects in his right field of vision. When asked to describe these objects, he has difficulty judging their size and distance. What part of the brain was likely damaged by the stroke?

- A) the left frontal lobe
- B) the right frontal lobe
- C) the left parietal lobe
- D) the right parietal lobe

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 49.3

46) An injury to the temporal lobe will likely impair the function of the _____.

- A) sense of hearing
- B) sense of sight
- C) sense of taste
- D) sense of touch

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 49.3

47) Short-term and long-term memory are related but have important differences. Short-term memory _____.

- A) involves temporary links formed in the cerebral cortex while long-term memory involves permanent connections within the hippocampus
- B) and long-term memory store information in the cerebellum but use different neurotransmitters
- C) is essential for acquiring and retaining long-term memories
- D) occurs within the hippocampus and is essential for acquiring new long-term memories within the cerebral cortex

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.4

48) One of the fundamental processes by which memories are stored and learning takes place _____.

- A) is related to changes in the degree of myelination of axons
- B) results in an increase in the diameter of axons
- C) results in a shift from aerobic to anaerobic respiration in neurons
- D) involves changing the responsiveness of postsynaptic neurons to neurotransmitter

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.4

49) The point of connection between two communicating neurons is called the _____.

- A) axon hillock
- B) dendrite
- C) synapse
- D) glia

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.4

50) Short-term memory information processing usually causes changes in the _____.

- A) brainstem
- B) medulla
- C) hypothalamus
- D) hippocampus

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.4

51) Forming new long-term memories is strikingly disrupted after damage to the _____.

- A) thalamus
- B) cerebral cortex
- C) somatosensory cortex
- D) primary motor cortex

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.4

52) In a simple synapse, neurotransmitter chemicals are released by _____.

- A) the dendritic membrane
- B) the presynaptic membrane
- C) axon hillocks
- D) cell bodies

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.4

53) In a simple synapse, neurotransmitter chemicals are received by _____.

- A) the postsynaptic membrane
- B) the presynaptic membrane
- C) axon hillocks
- D) cell bodies

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.4

- 54) For long-term potentiation to occur in the hippocampus, _____.
A) a presynaptic neuron must release more acetylcholine neurotransmitter into the synapse
B) NMDA receptors must be unblocked so that they can respond to glutamate
C) the postsynaptic cell responds to glutamate by opening AMPA receptors
D) the presynaptic cell must grow more axon terminals to synapse with the dendrites of the postsynaptic cell.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.4

- 55) Our understanding of mental illness has been most advanced by discoveries involving the _____.

- A) degree of convolutions in the brain's surface
B) sequence of developmental specialization
C) chemicals involved in brain communications
D) nature of the blood-brain barrier

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 49.5

- 56) Bipolar disorder differs from schizophrenia in that _____.

- A) schizophrenia typically involves hallucinations
B) schizophrenia typically involves manic and depressive states
C) bipolar disorder involves both genes and environment
D) bipolar disorder increases biogenic amines

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 49.5

- 57) One of the complications of Alzheimer's disease is an interference with learning and memory. This disease would most likely involve _____.

- A) changes in the concentration of ions in the extracellular fluid surrounding neurons
B) changes in myelination of axons
C) molecular and structural changes at synapses
D) structural changes to ion channels in axons

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 49.5

58) Stem cell transplants may someday be used to treat Parkinson's disease. Researchers are hopeful that these cells would alleviate the symptoms of Parkinson's disease by _____.
A) preventing temporal lobe seizures
B) repairing sites of traumatic brain injury
C) replenishing missing ion channels
D) secreting the neurotransmitter dopamine

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.5

59) The brain reward system _____.
A) represents an emergent brain property that has arisen independent of natural selection
B) is a reflex of the peripheral nervous primarily under autonomic control
C) is housed in the thalamus and primarily regulates the enteric division of the autonomic nervous system
D) utilizes the neurotransmitter dopamine and is affected by drug addiction

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 49.5

49.2 Student Edition End-of-Chapter Questions

1) Activation of the parasympathetic branch of the autonomic nervous system

- A) increases heart rate.
- B) enhances digestion.
- C) triggers release of epinephrine.
- D) causes conversion of glycogen to glucose.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

2) Which of the following structures or regions is *incorrectly* paired with its function?

- A) limbic system—motor control of speech
- B) medulla oblongata—homeostatic control
- C) cerebellum—coordination of movement and balance
- D) amygdala—emotional memory

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

3) Patients with damage to Wernicke's area have difficulty

- A) coordinating limb movement.
- B) generating speech.
- C) recognizing faces.
- D) understanding language.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 4) The cerebral cortex does *not* play a major role in
- A) short-term memory.
 - B) long-term memory.
 - C) circadian rhythm.
 - D) breath holding.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 5) After suffering a stroke, a patient can see objects anywhere in front of him but pays attention only to objects in his right field of vision. When asked to describe these objects, he has difficulty judging their size and distance. What part of the brain was likely damaged by the stroke?
- A) the left frontal lobe
 - B) the right frontal lobe
 - C) the right parietal lobe
 - D) the corpus callosum

Answer: C

Bloom's Taxonomy: Application/Analysis

- 6) Injury localized to the hypothalamus would most likely disrupt
- A) regulation of body temperature.
 - B) short-term memory.
 - C) executive functions, such as decision making.
 - D) sorting of sensory information.

Answer: A

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 50 Sensory and Motor Mechanisms

50.1 Multiple-Choice Questions

1) When the mammalian brain compares the actual temperature of the body to the preferred temperature of the body, which general component is being used?

- A) sensor
- B) effector
- C) integrator
- D) motor

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 50.1

2) A physiologist is studying the homeostatic control of blood pH. What type of receptor might be responsible for detecting changes in blood pH?

- A) mechanoreceptors
- B) electromagnetic receptors
- C) photoreceptors
- D) chemoreceptors

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 50.1

3) The 11 pairs of appendages projecting from the rostral area of star-nosed moles are _____.

- A) chemosensory structures
- B) tactile structures
- C) olfactory structures
- D) gustatory structures

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.1

4) The correct sequence of sensory processing is _____.

- A) sensory adaptation → stimulus reception → sensory transduction → sensory perception
- B) stimulus reception → sensory transduction → sensory perception → sensory adaptation
- C) sensory perception → stimulus reception → sensory transduction → sensory adaptation
- D) stimulus reception → sensory perception → sensory adaptation → sensory transduction

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.1

5) Artificial electrical stimulation of a human's capsaicin-sensitive neurons would likely produce the sensation of _____.

- A) cold temperature
- B) hot temperature
- C) tactile stimulus
- D) deep pressure

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.1

6) Artificial electrical stimulation of a human's menthol-sensitive neurons would likely produce the sensation of _____.

- A) cold temperature
- B) hot temperature
- C) odor of pepper
- D) deep pressure

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 50.1

7) The conversion of a stimulus into an action potential by a receptor cell is called _____.

- A) integration
- B) transmission
- C) transduction
- D) amplification

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.1

8) Immediately after putting on a shirt, your skin might feel itchy. However, this perception soon fades due to _____.

- A) sensory adaptation
- B) accommodation
- C) reduced motor unit recruitment
- D) reduced receptor amplification

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 50.1

9) A given photon of light may trigger an action potential with thousands of times more energy because the signal strength is amplified by _____.

- A) the receptor
- B) ion channels
- C) a signal transduction pathway
- D) triggering several receptors at once

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 50.1

10) Although some sharks close their eyes just before they bite, their bites are on target. Researchers have noted that sharks often misdirect their bites at metal objects and that they can find batteries buried under sand. This evidence suggests that sharks keep track of their prey during the split second before they bite in the same way that a _____.

- A) rattlesnake finds a mouse in its burrow
- B) male silkworm moth locates a mate
- C) bat finds moths in the dark
- D) platypus locates its prey in a muddy river

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 50.1

11) Which type of receptor would you expect to be most abundant in the antennae of a moth?

- A) thermoreceptors
- B) mechanoreceptors
- C) chemoreceptors
- D) electroreceptors

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 50.1

12) The structure of the mammalian middle ear is adapted to convert _____.

- A) air pressure waves to fluid pressure waves
- B) fluid pressure waves to air pressure waves
- C) air pressure waves to nerve impulses
- D) fluid pressure waves to nerve impulses

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.2

13) Statocysts contain cells that are _____.

- A) mechanoreceptors used to detect orientation relative to gravity
- B) chemoreceptors used in selecting migration routes
- C) photoreceptors used in setting biological rhythms
- D) thermoreceptors used in prey detection

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.2

14) During an auditory transduction, ion flow varies across the _____.

- A) tectorial membrane
- B) round-window membrane
- C) hair cell membrane
- D) basilar membrane

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.2

15) Dizziness is a perceived sensation that can occur when _____.

- A) the hair cells in the cochlea move more than their normal limits
- B) moving fluid in the semicircular canals encounters a stationary cupula
- C) rods and cones provide information that does not correspond with information received by cochlear hair cells
- D) the basilar membrane makes physical contact with the tectorial membrane

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.2

16) Use the figure to answer the following question.



The structure diagrammed in the figure is the _____.

- A) neuromast
- B) statocyst
- C) ommatidium
- D) olfactory bulb

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.2

17) A person able to hear only low-frequency sounds would probably have which of the following structural problems in the ear?

- A) The tympanum is damaged because of chronic ear infections.
- B) The basilar membrane is stiffened along its entire length.
- C) The ear ossicles are abnormally thickened.
- D) There is a loss of hair cell function in the area closest to the oval window.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 50.2

18) Partial or complete loss of hearing (deafness) can be caused by damage to the _____.

- I) axons of the neurons associated with each hair cell that carry information to the brain
- II) hair cells (the sensory receptors) in the cochlea
- III) tympanic membrane, or eardrum

- A) only II
- B) only III
- C) only I and II
- D) I, II, and III

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 50.2

19) The round window _____.

- I) dampens fluid vibrations
- II) collects sound pressure waves
- III) detects the frequency of sounds

- A) only I
- B) only II
- C) only III
- D) only II and III

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.2

20) Elephants hear sounds that are too low for humans to hear. This sensitivity is primarily due to the differences in the _____.

- A) arrangement and shape of the ossicles
- B) flexibility of the basilar membrane in the cochlea
- C) size and flexibility of the tympanic membrane (eardrum)
- D) size and shape of the outer ear

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.2

21) Hair cells in the vertebrate ear are responsible for transducing sound pressure waves. Ion channels in the hair cell membrane open when _____.

- A) a chemical ligand binds to the ion channel
- B) light is absorbed by a molecule in the membrane
- C) the cell membrane reaches a threshold voltage
- D) the membrane is distorted mechanically

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 50.2

22) It can be very difficult to select an angle for sneaking up to a grasshopper to catch it because grasshoppers have _____.

- A) excellent hearing for detecting predators
- B) compound eyes with multiple ommatidia
- C) eyes with multiple fovea
- D) a camera-like eye with multiple fovea

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.3

23) Compared to viewing a distant object, a human viewing an object held within five centimeters of the eye requires a lens that _____.

- A) has been flattened, as a result of contraction of the ciliary muscles
- B) has been made more spherical, as a result of contraction of the ciliary muscles
- C) has been flattened, as a result of relaxation of the ciliary muscles
- D) has been made more spherical, as a result of relaxation of the ciliary muscles

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.3

24) Sensory transduction of light in the vertebrate retina is accomplished by _____.

- A) ganglion cells
- B) amacrine cells
- C) bipolar cells
- D) rods and cones

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.3

25) Lateral inhibition via horizontal cells in the mammalian retina _____.

- A) underlies habituation of vision
- B) enhances visual contrast
- C) prevents bleaching in bright light
- D) recycles neurotransmitter molecules

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.3

26) The blind spot in the human retina is the location that has the collected axons of _____.

- A) ganglion cells
- B) bipolar cells
- C) primary visual cortex
- D) lateral geniculate nuclei

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 50.3

27) Corneal surgery is now routinely performed to change the shape of the cornea and improve vision. This surgery is beneficial because it _____.

- A) improves the circulation of nutrients to the eye
- B) improves the focusing of light onto the retina
- C) decreases the amount of light entering the eye
- D) increases the sensitivity of the photoreceptors

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.3

28) Rods exposed to light will _____.

- A) depolarize due to the opening of sodium channels
- B) hyperpolarize due to the closing of sodium channels
- C) depolarize due to the opening of potassium channels
- D) hyperpolarize due to the closing of potassium channels

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.3

29) What structures would neurobiologists look for if they are interested in determining if an animal can see in color?

- A) opsins
- B) electroreceptors
- C) pupil
- D) lens

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.3

30) How could you genetically modify an animal so that it would distinguish more shades of green?

- A) Induce genes to produce a greater number of cone cells in the fovea.
- B) Introduce genes for different opsins that respond in the green region of the spectrum.
- C) Introduce genes to produce green fluid in the eyeball, because green fluids will not absorb green light.
- D) Induce increased production of cGMP to increase opening of cGMP-gated sodium channels.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.3

31) In a mammalian visual system, visual information is integrated at _____.

- I) the lens
- II) the retina
- III) the optic nerve
- IV) the visual cortex

- A) I and II
- B) only II
- C) II, III, and IV
- D) II and IV

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.3

- 32) Tastes and smells are distinct kinds of environmental information where _____.
A) neural projections from taste receptors reach different parts of the brain than the neural projections from olfactory receptors
B) the single area of the cerebral cortex that receives smell and taste signals can distinguish tastes and smells by the pattern of action potentials received
C) tastant molecules are airborne, whereas odorant molecules are dissolved in fluids
D) distinguishing tastant molecules requires learning, whereas smell discrimination is an innate process

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 50.4

- 33) Most of the chemosensory neurons arising in the nasal cavity have axonal projections that terminate in the _____.
A) gustatory complex
B) olfactory bulb
C) occipital lobe
D) posterior pituitary gland

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.4

- 34) Umami perception would be stimulated by _____.
A) chocolate milk
B) a slice or roast beef
C) acidic orange juice
D) salt water

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.4

- 35) Which of the following sensory receptors is correctly paired with its category?
A) hair cell—mechanoreceptor
B) muscle spindle—electromagnetic receptor
C) taste receptor—mechanoreceptor
D) rod—chemoreceptor

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.2

36) The umami receptor in the sense of taste detects _____.

- A) glucose
- B) potassium ions
- C) hydrogen ions
- D) monosodium glutamate

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.4

37) Experiments with genetically altered mice showed that the mice would consume abnormally high amounts of bitter-tasting compounds in water after their _____.

- A) hormone receptors for digestive hormones were reduced or eliminated, showing that bitter tastes are reinforced by digestive responses
- B) salt-taste cells were altered to express receptors for bitter tastants, suggesting that animals have unregulated salt appetites
- C) visual sense was reduced or eliminated, suggesting that mice learn visual cues about bitter tastes
- D) sweet-taste cells were altered to express receptors for bitter tastants, suggesting that the sensation of taste depends only on which taste cell is stimulated

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 50.4

38) Two students studying physiology taste a known "bitter" substance, and both report sensing bitterness. They then sample another substance. Student A reports sensing both a bitter taste and a salty taste, but student B reports only a salty taste. What is the most logical explanation?

- A) Student A had an allergic reaction to the food, causing him to perceive the food as being bitter.
- B) Student A has normal "bitter" taste buds; student B has defective "bitter" taste buds that result in lower sensitivity to bitterness.
- C) Student A has a protein receptor capable of detecting a bitter molecule found in that substance, whereas student B lacks that particular protein receptor.
- D) Student A has normal saliva, whereas student B's saliva is more alkaline than normal.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 50.4

39) Methyl jasmonate is a plant-derived compound that blocks mosquito carbon dioxide receptors. What would you expect to happen if you applied this compound to your skin and then exposed yourself to a swarm of mosquitos?

- A) The mosquitos would be repelled and fly as far away as possible from you.
- B) The mosquitos would lack an important piece of sensory information for finding a host, and so would be less likely to bite you.
- C) You would be a more attractive host for the mosquitos.
- D) There would be no difference in the behavior of the mosquitos; they rely on visual cues to find their hosts.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 50.4

40) In the odorant cells of mammals, specific odorants are detected by binding to _____.

- A) G protein-coupled receptors.
- B) ligand-gated ion channels
- C) acetylcholine receptors
- D) glutamate receptors

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.4

41) Which of the following are present in high densities in both smooth and skeletal muscle cells?

- I) cilia
- II) mitochondria
- III) nuclei
- IV) intercalated disks

- A) only I
- B) only II
- C) III and IV
- D) I, II, and III

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.5

- 42) The contraction of skeletal muscles is based on _____.
A) myosin filaments coiling up to become shorter
B) actin and myosin filaments both coiling up to become shorter
C) actin cross-bridges binding to myosin and transitioning from a high-energy to a low-energy state
D) myosin cross-bridges binding to actin and transitioning from a high-energy to a low-energy state

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.5

- 43) Compared to oxidative skeletal muscle fibers, those classified as glycolytic typically have _____.
A) a higher concentration of myoglobin
B) a higher density of mitochondria
C) a smaller diameter
D) less resistance to fatigue

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.5

- 44) Myasthenia gravis is a form of muscle paralysis in which _____.
A) motor neurons lose their myelination and the ability to rapidly fire action potentials
B) acetylcholine receptors are destroyed by an overactive immune system
C) ATP production becomes uncoupled from mitochondrial electron transport
D) troponin molecules become unable to bind calcium ions

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.5

- 45) A skeletal muscle deprived of adequate ATP supplies will _____.
A) immediately relax
B) enter a state where actin and myosin are unable to separate
C) fire many more action potentials than usual and enter a state of "rigor"
D) sequester all free calcium ions into the sarcoplasmic reticulum

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.5

46) Most of the ATP supplies for a skeletal muscle undergoing one hour of sustained exercise come from _____.

- A) creatine phosphate
- B) glycolysis
- C) substrate phosphorylation
- D) oxidative phosphorylation

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 50.5

47) The motor unit in vertebrate skeletal muscle refers to _____.

- A) one actin binding site and its myosin partner
- B) one sarcomere and all of its actin and myosin filaments
- C) one myofibril and all of its sarcomeres
- D) one motor neuron and all of the muscle fibers on which it has synapses

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.5

48) The muscles of a recently deceased human can remain in a contracted state, termed *rigor mortis*, for several hours, due to the lack of _____.

- A) ATP needed to break actin-myosin bonds
- B) calcium ions needed to bind to troponin
- C) oxygen supplies needed for myoglobin
- D) sodium ions needed to fire action potentials

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 50.5

49) Which of the following is the correct sequence that describes the excitation and contraction of a skeletal muscle fiber?

1. Tropomyosin shifts and unblocks the cross-bridge binding sites.
2. Calcium is released and binds to the troponin complex.
3. Transverse tubules depolarize the sarcoplasmic reticulum.
4. The thin filaments are ratcheted across the thick filaments by the heads of the myosin molecules using energy from ATP.
5. An action potential in a motor neuron causes the axon to release acetylcholine, which depolarizes the muscle cell membrane.

- A) 1 → 2 → 3 → 4 → 5
- B) 2 → 1 → 3 → 5 → 4
- C) 2 → 3 → 4 → 1 → 5
- D) 5 → 3 → 2 → 1 → 4

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 50.5

- 50) The leg muscles of a sprinter would differ from a marathon runner in that _____.
A) per gram, the sprinter's muscles would have more mitochondria than the marathon runner's muscles
B) per gram, the marathon runner's muscles would contain more myoglobin than the sprinter's muscles
C) the marathon runner's muscles would have a greater rate of contraction than the sprinter's muscles
D) per gram, the sprinter's muscles would use more oxygen than the marathon runner's muscles

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.5

- 51) Action potentials in the heart move from one contractile cell to the next via _____.
A) chemical synapses using acetylcholine
B) chemical synapses using norepinephrine
C) intercalated disks
D) non-myelinated motor neurons

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.5

- 52) The venom of cobras contains a mixture of substances that have a variety of physiological effects. One substance in the venom works by preventing acetylcholine from binding to muscle receptors. How does the venom affect the prey of the cobra?
A) Action potentials would be continuously generated, causing convulsive muscle contractions.
B) Muscle contractions would be prevented, causing paralysis.
C) Muscle contractions could still occur, but relaxation of the muscle would be impaired.
D) Action potentials would be continuously generated, causing convulsive muscle contractions; muscle contractions would then be prevented, causing paralysis.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.5

- 53) When an action potential from a motor neuron arrives at the neuromuscular junction (NMJ), a series of events occurs that leads to muscle contraction. Which of the following events will occur last (that is, after all of the others listed below)?
A) acetylcholine (ACh) release
B) conformational change in troponin
C) depolarization of the muscle cell
D) release of Ca^{2+} from the sarcoplasmic reticulum

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.5

54) A patient is hospitalized with muscle spasms caused by failure of back muscles to relax after contraction. Which of the following would be most likely to help?

- A) Inject calcium into the muscle cell, because it is not being released from the sarcoplasmic reticulum.
- B) Induce tropomyosin and troponin to bind to the myosin binding sites on actin.
- C) Increase the amount of acetylcholine at the synapses between motor neurons and muscle cells.
- D) Depolarize the motor neurons to send an action potential to the muscle cells.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.5

55) Use the following information to answer the question.

"Marine cone snails from the genus *Conus* are estimated to consist of up to 700 species. These predatory molluscs have devised an efficient venom apparatus that allows them to successfully capture polychaete worms, other molluscs, or in some cases fish as their primary food sources. . . . conotoxins from Australian species of *Conus* . . . have the capacity to inhibit specifically the nicotinic acetylcholine receptors in higher animals." (B. G. Livett, K. R. Gayler, and Z. Khalil. 2004. Drugs from the sea: Conopeptides as potential therapeutics. *Current Medicinal Chemistry* 11:1715-23.)

This particular conotoxin inhibits acetylcholine receptors that are located _____.

- A) along the motor neuron axon
- B) on motor neuron dendrites
- C) on the presynaptic membrane of the neuromuscular junction
- D) on the postsynaptic membrane, on the muscle cell

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 50.5

56) Use the following information to answer the question.

"Marine cone snails from the genus *Conus* are estimated to consist of up to 700 species. These predatory molluscs have devised an efficient venom apparatus that allows them to successfully capture polychaete worms, other molluscs, or in some cases fish as their primary food sources. . . . conotoxins from Australian species of *Conus* . . . have the capacity to inhibit specifically the nicotinic acetylcholine receptors in higher animals." (B. G. Livett, K. R. Gayler, and Z. Khalil. 2004. Drugs from the sea: Conopeptides as potential therapeutics. *Current Medicinal Chemistry* 11:1715-23.)

What is the adaptive value of this toxin?

- I) It would cause muscle spasms in the prey.
- II) It would result in paralysis of the skeletal muscle of the prey.
- III) It would stimulate digestive tract smooth muscle to cause nausea and vomiting of the prey.

- A) only I
- B) only II
- C) only III
- D) only I and II

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 50.5

57) An endoskeleton is the primary body support for the _____.

- A) annelids, including earthworms
- B) insects, including beetles
- C) cartilaginous fishes, including sharks
- D) bivalves, including clams

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 50.6

58) A ball-and-socket joint connects _____.

- A) the radius to the ulna
- B) the radius to the humerus
- C) the ulna to the humerus
- D) the humerus to the scapula

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.6

59) Among these choices, the most energetically efficient locomotion per unit mass is likely _____.

- A) running by a 50-gram rodent
- B) running by a 40-kilogram ungulate
- C) flying by a 100-gram bird
- D) swimming by a 100-kilogram tuna (bony fish)

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 50.6

60) The hydrostatic skeleton of the earthworm allows it to move around in its environment by _____.

- A) walking on its limbs
- B) swimming with its setae
- C) using peristaltic contractions of its circular and longitudinal muscles
- D) alternating contractions and relaxations of its flagella

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.6

61) Chitin is a major component of the _____.

- A) skeleton of mammals
- B) hydrostatic skeletons of earthworms
- C) exoskeleton of insects
- D) body hairs of mammals

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 50.6

50.2 Student Edition End-of-Chapter Questions

1) Which of the following sensory receptors is *incorrectly* paired with its category?

- A) hair cell—mechanoreceptor
- B) snake pit organ—thermoreceptor
- C) taste receptor—chemoreceptor
- D) olfactory receptor—electromagnetic receptor

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

2) The middle ear converts

- A) air pressure waves to fluid pressure waves.
- B) air pressure waves to nerve impulses.
- C) fluid pressure waves to nerve impulses.
- D) pressure waves to hair cell movements.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 3) During the contraction of a vertebrate skeletal muscle fiber, calcium ions
- A) break cross-bridges as a cofactor in hydrolysis of ATP.
 - B) bind with troponin, changing its shape so that the myosin-binding sites on actin are exposed.
 - C) transmit action potentials from the motor neuron to the muscle fiber.
 - D) spread action potentials through the T tubules.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Which sensory distinction is *not* encoded by a difference in neuron identity?
- A) white and red
 - B) red and green
 - C) loud and faint
 - D) salty and sweet

Answer: C

Bloom's Taxonomy: Application/Analysis

- 5) The transduction of sound waves into action potentials occurs
- A) in the tectorial membrane as it is stimulated by hair cells.
 - B) when hair cells are bent against the tectorial membrane, causing them to depolarize and release neurotransmitter that stimulates sensory neurons.
 - C) as the basilar membrane vibrates at different frequencies in response to the varying volume of sounds.
 - D) within the middle ear as the vibrations are amplified by the malleus, incus, and stapes.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 6) Although some sharks close their eyes just before they bite, their bites are on target. Researchers have noted that sharks often misdirect their bites at metal objects and that they can find batteries buried under sand. This evidence suggests that sharks keep track of their prey during the split second before they bite in the same way that
- A) a rattlesnake finds a mouse in its burrow.
 - B) an insect avoids being stepped on.
 - C) a star-nosed mole locates its prey in tunnels.
 - D) a platypus locates its prey in a muddy river.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Campbell Biology, 11e (Urry)
Chapter 51 Animal Behavior

51.1 Multiple-Choice Questions

1) What type of signal is long-lasting and works at night?

- A) olfactory
- B) visual
- C) auditory
- D) electrical

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 51.1

2) What type of signal is brief and can work among obstructions at night?

- A) olfactory
- B) visual
- C) auditory
- D) magnetic

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 51.1

3) What type of signal is fast and requires daylight with no obstructions?

- A) olfactory
- B) visual
- C) auditory
- D) tactile

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 51.1

4) Circannual rhythms in birds are influenced by _____.

- A) periods of food availability
- B) periods of daylight and darkness
- C) magnetic fields
- D) lunar cycles

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.1

5) Upon returning to its hive, a European honeybee communicates to other worker bees the presence of a nearby food source it has discovered by _____.

- A) vibrating its wings at varying frequencies
- B) performing a round dance
- C) performing a waggle dance
- D) visual cues

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.1

6) Displays of nocturnal mammals are usually _____.

- A) visual and auditory
- B) tactile and visual
- C) olfactory and auditory
- D) visual and olfactory

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.1

7) A cage containing male mosquitoes has a small earphone placed on top, through which the sound of a female mosquito is played. All the males immediately fly to the earphone and go through all of the steps of copulation. What is the best explanation for this behavior?

- A) Copulation is a fixed action pattern, and the female flight sound is a sign stimulus that initiates it.
- B) The sound from the earphone irritates the male mosquitoes, causing them to attempt to sting it.
- C) The reproductive drive is so strong that when males are deprived of females, they will attempt to mate with anything that has even the slightest female characteristic.
- D) Through classical conditioning, the male mosquitoes have associated the inappropriate stimulus from the earphone with the normal response of copulation.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 51.1

8) A stickleback fish will attack a fish model as long as the model has red coloring. What animal behavior idea is manifested by this observation?

- A) sign stimulus
- B) cognition
- C) imprinting
- D) classical conditioning

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.1

9) Which of the following experiments best addresses the hypothesis that moths stop flying in response to high-intensity bat sounds?

- A) Isolate and characterize the neurons that control flight muscle.
- B) Play prerecorded high-intensity bat sounds to flying moths.
- C) Observe responses of moths to bats in nature.
- D) Put bats and moths in an enclosure and make detailed observations of predator-prey interactions.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 51.1

10) A lizard's bobbing dewlap (a colorful flap of skin hanging from an *Anolis* lizard's throat) is an example of a(n) _____.

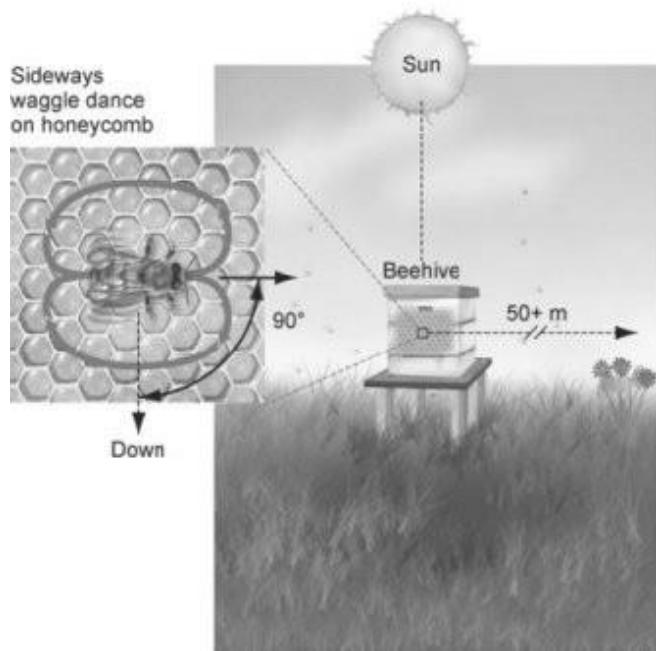
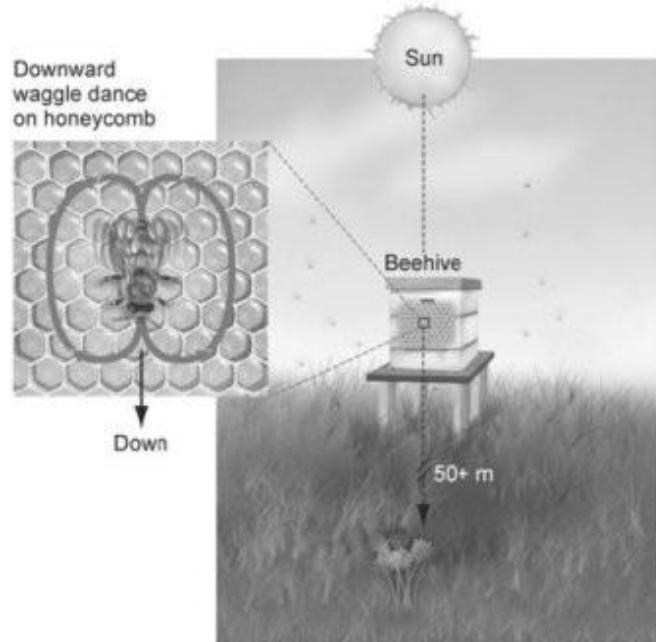
- A) stimulus
- B) reflex
- C) signal
- D) innate releasing mechanism

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 51.1

11) Use the following figures to answer the question.



From the figure, what can we determine about the location of the food source?

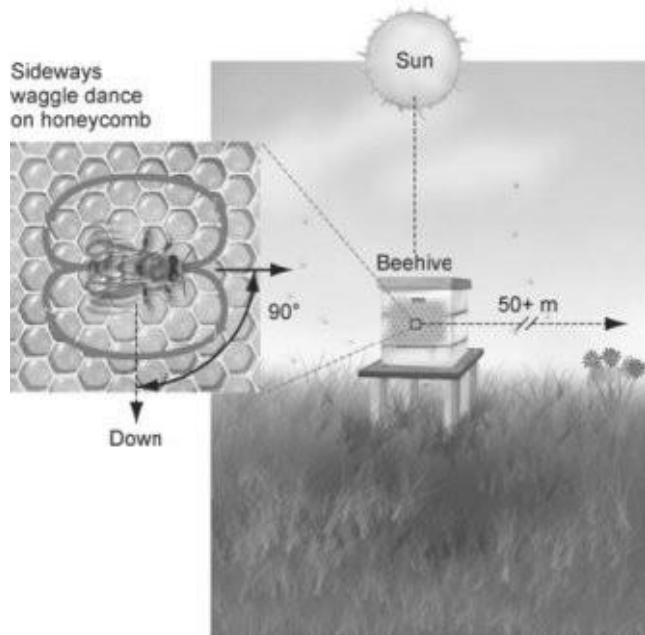
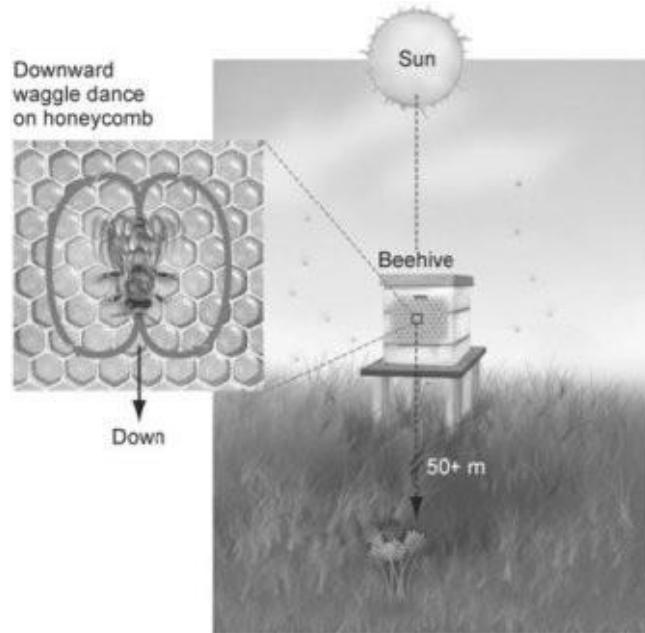
- A) The waggle dance in the top figure indicates that the food is directly under the hive.
- B) The waggle dance in the bottom figure indicates that the food is to the west of the hive.
- C) The waggle dance in the top figure indicates that the food is close to the hive.
- D) The waggle dance in the bottom figure indicates that the food is 90° to the right of the sun.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 51.1

12) Use the following figures to answer the question.



What could you conclude if the honeybee in the figure switched from the "waggle dance" to the "round dance"?

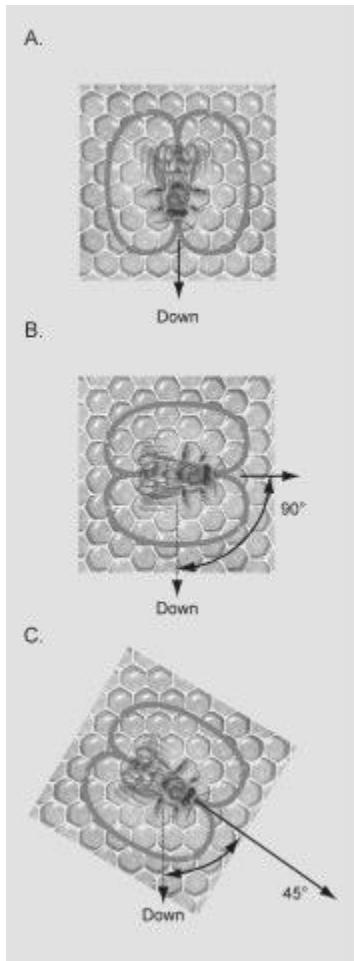
- A) The food source is no longer available; all the nectar has been harvested.
- B) The preferred food source was farther away.
- C) The bee is trying to conserve energy by switching to the round dance.
- D) The food source is close to the hive.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 51.1

13) Use the following figures to answer the question.



If the figure shows the dances of bees in a hive at noon on June 21 in the northern hemisphere (the sun is directly north of the hive), which dance is communicating that the food is to the south of the hive?

- A) dance A
- B) dance B
- C) dance C
- D) It is not possible to tell if any of the dances indicate the food is to the south of the hive.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 51.1

14) Scientists believe that the direction birds go when migrating is guided in part by _____.

- I) the stars in the night sky
- II) the sun during the day
- III) the magnetic field of the Earth

- A) only I
- B) only II
- C) only III
- D) I, II, and III

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.1

15) Which of the following examples describes a behavioral pattern that results from a proximate cause?

- A) A cat kills a mouse to obtain nutrition.
- B) A male sheep fights with another male because it helps to improve its social position.
- C) A female bird lays its eggs because the amount of daylight is decreasing slightly each day.
- D) A goose squats and freezes motionless to escape a predator.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.1

16) The proximate causes of behavior are interactions with the environment, but behavior is ultimately shaped by _____.

- A) hormones
- B) evolution
- C) pheromones
- D) the nervous system

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.1

17) During a field trip, an instructor touched a moth resting on a tree trunk. The moth raised its forewings to reveal large eyespots on its hind wings. The instructor asked why the moth lifted its wings. One student answered that sensory receptors had fired and triggered a neuronal reflex culminating in the contraction of certain muscles. A second student responded that the behavior might frighten predators. Which statement best describes these explanations?

- A) The first explanation is correct, but the second is incorrect.
- B) The first explanation refers to proximate causation, whereas the second refers to ultimate causation.
- C) The first explanation is testable as a scientific hypothesis, whereas the second is not.
- D) Both explanations are reasonable and simply represent a difference of opinion.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 51.1

- 18) Which of the following is required for a behavioral trait to evolve by natural selection?
- A) The behavior is determined entirely by genes.
 - B) The behavior is the same in all individuals in the population.
 - C) An individual's reproductive success depends in part on how the behavior is performed.
 - D) The behavior is not genetically inherited.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 51.1

- 19) In testing a hypothesis that "territorial defense in European robins is a fixed action pattern that is released by the sight of orange feathers," researchers found that robins defended their territory by attacking anything that was of similar size and had an orange patch. What experiment would you perform next to determine that the color initiated the defense response?
- A) Repeat the experiment using a blue patch instead of an orange patch.
 - B) Repeat the experiment by removing the patch completely.
 - C) Repeat the experiment by using a model of a robin that was twice the size of a normal robin but with a small orange patch.
 - D) Repeat the experiment by using a model of a robin that had an orange patch that was twice the size of a normal patch.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 51.1

- 20) Squirrels will make alarm sounds when a model of an owl is placed in their territory. When a red block the same size of the owl is placed in the territory, the squirrel does not alarm. What can you conclude from these observations?
- A) The squirrel cannot see red objects, and so does not make alarm sounds.
 - B) The owl model, but not the red block, is a sign that triggers the fixed action pattern of alarm vocalizations.
 - C) The owl model is the ultimate cause of alarm vocalization behavior.
 - D) The squirrel is trying to attract the owl into its territory.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 51.1

Listed are several examples of types of animal behavior. Choose the letter of the correct term (A-E) that matches each example in the following questions.

- A. operant conditioning
- B. classical conditioning
- C. innate behavior
- D. imprinting
- E. altruistic behavior

21) Through trial and error, a rat learns to run a maze without mistakes to receive a food reward.

- A) A
- B) B
- C) C
- D) D

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.2

22) A human baby performs a sucking behavior perfectly when it is put in the presence of the nipple of its mother's breast.

- A) A
- B) B
- C) C
- D) D

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.2

23) A mother goat can recognize its own kid by smell.

- A) A
- B) B
- C) C
- D) D

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.2

24) A cat runs to its food dish when it hears the sound of a can opener.

- A) A
- B) B
- C) C
- D) E

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.2

25) Every morning at the same time, John went into the den to feed his new tropical fish. After a few weeks, he noticed that the fish swam to the top of the tank when he entered the room. This is an example of _____.

- A) cognition
- B) imprinting
- C) classical conditioning
- D) operant conditioning

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.2

26) Some dogs love attention, and Frodo the beagle learns that if he barks, he gets attention. Which of the following might you use to describe this behavior?

- A) The dog is displaying an instinctive fixed action pattern.
- B) The dog is trying to protect its territory.
- C) The dog has been classically conditioned.
- D) The dog's behavior is a result of operant conditioning.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 51.2

27) Scientists have tried raising endangered whooping cranes in captivity by using sandhill cranes as foster parents. This strategy is no longer used because _____.

- A) the fostered whooping cranes' critical period was variable such that different chicks imprinted on different "mothers"
- B) sandhill crane parents rejected their fostered whooping crane chicks soon after incubation
- C) none of the fostered whooping cranes formed a mating pair-bond with another whooping crane
- D) sandhill crane parents did not properly incubate whooping crane eggs

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.2

28) White-crowned sparrows can only learn the "crystallized" song for their species by _____.

- A) listening to adult sparrow songs during a sensitive period as a fledgling, followed by a practice period until the juvenile matches its melody to its memorized fledgling song
- B) listening to the song of its own species during a critical period so that it will imprint to its own species song and not the songs of other songbird species
- C) performing the crystallized song as adults when they become sexually mature, as the song is programmed into the innate behavior for the species
- D) observing and practicing after receiving social confirmation from other adults at a critical period during their first episode of courtship behavior

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.2

29) One way to understand how early environment influences behaviors in similar species is through the "cross-fostering" experimental technique. Suppose that the curly-whiskered mud rat differs from the bald mud rat in several ways, including being much more aggressive. How would you set up a cross-fostering experiment to determine if environment plays a role in the curly-whiskered mud rat's aggression?

- A) You would cross curly-whiskered mud rats and bald mud rats and hand-rear the offspring to see if any grew up to be aggressive.
- B) You would place newborn curly-whiskered mud rats with bald mud rat parents and place newborn bald mud rats with curly-whiskered mud rat parents. Finally, let some mud rats of both species be raised by their own species. Then you would compare the outcomes.
- C) You would remove the offspring of curly-whiskered mud rats and bald mud rats from their parents, raise them in the same environment but without parents, and then compare the outcomes.
- D) You would replace normal newborn mud rats with deformed newborn mud rats to see if it triggered an altruistic response.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 51.2

30) Which of the following is true of innate behaviors? Innate behaviors _____.

- A) are only weakly influenced by genes
- B) occur in invertebrates and some vertebrates but not mammals
- C) are limited to invertebrate animals
- D) are expressed in most individuals in a population

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.2

31) A region of the canary forebrain shrinks during the nonbreeding season and enlarges when breeding season begins. This change is probably associated with the annual _____.

- A) addition of new syllables to a canary's song repertoire
- B) crystallization of subsong into adult songs
- C) renewal of mating and nest-building behaviors
- D) elimination of the memorized template for songs sung the previous year

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 51.2

32) Although many chimpanzees live in environments containing oil palm nuts, members of only a few populations use stones to crack open the nuts. The likely explanation is that _____.

- A) the behavioral difference is caused by genetic differences between populations
- B) members of different populations have different nutritional requirements
- C) the cultural tradition of using stones to crack nuts has arisen in only some populations
- D) members of different populations differ in learning ability

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 51.2

33) You observe a species of bird that, upon hatching, has contact with its parents only while being fed. You also never hear the parents sing during the feeding process. What would you propose about song learning in this species of bird?

- A) Song learning in this species is most likely learned.
- B) The period of imprinting is likely later in the bird's life.
- C) The males will learn song when they congregate with other males of their species during the winter.
- D) Song learning in this species is most likely innate.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 51.2

34) Learning has the most influence on behavior when _____.

- A) making mistakes does not result in death
- B) animals reproduce asexually
- C) animals have enormous cognitive ability
- D) making mistakes results in death

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 51.2

35) You have captured a number of rats from a wild population and quickly surmise with tests that they are very good at avoiding food with poisons. What would best explain this observation?

- A) Rats are probably just intelligent enough to avoid poison.
- B) Rats may experience a large variety of toxins in their environment and learn to avoid them.
- C) Rats are taught by their parents to test small bits of food first and then return later if the food seems safe.
- D) Rats may be able to tolerate large amounts of poison.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 51.2

36) You observe scrub jays hiding food and notice that one particular individual only pretends to hide food. What kind of experiment could you perform to test whether this behavior was random or in response to another signal?

- A) Observe more of these behaviors in the wild and try to determine if the behavior is random.
- B) Hypothesize a set of signals that could produce this behavior and try to match the behaviors with the signals.
- C) Attempt to reproduce the behavior in captivity by using bird models and a computer simulation.
- D) Isolate the individual birds in a laboratory and repeat the observations.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 51.2

37) You observe scrub jays hiding food and notice that one particular individual only pretends to hide food. Your experiments associate the presence of other individuals with the frequency of pretending to cache food. A colleague shows you animals of the same species that do not perform this pretend caching. How does this information affect your conclusions about this behavior?

- A) It suggests that this behavior might be learned.
- B) It prevents you from making conclusions.
- C) It suggests that your experimental design is flawed.
- D) It does not change your initial conclusions.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 51.2

38) You discover a rare new bird species, but you are unable to observe its mating behavior. You see that the male is large and ornamental compared with the female. On this basis, you can probably conclude that the species is _____.

- A) polygamous
- B) monogamous
- C) polyandrous
- D) agonistic

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 51.3

39) Fred and Joe, two unrelated, mature male gorillas, encounter one another. Fred is courting a female. Fred grunts as Joe comes near. As Joe continues to advance, Fred begins drumming (pounding his chest) and bares his teeth. Joe then rolls on the ground on his back, gets up, and quickly leaves. This behavioral pattern is repeated several times during the mating season. Choose the most specific behavior described by this example.

- A) agonistic behavior
- B) territorial behavior
- C) learned behavior
- D) fixed action pattern

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 51.3

40) Female spotted sandpipers aggressively court males and, after mating and egg laying, leave the clutch of young for the male to incubate. This sequence may be repeated several times with different males until no available males remain, forcing the female to incubate her last clutch. Which of the following terms best describes this behavior?

- A) monogamy
- B) polygyny
- C) polyandry
- D) promiscuity

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 51.3

41) Feeding behavior with a high-energy intake-to-expenditure ratio is called _____.

- A) autotrophy
- B) heterotrophy
- C) search scavenging
- D) optimal foraging

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.3

42) Which of the following examples reflects the concept of optimal foraging?

- A) During foraging, a mule deer will consume food as soon as it finds it, regardless of the location.
- B) A cheetah will continue a chase for prey, regardless of how long the chase lasts or how much energy is consumed.
- C) A moose spends more time looking for food when the food is high quality than when the food is low quality.
- D) If an animal is hungry it will consume food as soon as it is found, regardless of the food quality or the risk.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 51.3

43) The occurrence of sexual dimorphism in a species is a likely indicator of _____.

- A) a monogamous mating system
- B) monogamy
- C) certainty of paternity
- D) agonistic behavior

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.3

44) The head-butting behavior of male bighorn sheep to establish a mating hierarchy is an example of _____.

- A) mate-choice copying
- B) sexual dimorphism
- C) agonistic behavior
- D) polygamy

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 51.3

45) Which of the following statements is true about certainty of paternity?

- A) Certainty of paternity is high in most species with internal fertilization because the acts of mating and birth are separated by time.
- B) Certainty of paternity is low when males guard females they have mated.
- C) Certainty of paternity is low when egg laying and mating occur together, as in external fertilization.
- D) Paternal behavior exists because it has been reinforced over generations by natural selection.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 51.3

46) Which of the following best describes "game theory" as it applies to animal behavior?

- A) The fitness of a particular behavior is influenced by other behavioral phenotypes in a population.
- B) The total of all of the behavioral displays, both male and female, is related to courtship.
- C) The play behavior performed by juveniles allows them to perfect adult behaviors that are needed for survival, such as hunting, courtship, and so on.
- D) The evolutionary "game" is played between predator and prey. A behavior evolves in the prey in response to the nature of the predatory behavior.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 51.3

47) The color of throats of males in a population of side-blotched lizards is determined by _____.

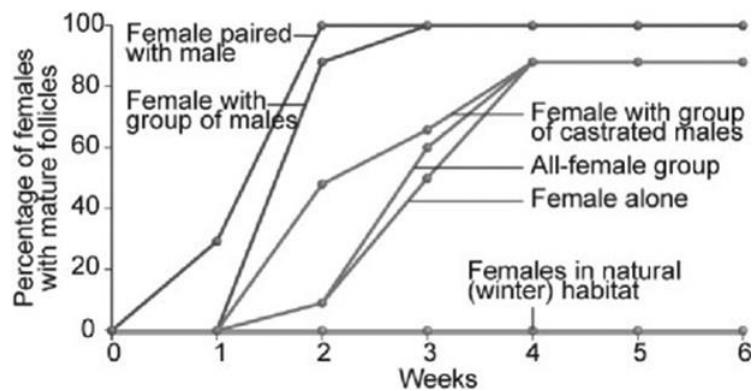
- A) ambient temperature: blue = cold; orange = normal; yellow = hot
- B) stage of development/maturity
- C) their receptiveness to mate
- D) the success of the mating behavior of each of the throat-color phenotypes

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.3

48) Use the following figure to answer the question.



Based only on the information in the figure, which of the following conclusions is most logical?

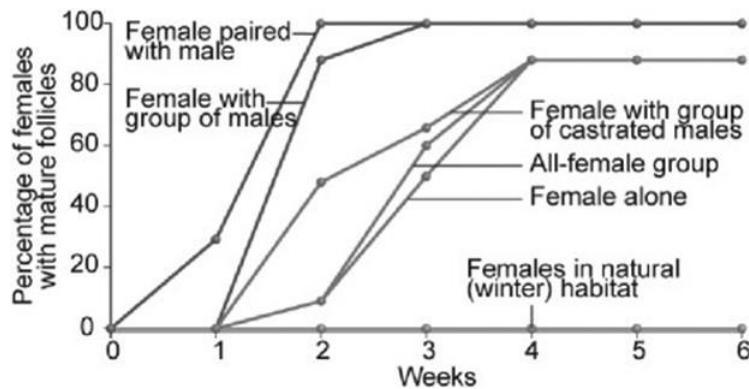
- A) Females produce more eggs more quickly when exposed to breeding males.
- B) Females produce eggs more quickly when exposed to many males than females paired with a male.
- C) All non-isolated females do just as well as isolated females.
- D) After four weeks together, females with males produce mature follicles to the same extent as females without males.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 51.3

49) Use the following figure to answer the question.



Based on the information in the figure, which of the following would you expect to observe in these animals?

- I) sexual dimorphism
- II) polygamy
- III) agonistic behavior

- A) only II
- B) I and II
- C) I and III
- D) I, II, and III

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 51.3

Listed are several examples of types of animal behavior. Choose the letter of the correct term (A-E) that matches each example in the following questions.

- A. operant conditioning
- B. classical conditioning
- C. innate behavior
- D. imprinting
- E. altruistic behavior

50) Upon observing a golden eagle flying overhead, a sentry prairie dog gives a warning call to other foraging members of the prairie dog community.

- A) B
- B) C
- C) D
- D) E

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.4

51) The *fru* gene in fruit flies _____.

- I) is a master regulatory gene that directs expression of many other genes
 - II) can be genetically manipulated in females so that they will perform male sex behaviors
 - III) programs males for appropriate courtship behaviors
- A) only I and II
 - B) only I and III
 - C) only III
 - D) I, II, III

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 51.4

52) Pair-bonding in a population of prairie voles can be prevented by _____.

- A) the ensuing confusion caused by introducing meadow voles
- B) administering a drug that inhibits the brain receptor for vasopressin in the central nervous system (CNS) of males
- C) dying the coat color from brown to blond in either male or female prairie voles
- D) allowing the population size to reach critically low levels

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.4

53) Which of the following statements about evolution of behavior is correct?

- A) Natural selection will favor behavior that enhances survival and reproduction.
- B) An animal may show behavior that minimizes reproductive fitness.
- C) If a behavior is less than optimal, it will eventually become optimal through natural selection.
- D) Innate behaviors cannot be altered by natural selection.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 51.4

54) How do altruistic behaviors arise through natural selection?

- A) By his/her actions, the altruist increases the likelihood that some of its genes will be passed on to the next generation.
- B) The altruist is appreciated by other members of the population because its survivability has been enhanced by virtue of its risky behavior.
- C) Animals that perform altruistic acts are allowed by their population to breed more, thereby passing on their behavior genes to future generations.
- D) Altruistic behaviors lower stress in populations, which increases the survivability of all the members of the population.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 51.4

55) Which of the following has a coefficient of relatedness of 0.25?

- A) a father to his daughter
- B) an uncle to his nephew
- C) a brother to his brother
- D) a sister to her brother

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.4

56) Animals that help other animals of the same species _____.

- A) have excess energy reserves
- B) are bigger and stronger than the other animals
- C) are usually related to the other animals helped
- D) are always male

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.4

57) The presence of altruistic behavior is most likely due to kin selection, a theory maintaining that _____.

- A) genes enhance survival of copies of themselves by directing organisms to assist others who share those genes
- B) companionship is advantageous to animals because in the future they can help each other
- C) critical thinking abilities are normal traits for animals and they have arisen, like other traits, through natural selection
- D) natural selection has generally favored the evolution of exaggerated aggressive and submissive behaviors to resolve conflict without grave harm to participants

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.4

58) If a prairie dog had the opportunity to perform an altruistic act (that is, give an alarm call) to help its relatives, which combination of the following relatives would the prairie dog be most likely to help (base your answer solely on the genetic relationships)?

- A) two nieces, two cousins, and one half-brother
- B) two half-sisters and two nieces
- C) one son, one niece, and one half-sister
- D) equal altruism to all combinations described

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 51.4

- 59) How would you classify the genetic basis for most behavioral traits in the animal kingdom?
- A) One gene typically codes for one behavior.
 - B) One gene typically codes for many behaviors.
 - C) Many genes typically code for one behavior.
 - D) Behaviors are learned, not coded by genes.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 51.4

- 60) What probably explains why coastal and inland garter snakes react differently to banana slug prey?

- A) Ancestors of coastal snakes that could eat the abundant banana slugs had increased fitness. No such selection occurred inland, where banana slugs were absent.
- B) Banana slugs are camouflaged, and inland snakes, which have poorer vision than coastal snakes, are less able to see them.
- C) Garter snakes learn about prey from other garter snakes. Inland garter snakes have fewer types of prey because they are less social.
- D) Inland banana slugs are distasteful, so inland snakes learn to avoid them. Coastal banana slugs are palatable to garter snakes.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.4

- 61) Behaviors are diverse and important for survival and reproduction. Some behaviors are learned, such as the species-specific song of a yellow warbler that is different from the song of a blue-winged warbler. Other behaviors are innate, such as a female cat in heat urinating more often and in many places to attract a mate or the honeybees' "dance" that indicates the distance and direction of a food source when they return to their hive. Which of the following statements supports the idea that behaviors are important in survival and therefore affect natural selection?

- A) Learned behaviors always increase fitness.
- B) Innate behaviors are the result of selection for individual survival and reproductive success.
- C) All behaviors are survival mechanisms that increase reproductive fitness by increasing mutation rates.
- D) Both innate and learned behaviors are entirely based on genes inherited from parents.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 51.1

62) A male stickleback fish will attack other male sticklebacks that invade its nesting territory. It will only attack male fish, which display the red belly characteristic of the species. Why has natural selection favored this behavior?

- A) The behavior reduces competition between species, which gives the male stickleback access to more food.
- B) The behavior allows the male stickleback to attract females with its aggressive display.
- C) The behavior allows the male to establish a defined space for breeding with female sticklebacks.
- D) The behavior is a mechanism to reduce predation and resource competition.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 51.1

63) A vampire bat sharing blood with another bat that is not its kin is an example of _____.

- A) optimal foraging behavior
- B) reciprocal altruism
- C) learned behavior
- D) agonistic behavior

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 51.4

51.2 Student Edition End-of-Chapter Questions

1) Which of the following is true of innate behaviors?

- A) Their expression is only weakly influenced by genes.
- B) They occur with or without environmental stimuli.
- C) They are expressed in most individuals in a population.
- D) They occur in invertebrates and some vertebrates but not mammals.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

2) According to Hamilton's rule,

- A) natural selection does not favor altruistic behavior that causes the death of the altruist.
- B) natural selection favors altruistic acts when the resulting benefit to the recipient, corrected for relatedness, exceeds the cost to the altruist.
- C) natural selection is more likely to favor altruistic behavior that benefits an offspring than altruistic behavior that benefits a sibling.
- D) the effects of kin selection are larger than the effects of direct natural selection on individuals.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

3) Female spotted sandpipers aggressively court males and, after mating, leave the clutch of young for the male to incubate. This sequence may be repeated several times with different males until no available males remain, forcing the female to incubate her last clutch. Which of the following terms best describes this behavior?

- A) polygyny
- B) polyandry
- C) promiscuity
- D) certainty of paternity

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

4) A region of the canary forebrain shrinks during the nonbreeding season and enlarges when breeding season begins. This change is probably associated with the annual

- A) addition of new syllables to a canary's song repertoire.
- B) crystallization of subsong into adult songs.
- C) sensitive period in which canary parents imprint on new offspring.
- D) elimination of the memorized template for songs sung the previous year.

Answer: A

Bloom's Taxonomy: Application/Analysis

5) Although many chimpanzees live in environments with oil palm nuts, members of only a few populations use stones to crack open the nuts. The likely explanation is that

- A) the behavioral difference is caused by genetic differences between populations.
- B) members of different populations have different nutritional requirements.
- C) the cultural tradition of using stones to crack nuts has arisen in only some populations.
- D) members of different populations differ in learning ability.

Answer: C

Bloom's Taxonomy: Application/Analysis

6) Which of the following is *not* required for a behavioral trait to evolve by natural selection?

- A) In each individual, the form of the behavior is determined entirely by genes.
- B) The behavior varies among individuals.
- C) An individual's reproductive success depends in part on how the behavior is performed.
- D) Some component of the behavior is genetically inherited.

Answer: A

Bloom's Taxonomy: Application/Analysis

52.1 Multiple-Choice Questions

1) If an ecologist were studying the regional interactions among multiple populations of different species and how they influence the exchange of materials between their various environments, then this would be an example of which kind of research?

- A) landscape ecology
- B) population ecology
- C) global ecology
- D) ecosystem ecology

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 52.1

2) What would happen to the seasons if Earth were tilted 35 degrees off its orbital plane instead of the usual 23.5 degrees?

- A) The seasons would disappear.
- B) Winters and summers would be more severe.
- C) Winters and summers would be less severe.
- D) The seasons would be shorter.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 52.1

3) Which of the following causes seasons on Earth?

- A) the variation in proximity of the Earth to the sun at different times of the year
- B) the constant tilt of the Earth, combined with its orbit around the sun
- C) the distance between the Earth and the sun in winter versus in the summer
- D) the variation or wobble of Earth's tilt during the year

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.1

4) Which of the following might be an investigation of microclimate?

- A) the effect of ambient temperature on the onset of caribou migration
- B) the seasonal population fluctuation of nurse sharks in coral reef communities
- C) competitive interactions among various species of songbirds during spring migration
- D) how sunlight intensity affects plant community composition in the zone where a forest transitions into a meadow

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 52.1

5) In creating global climate patterns, which of the following factors is the primary cause of all of the other factors that are listed?

- A) precipitation differences between tropical and polar regions
- B) global ocean currents
- C) global wind patterns
- D) variation in the heating of Earth's surface

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.1

6) For mountain ranges that are subjected to prevailing winds, why is the climate drier on the leeward (downwind) side?

- A) Deserts create dry conditions on the leeward side of mountain ranges.
- B) The sun illuminates the leeward side of mountain ranges at a more direct angle, converting to heat energy, which evaporates most of the water present.
- C) Pushed by the prevailing winds on the windward side, air is forced to rise, cool, condense, and drop its precipitation, leaving drier air to descend the leeward side.
- D) Air masses pushed by the prevailing winds are stopped by mountain ranges and the moisture is used up in the stagnant air masses on the leeward side.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.1

7) What would be the effect on climate in the temperate latitudes if Earth were to slow its rate of rotation from a 24-hour period of rotation to a 48-hour period of rotation?

- A) Seasons would be longer and more distinct (colder winters and warmer summers).
- B) Large-scale weather events such as tornadoes and hurricanes would no longer be a part of regional climates.
- C) Winter seasons in both the northern and southern hemispheres would have more abundant and frequent precipitation events.
- D) There often would be a larger range between daytime high and nighttime low temperatures.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 52.1

8) Subtropical plants are commonplace in Land's End, England, whose latitude is the equivalent of Labrador in coastal Canada, where the local flora is instead subarctic. Which statement best explains why this apparent anomaly exists between North America and Europe?

- A) Labrador does not get enough rainfall to support the subtropical flora found in Land's End.
- B) Warm ocean currents interact with England, whereas cold ocean currents interact with Labrador.
- C) Rainfall fluctuates greatly in England; rainfall is consistently high in Labrador.
- D) Labrador receives sunlight of lower duration and intensity than does Land's End.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.1

9) In mountainous areas of western North America, north-facing slopes would be expected to _____.

- A) receive more sunlight than similar southern exposures
- B) be warmer and drier than comparable southern-exposed slopes
- C) support biological communities similar to those found at lower elevations on similar south-facing slopes
- D) support biological communities similar to those found at higher elevations on similar south-facing slopes

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 52.1

10) In the region of the Rocky Mountains, imagine that one local variety of Ponderosa pine (*Pinus ponderosa*) predominantly occurs between 5,000-8,500 feet in elevation, where it can best tolerate temperatures and precipitation. If future climate change in this region causes the temperature to increase and rainfall to decrease, then which of the following changes might an ecologist predict about the variety's range?

- A) that variety will occur at lower elevations
- B) that variety will occur at higher elevations
- C) that variety will occur at lower elevations and/or lower latitudes
- D) that variety will occur at higher elevations and/or higher latitudes

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 52.1

11) Imagine some cosmic catastrophe jolts Earth so that its axis is perpendicular to the orbital plane between Earth and the sun. The most obvious effect of this change would be _____.

- A) the elimination of tides
- B) an increase in the length of a year
- C) a decrease in temperature at the equator
- D) the elimination of seasonal variation

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 52.1

12) The main reason polar regions are cooler than the equator is that _____.

- A) solar radiation strikes the poles at a lower angle and travels through more atmosphere
- B) the poles are farther from the sun than is the equator
- C) the polar atmosphere is thinner and contains fewer greenhouse gases
- D) the poles are permanently tilted away from the sun

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.1

13) The success of plants extending their range northward following glacial retreat is primarily determined by _____.

- A) whether there is simultaneous migration of herbivores
- B) their tolerance to shade
- C) their seed dispersal rate
- D) their tolerance to cooler temperatures

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 52.1

14) As climate changes because of global warming, plant species' ranges in the northern hemisphere may move northward. The trees that are most likely to avoid extinction in such an environment are those that _____.

- A) have larger, more contiguous established populations to begin with
- B) produce well-provisioned seeds
- C) have seeds that become viable only after a forest fire
- D) disperse many seeds in close proximity to the parent tree

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 52.1

15) Generalized global air circulation and precipitation patterns are caused by _____.

- A) solar radiation that warms moist air masses near the equator, which then cool and release precipitation as they rise, and then, at high altitude, move north or south of the tropics and sink back to the surface as dry air masses
- B) air masses that are dried and heated over continental areas, which then rise, cool aloft, and descend over oceanic areas, followed by a return flow of moist air from ocean to land, delivering high amounts of precipitation to coastal areas
- C) polar, cool, moist, high-pressure air masses from the poles that move along the surface, releasing precipitation along the way to the equator, where they are heated and dried
- D) solar radiation that warms dry air masses at the poles, causing them to sink toward the tropics, gain moisture, and then release it as precipitation.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 52.1

16) At 15-30°N, air masses formed over the Pacific Ocean are moved by prevailing westerlies, where they encounter extensive north-south mountain ranges. Which statement best describes the outcome of this encounter between a landform and an air mass?

- A) The cool, moist Pacific air heats as it rises, releasing its precipitation as it passes the tops of the mountains. This now warm and dry air cools as it descends on the leeward side of the range.
- B) The warm, moist Pacific air rises and cools, releasing precipitation as it moves up the windward side of the range. This now cool and dry air mass heats up as it descends on the leeward side of the range.
- C) The cool, dry Pacific air heats up and picks up moisture from evaporation of the snowcapped peaks of the mountain range, releasing this moisture as precipitation when the air cools while descending on the leeward side of the range.
- D) These air masses are blocked by the mountain ranges, producing high annual amounts of precipitation on the windward sides of these mountain ranges.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 52.1

17) Coral reefs occur on the southeast coast of the United States but not at similar latitudes on the southwest coast. Differences in which of the following most likely account for this?

- A) air temperatures driven by precipitation
- B) day length
- C) water temperatures driven by ocean currents
- D) salinity differences

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 52.1

18) Which of the following investigations would shed the most light on the future distribution of organisms in temperate regions that are faced with climate change?

- A) Remove, to the mineral soil, all of the organisms from an experimental plot, and monitor the colonization of the area over time in terms of both species diversity and abundance.
- B) Look at the climatic changes that occurred since the last ice age and how species redistributed as glaciers melted, then make predictions on future distribution in species based on past trends.
- C) Compare and contrast the flora and fauna of warm/cold/dry/wet climates to shed light on how they evolved to be suited to their present-day environment.
- D) Quantify the impact of man's activities on present-day populations of threatened and endangered species to assess the rate of extirpation and extinction.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 52.1

19) Generally speaking, deserts are located in places where air masses are usually _____.

- A) tropical
- B) ascending
- C) at the start of trade winds
- D) descending

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.1

20) When climbing a mountain, we can observe transitions in biological communities that are analogous to the changes _____.

- A) in biomes at different latitudes
- B) in a community through different seasons
- C) in an ecosystem as it evolves over time
- D) across the United States from east to west

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 52.2

21) If the direction of Earth's rotation reversed, the most predictable effect would be _____.

- A) an elimination of deserts and increase in tropics
- B) winds blowing from west to east along the equator
- C) a loss of seasonal variation at high latitudes
- D) the elimination of ocean currents

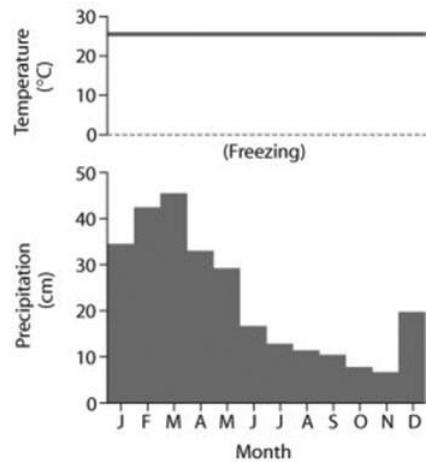
Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

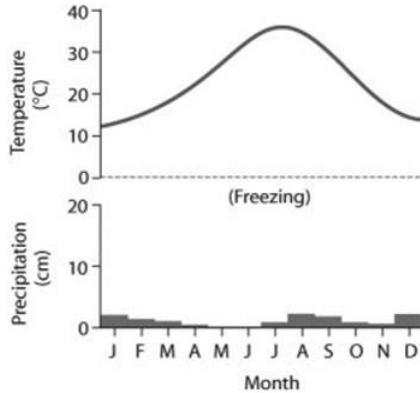
Section: 52.1

22) Use the following figures to answer the question below.

Area 1:



Area 2:



Based on the data in the figures, which of the following statements are correct?

- I) Area 1 would be considered a desert because of its high average temperature.
- II) Area 1 has more average precipitation than Area 2.
- III) Area 2 would be considered a desert because of its low average precipitation.
- IV) Area 2 has a larger annual temperature variation.

- A) only I and III
- B) only II and IV
- C) only I, II, and IV
- D) only II, III, and IV

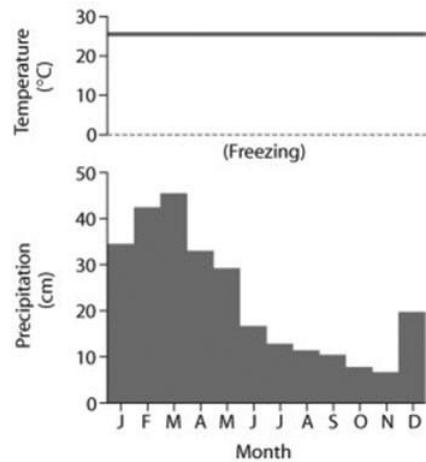
Answer: D

Bloom's Taxonomy: Application/Analysis

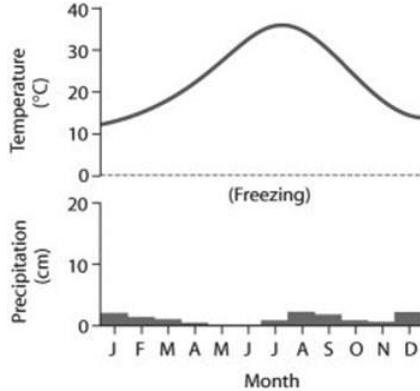
Section: 52.2

23) Use the following figures to answer the question below.

Area 1:



Area 2:



Based on the data in the figures, which of the following statements are correct?

- I) Area 1 has more average precipitation than Area 2.
- II) Area 1 has a higher average temperature than Area 2.
- III) Both areas have low variation in monthly precipitation.
- IV) Area 2 has a lower annual temperature variation compared to Area 1.

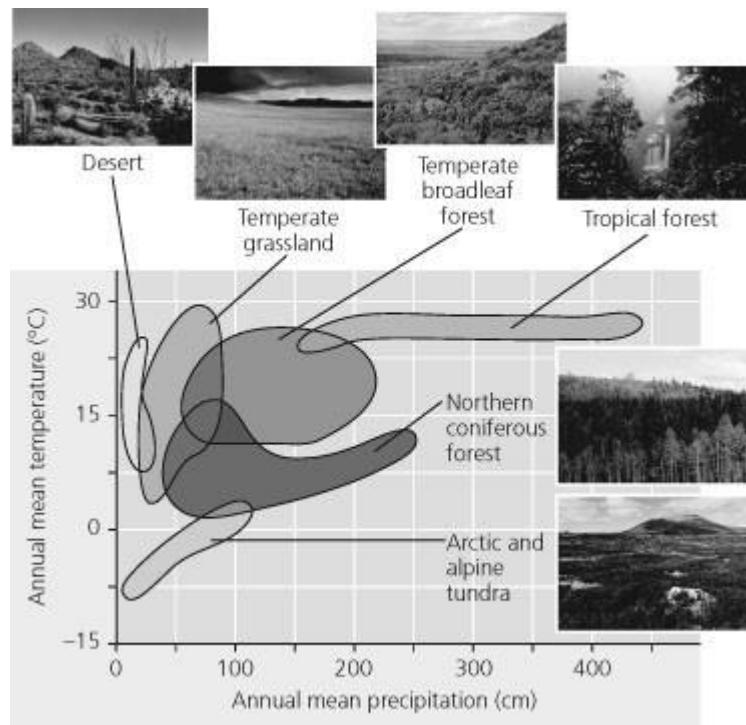
- A) only I and III
- B) only II and IV
- C) only II, III, and IV
- D) only I, II, and III

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 52.2

24) Use the following figures to answer the question below.



East of the Mississippi River, in Hopkinsville Kentucky, the mean annual precipitation is 130 cm. The mean annual temperature is 14.3°C. In the winter, the mean temperature is 7.3°C, while in summer it is 20.6°C. Using the climograph shown here, how would we classify the biome found in Hopkinsville?

- A) temperate rainforest
- B) temperate broadleaf forest
- C) shrubland during the winter, temperate forest during the summer
- D) temperate forest during the winter, tropical seasonal forest during the summer
- E) Biomes are not defined by annual values. It really depends on what season you're in.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 52.2

25) Which of the following biomes spans the largest annual mean temperature range, but the narrowest mean precipitation range?

- A) tropical forest
- B) temperate forest
- C) desert
- D) taiga

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 52.2

26) If global warming continues at its present rate, which biomes will likely take the place of the coniferous forest (taiga)?

- A) temperate broadleaf forest and grassland
- B) desert and chaparral
- C) tropical forest and savanna
- D) chaparral and temperate broadleaf forest

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 52.2

27) If you conclude that vegetation at every point on Earth exactly resembles the predicted biome distribution in a climograph, then _____.

- A) you are ignoring human land use changes or impacts, which have highly altered many regions within biomes
- B) the biome spanning the smallest combined ranges in precipitation and temperature is the tundra
- C) the biome most sensitive (in danger) from global warming is the desert
- D) you are ignoring the fact that local differences in soil, elevation, or topography can result in considerably different plant communities that are embedded within named biomes

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 52.2

28) Which of the following statements best describes the interaction between fire and ecosystems?

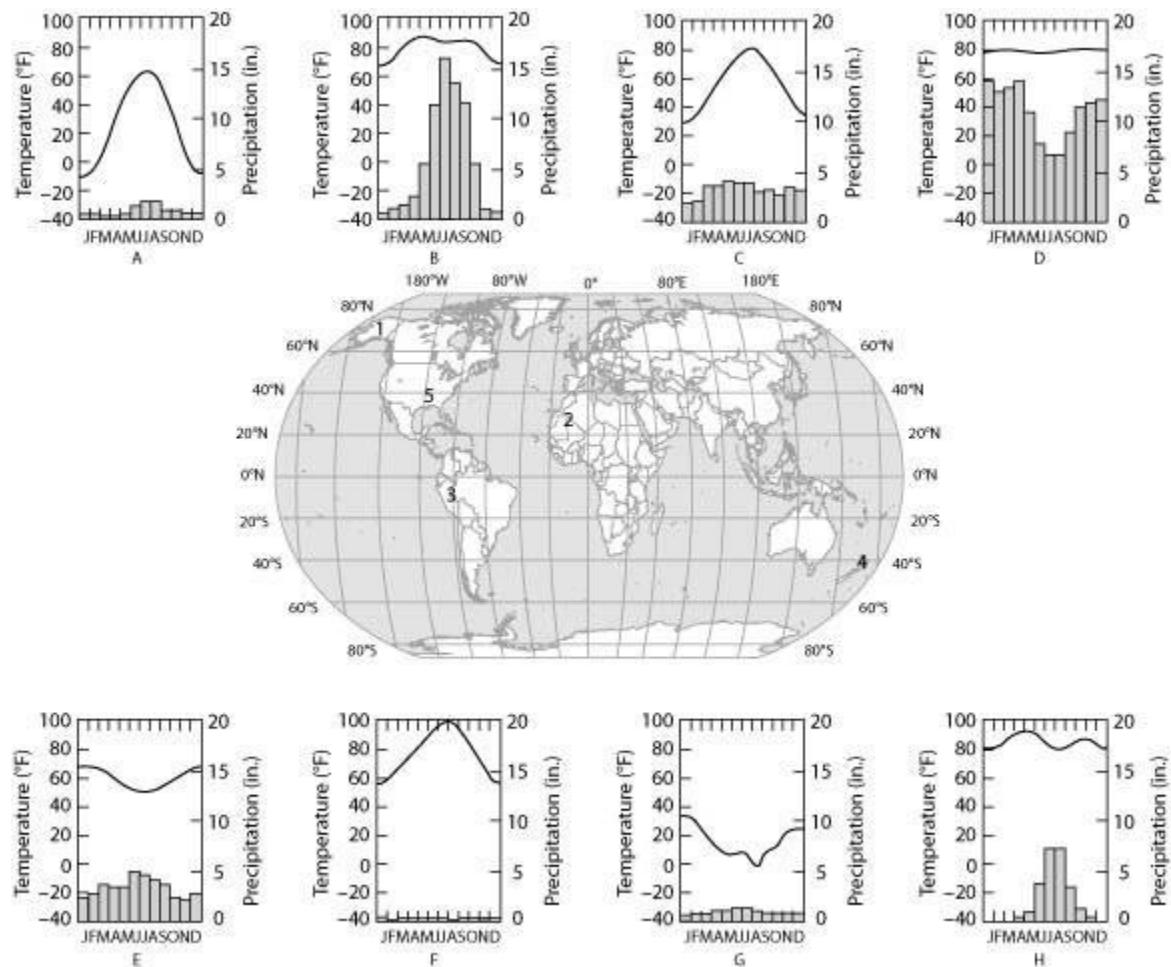
- A) The likelihood of a wildfire occurring in a given ecosystem is highly predictable over the short term.
- B) Many kinds of plants and plant communities have adapted to frequent fires.
- C) The suppression of forest fires by humans has prevented certain communities, such as grasslands, from reaching their climax stage.
- D) Chaparral communities have evolved to the extent that they rarely burn.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 52.2

29) The eight climographs show yearly temperature (line graph and left vertical axis) and precipitation (bar graph and right vertical axis) averages for each month for some locations on Earth.



Which climograph shows the climate for location 1?

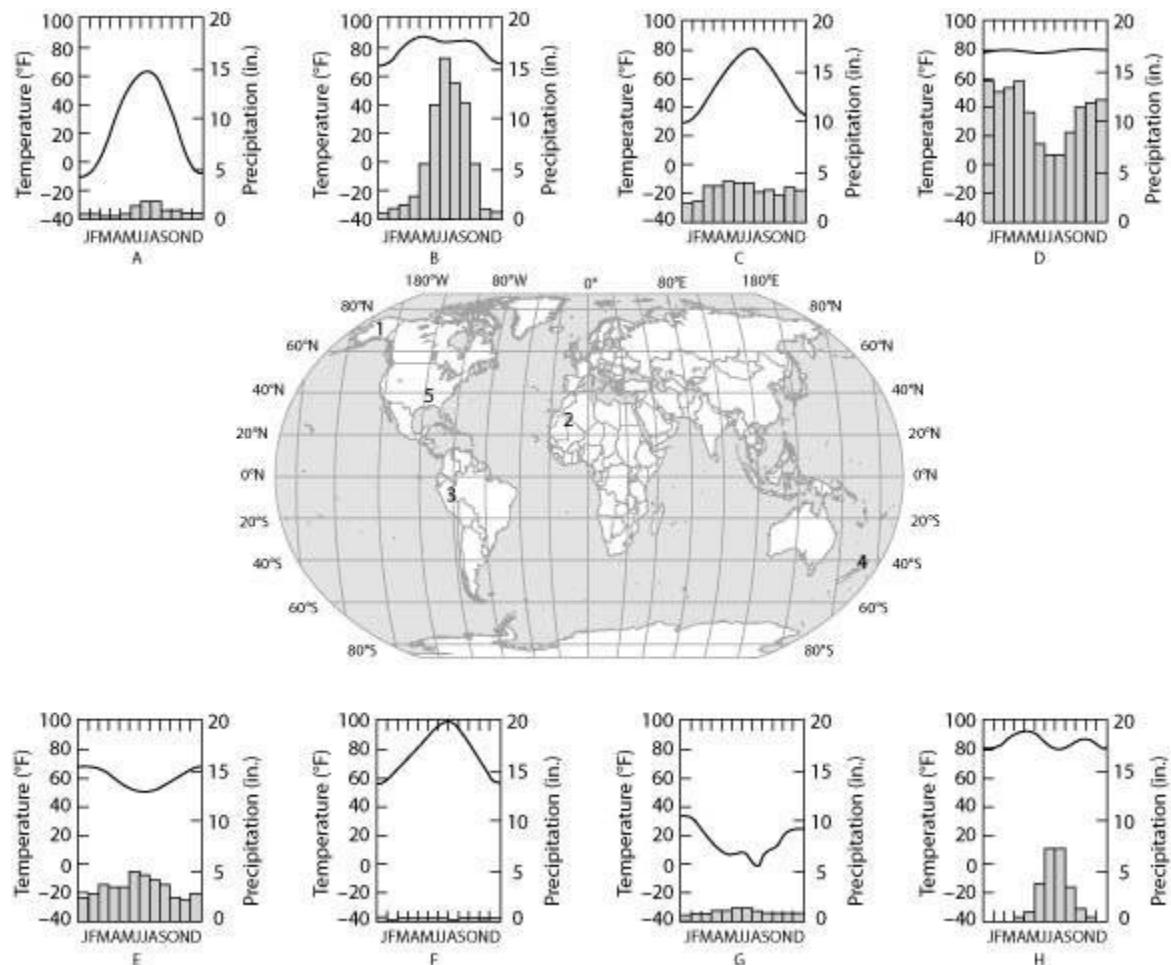
- A) A
- B) C
- C) E
- D) H

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 52.2

30) The eight climographs show yearly temperature (line graph and left vertical axis) and precipitation (bar graph and right vertical axis) averages for each month for some locations on Earth.



Which climograph shows the climate for location 2?

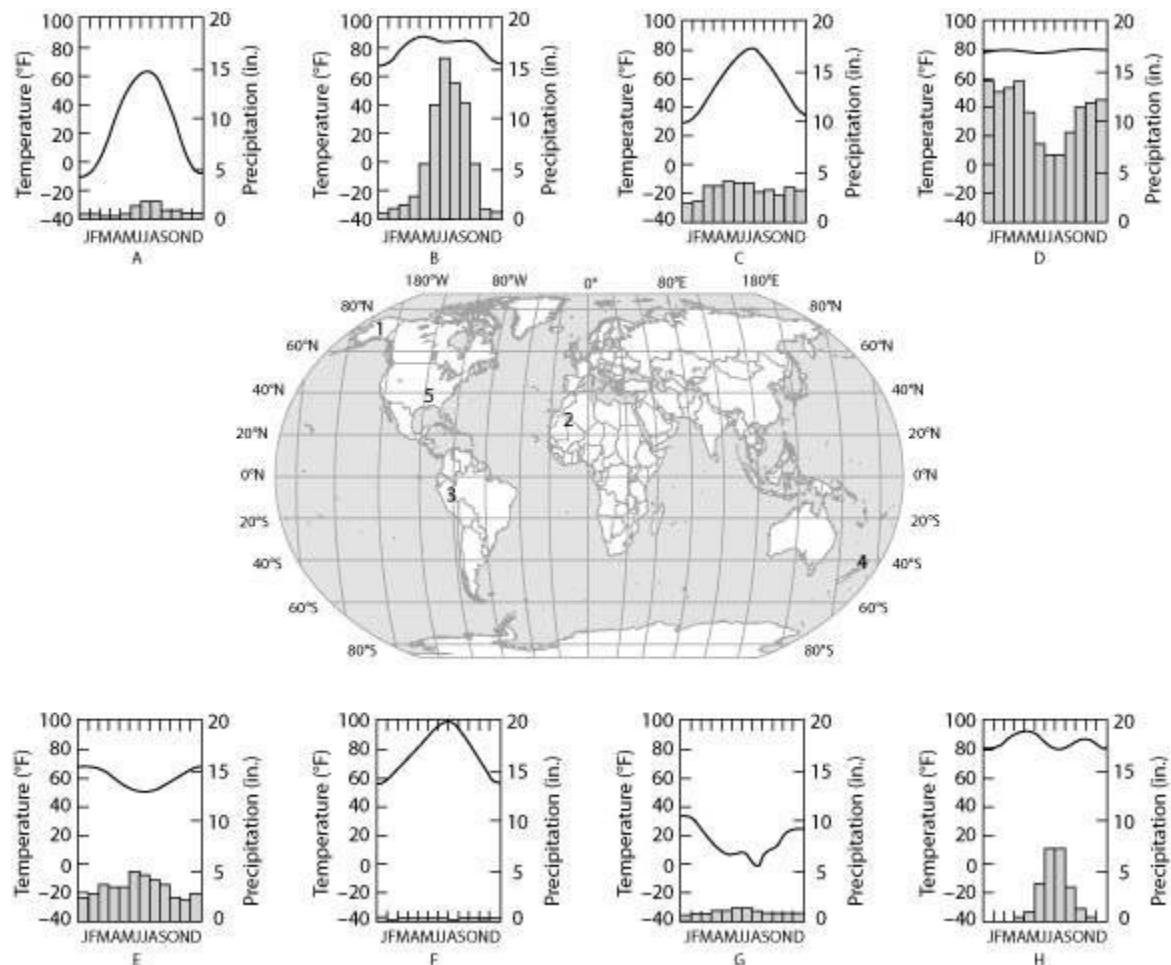
- A) C
- B) D
- C) F
- D) H

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 52.2

31) The eight climographs show yearly temperature (line graph and left vertical axis) and precipitation (bar graph and right vertical axis) averages for each month for some locations on Earth.



Which climograph shows the climate for location 3?

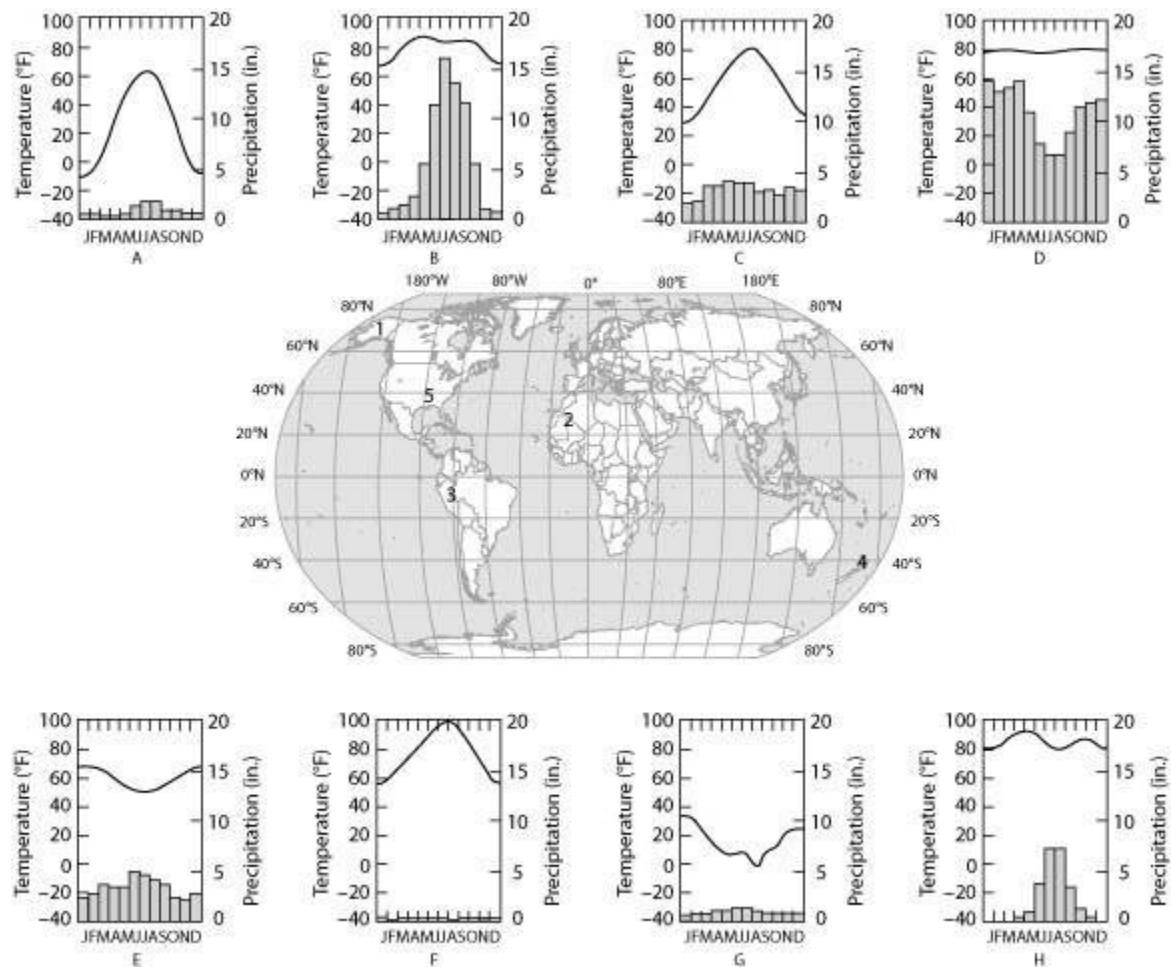
- A) B
- B) C
- C) D
- D) E

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 52.2

32) The eight climographs show yearly temperature (line graph and left vertical axis) and precipitation (bar graph and right vertical axis) averages for each month for some locations on Earth.



Which climograph shows the climate for location 4?

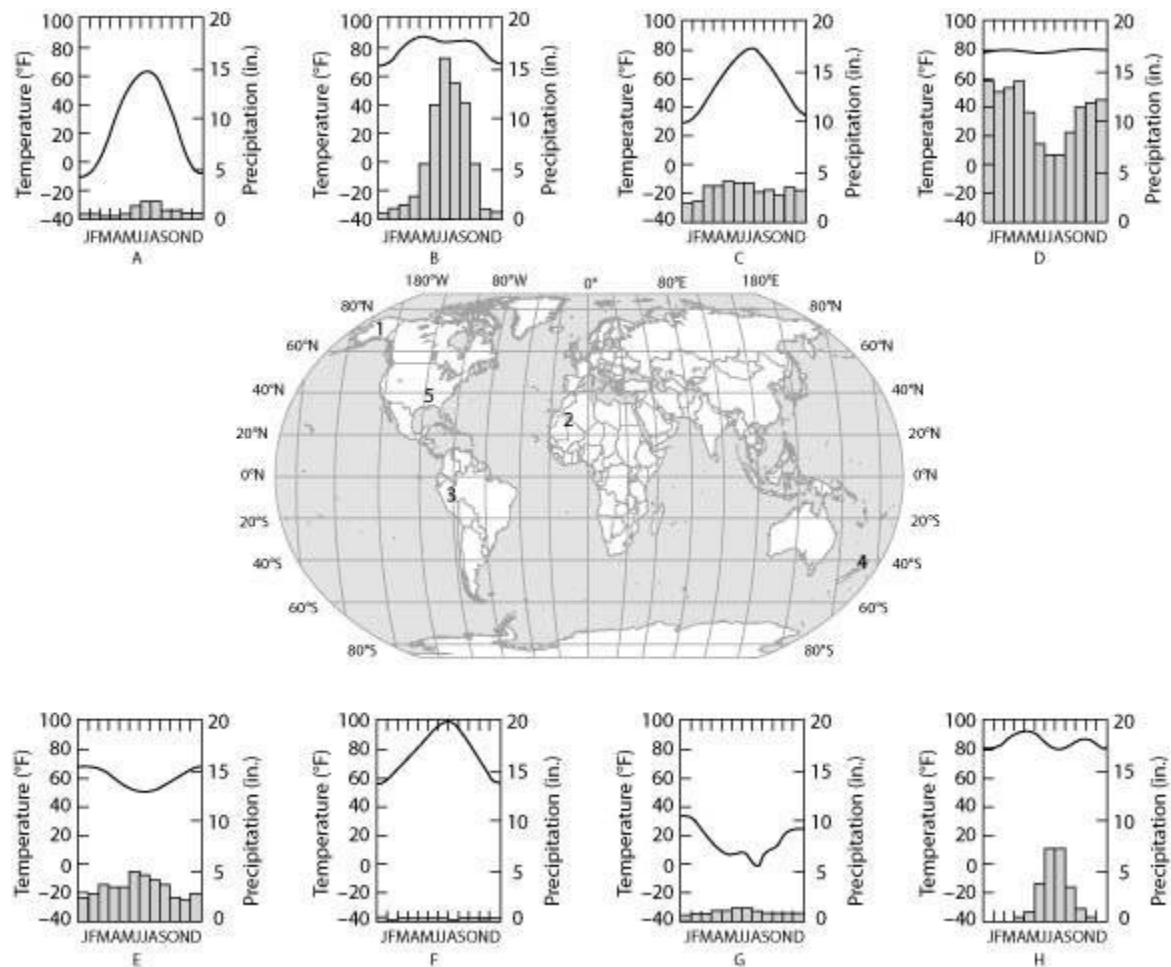
- A) A
- B) C
- C) E
- D) G

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 52.2

33) The eight climographs show yearly temperature (line graph and left vertical axis) and precipitation (bar graph and right vertical axis) averages for each month for some locations on Earth.



Which climograph shows the climate for location 5?

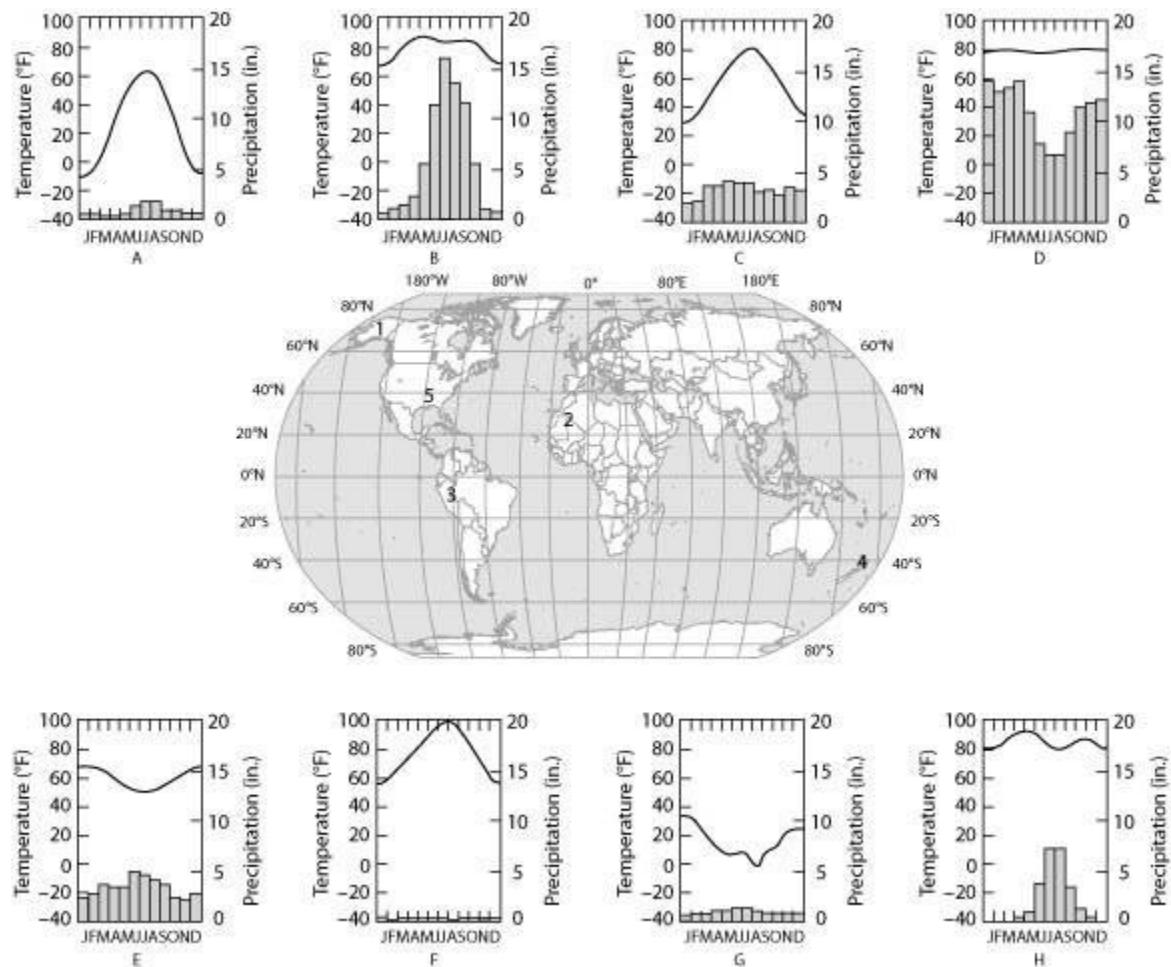
- A) A
- B) C
- C) D
- D) H

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 52.2

34) The eight climographs show yearly temperature (line graph and left vertical axis) and precipitation (bar graph and right vertical axis) averages for each month for some locations on Earth.



What would be the primary factor, other than precipitation or temperature, that could change the description of a site near location 3 from an equatorial (tropical) climate to alpine tundra?

- A) ocean currents
- B) soil type
- C) elevation
- D) rain shadow

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.2

35) In areas of permafrost, stands of black spruce are frequently observed in the landscape, while other tree species are noticeably absent. Often these stands are referred to as "drunken forests" because many of the black spruce often "lean over" (that is, they are displaced from their normal vertical alignment). What is the most likely explanation for the unusual growth of these forests in this marginal habitat?

- A) Branches are adapted to absorb more carbon dioxide with this displaced alignment.
- B) Taproot formation is impossible, so trees developed shallow root beds.
- C) Trees are tilted so snow prevents them from breaking or tipping over.
- D) Trees tip so that they do not compete with each other for sunlight.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 52.2

36) Which of the following is an important feature of most terrestrial biomes?

- A) annual average rainfall in excess of 250 centimeters
- B) a distribution predicted almost entirely by rock and soil patterns
- C) clear boundaries between adjacent biomes
- D) vegetation demonstrating vertical layering

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.2

37) Suppose that the number of bird species is determined mainly by the number of vertical strata found in the environment. If so, in which of the following biomes would you find the greatest number of bird species?

- A) tundra
- B) savanna
- C) temperate broadleaf forest
- D) temperate grassland

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 52.2

38) Two plant species live in the same biome but on different continents. Although the two species are not at all closely related, they may appear quite similar as a result of _____.

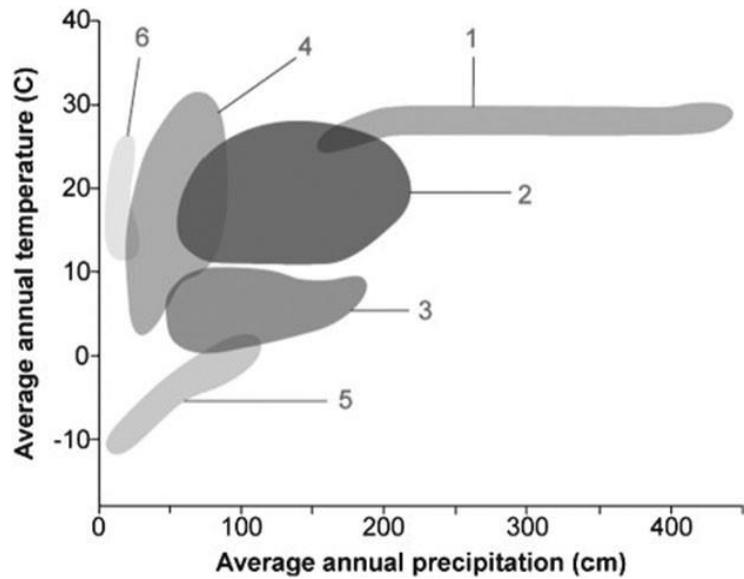
- A) convergent evolution
- B) allopatric speciation
- C) introgression
- D) gene flow

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.2

39) Use the following figure to answer the question below.



In the figure, which number would designate the arctic tundra biome?

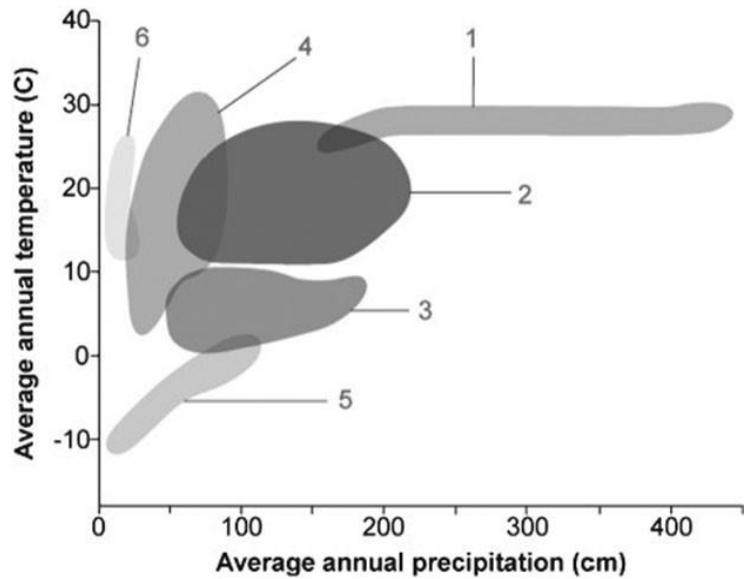
- A) 2
- B) 3
- C) 4
- D) 5

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.2

40) Use the following figure to answer the question below.



In the figure, which number would designate the biome with the highest variation in both annual precipitation and temperature?

- A) 1
- B) 2
- C) 3
- D) 4

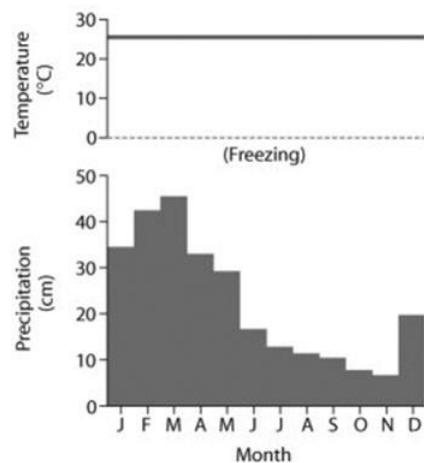
Answer: B

Bloom's Taxonomy: Application/Analysis

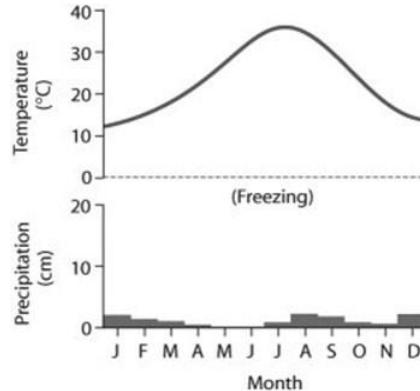
Section: 52.2

41) Use the following figures to answer the question below.

Area 1:



Area 2:



Based on the data in the figures, which of the following statements is accurate?

- A) Area 1 could be called a boreal forest/taiga.
- B) Area 2 could be called a temperate grassland.
- C) Area 1 could be called a tropical wet/rain forest.
- D) Area 2 could be tundra.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.2

42) In deep water, which of the following abiotic factors would most limit primary productivity?

- A) temperature
- B) light availability
- C) solute concentration
- D) chemical composition of the sea floor

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 52.3

43) Wetlands are standing bodies of freshwater, just like lakes and ponds. However, wetlands are different from lakes and ponds because wetlands have _____.

- A) emergent vegetation
- B) oxygen-poor water
- C) shallow water and emergent vegetation
- D) emergent vegetation and oxygen-poor water

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.3

- 44) Which of the following statements regarding turnover in a lake is correct?
- A) In fall turnover, dense water at 4°C sinks and disturbs sediments in the benthic zone.
 - B) In fall turnover, dense water at 4°C rises and disturbs sediments in the benthic zone.
 - C) The surface water gets to 4°C only by cooling.
 - D) Fall turnovers and spring turnovers are exactly the same.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.3

- 45) A fish swimming into an estuary from a river would have which of the following as its greatest physiological challenge?
- A) The high water flow would make the fish expend more energy.
 - B) The low oxygen content would give the fish difficulty in swimming aerobically.
 - C) The temperature change would stress the fish by denaturing its proteins.
 - D) The change in water solute content would challenge the osmotic balance of the fish.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.3

- 46) Which of the following types of organisms is likely to have the widest geographic distribution?
- A) bacteria
 - B) songbirds
 - C) bears
 - D) lizards

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 52.4

- 47) Which of the following statements can be accurately made about light in aquatic environments?
- A) Water equally reflects and absorbs all wavelengths of light.
 - B) Longer wavelengths penetrate to greater depths.
 - C) Light penetration largely limits the distribution of photosynthetic species.
 - D) Most photosynthetic organisms avoid the surface where the light is too intense.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 52.3

48) Turnover of water in temperate lakes during the spring and fall is caused by which of the following?

- A) warm, less dense water layered at the top
- B) cold, more dense water layered at the bottom
- C) a distinct thermocline between less dense, warm water and cold, dense water
- D) the changes in the density of water as seasonal temperatures change

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 52.3

49) Imagine that a deep temperate zone lake did not turn over during the spring and fall seasons. Based on the physical and biological properties of limnetic ecosystems, what would be the difference from normal seasonal turnover?

- A) The lake would fail to freeze over in winter.
- B) An algal bloom of algae would result every spring.
- C) Lakes would suffer a nutrient depletion in surface layers.
- D) The pH of the lake would become increasingly alkaline.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 52.3

50) If you are interested in observing a relatively simple community structure in a clear water lake, you would do well to choose diving into _____.

- A) an oligotrophic lake
- B) a eutrophic lake
- C) a relatively shallow lake
- D) a nutrient-rich lake

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 52.3

51) Which aquatic biome listed here is one of the most productive on Earth, and why?

- A) deep-sea vent, warm water temperatures
- B) coral reef, diversity of organisms
- C) wetlands, nutrient rich high-moisture soils
- D) oligotrophic lake, clear water for light penetration

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.3

52) The ocean ecosystems affect the biosphere by _____.

- I) producing a substantial amount of the biosphere's oxygen
- II) adding carbon dioxide to the atmosphere
- III) being the source of most of Earth's rainfall
- IV) regulating the pH of freshwater biomes and terrestrial groundwater

- A) only I and III
- B) only II and IV
- C) only I, II, and IV
- D) only I, II, and III

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.3

53) Which of the following is responsible for the differences in summer and winter temperature stratification of deep temperate zone lakes?

- A) Water is most dense at 4°C.
- B) Oxygen is most abundant in deeper waters.
- C) Winter ice sinks in the summer.
- D) Stratification is caused by a thermocline.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 52.3

54) Which of these environmental factor(s) is/are the key determining factor(s) that control(s) the biotic structure of aquatic biomes?

- A) average annual air temperature and precipitation
- B) seasonal fluctuation of water temperature
- C) oxygen concentrations and nutrient levels
- D) salinity

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 52.3

55) A certain species of pine tree survives only in scattered locations at elevations above 2,800 meters in the western United States. To understand why this tree grows only in these specific places, an ecologist should _____.

- A) study the anatomy and physiology of this species
- B) investigate the various biotic and abiotic factors that are unique to high altitude
- C) analyze the soils found in the vicinity of these trees, looking for unique chemicals that may support their growth
- D) collect data on temperature, wind, and precipitation at several of these locations for a year

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 52.4

56) Organisms evolve over generations to become adapted to the environmental conditions to which they are exposed. The diversity of organisms that occurs in any particular area thus may be largely determined by the abiotic factors limiting survivorship and reproduction of organisms in a region. Which of the following limit the range of Saguaro cactus in North America?

- I) pollinators
- II) sunlight
- III) precipitation
- IV) temperature

- A) only I and III
- B) only II, III, and IV
- C) only I, III, and IV
- D) I, II, III and IV

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 52.4

57) Studying species transplants is a way that ecologists _____.

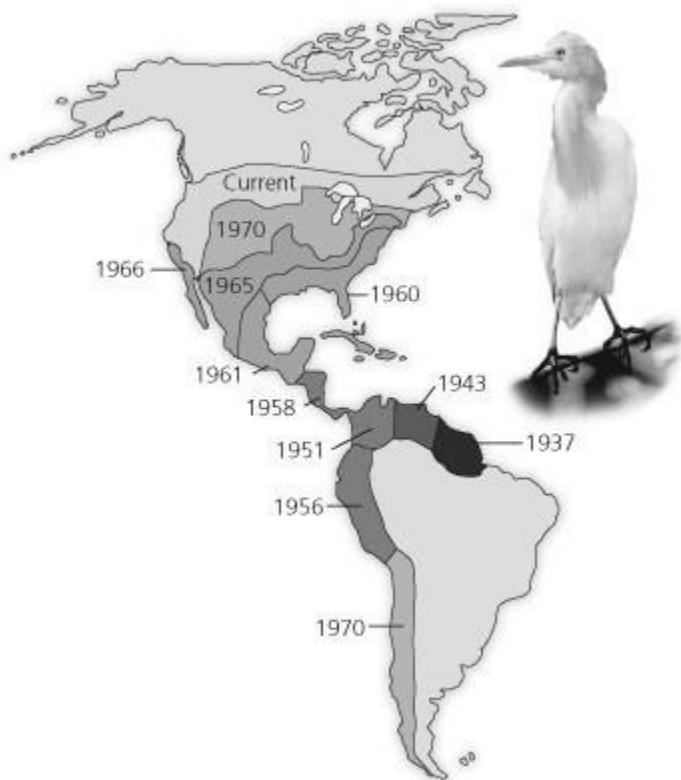
- A) determine the distribution of a species in a specified area
- B) develop mathematical models for distribution and abundance of organisms
- C) determine if dispersal is a key factor in limiting distribution of organisms
- D) consolidate a landscape region into a single ecosystem

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 52.4

58) Use the diagram showing the spread of the cattle egret, *Bubulcus ibis*, since its arrival in the New World, to answer the question.



The range of cattle egrets has expanded between 1937 and today. How would an ecologist likely best explain the expansion of the cattle egret?

- A) Climatic factors, such as sunlight, temperature, and precipitation, provide a suitable habitat for cattle egrets.
- B) There are no predators for cattle egrets in the New World, so they continue to expand their range.
- C) The abundant area and little competition with other birds occupying similar habitats met the biotic and abiotic requirements of the cattle egret expansion.
- D) The first egrets to colonize South America evolved into a new species capable of competing with the native species of herons and egrets.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 52.4

59) Which statements about dispersal are accurate?

- I) Dispersal is a common component of the life cycles of plants and animals.
- II) Colonization of devastated areas after floods or volcanic eruptions primarily depends upon climate.
- III) Seeds are important dispersal stages in the life cycles of most flowering plants.
- IV) Dispersal occurs only on an evolutionary time scale.

- A) only I and III
- B) only II and IV
- C) only I, II, and IV
- D) only II, III, and IV

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 52.4

60) Which of the following examples demonstrate an ecological effect leading to an evolutionary effect?

- A) When seeds are not plentiful, trees produce more seeds.
- B) A few individuals with denser fur survive the coldest years of an ice age, and the offspring of the reproducing survivors of the ice age will likely have more dense fur.
- C) Fish that swim the fastest in running water catch the most prey and more easily escape predation.
- D) The insects that spend the most time exposed to sunlight have the most mutations from UV light, and thus evolve the fastest

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 52.5

52.2 Student Edition End-of-Chapter Questions

1) Which of the following areas of study focuses on the exchange of energy, organisms, and materials between ecosystems?

- A) organismal ecology
- B) landscape ecology
- C) ecosystem ecology
- D) community ecology

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

2) Which lake zone would be absent in a very shallow lake?

- A) benthic zone
- B) aphotic zone
- C) pelagic zone
- D) littoral zone

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

3) Which of the following is characteristic of most terrestrial biomes?

- A) a distribution predicted almost entirely by rock and soil patterns
- B) clear boundaries between adjacent biomes
- C) vegetation demonstrating vertical layering
- D) cold winter months

Answer: C

Bloom's Taxonomy: Application/Analysis

4) The oceans affect the biosphere in all of the following ways *except*

- A) producing a substantial amount of the biosphere's oxygen.
- B) removing carbon dioxide from the atmosphere.
- C) moderating the climate of terrestrial biomes.
- D) regulating the pH of freshwater biomes and terrestrial groundwater.

Answer: D

Bloom's Taxonomy: Application/Analysis

5) Which statement about dispersal is *false*?

- A) Dispersal is a common component of the life cycles of plants and animals.
- B) Colonization of devastated areas after floods or volcanic eruptions depends on dispersal.
- C) Dispersal occurs only on an evolutionary time scale.
- D) The ability to disperse can expand the geographic distribution of a species.

Answer: C

Bloom's Taxonomy: Application/Analysis

6) When climbing a mountain, we can observe transitions in biological communities that are analogous to the changes

- A) in biomes at different latitudes.
- B) in different depths in the ocean.
- C) in a community through different seasons.
- D) in an ecosystem as it evolves over time.

Answer: A

Bloom's Taxonomy: Application/Analysis

7) Suppose that the number of bird species is determined mainly by the number of vertical strata found in the environment. If so, in which of the following biomes would you find the greatest number of bird species?

- A) tropical rain forest
- B) savanna
- C) desert
- D) temperate broadleaf forest

Answer: A

Bloom's Taxonomy: Application/Analysis

- 8) If the direction of Earth's rotation reversed, the most predictable effect would be
- A) a big change in the length of the year.
 - B) winds blowing from west to east along the equator.
 - C) a loss of seasonal variation at high latitudes.
 - D) the elimination of ocean currents.

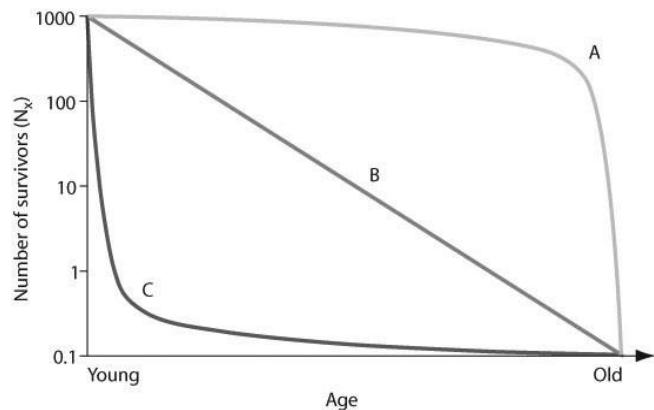
Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Campbell Biology, 11e (Urry)
Chapter 53 Population Ecology

53.1 Multiple-Choice Questions

- 1) Use the graph to answer the following question.



In the figure, which of the following survivorship curves implies that an animal may lay many eggs, of which a regular number die each year on a logarithmic scale?

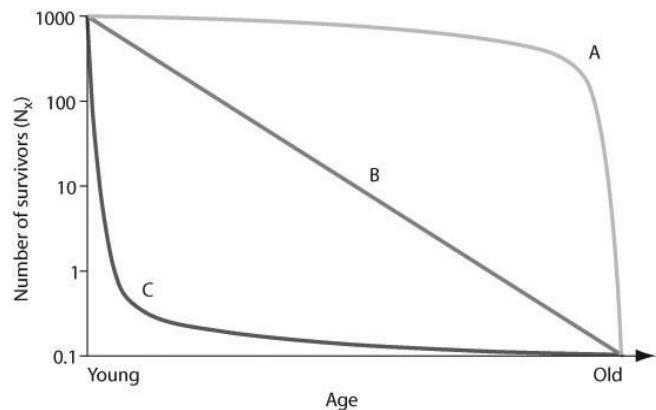
- A) curve A
- B) curve B
- C) curve C
- D) curves A or C

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.1

2) Use the graph to answer the following question.



In the figure, which of the following survivorship curves most applies to humans living in developed countries?

- A) curve A
- B) curve B
- C) curve C
- D) curve A or curve B

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.1

3) Use the figure to answer the following question.

Life Table for *Zootoca vivipara* in the Netherlands

Year	Number alive	Survivorship	Fecundity	Survivorship × Fecundity = Average Number of Offspring Produced per Female of Age x
0	1000	1.000	0.00	0.00
1	763	0.763	1.70	1.30
2	308	0.308	2.94	0.91
3	158	0.158	4.13	0.65
4	57	0.057	4.88	0.28
5	10	0.010	6.50	0.07
6	7	0.007	6.40	0.04
7	2	0.002	6.30	0.01

Data are from Strijbosch and Creemers, 1988.

Using the table, how would you describe the population dynamics of the Eurasian lizard, *Z. vivipara*?

- A) The population is increasing.
- B) The population is decreasing.
- C) The population is stable.
- D) The table does not provide this information.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 53.1

4) Use the figure to answer the following question.

Life Table for *Zootoca vivipara* in the Netherlands

Year	Number alive	Survivorship	Fecundity	Survivorship × Fecundity = Average Number of Offspring Produced per Female of Age x
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5	10	0.010	6.50	0.07
6	7	0.007	6.40	0.04
7	2	0.002	6.30	0.01

Data are from Strijbosch and Creemers, 1988.

Using the table, determine which age class year would cause the largest decline in the resulting population growth, if it were wiped out by disease.

- A) age class year 1
- B) age class year 2
- C) age class year 3
- D) age class year 4

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 53.1

5) Suppose researchers marked 800 turtles and later were able to trap a total of 300 individuals in that population, of which 150 were marked. What is the estimate for total population size?

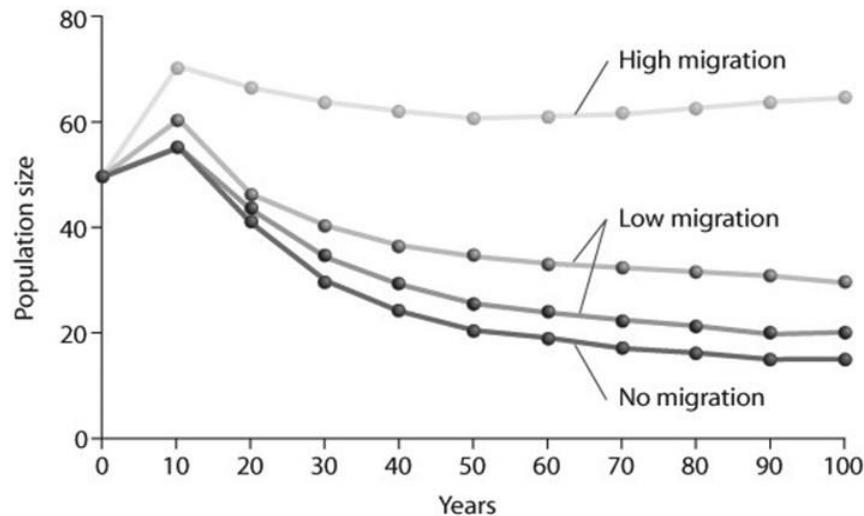
- A) 200
- B) 1,050
- C) 1,600
- D) 2,100

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 53.1

6) Use the graph to answer the following question.



Looking at the figure, what factor is contributing significantly to stabilizing the population size over time?

- I) no migration
- II) low migration
- III) high migration

- A) only I
- B) only II
- C) only III
- D) only II and III

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 53.1

7) Which of the following assumptions must be made regarding the mark-recapture estimate of population size?

- I) Marked and unmarked individuals have the same probability of being trapped.
- II) The marked individuals have thoroughly mixed with the population after being marked.
- III) No individuals have entered or left the population by immigration or emigration, and no individuals have been added by birth or eliminated by death during the course of the estimate.

- A) I only
- B) II only
- C) I and II only
- D) I, II, and III

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.1

8) Which of the following is the most important assumption for the mark-recapture method to estimate the size of wildlife populations?

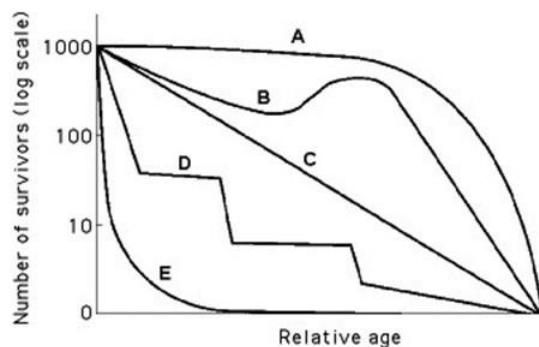
- A) More individuals emigrate from, as opposed to immigrate into, a population.
- B) Over 50% of the marked individuals were trapped during the recapture phase.
- C) There is a 50:50 ratio of males to females in the population before and after trapping and recapture.
- D) Marked individuals have the same probability of being recaptured as unmarked individuals during the recapture phase.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 53.1

9) Use the survivorship curves in the figure to answer the following question.



Which curve best describes survivorship in marine mollusks?

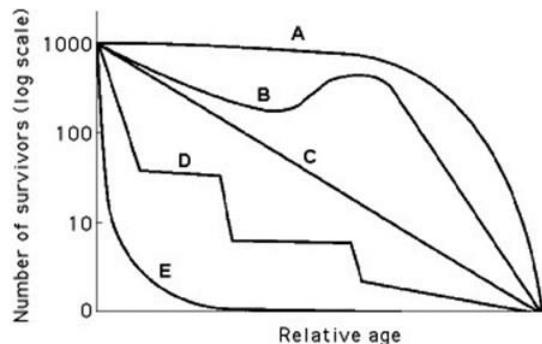
- A) A
- B) B
- C) C
- D) E

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 53.1

10) Use the survivorship curves in the figure to answer the following question.



Which curve best describes survivorship in elephants?

- A) A
- B) B
- C) C
- D) E

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 53.1

11) To measure the population of lake trout in a 250-hectare lake, 400 individual trout were netted and marked with a fin clip, then returned to the lake. The next week, the lake was netted again, and out of the 200 lake trout that were caught, 50 had fin clips. Using the mark-recapture estimate, the lake trout population size could be closest to which of the following?

- A) 200
- B) 400
- C) 1,600
- D) 80,000

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 53.1

12) Long-term studies of Belding's ground squirrels show that immigrants move nearly 2 kilometers from where they are born and become 1%-8% of the males and 0.7%-6% of the females in other populations. On an evolutionary scale, why is this significant?

- A) These immigrants make up for the deaths of individuals, keeping the other populations' size stable.
- B) These immigrants provide a source of genetic diversity for the other populations.
- C) Those individuals that emigrate to these new populations are looking for less crowded conditions with more resources.
- D) Gradually, the populations of ground squirrels will move from a clumped to a uniform population pattern of dispersion.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 53.1

13) Use the table to answer the following question.

Age (years) x	Number alive at start of year n_x	l_x
1	100	1.0
2	50	0.5
3	50	y
4	10	z

In the accompanying life table of a hypothetical population, what are the missing values for l_x (y and z)? l_x = the proportion alive at the start of year (age specific survivorship rate).

- A) $y = 0.5, z = 0.5$
- B) $y = 1.0, z = 0.5$
- C) $y = 0.5, z = 0.1$
- D) $y = 1.0, z = 0.2$

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 53.1

14) An ecologist recorded 12 white-tailed deer, *Odocoileus virginianus*, per square kilometer (km^2) in one woodlot and 20 km^2 in another woodlot. What was the ecologist comparing?

- A) density
- B) dispersion
- C) carrying capacity
- D) range

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 53.1

15) Uniform spacing patterns in plants such as the creosote bush are most often associated with _____.

- A) patterns of high humidity
- B) the random distribution of seeds
- C) competitive interaction between individuals of the same population
- D) the concentration of nutrients within the population's range

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.1

16) Which of the following groups would be most likely to exhibit uniform dispersion?

- A) red squirrels, who actively defend territories
- B) cattails, which grow primarily at edges of lakes and streams
- C) dwarf mistletoes, which parasitize particular species of forest tree
- D) lake trout, which seek out cold, deep water high in dissolved oxygen

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 53.1

- 17) Which of the following examples would most accurately measure the dispersion of a population being studied?
- A) counting the number of times a one-kilometer transect is intersected by tracks of red squirrels after a snowfall
 - B) measuring the distance between several burrows within a large prairie dog colony in a grassland
 - C) measuring the average distance between individuals and their nearest neighbor, and then analyzing the variation and comparing those measurements at larger scales
 - D) counting the number of zebras from airplane census observations

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 53.1

- 18) Which of the following scenarios would provide the most accurate data on population density?
- A) Count the number of nests of a particular species of songbird and multiply this by a factor that extrapolates these data to actual animals.
 - B) Count the number of pine trees in several randomly selected 10-meter-square plots and extrapolate this number to the fraction of the study area these plots represent.
 - C) Use the mark-recapture method to estimate the size of the population.
 - D) Calculate the difference between all of the immigrants and emigrants to see if the population is growing or shrinking.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 53.1

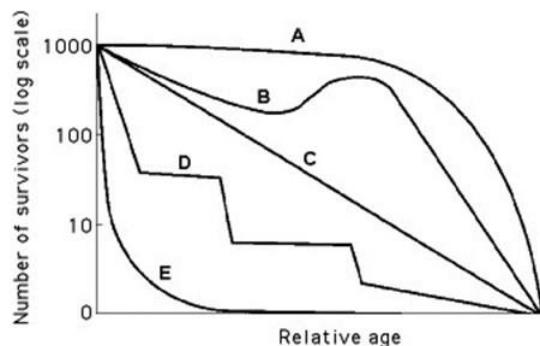
- 19) Which of the following is the best natural example of a uniform pattern of dispersion?
- A) bees collecting pollen in a wildflower meadow
 - B) moss spores floating in the wind to new locations of a forest
 - C) territorial songbirds in a mature forest during mating season
 - D) mushrooms growing on the floor of an old growth forest

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.1

20) Use the survivorship curves in the figure to answer the following question.



Which statement best explains survivorship curve B?

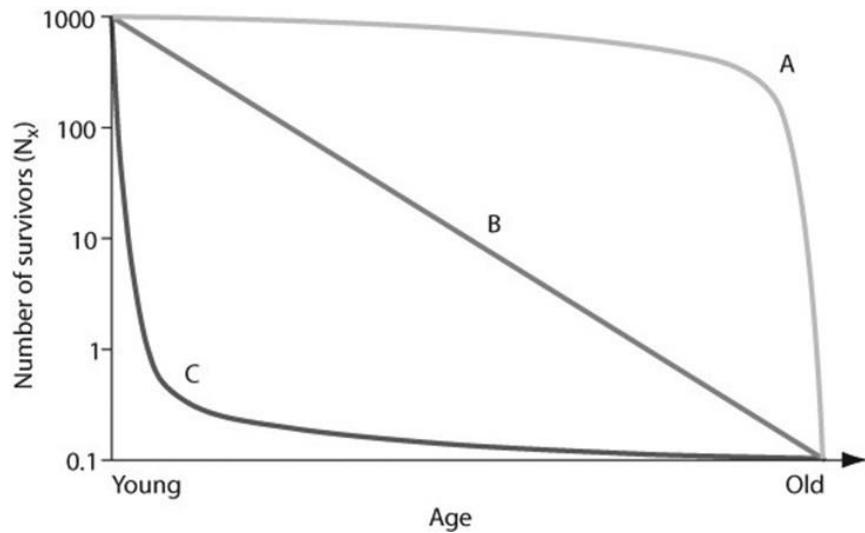
- A) It is likely a species that provides little postnatal care, but lots of care for offspring during midlife as indicated by increased survivorship.
- B) This curve is likely for a species that produces lots of offspring, only a few of which are expected to survive.
- C) It is likely a species where no individuals in the cohort die when they are at 60-70% relative age.
- D) Survivorship can only decrease; therefore, this curve could not happen in nature.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 53.1

21) Use the graph to answer the following question.



Which of the following examples are plausible explanations for a population that would produce curve A in the figure?

- I. Ongoing predation of rabbits throughout their lives
- II. Susceptibility of older humans to heart disease
- III. High seedling mortality in sunflowers

- A) I only
- B) II only
- C) I and II
- D) II and III

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 53.1

22) In July 2008, the United States had a population of approximately 302,000,000 people. How many Americans were there in July 2009, if the estimated 2008 growth rate was 0.88%?

- A) 567,760,000
- B) 304,657,600
- C) 304,000,000
- D) 2,657,600

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 53.2

23) In 2008, the population of New Zealand was approximately 4,275,000 people. If the birth rate was 14 births for every 1,000 people, approximately how many births occurred in New Zealand in 2008?

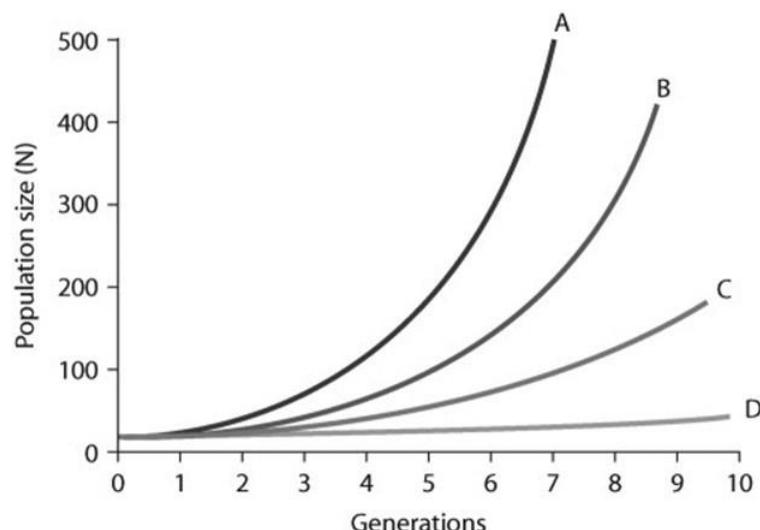
- A) 6,000
- B) 42,275
- C) 59,850
- D) 140,000

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 53.2

24) Use the graph to answer the following question.



In the figure, curves A-D depict per capita rate increases (r). Which of the following best explains the difference between the shapes of these curves?

- A) The population growth is logistic as generations continue to form.
- B) The growth is exponential for curves A and B, but because population growth for C and D is slower, it is considered logistic.
- C) Population growth within each curve gets steeper as time passes because growth depends on both per capita rates of increase and current population size.
- D) Curve A has the fastest rate of logistic growth.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 53.2

25) A population of ground squirrels has an annual per capita birth rate of 0.06 and an annual per capita death rate of 0.02. Using these birth and death rates, calculate an estimate of the total number of individuals added to (or lost from) a population of 1,000 individuals in one year.

- A) 120 individuals added
- B) 40 individuals added
- C) 20 individuals added
- D) 400 individuals added

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 53.2

26) Starting from a single individual, what is the size of a population of bacteria at the end of a 2-hour time period if they reproduce by binary fission every 20 minutes? (Assume unlimited resources and no mortality.)

- A) 16
- B) 32
- C) 64
- D) 128

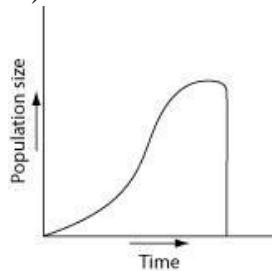
Answer: C

Bloom's Taxonomy: Application/Analysis

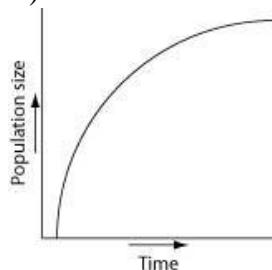
Section: 53.2

27) Which of the following graphs illustrates the population growth curve starting with a single bacterium growing in a flask of ideal medium at optimum temperature over a two-hour period? Assume resources do not become limiting over this time frame.

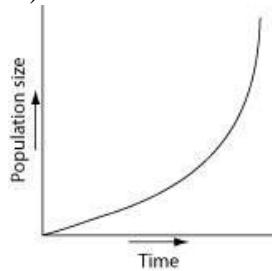
A)



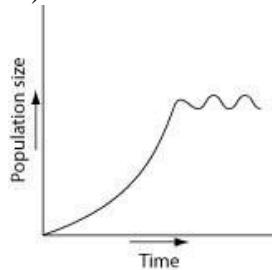
B)



C)



D)



Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 53.2

28) During exponential growth, a population always _____.

- A) grows at its maximum per capita rate
- B) quickly reaches its carrying capacity
- C) adds more new individuals when the population is small than when it is large
- D) loses some individuals to emigration

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.2

29) Consider two old-growth forests: One is undisturbed while the other is being logged. In which region are species likely to experience exponential growth, and why?

- A) old growth, because of stable conditions that would favor exponential growth of all species in the forest
- B) old growth, because each of the species is well established and can produce many offspring
- C) logged, because the disturbed forest affords more resources for increased specific populations to grow
- D) logged, because the various populations are stimulated to a higher reproductive potential

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 53.2

30) Imagine that you are managing a large game ranch. You know from historical accounts that a species of deer used to live there, but they have been extirpated. After doing some research to determine what might be an appropriately sized founding population, you reintroduce them. You then watch the population increase for several generations, and graph the number of individuals (vertical axis) against the number of generations (horizontal axis). With no natural predators impacting the population, the graph will likely appear as _____.

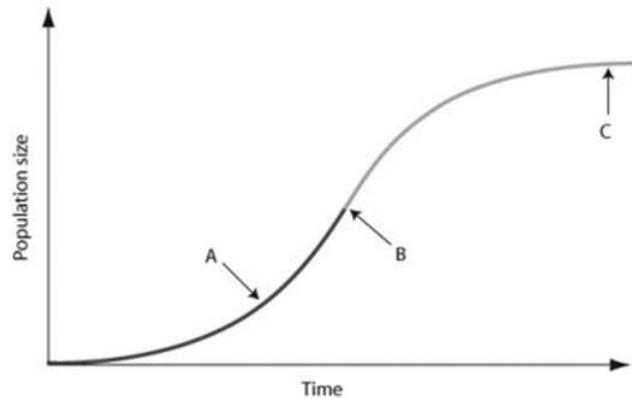
- A) a diagonal line, getting higher with each generation
- B) an "S" that ends with a vertical line
- C) an upside-down "U"
- D) a "J," increasing with each generation

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 53.3

31) Use the graph to answer the following question.



In the figure, which of the arrows represents the carrying capacity?

- A) arrow A
- B) arrow B
- C) arrow C
- D) Carrying capacity cannot be found in the figure because species under density-dependent control never reach carrying capacity.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.3

32) Which statements about K are correct?

- I) K varies among populations.
- II) K varies in space.
- III) K varies in time.
- IV) K is constant for any given species.

- A) only I and III
- B) only II and IV
- C) only I, II, and III
- D) only II, III, and IV

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.3

33) As N approaches K for a certain population, which of the following outcomes is predicted by the logistic equation?

- A) The population growth rate will not change.
- B) The population growth rate will approach zero.
- C) The population size will increase exponentially.
- D) The carrying capacity of the environment will increase.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.3

34) Which of the following causes populations to shift most quickly from an exponential to a logistic population growth?

- A) favorable climatic conditions
- B) removal of predators
- C) decreased death rate
- D) competition for resources

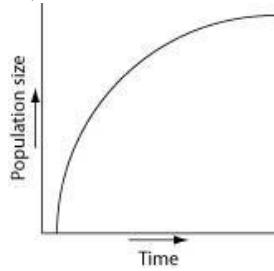
Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

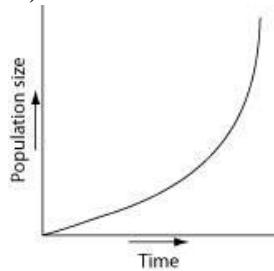
Section: 53.3

35) Which of the following graphs best illustrates the growth curve of a small population of rodents that has increased to a static carrying capacity?

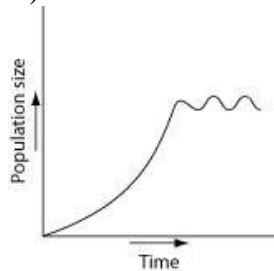
A)



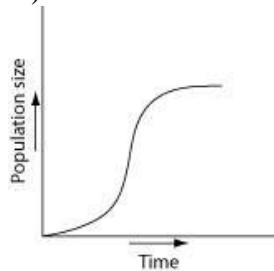
B)



C)



D)



Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 53.3

36) According to the logistic growth equation, $\frac{dN}{dt} = rN\frac{(K - N)}{K}$, _____.

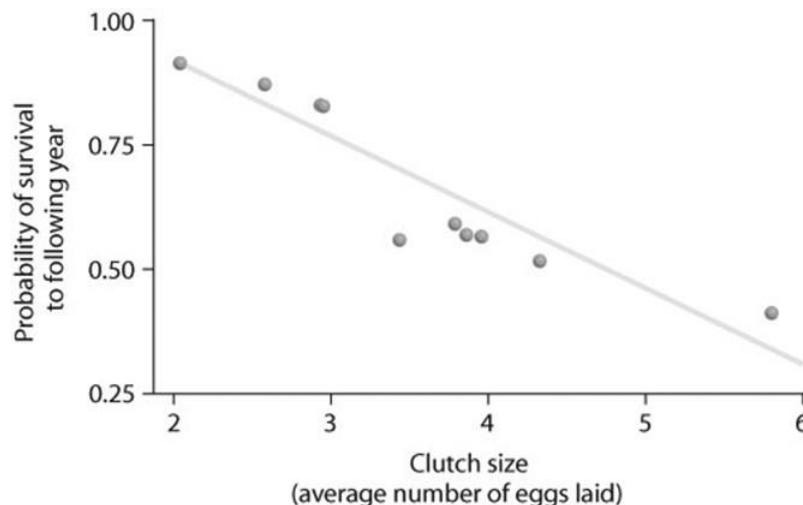
- A) the number of individuals added per unit time is greatest when N is close to zero
- B) the per capita growth rate (r) increases as N approaches K
- C) population growth is zero when N equals K
- D) the population grows exponentially when K is small

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 53.3

37) Use the graph to answer the following question.



Looking at the data in the figure, what can be said about survival and clutch size?

- A) Animals with low survival tend to have smaller clutch sizes.
- B) Large clutch size correlates with low survival.
- C) Animals with high survival tend to have medium-sized clutches.
- D) Probability of survivorship does not correlate with clutch size.

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 53.4

38) What is the primary limiting factor that determines why no female animal can produce a very large number of very large eggs?

- A) Time is limited.
- B) There are energy constraints.
- C) Temperature constraints will prevent females from carrying too many eggs.
- D) There will be an increase in predation pressure if the females carry too many large eggs.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.4

39) You observe two breeding female fish of the same species. One female lays 100 eggs and the other female lays 1,000 eggs. Which one of the following outcomes is most likely, given the limits of fitness trade-offs?

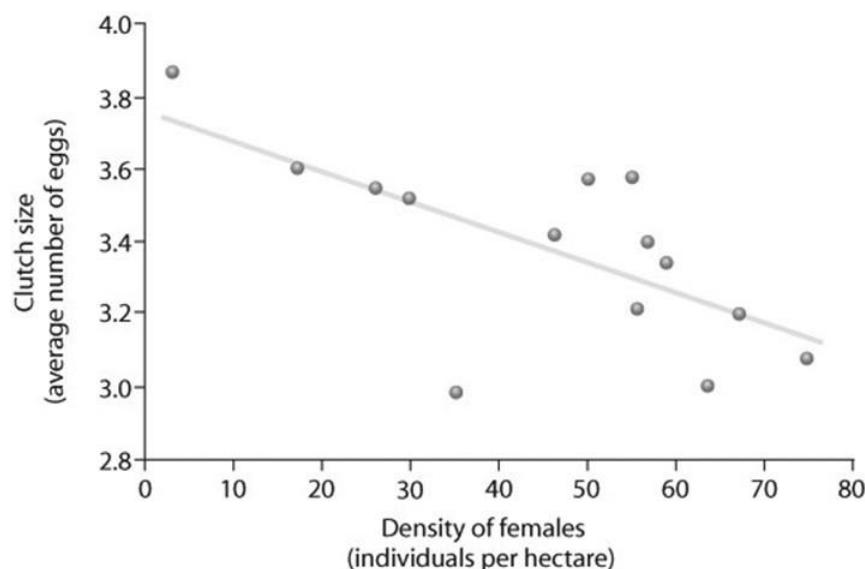
- A) The female laying 1,000 eggs breeds more often than the female laying 100 eggs.
- B) The female laying 100 eggs lives longer than the female laying 1,000 eggs.
- C) The eggs from the female laying 1,000 eggs have larger yolks than the yolks of the eggs from the female laying 100 eggs.
- D) The female laying 100 eggs is larger than the female laying 1,000 eggs.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 53.4

40) Use the graph to answer the following question.



Based on the figure, which of the following statements correctly interprets the data?

- A) Clutch size is always lowest at a density of about 35 females.
- B) As female density increases, survivorship decreases.
- C) Clutch size increases as female density increases.
- D) Clutch size is inversely related to density.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 53.4

41) Which pair of terms most accurately describes life history traits for a stable population of wolves?

- A) semelparous; *r*-selected
- B) semelparous; *K*-selected
- C) iteroparous; *r*-selected
- D) iteroparous; *K*-selected

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 53.4

42) Natural selection involves energetic trade-offs between _____.

- A) choosing how many offspring to produce over the course of a lifetime and how long to live
- B) producing large numbers of gametes when employing internal fertilization versus fewer numbers of gametes when employing external fertilization
- C) increasing the number of individuals produced during each reproductive episode and a corresponding decrease in parental care
- D) high survival rates of offspring and the cost of parental care

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 53.4

43) Which of the following traits is characteristic of *K*-selected populations?

- A) offspring with good chances of survival
- B) many offspring per reproductive episode
- C) small offspring
- D) a high intrinsic rate of increase

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 53.4

44) In which of the following situations would you expect to find the largest number of *r*-selected individuals?

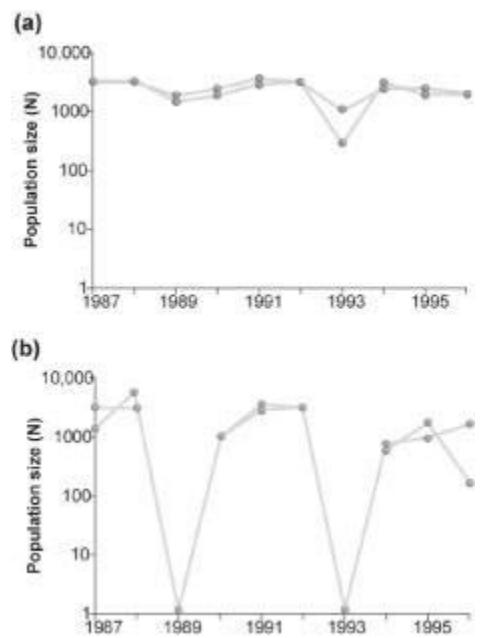
- A) a recently abandoned agricultural field in Colorado
- B) a sand dune community south of Lake Michigan
- C) an old-growth forest with large, mature trees
- D) a coral reef community off the coast of Mexico

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 53.4

45) Use the graphs to answer the following question.



Graph (b) in the figure shows the normal fluctuations of a population of grouse, a ground-nesting bird. Assuming graph (a) in the figure is the result of some experimental treatment in the grouse population, what can be concluded?

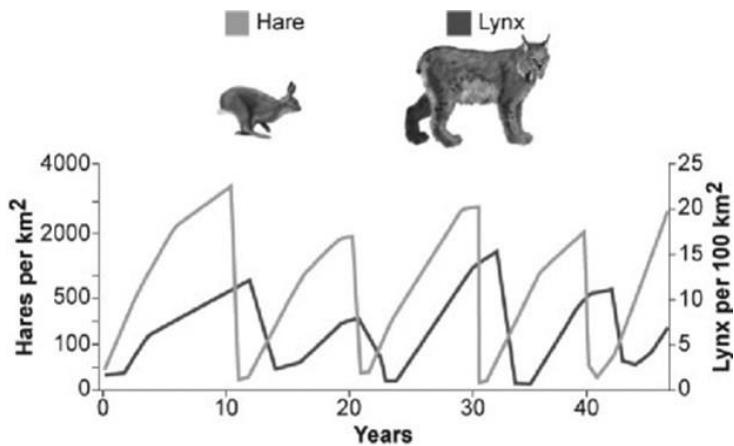
- A) The experimental treatment intensified the population cycling.
- B) The experimental treatment did not affect population cycling in this species.
- C) The experimental treatment has most likely identified the cause of population cycling.
- D) The experimental treatment involved the introduction of a predator of the bird.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 53.5

46) Use the graph to answer the following question.



What conclusion can you draw from the figure?

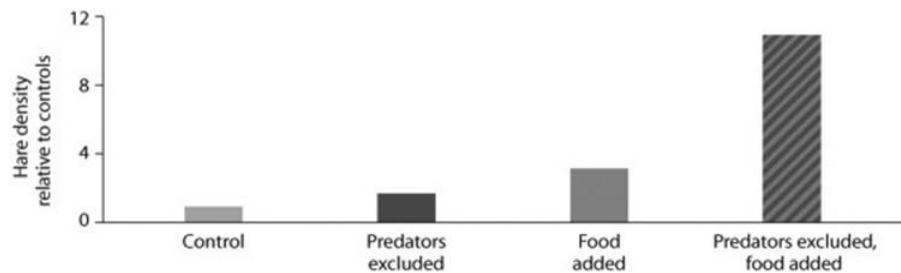
- A) Hares decrease in number just before lynx population size increases.
- B) Lynx control hare population size.
- C) Lynx and hare populations are independent of each other.
- D) The relationship between the populations cannot be determined only from this graph.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 53.5

47) Use the figure to answer the following question.



Looking at the data in the figure from the hare/lynx experiment, what conclusion(s) can you draw?

- I) Food is a factor in controlling hare population size.
 - II) Excluding lynx is a factor in controlling hare population size.
 - III) The effect of excluding predators and adding food in the same experiment is greater than the sum of excluding lynx alone plus adding food alone.
- A) only I
B) only II
C) only III
D) I, II, and III
- Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 53.5

48) Often the growth cycle of one population has an effect on the cycle of another. As moose populations increase, for example, wolf populations also increase. Thus, if we are considering the logistic equation for the wolf population,

$$\frac{dN}{dt} = rN \frac{(K - N)}{K},$$

which of the factors accounts for the effect of the moose population?

- A) r
- B) N
- C) rN
- D) K

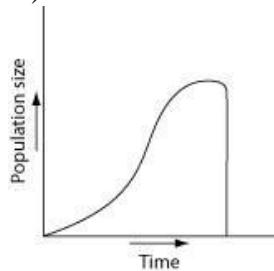
Answer: D

Bloom's Taxonomy: Application/Analysis

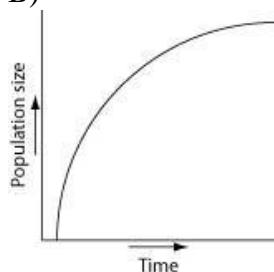
Section: 53.5

49) Which of the following graphs illustrates the growth over several seasons of a population of snowshoe hares that were introduced to an appropriate habitat also inhabited by predators in northern Canada?

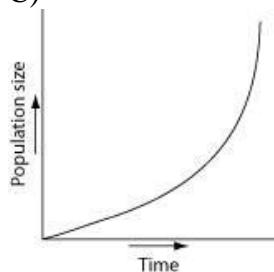
A)



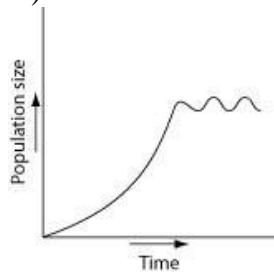
B)



C)



D)

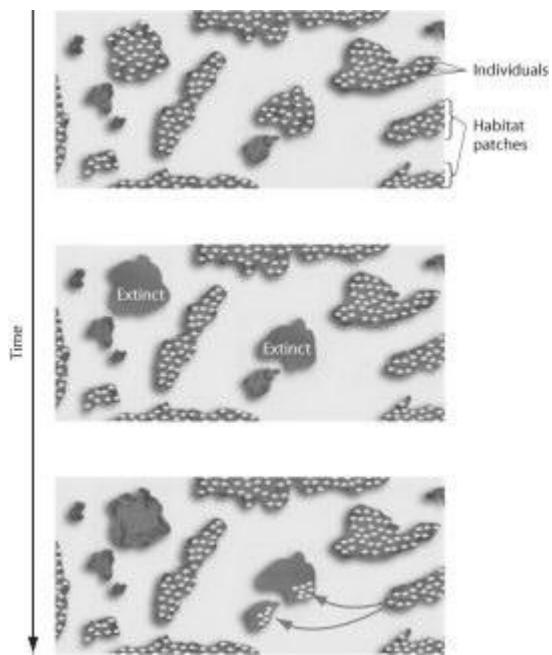


Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 53.5

50) Use the figure to answer the following question.



The figure represents the dynamics of _____.

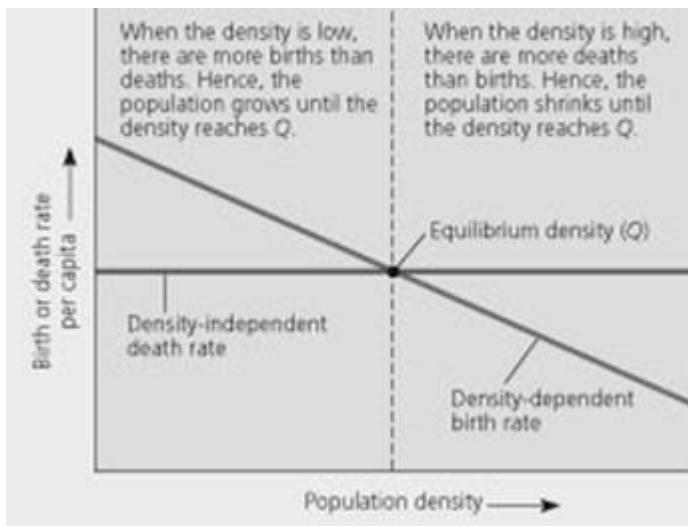
- A) metapopulations
- B) extinction
- C) emigration
- D) both extinction and emigration

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.5

51) Use the figure to answer the following question.



In the figure, imagine a different scenario where the death rate per capita was dependent upon (and positively correlated with) the density of the population, and the birth rate was instead density independent. As the density of the population increased, _____.

- A) the death rate would decrease and the birth rate would decrease
- B) the death rate would increase and the birth rate would decrease
- C) the death rate would increase and the birth rate would remain stable
- D) the death rate would remain stable and the birth rate would increase

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 53.5

52) A population of white-footed mice becomes severely overpopulated in a habitat that has been disturbed by human activity. Sometimes intrinsic factors cause the population to increase in mortality and cause lower reproduction rates to occur in reaction to the stress of overpopulation. Which of the following is an example of intrinsic population control?

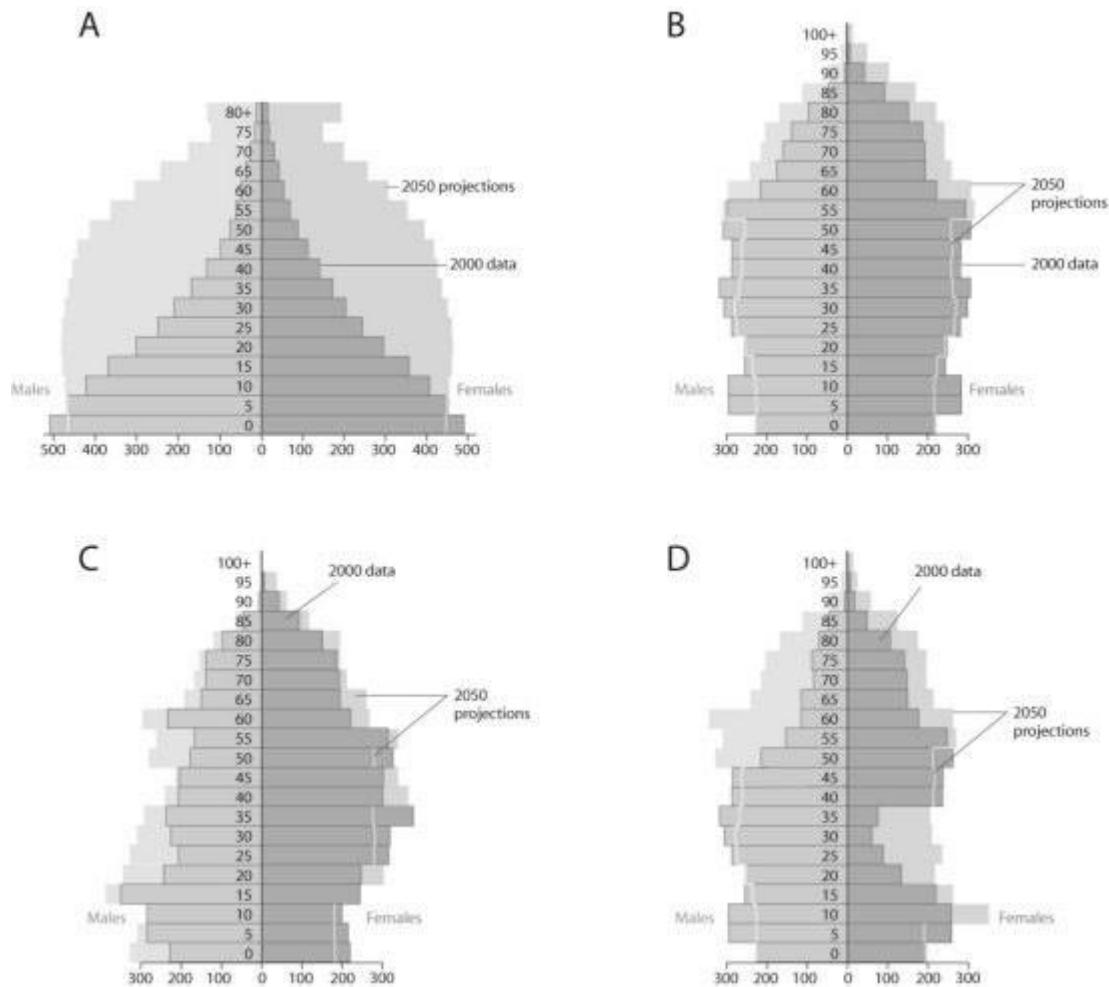
- A) Owl populations frequent the area more often because of increased hunting success.
- B) Females undergo hormonal changes that delay sexual maturation, and many individuals suffer depressed immune systems and die due to the stress of overpopulation.
- C) Clumped dispersion of the population leads to increased spread of disease and parasites, resulting in a population crash.
- D) All of the resources (food and shelter) are used up by overpopulation, and much of the population dies of exposure and/or starvation.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 53.5

53) Use the figures to answer the following question.



Based on the diagrams in the figure and on the large population of baby boomers in the United States, which graph best reflects U.S. population in 20 years?

- A) A
- B) B
- C) C
- D) D

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 53.6

54) Which of the following statements regarding the future of populations in developing, less industrialized countries are correct?

- I) The reproductive rates are predicted to remain below replacement level.
 - II) Survivorship will increase.
 - III) Overall population size will increase dramatically.
 - IV) The fertility rate is predicted to remain high, especially in some regions.
- A) only I and III
 - B) only II and IV
 - C) only II, III, and IV
 - D) only I, II, and III

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.6

55) Why does the U.S. population continue to grow even though the United States has essentially established a zero population growth (ZPG)?

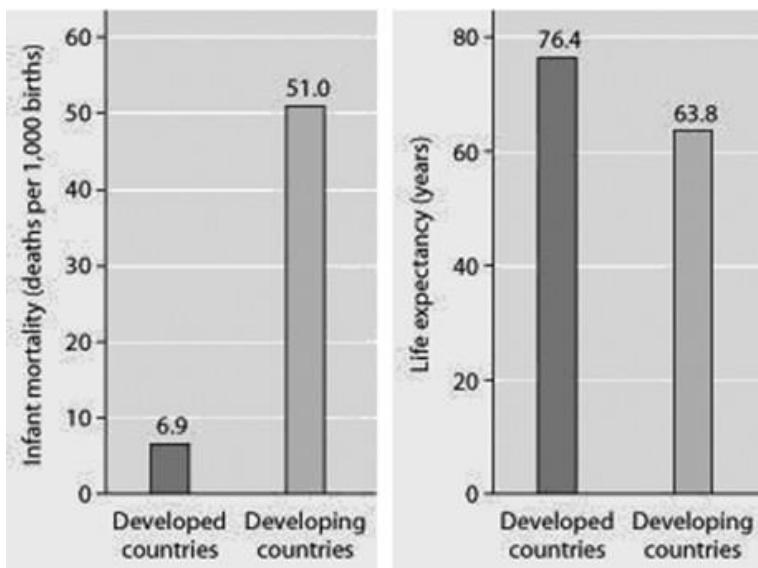
- A) emigration
- B) immigration
- C) baby boomer reproduction
- D) the 2007-2009 economic recession

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.6

56) Use the figure to answer the following question.



Infant mortality and life expectancy at birth in developed and developing countries (data as of 2005).

What is a logical conclusion that can be drawn from the graphs? Developed countries have _____.

- A) lower infant mortality rates and lower life expectancy than developing countries
- B) higher infant mortality rates and lower life expectancy than developing countries
- C) lower infant mortality rates and higher life expectancy than developing countries
- D) higher infant mortality rates and higher life expectancy than developing countries

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 53.6

57) A recent study of ecological footprints concluded that _____.

- A) Earth's carrying capacity would increase if per capita meat consumption increased
- B) current demand by industrialized countries for resources is much smaller than the ecological footprint of those countries
- C) it is not possible for technological improvements to increase Earth's carrying capacity for humans
- D) the ecological footprint of the United States is large because per capita resource use is high

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 53.6

58) Which of the following statements about human population in industrialized countries are correct?

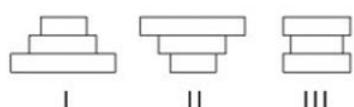
- I) Life history is *r*-selected.
 - II) The population has undergone the demographic transition.
 - III) The survivorship curve is Type III.
 - IV) Age distribution is relatively uniform.
- A) only I and III
 - B) only II and IV
 - C) only I, II, and IV
 - D) only II, III, and IV

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 53.6

59) The following question refers to the figure below, which depicts the age structure populations.



In the figure, populations of a plant species labeled I, II, and III are depicted using simplified age structures containing three age classes: young seedlings, middle-aged juveniles, and older adults. Which population(s) appear(s) to have stable growth?

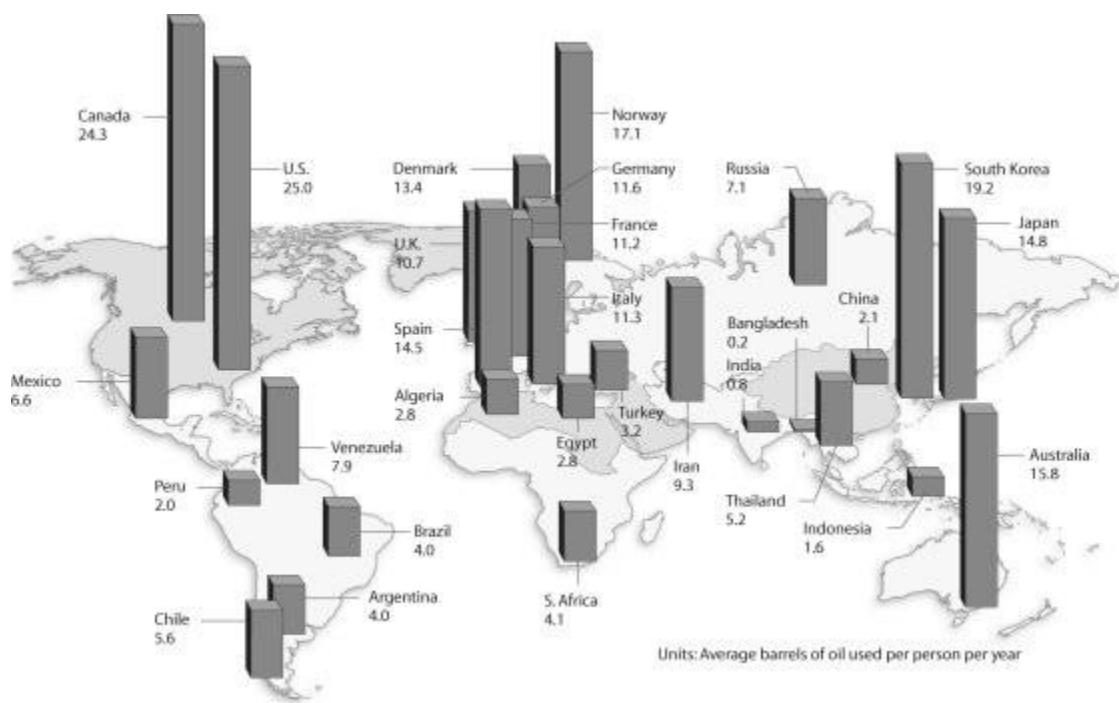
- A) I
- B) III
- C) I and II
- D) II and III

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 53.6

60) Use the figure to answer the following question.



Based on the figure and given the populations of the following countries, which country uses the most oil overall?

- A) United States (population = 320 million)
- B) Canada (population = 36 million)
- C) China (population = 1.33 billion)
- D) Russia (population = 144 million)

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 53.6

53.2 Student Edition End-of-Chapter Questions

- 1) Population ecologists follow the fate of same-age cohorts to
- A) determine a population's carrying capacity.
 - B) determine the birth rate and death rate of each group in a population.
 - C) determine if a population is regulated by density-dependent processes.
 - D) determine the factors that affect the size of a population.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 2) A population's carrying capacity
- A) may change as environmental conditions change.
 - B) can be accurately calculated using the logistic growth model.
 - C) increases as the per capita population growth rate decreases.
 - D) can never be exceeded.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 3) Scientific study of the population cycles of the snowshoe hare and its predator, the lynx, has revealed that
- A) predation is the dominant factor affecting prey population cycling.
 - B) hares and lynx are so mutually dependent that each species cannot survive without the other.
 - C) both hare and lynx population sizes are affected mainly by abiotic factors.
 - D) the hare population is *r*-selected and the lynx population is *K*-selected.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Analyzing ecological footprints reveals that
- A) Earth's carrying capacity would increase if per capita meat consumption increased.
 - B) current demand by industrialized countries for resources is much smaller than the ecological footprint of those countries.
 - C) it is not possible for technological improvements to increase Earth's carrying capacity for humans.
 - D) the ecological footprint of the United States is large because per capita resource use is high.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 5) Based on current growth rates, Earth's human population in 2019 will be closest to
- A) 2.5 million.
 - B) 4.5 billion.
 - C) 7.5 billion.
 - D) 10.5 billion.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 6) The observation that members of a population are uniformly distributed suggests that
- A) resources are distributed unevenly.
 - B) the members of the population are competing for access to a resource.
 - C) the members of the population are neither attracted to nor repelled by one another.
 - D) the density of the population is low.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 7) According to the logistic growth equation below,

$$\frac{dN}{dt} = rN \frac{(K - N)}{K}$$

- A) the number of individuals added per unit time is greatest when N is close to zero.
- B) the per capita population growth rate increases as N approaches K .
- C) population growth is zero when N equals K .
- D) the population grows exponentially when K is small.

Answer: C

Bloom's Taxonomy: Application/Analysis

- 8) During exponential growth, a population always

- A) has a constant per capita population growth rate.
- B) quickly reaches its carrying capacity.
- C) cycles through time.
- D) loses some individuals to emigration.

Answer: A

Bloom's Taxonomy: Application/Analysis

- 9) Which of the following statements about human populations in industrialized countries is *incorrect*?

- A) Birth rates and death rates are high.
- B) Average family size is relatively small.
- C) The population has undergone the demographic transition.
- D) The survivorship curve is Type I.

Answer: A

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 54 Community Ecology

54.1 Multiple-Choice Questions

1) Some birds follow moving swarms of army ants in the tropics. As the ants march along the forest floor hunting insects and small vertebrates, birds follow and pick off any insects or small vertebrates that fly or jump out of the way of the ants. This situation is an example of what kind of species interaction between the birds and the ants?

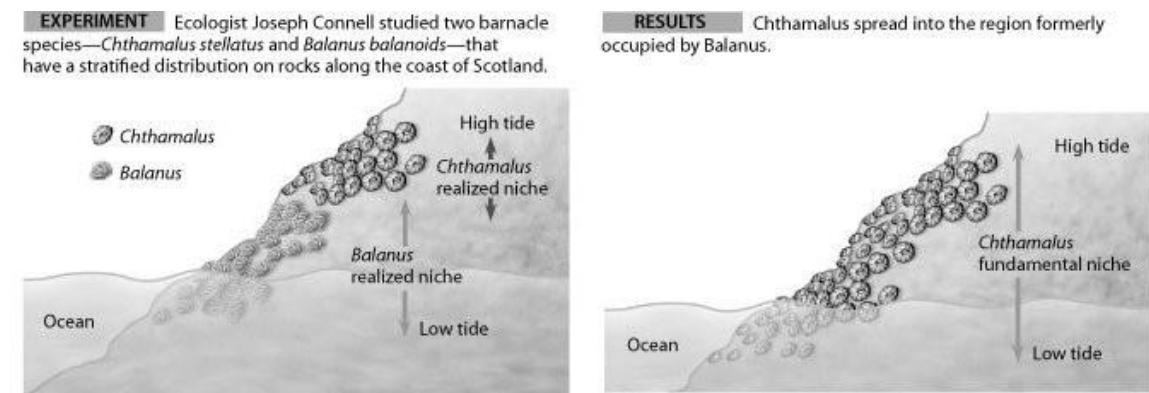
- A) consumption
- B) commensalism
- C) parasitism
- D) mutualism

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.1

2) Use the figures to answer the following question.



In the hypothesis that *Chthamalus stellatus* (a species of barnacle) is competitively excluded from the lower intertidal zone by *Balanus balanoides* (another species of barnacle), what could be concluded about the two species?

- A) The fundamental and realized niches of *B. balanoides* and *C. stellatus* are identical.
- B) The fundamental and realized niches of *B. balanoides* and *C. stellatus* are different.
- C) The fundamental and realized niches of *B. balanoides* are different, but the fundamental and realized niches of *C. stellatus* are identical.
- D) The fundamental and realized niches of *B. balanoides* are identical, but the fundamental and realized niches of *C. stellatus* are different.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 54.1

3) Use the figure to answer the following question.

Experiment

Question: Are mussel defenses induced by the presence of crabs?

Hypothesis: Mussels increase investment in defense in the presence of crabs.

Null hypothesis: Mussels do not increase investment in defense in the presence of crabs.

Experimental setup:

The diagram illustrates a flow system. At the top, there is a rectangular container labeled "Crab (fed fish, not mussels)" containing a crab. Another container to its left is labeled "No crab". Arrows indicate that seawater flows from both containers down into two separate rectangular tanks at the bottom, each labeled "Mussels".

Prediction: Mussels downstream of the crab tank will have thicker shells than mussels downstream of the empty tank.

Prediction of null hypothesis: Mussels in the two tanks will have shells of equal thickness.

Results:

A bar chart comparing shell thickness between two groups. The y-axis is labeled "Shell thickness (mm)" and ranges from 0.0 to 0.6. The x-axis has two categories: "No crab" and "Crab". The "No crab" bar is light gray and reaches approximately 0.55. The "Crab" bar is dark gray and reaches approximately 0.60.

Condition	Shell thickness (mm)
No crab	~0.55
Crab	~0.60

What conclusion can you draw from the figure?

- A) Without direct contact, mussels can sense the presence of crabs.
- B) Mussels can sense the presence of crabs only visually.
- C) Mussels are increasing their shell thickness in response to water current.
- D) Crabs hunt for mussels by focusing on the chemicals they emit into the water.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 54.1

4) As you study two closely related predatory insect species, the two-spot and the three-spot avenger beetles, you notice that each species seeks prey at dawn in areas without the other species. However, where their ranges overlap, the two-spot avenger beetle hunts at night and the three-spot hunts in the morning. When you bring them into the laboratory and isolate the two different species, you discover that the offspring of both species are found to be nocturnal. You have discovered an example of _____.

- A) mutualism
- B) character displacement
- C) Batesian mimicry
- D) resource partitioning

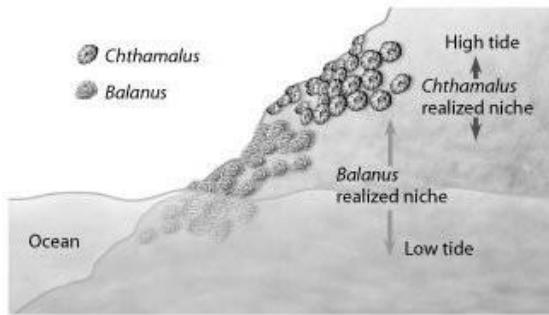
Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 54.1

5) Use the figures to answer the following question.

EXPERIMENT Ecologist Joseph Connell studied two barnacle species—*Chthamalus stellatus* and *Balanus balanoides*—that have a stratified distribution on rocks along the coast of Scotland.



RESULTS *Chthamalus* spread into the region formerly occupied by *Balanus*.



In this experiment, *Balanus* was removed from the habitat shown on the left.

Which of the following statements is a valid conclusion of this experiment?

- A) *Balanus* can survive only in the lower intertidal zone because it is unable to resist desiccation.
- B) *Balanus* is inferior to *Chthamalus* in competing for space on rocks lower in the intertidal zone.
- C) When the two species of barnacles compete with each other, both species still occupy low and high tide areas.
- D) The removal of *Balanus* shows that competitive exclusion prevented *Chthamalus* from occupying the lower tide region of its fundamental niche.

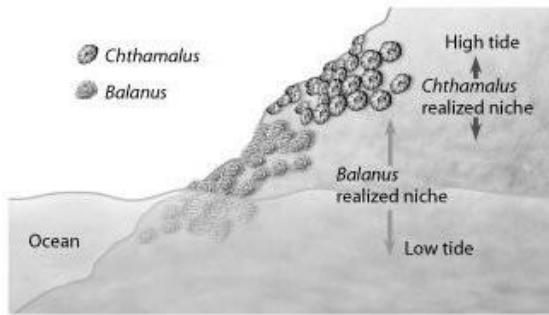
Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 54.1

6) Use the figures to answer the following question.

EXPERIMENT Ecologist Joseph Connell studied two barnacle species—*Chthamalus stellatus* and *Balanus balanoides*—that have a stratified distribution on rocks along the coast of Scotland.



RESULTS Chthamalus spread into the region formerly occupied by Balanus.



Connell conducted this experiment to learn more about _____.

- A) character displacement in the color of barnacles
- B) habitat preference in two different species of barnacles
- C) how sea-level changes affect barnacle distribution
- D) competitive exclusion and distribution of barnacle species

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.1

7) The symbols +, -, and 0 are used to show the results of interactions between individuals and groups of individuals. The symbol + denotes a positive interaction, - denotes a negative interaction, and 0 denotes interactions in which individuals are not affected. The first symbol refers to the first organism mentioned. What interactions exist between a lion pride and African wild dogs, if the dogs are found to typically avoid areas with lions?

- A) +/+
- B) +/-
- C) 0/0
- D) -/-

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.1

8) The symbols +, -, and 0 are used to show the results of interactions between individuals and groups of individuals. The symbol + denotes a positive interaction, - denotes a negative interaction, and 0 denotes interactions in which individuals are not affected. The first symbol refers to the first organism mentioned. Which fact is correct when describing species interactions?

- A) +/- will always remain such.
- B) A +/- interaction could shift to +/0 or +/+ over time, depending on other factors such as competition, population density, or environmental changes.
- C) Species interactions occur in isolation and cannot affect the structure of ecological communities.
- D) A -/- interaction benefits both of the species in the relationship.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.1

9) Which of the following statements is consistent with the principle of competitive exclusion?

- A) The random distribution of one competing species will have a positive impact on the population growth of the other competing species.
- B) If two species have the same fundamental niche, one will exclude the other competing species.
- C) Even a slight reproductive advantage will eventually lead to the elimination of the less well adapted of two competing species.
- D) Natural selection tends to increase competition between related species.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 54.1

10) If two species are close competitors, and one species is experimentally removed from the community, the remaining species would be expected to _____.

- A) change its fundamental niche
- B) decline in abundance
- C) become the target of specialized parasites
- D) expand its realized niche

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 54.1

11) Which of the following is an example of a commensalism?

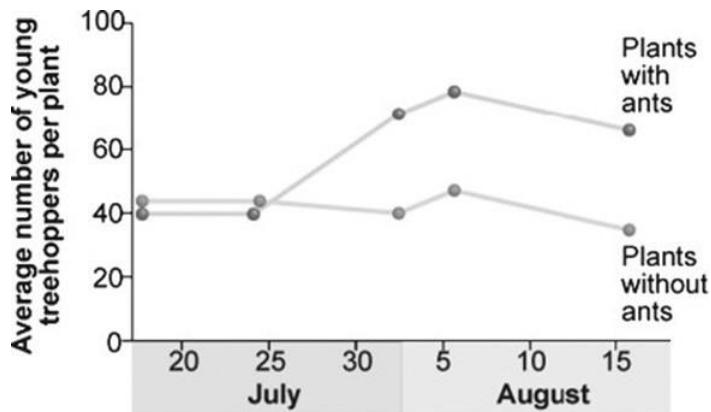
- A) fungi residing in plant roots, such as endomycorrhizae
- B) bacteria fixing nitrogen on the roots of some plants
- C) rancher ants that protect aphids in exchange for sugar-rich honeydew
- D) cattle egrets eating insects stirred up by grazing bison

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.1

12) Use the figure to answer the following question.



Treehoppers (a type of insect) produce honeydew, which ants use for food. Treehoppers have a major predator, the jumping spider. Researchers hypothesized that the ants would protect the treehoppers from the spiders. In an experiment, researchers followed study plots with ants removed from the system and compared them to a control plot. From the figure, what can you conclude?

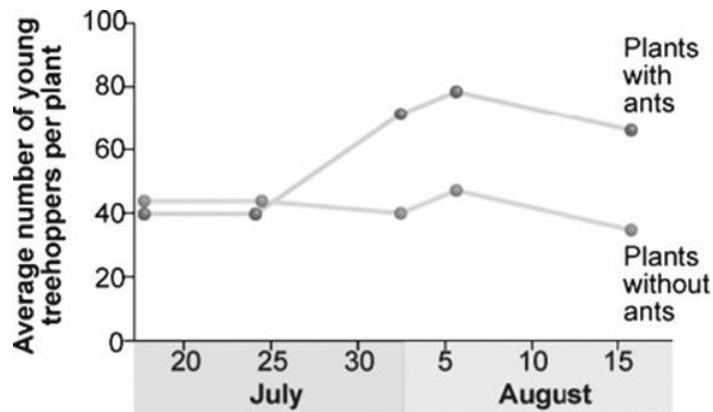
- A) Ants do somehow protect the treehoppers from spiders.
- B) Ants eat the honeydew produced by treehoppers.
- C) Ants reduce the numbers of treehoppers.
- D) No specific conclusions can be drawn from this figure.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 54.1

13) Use the figure to answer the following question.



Treehoppers (a type of insect) produce honeydew, which ants use for food. Treehoppers have a major predator, the jumping spider. Researchers hypothesized that the ants would protect the treehoppers from the spiders. During a one-year study, researchers found no difference in treehopper populations in any of their control and experimental groups. What could they measure during the second year to gain information about why this might have occurred?

- A) Measure the number of ant females.
- B) Measure the relative sizes of the treehoppers.
- C) Measure the relative abundance of jumping spiders.
- D) Measure the relative sizes of different ant species.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 54.1

14) Resource partitioning would be most likely to occur between _____.

- A) sympatric populations of species with similar ecological niches
- B) sympatric populations of a flowering plant and its specialized insect pollinator
- C) allopatric populations of the same animal species
- D) allopatric populations of species with similar ecological niches

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 54.1

15) Character displacement differs from resource partitioning because character displacement _____.

- A) is a fundamental difference in feeding behaviors of individuals
- B) is directly linked to the evolution of genotypes that have allowed alternate resource use
- C) is a difference in the niche within a habitat that is preferred to be used by a species
- D) is not the result of competition

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.1

16) Which of the following is an example of Müllerian mimicry?

- A) two species of unpalatable butterfly that have the same color pattern
- B) a day-flying hawkmoth that looks like a wasp
- C) a chameleon that changes its color to look like a dead leaf
- D) one species of a non-venomous snake which rattles its tail to mimic a venomous rattlesnake

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.1

17) Which of the following is an example of Batesian mimicry?

- A) a butterfly that resembles a leaf
- B) a nonvenomous larva of a moth that moves like a venomous snake
- C) a fawn with fur coloring that camouflages it in the forest environment
- D) a snapping turtle that uses its tongue to mimic a worm, thus attracting fish

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.1

18) Which of the following is an example of aposematic coloration?

- A) a non-poisonous snake mimics the color of a poisonous one
- B) the brightly colored patterns of monarch butterfly caterpillars
- C) green color of a plant
- D) a katydid whose wings look like a dead leaf

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.1

19) Dwarf mistletoes are flowering plants that grow on certain forest trees. They obtain nutrients and water from the vascular tissues of the trees. The trees derive no known benefits from the dwarf mistletoes, nor are they negatively affected by this interaction. Which of the following best describes the interactions between dwarf mistletoes and trees?

- A) mutualism
- B) commensalism
- C) competition
- D) facilitation

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.1

20) In some circumstances, grasses that initially lose tissues from being consumed by animals such as elk or cattle regrow more than they would have otherwise, and benefit from the moderate levels of grazing. Which of the following terms would best describe such a plant-herbivore interaction?

- A) mutualism
- B) commensalism
- C) parasitism
- D) predation

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 54.1

21) Which of the following measurements would be most helpful in understanding the structure of an ecological community?

- I) determining how many species are present overall
- II) determining which particular species are present
- III) determining the kinds of interactions that occur among individuals of the same species
- IV) determining the abundance of resources available for one species

- A) only I and II
- B) only II and IV
- C) only I, II, and III
- D) I, II, III, and IV

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 54.1

22) Which of the following studies would a community ecologist undertake to learn about competitive interactions?

- I) selectivity of nest sites among cavity-nesting songbirds
- II) the grass species preferred by grazing pronghorn antelope and bison
- III) stomach analysis of brown trout and brook trout in streams where they coexist

- A) only I and II
- B) only I and III
- C) only II and III
- D) I, II, and III

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 54.1

23) How might an ecologist test whether a species is occupying all of its fundamental niche or only a portion of it?

- A) Study the temperature range and humidity requirements of the species.
- B) Observe if the species expands its range after the removal of a competitor.
- C) Measure the change in reproductive success when the species is subjected to environmental stress.
- D) Observe if the niche size changes after the introduction of a similar non-native species.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.1

24) The symbols +, -, and 0 are to be used to show the results of interactions between individuals and groups of individuals. The symbol + denotes a positive interaction, - denotes a negative interaction, and 0 denotes where individuals are not affected by interacting. The first symbol refers to the first organism mentioned. What interactions exist between cellulose-digesting organisms in the gut of a termite and the termite?

- A) +/+
- B) +/0
- C) +/-
- D) 0/0

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.1

25) The symbols +, -, and 0 are to be used to show the results of interactions between individuals and groups of individuals. The symbol + denotes a positive interaction, - denotes a negative interaction, and 0 denotes where individuals are not affected by interacting. The first symbol refers to the first organism mentioned. What interactions exist between mycorrhizae and evergreen tree roots?

- A) +/+
- B) +/0
- C) +/-
- D) 0/0

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.1

26) Bouchard and Brooks studied the effect of insect flight on dispersal and speciation in rain forest insects. They sampled all of the insects in the study area and found that 60 insect species are flightless and 19 are able to fly. What can you conclude so far about this study?

(P. Bouchard and D. R. Brooks. 2004. Effect of vagility potential on dispersal and speciation in rainforest insects. *Journal of Evolutionary Biology* 17:994-1006.)

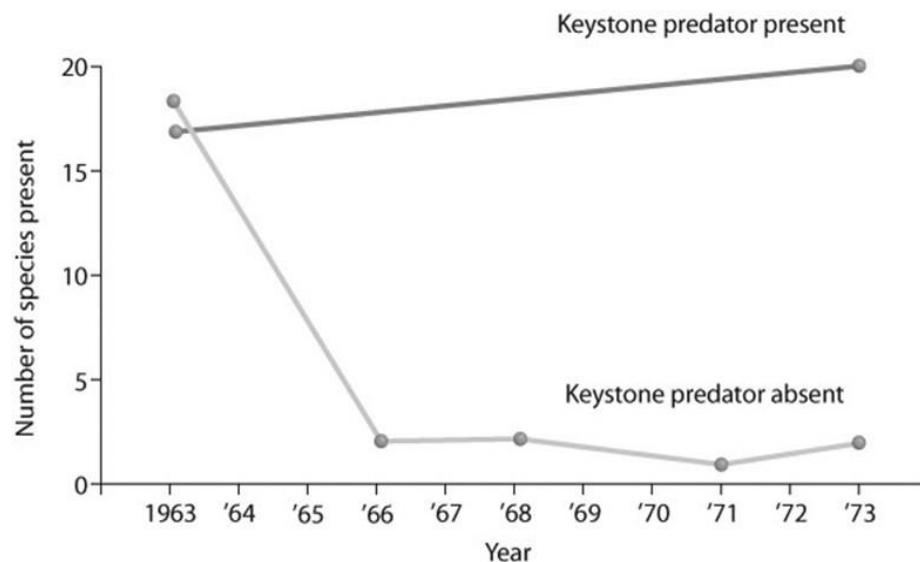
- A) Flightless insects have a greater dispersal potential from this study area.
- B) Flightless insects are more numerous in the study area.
- C) Flightless insects have a higher species richness in the study area.
- D) Flightless insects are better suited for the tropics.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 54.2

27) Use the graph to answer the following question.



What does the graph tell you about the effect of a keystone species?

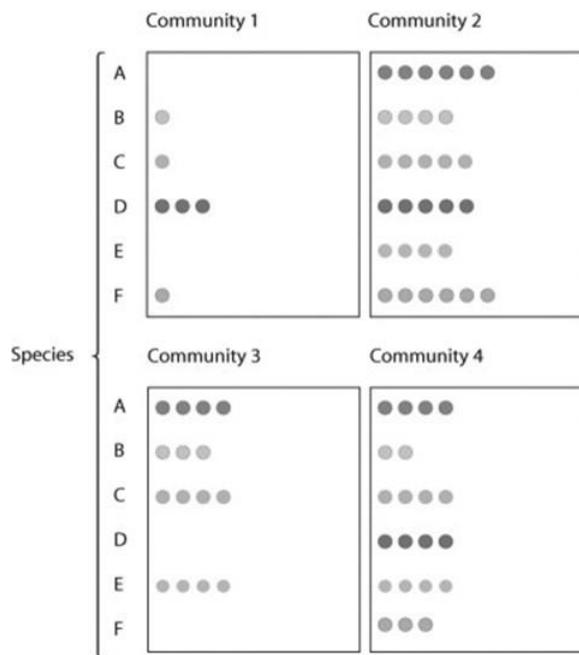
- A) A keystone species has little interaction with other species in an environment.
- B) Removing a keystone species from the community drastically reduces species richness.
- C) Adding a keystone species to the community will make it more diverse.
- D) Removing a keystone species from the community will eventually allow for the invasion of a new species.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.2

28) Use the figure to answer the following question.



In the figure, species A through F are found among four communities, with the number of circles representing their abundance. Which community has the highest species richness but does *not* have the highest diversity overall because of the relative abundance of the different species?

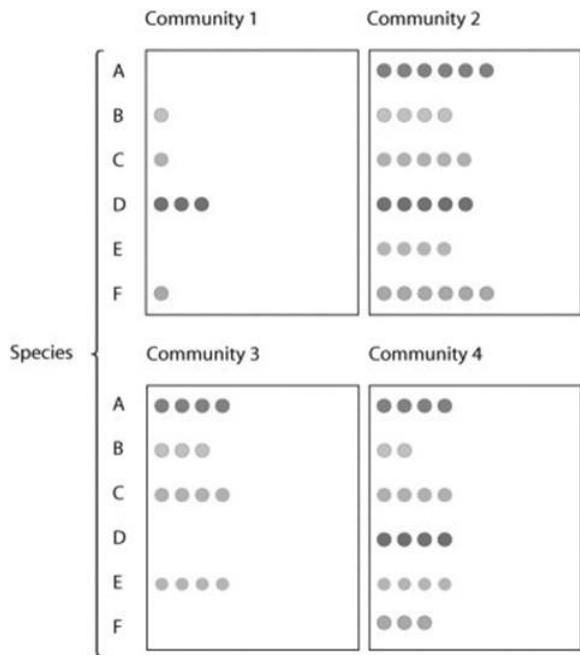
- A) Community 1
- B) Community 2
- C) Community 1 and community 3 have the highest species diversity.
- D) Community 4

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 54.2

29) Use the figure to answer the following question.



In the figure, imagine that community 4 represents a marine community off the coast of Florida, where overfishing of a particular trophy fish (imagine a species G) for two decades gradually shifted it to resemble community 3. The species that was overfished was likely _____.

- A) an invasive species
- B) a keystone species
- C) a primary producer
- D) species A, B, C, E, and F

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.2

30) Approximately how many kilograms (kg) of carnivore (secondary consumer) biomass can be supported by a field plot containing 1000 kg of plant material?

- A) 1000
- B) 100
- C) 10
- D) 1

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.2

31) Elephants are not the most abundant species in African grasslands, yet they influence community structure. The grasslands contain scattered woody plants, but they are kept in check by the uprooting activities of the elephants. Take away the elephants, and the grasslands are converted to forests or to shrublands. The newly growing forests support fewer species than the previous grasslands. Which of the following statements describes why elephants are the keystone species in this scenario?

- A) Elephants exhibit a disproportionate influence on the structure of the community relative to their abundance.
- B) Grazing animals depend upon the elephants to convert forests to grassland.
- C) Elephants are the biggest herbivore in this community.
- D) Elephants help other populations survive by keeping out many of the large African predators.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 54.2

32) According to bottom-up and top-down control models of community organization, which of the following expressions would imply that an increase in the size of a carnivore (C) population would negatively impact its prey (P) population, but not vice versa? The arrows between species indicate a negative impact toward the population at the arrowhead.

- A) $P \leftarrow C$
- B) $P \rightarrow C$
- C) $C \leftrightarrow P$
- D) $P \leftarrow C \rightarrow P$

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 54.2

33) Which of the following statements is a likely explanation for why invasive species take over communities into which they have been introduced?

- A) Invasive species are less efficient than native species in competing for the limited resources of the environment.
- B) Invasive species are not held in check by the predators and agents of disease that have always been in place for native species.
- C) Invasive species have a higher reproductive potential than native species.
- D) Invasive species come from geographically isolated regions, so when they are introduced to regions where there is more competition, they thrive.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.2

34) Imagine five forest communities, each with one hundred individuals distributed among four different tree species (W, X, Y, and Z). Which forest community would be most diverse?

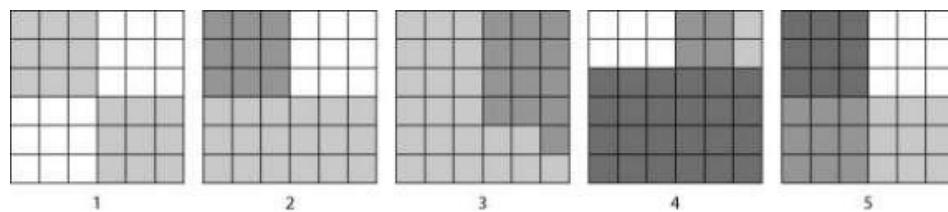
- A) 25W, 25X, 25Y, 25Z
- B) 40W, 30X, 20Y, 10Z
- C) 50W, 25X, 15Y, 10Z
- D) 70W, 10X, 10Y, 10Z

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 54.2

35) Use the figures to answer the following question.



According to the Shannon Diversity Index, which of the five blocks above, with each containing 36 squares, would show the greatest diversity? The different shades represent different species, and more squares of a shade represent higher abundance.

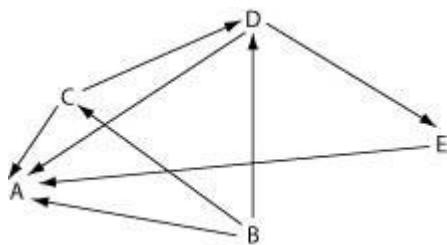
- A) 1
- B) 2
- C) 4
- D) 5

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 54.2

36) Use the following diagram of a hypothetical food web to answer the question. The arrows represent the transfer of energy between the various trophic levels.



Which letter represents an organism that could be a producer?

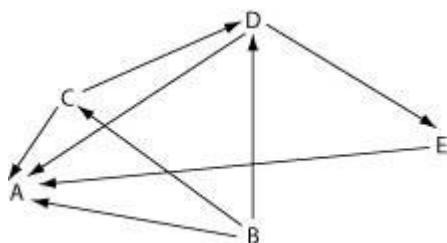
- A) A
- B) B
- C) D
- D) E

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.2

37) Use the following diagram of a hypothetical food web to answer the question. The arrows represent the transfer of energy between the various trophic levels.



Which letter represents an organism that could only be a primary consumer?

- A) A
- B) B
- C) C
- D) D

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 54.2

38) Keystone predators can maintain species diversity in a community if they _____.

- A) competitively exclude other predators
- B) prey on the community's dominant species
- C) allow immigration of other predators
- D) prey only on the least abundant species in the community

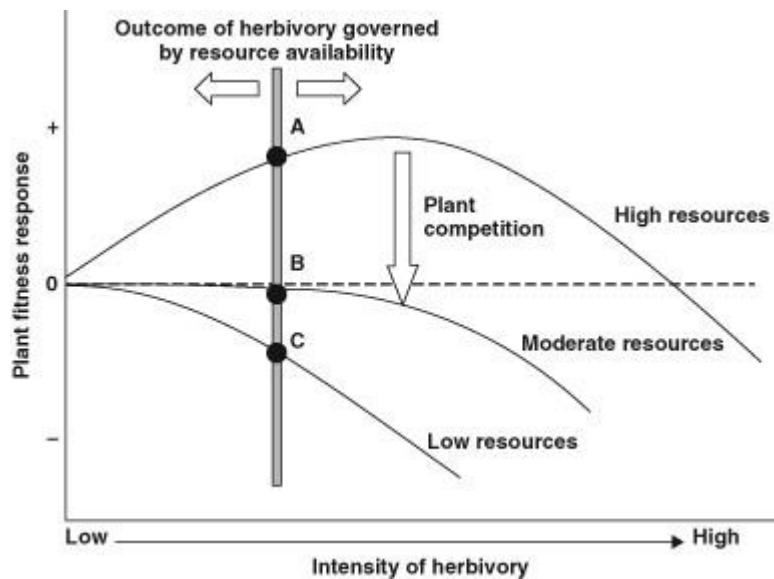
Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.2

- 39) Food chains are sometimes short because _____.
A) only a single species of herbivore feeds on each plant species
B) local extinction of a species causes extinction of the other species in its food chain
C) most of the energy in a trophic level is lost as it passes to the next higher level
D) predator species tend to be less diverse and less abundant than prey species
Answer: C
Bloom's Taxonomy: Application/Analysis
Section: 54.2
- 40) Which of the following could qualify as a top-down control on a grassland community?
A) limitation of plant biomass by rainfall amount
B) influence of temperature on competition among plants
C) influence of soil nutrients on the abundance of grasses versus wildflowers
D) effect of grazing intensity by bison on plant species diversity
Answer: D
Bloom's Taxonomy: Application/Analysis
Section: 54.2

41) Use the figure to answer the following question.



The figure proposes a combination of a top-down and bottom-up model (a hypothesis) to describe the variable effects of biological control herbivores on the fitness (growth and reproduction) of an invasive, non-native plant, spotted knapweed (*Centaurea stoebe*). These herbivores include multiple insects that were first studied in the plant's native home range in eastern Europe, where the plant is not dominant in grassland communities and does not pose a problem to land managers and conservationists. Many insects there were found to consume the plant's tissues, including stems, leaves, and seeds, and some were very host specific and were not found to attack plants other than *C. stoebe*. Several insects were subsequently transported and released in an attempt to reduce densities of this non-native and problematic weed in the United States. The y-axis shows *C. stoebe* plant fitness, and the x-axis represents the intensity of herbivory by the insects, from low to high. As the vertical shaded bar is moved along the x-axis, the ultimate effect of herbivory (now A, B, and C) on plant fitness can change based on its intensity and also may depend on the other factors. The horizontal dashed line represents no predicted change in fitness under the effects of varying intensity of herbivory, plant competition, and soil resources available to the plant (such as nitrogen or water), while the three solid lines represent other possible outcomes.

(D.G. Knochel and T.R. Seastedt. 2011. Reconciling contradictory findings of herbivore impacts on spotted knapweed (*Centaurea stoebe*) growth and reproduction. *Ecological Applications* 20(7):1903-1912.

What portion of the model would be characterized as bottom-up?

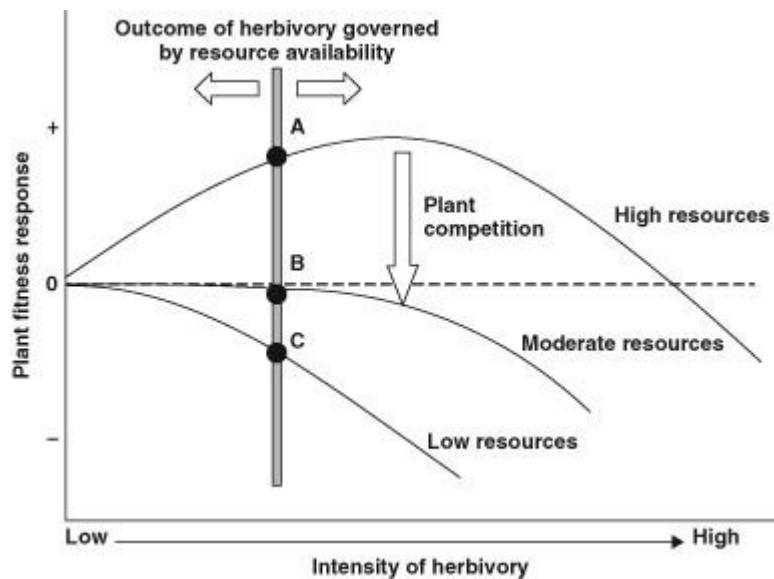
- A) plant fitness
- B) resources available to the plant
- C) intensity of herbivory on the plant
- D) plant competition and fitness

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 54.2

42) Use the figure to answer the following question.



The figure proposes a combination of a top-down and bottom-up model (a hypothesis) to describe the variable effects of biological control herbivores on the fitness (growth and reproduction) of an invasive, non-native plant, spotted knapweed (*Centaurea stoebe*). These herbivores include multiple insects that were first studied in the plant's native home range in eastern Europe, where the plant is not dominant in grassland communities and does not pose a problem to land managers and conservationists. Many insects there were found to consume the plant's tissues, including stems, leaves, and seeds, and some were very host specific and were not found to attack plants other than *C. stoebe*. Several insects were subsequently transported and released in an attempt to reduce densities of this non-native and problematic weed in the United States. The y-axis shows *C. stoebe* plant fitness, and the x-axis represents the intensity of herbivory by the insects, from low to high. As the vertical shaded bar is moved along the x-axis, the ultimate effect of herbivory (now A, B, and C) on plant fitness can change based on its intensity and also may depend on the other factors. The horizontal dashed line represents no predicted change in fitness under the effects of varying intensity of herbivory, plant competition, and soil resources available to the plant (such as nitrogen or water), while the three solid lines represent other possible outcomes.

(D.G. Knochel and T.R. Seastedt. 2011. Reconciling contradictory findings of herbivore impacts on spotted knapweed (*Centaurea stoebe*) growth and reproduction. *Ecological Applications* 20(7):1903-1912.

What is the model's prediction for *C. stoebe* plant fitness when growing under high soil resource conditions?

- A) Plant fitness decreases as a result of low intensity herbivory.
- B) Plant fitness increases under all levels of intensity of herbivory.
- C) Plant fitness decreases only if the intensity of herbivory is very high.
- D) Plant fitness does not change.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 54.2

43) Recall that Clements's view of biological communities is that of a highly predictable and interrelated structure, while Gleason's view of biological communities is that individual species operate independently. If we set up many identical sterilized ponds in the same area and allowed them to be colonized, what result should we expect Gleason had a more accurate view of communities than did Clement's hypothesis?

- A) Identical plankton communities will develop in all ponds.
- B) Similar plankton communities will develop in all ponds.
- C) Different plankton communities will develop in all ponds.
- D) Limited plankton communities will develop in all ponds.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.3

44) According to the nonequilibrium model of community diversity, _____.

- A) community structure remains stable in the absence of interspecific competition
- B) communities are assemblages of closely linked species that are permanently changed by disturbance
- C) interspecific interactions induce changes in community composition over time
- D) communities are constantly changing after being influenced by disturbances

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.3

45) Why do moderate levels of disturbance result in an increase in community diversity?

- A) Habitats are opened up for less competitive species.
- B) Competitively dominant species infrequently exclude less competitive species after a moderate disturbance.
- C) The resulting uniform habitat supports stability, which in turn supports diversity.
- D) Less-competitive species evolve strategies to compete with dominant species.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.3

46) Based on the intermediate disturbance hypothesis, a community's species diversity is increased by _____.

- A) frequent immigrations of new species
- B) stable conditions with no disturbance
- C) moderate levels of disturbance
- D) intensive disturbance by humans

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.3

47) In a particular case of secondary succession, three species of wild grass all invaded a field. By the second season, a single species dominated the field and the other two species had a lower relative abundance. A possible factor contributing to the abundances of these species in this example of secondary succession is _____.

- A) equilibrium
- B) immigration
- C) inhibition
- D) parasitism

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 54.3

48) There are more species in tropical areas than in places more distant from the equator. This is probably a result of _____.

- A) fewer predators and parasites
- B) more dispersed annual solar radiation compared to the poles
- C) more frequent ecological disturbances over a longer time span
- D) a longer time frame without disturbances for evolution and speciation

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 54.4

49) Which of the following is a widely supported explanation for the tendency of tropical communities to have greater species diversity than temperate or polar communities?

- A) There are fewer parasites to negatively affect the health of tropical communities.
- B) Tropical communities are low in altitude, whereas temperate and polar communities are high in altitude.
- C) Tropical communities have higher sunlight and precipitation, and are generally older than temperate or polar communities.
- D) More competitive dominant species have evolved in temperate and polar communities.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.4

50) Which of the following is a correct statement about MacArthur and Wilson's island equilibrium model?

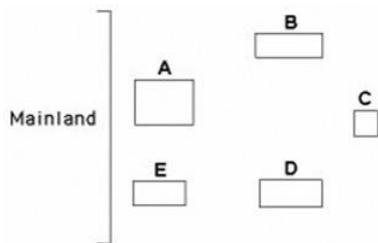
- A) As the number of species on an island increases, the emigration rate decreases.
- B) Competitive exclusion is less likely on an island that has large numbers of species.
- C) Small islands receive few new immigrant species.
- D) Islands closer to the mainland have higher extinction rates.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.4

51) Use the following diagram of five islands formed at around the same time near a particular mainland, as well as MacArthur and Wilson's island equilibrium model principles to answer the question.



Which region would likely have the greatest species diversity?

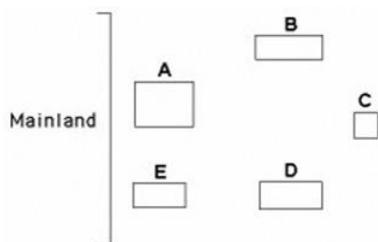
- A) island A
- B) island C
- C) island D
- D) the mainland

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.4

52) Use the following diagram of five islands formed at around the same time near a particular mainland, as well as MacArthur and Wilson's island equilibrium model principles to answer the question.



Imagine these are tropical islands. Which island would likely encounter the highest rate of species extinction if these islands were subject to unregulated, commercial logging in the rainforest?

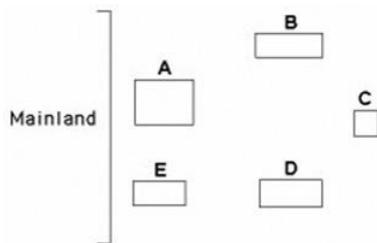
- A) A
- B) B
- C) C
- D) E

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 54.4

53) Use the following diagram of five islands formed at around the same time near a particular mainland, as well as MacArthur and Wilson's island equilibrium model principles to answer the question.



Which island would likely have the lowest extinction rate?

- A) A
- B) C
- C) D
- D) E

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.4

54) According to the island equilibrium model, species richness would be lowest on an island that is _____.

- A) large and close to a mainland
- B) large and remote
- C) small and remote
- D) small and close to a mainland

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.4

55) One plausible hypothesis to explain why species richness is higher in tropical than in temperate regions is that _____.

- A) tropical communities are younger
- B) tropical regions generally have more available water and higher levels of solar radiation
- C) higher temperatures cause more rapid speciation
- D) tropical regions have very high rates of immigration and very low rates of extinction

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.4

56) Zoonotic disease _____.

- A) is caused by suborganismal pathogens such as viruses, viroids, and prions only
- B) is caused by pathogens that are transferred from other animals to humans by direct contact or by means of a vector
- C) can only be spread from animals to humans through direct contact
- D) can only be transferred from animals to humans by means of an intermediate host

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.5

57) Why is a pathogen generally more virulent in a new habitat?

- A) Intermediate host species are more motile and transport pathogens to new areas.
- B) Pathogens evolve more efficient forms of reproduction in new environments.
- C) Hosts in new environments have not had a chance to become resistant to the pathogen through natural selection.
- D) New environments are almost always smaller in area so that transmission of pathogens is easily accomplished between hosts.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.5

58) Which of the following best describes the consequences of white-band disease in Caribbean coral reefs?

- A) Staghorn coral is decimated by the pathogen, and Elkhorn coral takes its place.
- B) Key habitat for lobsters, snappers, and other reef fishes improves.
- C) Algal species take the place of the dead coral, and the fish community is dominated by herbivores.
- D) Algal species take over and the overall reef diversity increases due to increases in primary productivity.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.5

59) Which of the following studies would shed light on the mechanism of spread of H5N1 virus from Asia to North America?

- A) Perform cloacal or saliva smears of migrating waterfowl to monitor whether any infected birds show up in Alaska.
- B) Test fecal samples for H5N1 in Asian waterfowl that live near domestic poultry farms in Asia.
- C) Test for the presence of H5N1 in poultry used for human consumption worldwide.
- D) Locate and destroy birds infected with H5N1 in Asian open-air poultry markets.

Answer: A

Bloom's Taxonomy: Synthesis/Evaluation

Section: 54.5

60) In terms of community ecology, why are pathogens often more virulent now than in the past?

- A) More new pathogens have recently evolved.
- B) Host organisms have become more susceptible because of weakened immune systems.
- C) Human activities are transporting pathogens into new habitats (or communities) at an unprecedented rate.
- D) Medicines for treating pathogenic disease are in short supply.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 54.5

61) The oak tree fungal pathogen, *Phytophthora ramorum*, has migrated 800 kilometers in 15 years. West Nile virus spread from New York State to 46 other states in 5 years. The difference in the rate of spread is probably related to _____.

- A) the lethality of each pathogen
- B) the mobility of their hosts
- C) the fact that viruses are very small
- D) innate resistance

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 54.5

62) Scientists interested in how populations interact within communities are attempting to determine the species diversity of an island under study. What kind of data would be most helpful to the scientists in determining diversity?

- A) the number of different species on the island and the size of the population of each species
- B) the number of species on the island that are consumers, producers, and decomposers
- C) the relative biomass of each species on the island separated by trophic level
- D) the number of trophic levels on the island and the niche of each species

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 54.2

63) Red-cheeked salamanders are partially protected from predators because of cardiac glycosides they produce from glands on their back. When ingested, cardiac glycosides disrupt normal heart rhythms. A different salamander species, the imitator salamander, also has red cheek patches, but does not produce cardiac glycosides. It does gain protection from predators that have learned to avoid red-cheeked salamanders. How does this relationship affect the population dynamics of both species?

- A) Both species are negatively affected.
- B) Both species are positively affected.
- C) The red-cheeked salamander is positively affected; the imitator is negatively affected.
- D) The red-cheeked salamander is not affected; the imitator is positively affected.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 54.1

54.2 Student Edition End-of-Chapter Questions

1) The feeding relationships among the species in a community determine the community's
A) secondary succession.

B) ecological niche.

C) species richness.

D) trophic structure.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

2) The principle of competitive exclusion states that

A) two species cannot coexist in the same habitat.

B) competition between two species always causes extinction or emigration of one species.

C) two species that have exactly the same niche cannot coexist in a community.

D) two species will stop reproducing until one species leaves the habitat.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

3) Based on the intermediate disturbance hypothesis, a community's species diversity is increased by

A) frequent massive disturbance.

B) stable conditions with no disturbance.

C) moderate levels of disturbance.

D) human intervention to eliminate disturbance.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

4) According to the island equilibrium model, species richness would be greatest on an island that is

A) large and remote.

B) small and remote.

C) large and close to a mainland.

D) small and close to a mainland.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

5) Predators that are keystone species can maintain species diversity in a community if they

A) competitively exclude other predators.

B) prey on the community's dominant species.

C) reduce the number of disruptions in the community.

D) prey only on the least abundant species in the community.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 6) Food chains are sometimes short because
- A) only a single species of herbivore feeds on each plant species.
 - B) local extinction of a species causes extinction of the other species in its food chain.
 - C) most of the energy in a trophic level is lost as energy passes to the next higher level.
 - D) most producers are inedible.

Answer: C

Bloom's Taxonomy: Application/Analysis

- 7) Which of the following could qualify as a top-down control on a grassland community?
- A) limitation of plant biomass by rainfall amount
 - B) influence of temperature on competition among plants
 - C) influence of soil nutrients on the abundance of grasses versus wildflowers
 - D) effect of grazing intensity by bison on plant species diversity

Answer: D

Bloom's Taxonomy: Application/Analysis

- 8) The most plausible hypothesis to explain why species richness is higher in tropical than in temperate regions is that
- A) tropical communities are younger.
 - B) tropical regions generally have more available water and higher levels of solar radiation.
 - C) higher temperatures cause more rapid speciation.
 - D) diversity increases as evapotranspiration decreases.

Answer: B

Bloom's Taxonomy: Application/Analysis

Campbell Biology, 11e (Urry)
Chapter 55 Ecosystems and Restoration Ecology

55.1 Multiple-Choice Questions

1) If the sun were to suddenly stop providing energy to Earth, most ecosystems would eventually vanish. Which of the following ecosystems would likely survive the longest after this hypothetical disaster?

- A) pelagic ocean
- B) tundra
- C) deep benthic ocean
- D) a desert spring

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 55.1

2) Which of the following terms encompasses all of the others?

- A) heterotrophs
- B) herbivores
- C) carnivores
- D) primary consumers

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.1

3) To recycle nutrients, an ecosystem must have, at a minimum, _____.

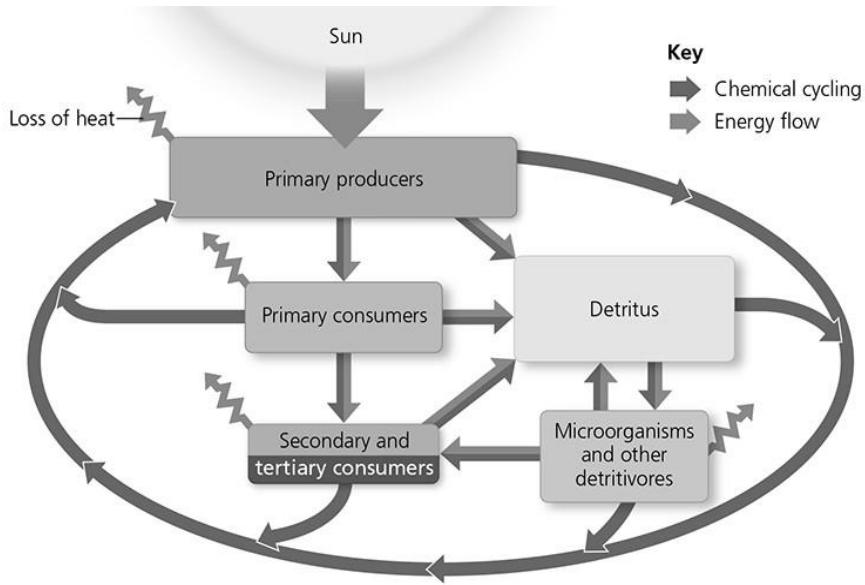
- A) producers
- B) producers and decomposers
- C) producers, primary consumers, and decomposers
- D) producers, primary consumers, secondary consumers, and decomposers

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 55.1

4) Use the following figure to answer the question.



In the figure, what could the jagged arrow leaving microorganisms and other detritivores represent?

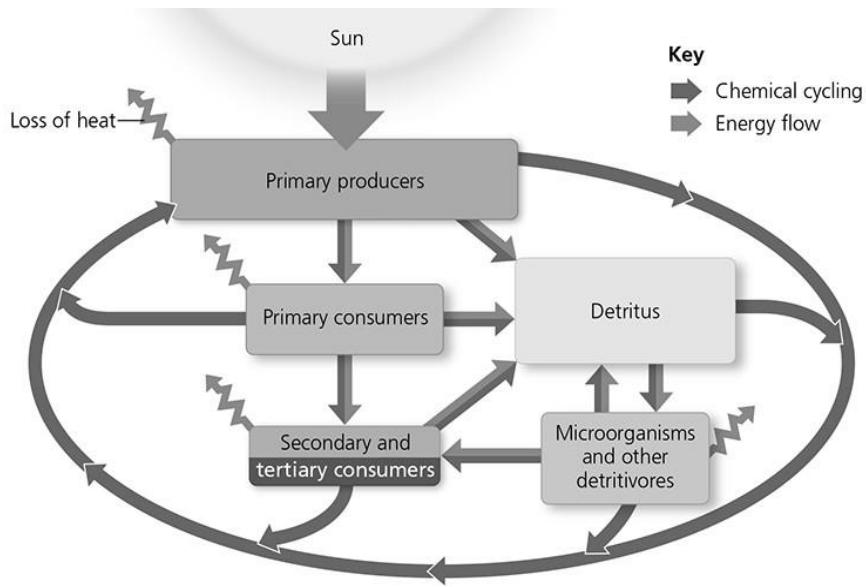
- A) organic compounds broken down by bacteria
- B) energy consumed by bacteria
- C) energy lost from a worm during cellular respiration
- D) CO₂ and heat loss from decomposing materials due to the effects of solar radiation and precipitation

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 55.1

5) Use the following figure to answer the question.



In the ecosystem figure, which unit of the food web has the potential to lose the most energy as heat?

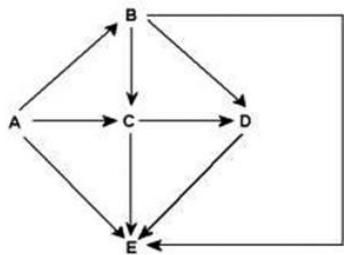
- A) secondary and tertiary consumers
- B) primary consumers
- C) primary producers
- D) microorganisms and other detritivores

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 55.1

6) Use the following figure to answer the question.



Food web for a particular terrestrial ecosystem (arrows represent energy flow and letters represent species)

Examine this food web for a particular terrestrial ecosystem. Which species is most likely a decomposer on this food web?

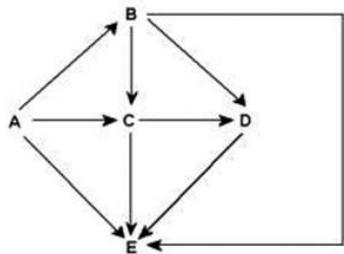
- A) A
- B) B
- C) C
- D) E

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 55.1

7) Use the following figure to answer the question.



Food web for a particular terrestrial ecosystem (arrows represent energy flow and letters represent species)

Examine this food web for a particular terrestrial ecosystem. Species C is toxic to predators. Which species is most likely to benefit from being a mimic of C?

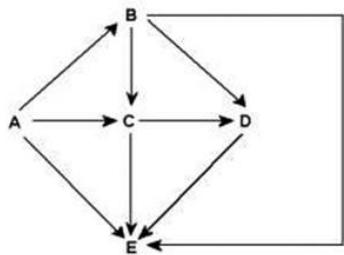
- A) A
- B) B
- C) C
- D) E

Answer: B

Bloom's Taxonomy: Synthesis/Evaluation

Section: 55.1

8) Use the following figure to answer the question.



Food web for a particular terrestrial ecosystem (arrows represent energy flow and letters represent species)

Examine this food web for a particular terrestrial ecosystem. Which pair of species could be omnivores?

- A) A and D
- B) B and C
- C) C and D
- D) C and E

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 55.1

9) Use the following figure to answer the question.

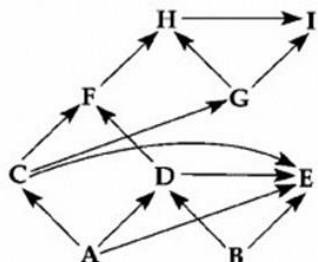


Diagram of a food web (arrows represent energy flow and letters represent species)

If the figure represents a marine food web, zooplankton are most likely _____.

- A) A
- B) B
- C) C
- D) E

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 55.1

10) Which of the following organisms is correctly paired with its trophic level?

- A) cyanobacterium—primary consumer
- B) grasshopper—secondary consumer
- C) phytoplankton—primary producer
- D) fungus—primary consumer

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 55.1

11) Which of the following has the greatest effect on the rate of chemical cycling within an ecosystem?

- A) the ecosystem's rate of primary production
- B) the secondary production efficiency of the ecosystem's consumers
- C) the rate of decomposition in the ecosystem
- D) the trophic efficiency of the ecosystem

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 55.1

12) Matter may be gained by, or lost from, ecosystems. How does this occur?

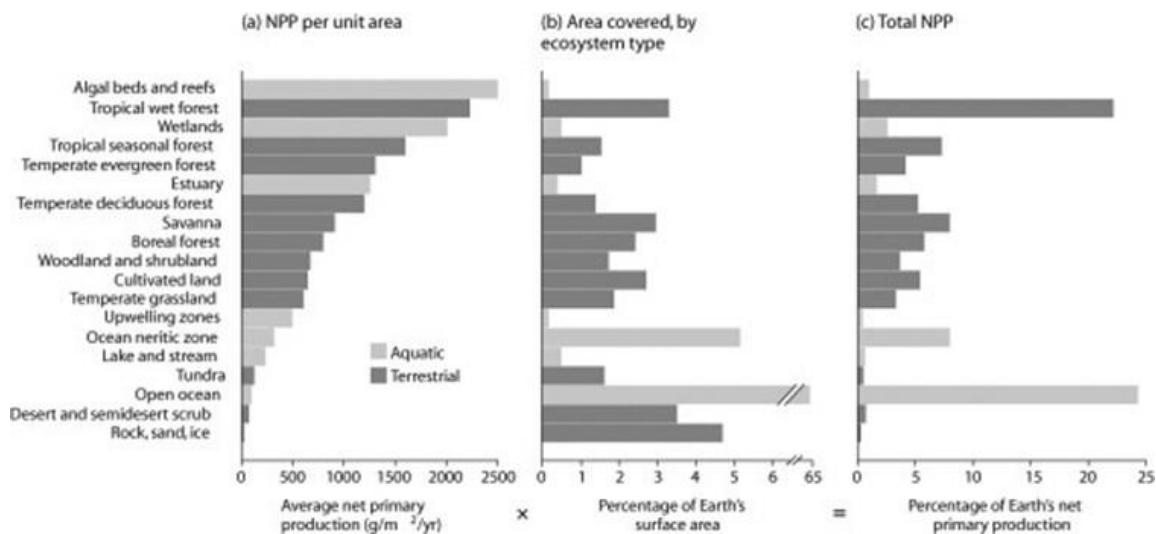
- A) Chemoautotrophic organisms can convert matter to energy.
- B) Matter can move from one ecosystem to another.
- C) Photosynthetic organisms convert solar energy to sugars.
- D) Heterotrophs convert heat to energy.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.4

13) Use the following figure to answer the question.



Which habitat types in the figure cover the largest area?

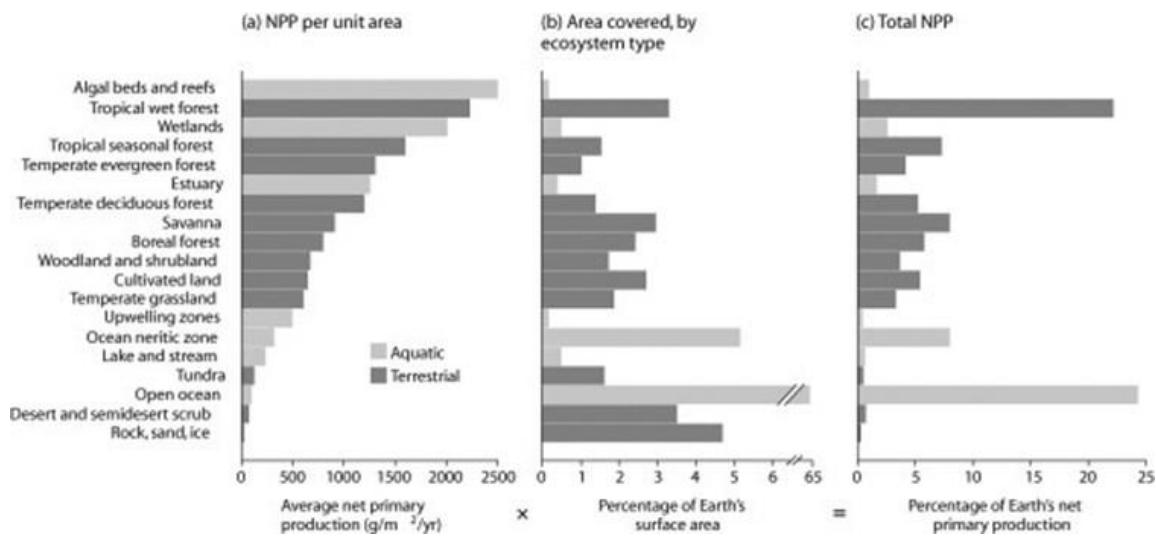
- A) tropical wet forest
- B) rock, sand, ice
- C) algal beds and reefs
- D) wetlands plus the ocean neritic zone

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 55.2

14) Use the following figure to answer the question.



Which habitat type in the figure makes available the most new tissue to consumers?

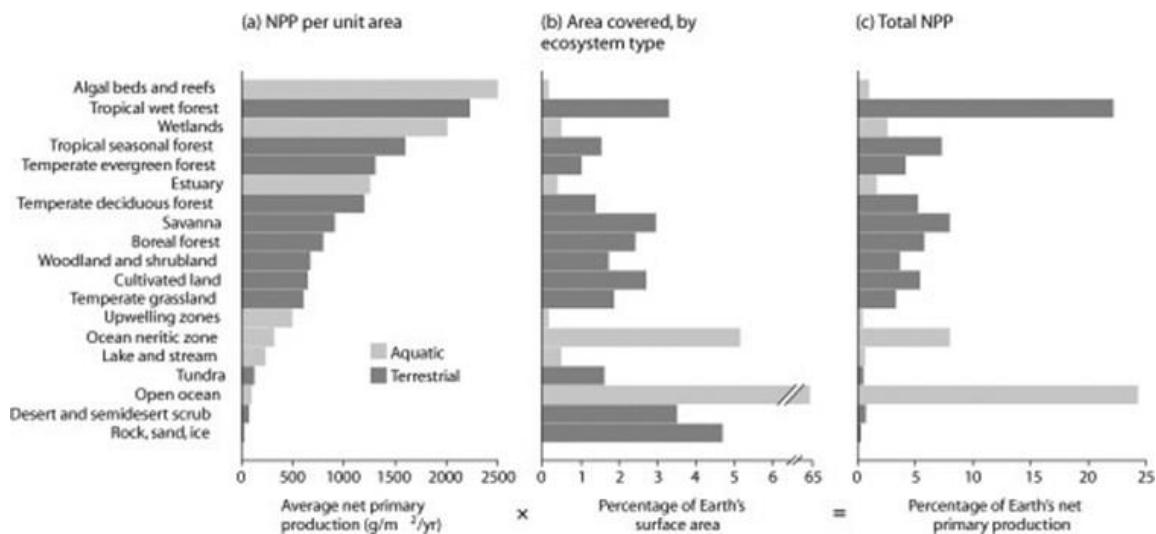
- A) tropical wet forest
- B) open ocean
- C) algal beds and reefs
- D) wetlands

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 55.2

15) Use the following figure to answer the question.



Which category in the figure makes available the highest productivity per square meter?

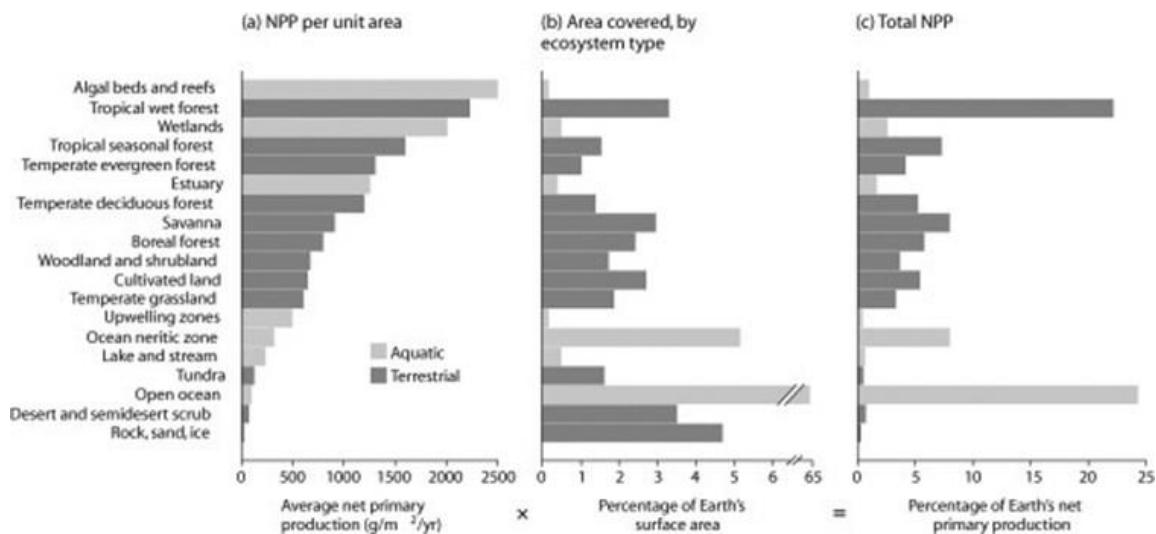
- A) tropical wet forest
- B) open ocean
- C) algal beds and reefs
- D) wetlands

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 55.2

16) Use the following figure to answer the question.



Considering its total area covered, which ecosystem type represented in the figure has a very low level of economic impact on Earth's ecosystem?

- A) tropical wet forest
- B) rock, sand, and ice
- C) tropical seasonal forest
- D) ocean neritic zone

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 55.2

17) Why is terrestrial productivity higher in equatorial climates?

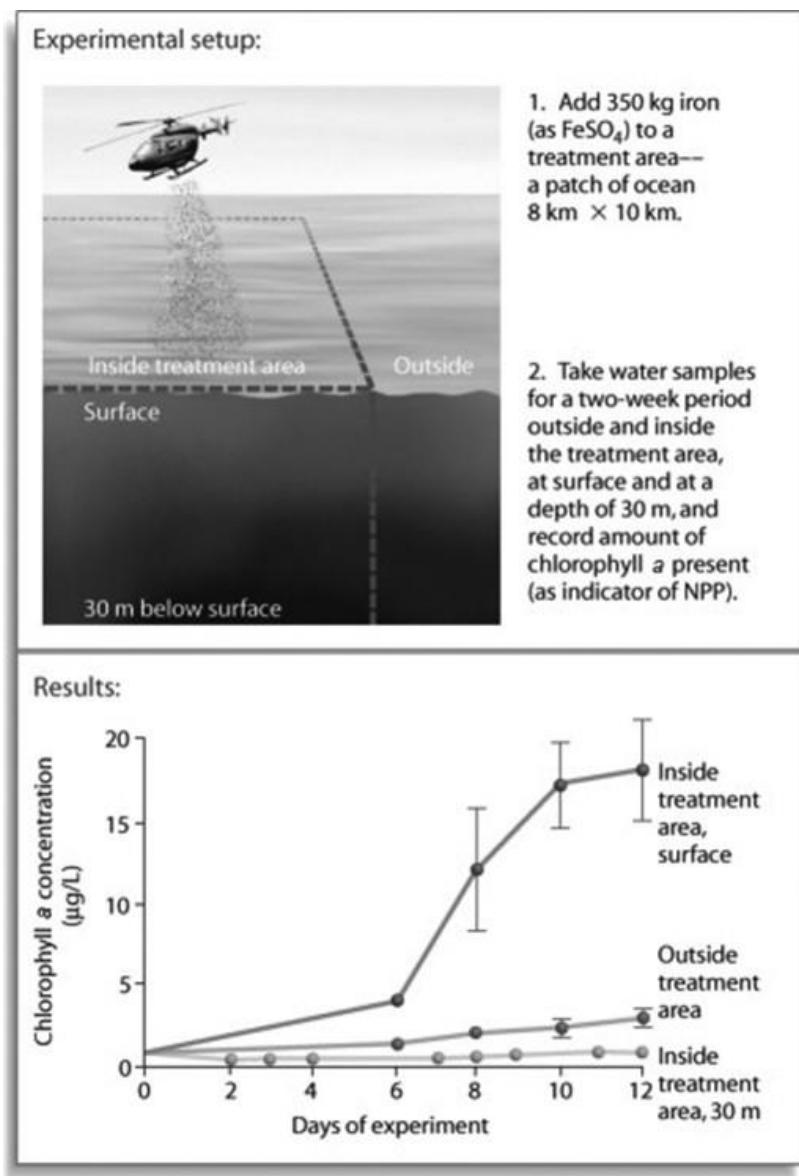
- A) Productivity increases with temperature.
- B) Productivity increases with water availability.
- C) Productivity increases with available sunlight.
- D) The answer is most likely a combination of the other responses.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 55.2

18) Use the following figure to answer the question.



After looking at the experiment in the figure, what can be concluded about productivity in marine ecosystems?

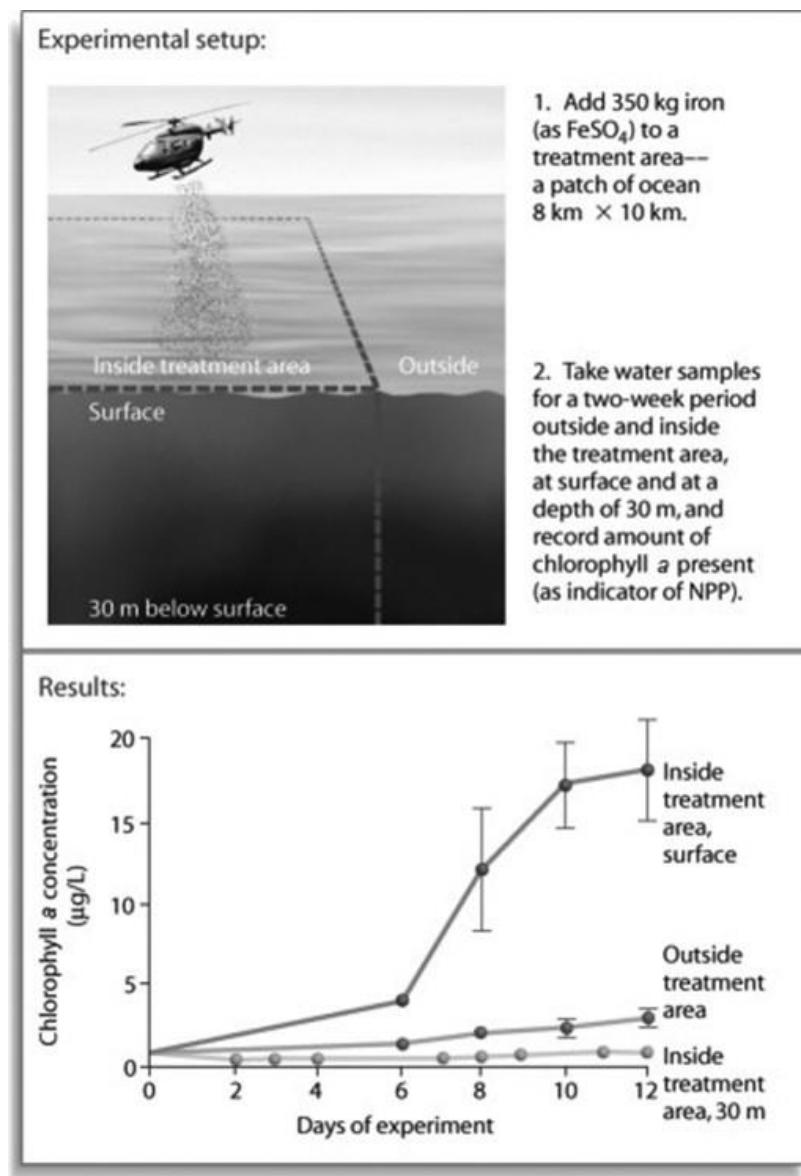
- A) Nothing can be said based on this information.
- B) Marine organisms break down iron for energy and thus for productivity.
- C) Iron can be a limiting nutrient in productivity.
- D) Productivity increases when chlorophyll *a* is added.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 55.2

19) Use the following figure to answer the question.



What treatment results that were presumably part of the experimental design are not fully depicted in the graph?

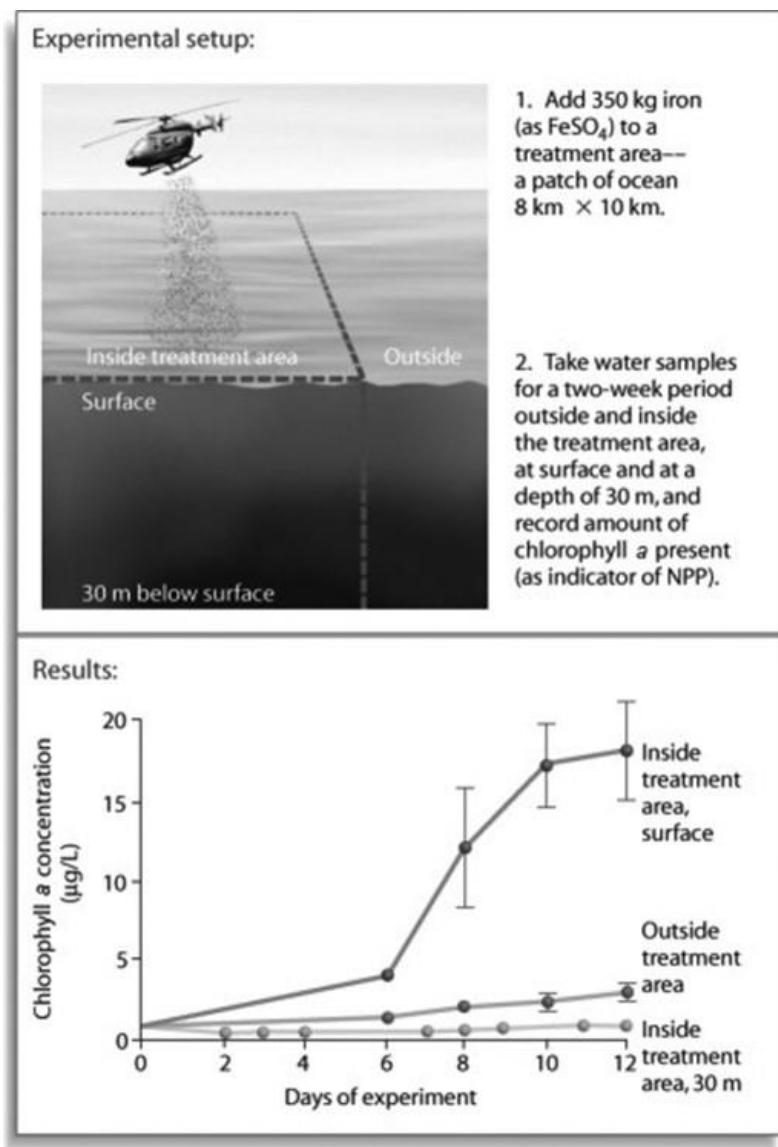
- A) Chlorophyll *a* concentration at 30 m depth within the treatment area
- B) Chlorophyll *a* concentration at the surface within the treatment area
- C) An indicator of net primary production in the treatment area at the surface and at 30 m deep
- D) An indicator of net primary production outside the treatment area at depth and at 30 m deep

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 55.2

20) Use the following figure to answer the question.



After looking at the results in the figure, what can be concluded about productivity in the experimental ecosystem?

- A) Productivity is higher at depth than at the surface, but only initially.
- B) Productivity is higher at the surface than at depth; however, an additional experiment could further test the effect of depth by introducing FeSO_4 at 30 m deep and measuring the chlorophyll *a* response.
- C) Productivity is higher at the surface than at depth, and would be predicted to increase sharply after day 12.
- D) Productivity at a depth of 30 m is low only because of a lack of sunlight, not a lack of iron sulfate.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 55.2

- 21) During a year, plants never use 100% of the incoming solar radiation for photosynthesis. What is a reasonable explanation for this?
- A) Plants cannot photosynthesize as well in warm temperatures as in cold temperatures.
 - B) Plants do not intercept all incoming light, as some light will strike water, bare soil, or rock.
 - C) The pigments that drive photosynthesis absorb all of the wavelengths of light that are available; however, some of the light is subsequently reflected.
 - D) At least 75% of all incoming light is reflected, absorbed, or scattered back by clouds in the atmosphere.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.2

- 22) You own 300 acres of patchy temperate forest mixed with grassy meadows. Which one of the following actions would increase the net primary productivity of the area the most?
- A) adding fertilizer to the entire area
 - B) introducing 100 rabbits into the area
 - C) planting 500 new trees
 - D) relocating all of the deer found in the area

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 55.2

- 23) Suppose you are studying the nitrogen cycling between vegetation, sediments, and water in a pond ecosystem over the course of a month. While you are collecting data, a flock of 100 Canada geese lands and spends the night during a fall migration. What could you do to eliminate error in your study as a result of this event?
- A) Find out how much nitrogen is consumed in plant material by a Canada goose over about a 12-hour period, multiply this number by 100, and add that amount to the total nitrogen in the ecosystem.
 - B) Find out how much nitrogen is eliminated by a Canada goose over about a 12-hour period, multiply this number by 100, and subtract that amount from the total nitrogen in the ecosystem.
 - C) Find out how much nitrogen is consumed from vegetation and eliminated by a Canada goose over about a 12-hour period and multiply this number by 100; enter this +/- value into the nitrogen budget of the ecosystem.
 - D) Put a net over the pond so that no more migrating flocks can land on the pond and alter the nitrogen balance of the pond.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 55.2

24) Many of the organisms in the ocean are nutrient-limited. If you wanted to investigate this phenomenon, one reasonable approach would be to _____.

- A) observe Antarctic Ocean productivity from year to year to see if it changes
- B) experimentally enrich some areas of the ocean and compare their productivity to that of untreated areas
- C) compare nutrient concentrations between the photic zone and the benthic zone in various marine locations
- D) contrast nutrient uptake by autotrophs in marine locations that are different temperatures

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 55.2

25) If you applied a fungicide to a cornfield, what would you expect to happen to the rate of decomposition and net ecosystem production (NEP)?

- A) Both decomposition rate and NEP would decrease.
- B) Both decomposition rate and NEP would increase.
- C) Decomposition rate would increase and NEP would decrease.
- D) Decomposition rate would decrease and NEP would increase.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 55.2

26) Which of the following is an accurate statement regarding mineral nutrients in soils and their implication for primary productivity?

- A) Globally, phosphorous availability is most limiting to primary productivity.
- B) Adding a nonlimiting nutrient will stimulate primary productivity.
- C) Phosphorous is sometimes unavailable to producers due to leaching.
- D) Alkaline soils are more productive than acidic soils.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.2

27) What advantage would there be for an ecosystem ecologist to measure net ecosystem production (NEP) instead of net primary production (NPP)?

- A) NPP cannot be expressed in energy/unit of area/unit of time.
- B) NEP can be expressed in terms of carbon fixed by photosynthesis for an entire ecosystem, minus respiration by producers, allowing the measurement of net CO₂ flux.
- C) NEP represents the amount of energy from light converted to chemical energy, minus the energy used by all organisms for cellular respiration, which could indicate whether or not carbon is being stored.
- D) NPP shows the rate at which the standing crop is utilized by consumers.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.2

- 28) How is net ecosystem production (NEP) typically estimated in ecosystems?
- A) by detecting the amount of heat energy released by the ecosystem
 - B) by measuring gas exchange from vegetation as well as estimates of respiration by all other organisms
 - C) by measuring the rate of decomposition by detritivores
 - D) by calculating the annual total of incoming solar radiation per unit of area

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.2

- 29) Which of the following ecosystems would likely have the largest net primary productivity per hectare and why?
- A) open ocean, because of the total biomass of photosynthetic autotrophs
 - B) grassland, because of rapid growth, the small standing crop biomass that results from consumption by herbivores, and rapid decomposition
 - C) tundra, because of the incredibly rapid period of growth during the summer season
 - D) deep ocean, due to the high activity of chemoautotrophs at deep sea vents

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 55.2

- 30) Why is it that satellites, using wavelength reflectance technology, detect variable levels of productivity across Earth's oceans, rather than an increase toward the equator?
- A) Temperatures at the equator often exceed those which are optimal for primary production.
 - B) Light at the equator is too constant and direct.
 - C) NPP in Earth's open oceans could differ due to variability in depth, the presence of coral reefs, or by ocean currents.
 - D) Satellites detect differences by measuring the amount of water vapor emitted by transpiring producers, and this is a variable measurement in the oceans.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 55.2

- 31) Which one of the following correctly ranks these organisms in order from lowest to highest percent in production efficiency?
- A) mammals, fish, insects
 - B) insects, fish, mammals
 - C) fish, insects, mammals
 - D) mammals, insects, fish

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 55.3

32) Owls eat rats, mice, shrews, and small birds. Assume that, over a period of time, an owl consumes 5,000 J of animal material. The owl loses 2,300 J in feces and owl pellets and uses 2,500 J for cellular respiration. What is the production efficiency of this owl?

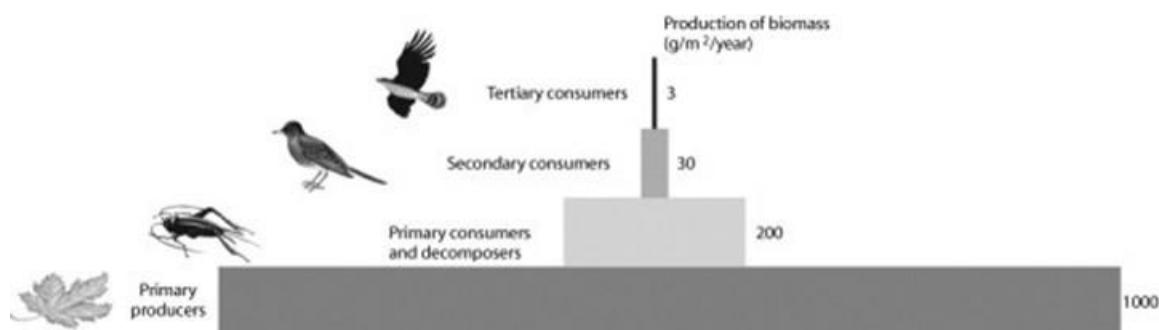
- A) 8%
- B) 7.4%
- C) 2%
- D) 40%

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 55.3

33) Use the following figure to answer the question.



After looking at the figure, what can be said about productivity in this ecosystem?

- A) Nothing can be said based on this information.
- B) Between 80% and 90% of the energy is lost between most trophic levels.
- C) Between 10% and 20% of the energy is lost between most trophic levels.
- D) Productivity increases with each trophic level.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 55.3

34) How does inefficient transfer of energy among trophic levels result in the typically high endangerment status of many top-level predators?

- A) Top-level predators are destined to have small populations that are sparsely distributed.
- B) Predators have relatively large population sizes.
- C) Predators are more disease-prone than animals at lower trophic levels.
- D) Top-level predators are more likely to be stricken with parasites.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.3

35) Why does a vegetarian leave a smaller ecological footprint than an omnivore?

- A) Fewer animals are slaughtered for human consumption.
- B) There is an excess of plant biomass in all terrestrial ecosystems.
- C) Vegetarians need to ingest less chemical energy than omnivores.
- D) Eating meat is an inefficient way of acquiring photosynthetic productivity.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.3

36) For most terrestrial ecosystems, pyramids composed of species abundances, biomass, and energy are similar in that they have a broad base and a narrow top. The primary reason for this pattern is that _____.

- A) secondary consumers and top carnivores require less energy than producers
- B) at each step, energy is lost from the system
- C) biomagnification of toxic materials limits the secondary consumers and top carnivores
- D) top carnivores and secondary consumers have a more general diet than primary producers

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.3

37) Which of the following is primarily responsible for limiting the number of trophic levels in most ecosystems?

- A) Many primary and higher-order consumers are opportunistic feeders.
- B) Decomposers compete with higher-order consumers for nutrients and energy.
- C) Nutrient cycling rates tend to be limited by decomposition.
- D) Energy transfer between trophic levels is usually less than 20 percent efficient.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.3

38) Which trophic level is most vulnerable to extinction?

- A) producer level
- B) primary consumer level
- C) secondary consumer level
- D) tertiary consumer level

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.3

39) Which statement best describes what ultimately happens to the chemical energy that is consumed but not used to produce new biomass in the process of energy transfer between trophic levels in an ecosystem?

- A) It is undigested and winds up in the feces and is not passed on to higher trophic levels.
- B) It is used by organisms to maintain their life processes through the reactions of cellular respiration.
- C) Heat produced by cellular respiration is used by heterotrophs for thermoregulation.
- D) It is eliminated as feces or is dissipated into space as heat as a result of cellular respiration consistent with the second law of thermodynamics.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 55.3

40) Consider the food chain of grass → grasshopper → mouse → snake → hawk. About how much of the chemical energy fixed by photosynthesis of the grass (100 percent) is available to the hawk?

- A) 0.01%
- B) 0.1%
- C) 1%
- D) 10%

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 55.3

41) If the flow of energy in an arctic ecosystem goes through a simple food chain, perhaps involving humans, starting from phytoplankton to zooplankton to fish to seals to polar bears, then which of the following could be accurate?

- A) Polar bears can provide more food for humans than seals can.
- B) The total biomass of the fish is lower than that of the seals.
- C) Seal populations are larger than fish populations.
- D) Fish can potentially provide more food for humans than seal meat.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 55.3

42) Use the following figure to answer the question.

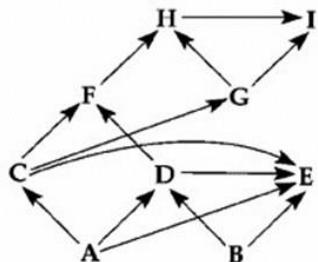


Diagram of a food web (arrows represent energy flow and letters represent species)

If the figure represents a terrestrial food web, the combined biomass of C + D would probably be _____.

- A) greater than the biomass of A
- B) greater than the biomass of B
- C) less than the biomass of A + B
- D) less than the biomass of E

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 55.3

43) A porcupine eats 3,000 J of plant material. Of this, 2,100 J is indigestible and is eliminated as feces, 800 J are used in cellular respiration, and 100 J are used for growth and reproduction.

What is the approximate production efficiency of this animal?

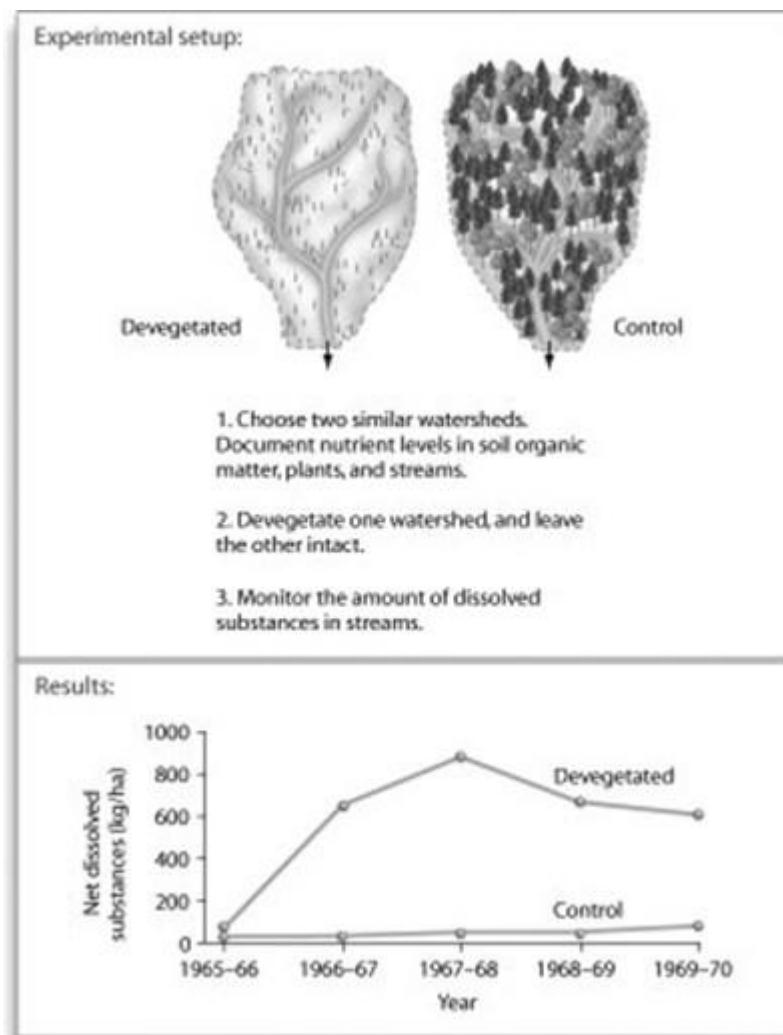
- A) 0.03%
- B) 3%
- C) 11%
- D) 33%

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 55.3

44) Use the following figure to answer the question.



Based on the figure, which of the following are plausible reasons for the results?

- I) Nutrients in the control watershed are being lost due to evapotranspiration from leaves.
- II) Nutrients dissolve in the water running through the watershed.
- III) Nutrients are attached to small particles of sand or clay that leave the watershed.
- IV) Intact vegetation includes plant roots that held soil particles and prevented nutrient loss.

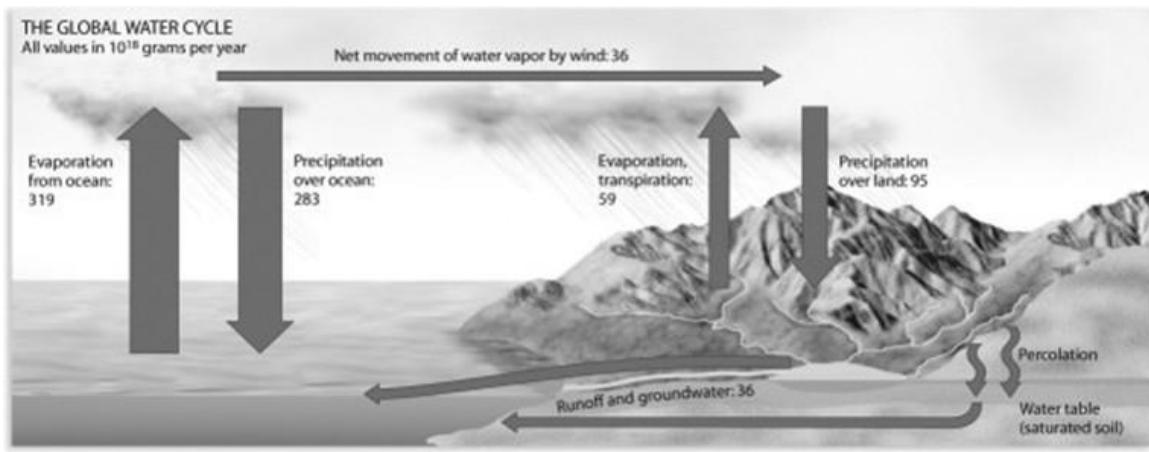
- A) only I and III
- B) only II and IV
- C) I, II, III, and IV
- D) only II, III, and IV

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 55.4

45) Use the following figure to answer the question.



Consider the global water cycle depicted in the figure. Where is the greatest flux of water from one reserve to another?

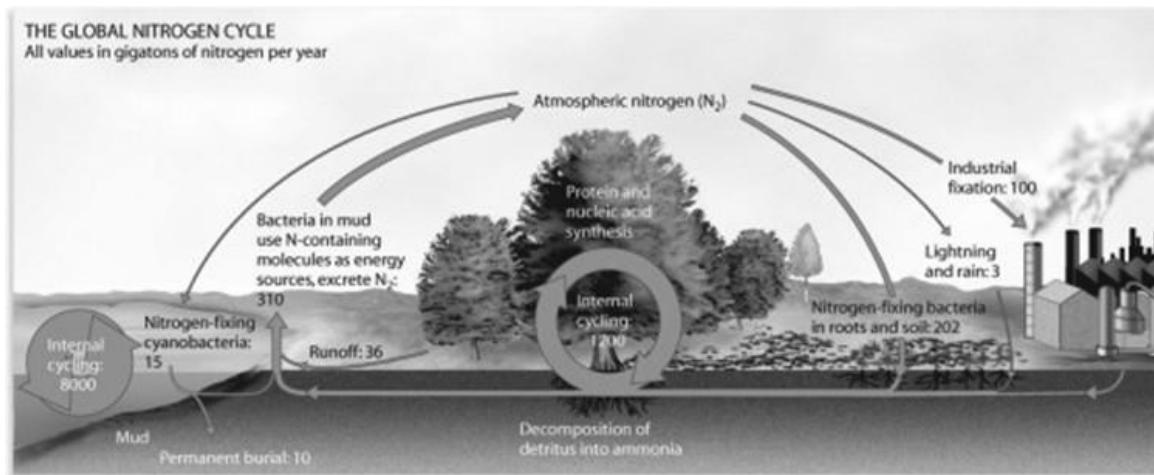
- A) from precipitation to the ocean
- B) from the ocean to the atmosphere
- C) from runoff in streams and the water table to the ocean
- D) from evaporation and transpiration of terrestrial vegetation to the atmosphere

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 55.4

46) Use the following figure to answer the question.



Consider the global nitrogen cycle depicted in the figure. What is the limiting portion of the cycle for plants?

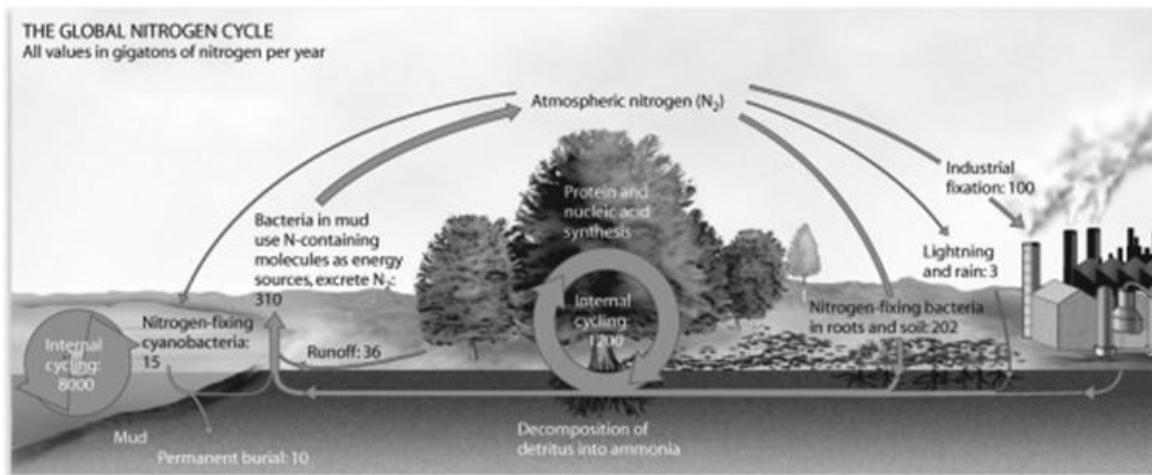
- A) industrial nitrogen fixation
- B) nitrogen lost to the atmosphere
- C) internal nitrogen cycling in the oceans
- D) nitrogen fixation by bacteria

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.4

47) Use the following figure to answer the question.



Consider the global nitrogen cycle depicted in the figure. How are humans altering this cycle?

- A) industrial nitrogen fixation
- B) nitrogen lost to the atmosphere
- C) reduction of nitrogen available to terrestrial ecosystems
- D) reduction of nitrogen fixation by bacteria

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.4

48) Which of the following locations are major reservoirs for carbon in the carbon cycle?

- A) the ocean, atmosphere, and fossilized and live plant and animal biomass
- B) the atmosphere
- C) fossilized plant and animal remains (coal, oil, and natural gas)
- D) sediments and sedimentary rocks

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.4

49) Which of the following statements is correct about biogeochemical cycling?

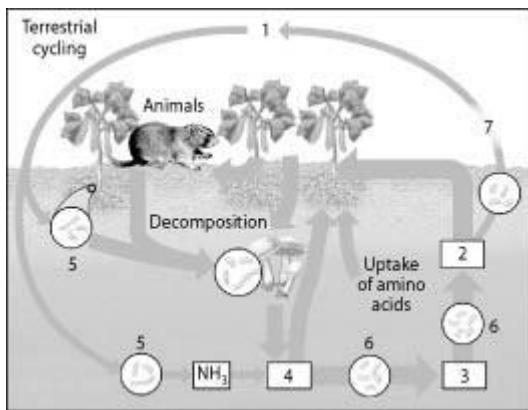
- A) Phosphorus is the limiting nutrient that most widely affects biomass production.
- B) The phosphorus cycle involves the weathering of rocks.
- C) The carbon cycle has maintained a constant atmospheric concentration of carbon dioxide for the past million years.
- D) The nitrogen cycle involves movement of diatomic nitrogen between the biotic and abiotic components of the ecosystem.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.4

50) Use the following figure to answer the question.



On the diagram of the nitrogen cycle, which number represents nitrite (NO_2)?

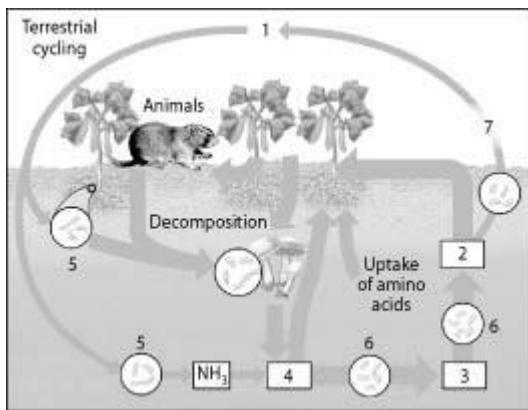
- A) 1
- B) 2
- C) 3
- D) 4

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 55.4

51) Use the following figure to answer the question.



On the diagram of the nitrogen cycle, which number represents the ammonium ion (NH_4^+)?

- A) 1
- B) 2
- C) 3
- D) 4

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 55.4

52) Nitrifying bacteria participate in the nitrogen cycle mainly by _____.

- A) converting nitrogen gas to ammonia
- B) releasing ammonium from organic compounds, thus returning it to the soil
- C) converting ammonium to nitrate, which plants absorb
- D) incorporating nitrogen into amino acids and organic compounds

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 55.4

53) The Hubbard Brook watershed deforestation experiment revealed that _____.

- I) deforestation increased water runoff
- II) nitrate concentration in waters draining the deforested area became dangerously high
- III) calcium levels remained high in the soil of deforested areas

- A) only I
- B) only II
- C) only III
- D) only I and II

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.4

54) Why do logged tropical rain forest soils typically have nutrient-poor soils?

- A) Tropical bedrock contains little phosphorous.
- B) Logging results in soil temperatures that are lethal to nitrogen-fixing bacteria.
- C) Most of the nutrients in the ecosystem are removed in the harvested timber.
- D) The cation exchange capacity of the soil is reversed as a result of logging.

Answer: C

Bloom's Taxonomy: Synthesis/Evaluation

Section: 55.4

55) How can biodiversity affect the way we decontaminate industrial sites?

- I) Bacteria have been found to be able to detoxify certain chemicals; perhaps there are more.
- II) Trees produce sawdust, which can be used to soak up chemicals.
- III) Species evolving in contaminated areas could adapt and detoxify the area.

- A) only I
- B) only II
- C) only III
- D) only II and III

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 55.5

56) The first step in ecosystem restoration is to _____.

- A) restore the physical structure
- B) restore native species that have been extirpated due to disturbance
- C) remove competitive invasive species
- D) remove toxic pollutants

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.5

57) The goal of restoration ecology is to _____.

- A) replace a ruined ecosystem with a more suitable ecosystem for that area
- B) return degraded ecosystems to a more natural state
- C) manage competition among species in human-altered ecosystems
- D) prevent further degradation by protecting an area with park status

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.5

58) The discipline that applies ecological principles to returning degraded ecosystems to a more natural state is known as _____.

- A) landscape ecology
- B) conservation ecology
- C) restoration ecology
- D) resource conservation

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 55.5

59) Which of the following would be considered an example of bioremediation?

- A) adding nitrogen-fixing microorganisms to a degraded ecosystem to increase nitrogen availability
- B) using a bulldozer to regrade a strip mine
- C) dredging a river bottom to remove contaminated sediments
- D) adding fertilizer to soil poor in nutrients to increase plant growth

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 55.5

60) Acid precipitation lowered the pH of soil in a terrestrial ecosystem that supported a diverse community of plants and animals. The decrease in pH eliminated all nitrogen-fixing bacteria populations in the area. Which prediction most accurately reflects the impact this will have on the community?

- A) Since phosphorus can replace nitrogen as an essential nutrient, the impact will be minimal.
- B) Plants can obtain the nitrogen necessary for growth from the atmosphere, but bacterial communities will be negatively impacted.
- C) Primary producers will suffer from nitrogen deficiency and the entire community will experience a decrease in carrying capacity.
- D) The decrease in pH actually increases the availability of soil nutrients, so other nutrients that were less available cause an increase in primary production and an increase in biomass at other trophic levels.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 55.2

55.2 Student Edition End-of-Chapter Questions

1) Which of the following organisms is *incorrectly* paired with its trophic level?

- A) cyanobacterium—primary producer
- B) grasshopper—primary consumer
- C) zooplankton—primary producer
- D) fungus—detritivore

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

2) Which of these ecosystems has the *lowest* net primary production per square meter?

- A) a salt marsh
- B) an open ocean
- C) a coral reef
- D) a tropical rain forest

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

3) The discipline that applies ecological principles to returning degraded ecosystems to a more natural state is known as

- A) restoration ecology.
- B) thermodynamics.
- C) eutrophication.
- D) biogeochemistry.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Nitrifying bacteria participate in the nitrogen cycle mainly by
- A) converting nitrogen gas to ammonia.
 - B) releasing ammonium from organic compounds, thus returning it to the soil.
 - C) converting ammonium to nitrate, which plants absorb.
 - D) incorporating nitrogen into amino acids and organic compounds.

Answer: C

Bloom's Taxonomy: Application/Analysis

- 5) Which of the following has the greatest effect on the rate of chemical cycling in an ecosystem?

- A) the rate of decomposition in the ecosystem
- B) the production efficiency of the ecosystem's consumers
- C) the trophic efficiency of the ecosystem
- D) the location of the nutrient reservoirs in the ecosystem

Answer: A

Bloom's Taxonomy: Application/Analysis

- 6) The Hubbard Brook watershed deforestation experiment yielded all of the following results *except* which of the following?

- A) Most minerals were recycled within a forest ecosystem.
- B) Calcium levels remained high in the soil of deforested areas.
- C) Deforestation increased water runoff.
- D) The nitrate concentration in waters draining the deforested area became dangerously high.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 7) Which of the following would be considered an example of bioremediation?

- A) adding nitrogen-fixing microorganisms to a degraded ecosystem to increase nitrogen availability
- B) using a bulldozer to regrade a strip mine
- C) reconfiguring the channel of a river
- D) adding seeds of a chromium-accumulating plant to soil contaminated by chromium

Answer: D

Bloom's Taxonomy: Application/Analysis

- 8) If you applied a fungicide to a cornfield, what would you expect to happen to the rate of decomposition and net ecosystem production (NEP)?

- A) Both decomposition rate and NEP would decrease.
- B) Neither would change.
- C) Decomposition rate would increase and NEP would decrease.
- D) Decomposition rate would decrease and NEP would increase.

Answer: D

Bloom's Taxonomy: Application/Analysis

56.1 Multiple-Choice Questions

1) Philippe Bouchet and colleagues conducted a massive survey of marine molluscs on the west coast of New Caledonia. For 20% of the total species that were located and identified, only a single specimen was found. What does that suggest about the diversity of molluscs in this area?

- A) The west coast of New Caledonia is not an appropriate habitat for molluscs.
- B) Many of the species from this 20% are probably rare.
- C) They were not sampling uniformly throughout the area.
- D) Many of the species from this 20% are most likely just dispersing through the area.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 56.1

2) If all individuals in the last remaining population of a particular frog species were all highly related, which type of diversity would be of greatest concern when planning to prevent the species from going extinct?

- A) global diversity
- B) local diversity
- C) ecosystem diversity
- D) genetic diversity

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.1

3) What is the biological significance of genetic diversity between populations?

- A) Genes for traits conferring an advantage to local conditions are unlikely.
- B) The population that is most fit would survive by competitive exclusion.
- C) Genetic diversity reduces the probability of extinction.
- D) Diseases and parasites are not spread between separated populations.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 56.1

4) Tropical forests are being converted to farm or pasture land at an alarming rate, and one major focus is on the biodiversity and the impact to these ecosystems. What is a direct benefit to humans that helps explain why these forests need to be preserved?

- A) This diversity provides areas for coffee growing.
- B) Natural and undisturbed areas are important wildlife habitats.
- C) The diversity could contain novel drugs for consumers.
- D) The plant diversity provides shade, which lowers global warming.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 56.1

5) Ecosystem services include processes that increase the quality of the abiotic environment.

Which of the following processes would fall under this category?

- A) Keystone predators have a marked effect on species diversity.
- B) Green plants and phytoplankton produce the oxygen we breathe.
- C) Bees, flies, and wasps pollinate many plants.
- D) The presence of dams improves flood control.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.1

6) During the inventory of bacterial genes present in the Sargasso Sea, a deep isolated area in the middle of the Atlantic Ocean, a research team concluded that at least 1,800 bacterial species were present. Based on what you might predict about the habitat structure of such an area, what kind of bacterial diversity would you expect to see in tropical coral reef waters?

- A) slightly greater genetic diversity
- B) slightly smaller genetic diversity
- C) markedly smaller genetic diversity
- D) markedly greater genetic diversity

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 56.4

7) Erwin and Scott used an insecticidal fog to knock down insects from the top section of a *L. seemannii* tree. The researchers identified over 900 species of beetles among the individuals that fell. Erwin also projected that this entire tree from top to bottom is host to about 600 arthropod species that are unique to this tree species and not found on any other tree species. There are approximately 50,000 species of tropical trees. Although it could not be entirely accurate, what would be the best way to estimate the total number of arthropod species?

- A) Estimate the species density and then multiply by 50,000.
- B) Multiply 600 by 50,000.
- C) Multiply 50,000 by 900.
- D) Add 900 to 600, and then multiply by 50,000.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 56.1

8) Which of the following statements regarding extinction is accurate?

- A) A large percentage of species are immune from extinction; however, rates of extinction may increase with continued human impacts.
- B) Extinctions occur only periodically, separated by long time spans with no extinctions.
- C) Extinction is occurring at a similar rate now as compared to historical fossil evidence.
- D) The small-population approach is inferior to the declining-population approach if the goal is to conserve the maximum number of species in a given region.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 56.2

9) The human impact that scientists determined has caused the most extinctions on record is _____, and beyond further losses from this impact, the other impact with the largest potential to cause future extinctions is _____.

- A) introduced species; habitat loss
- B) habitat loss; overharvesting
- C) climate change; habitat loss
- D) habitat loss; climate change

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.4

10) Which of the following observations provides the best evidence of a biodiversity crisis?

- A) the incursion of a non-native species
- B) increasing pollution levels
- C) high rate of extinction
- D) climate change

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.1

11) Which of the following terms includes all of the others?

- A) species diversity
- B) biodiversity
- C) genetic diversity
- D) ecosystem diversity

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.1

12) To better comprehend the magnitude of current extinctions, it will be necessary to _____.

- A) differentiate between plant extinction and animal extinction numbers
- B) focus on identifying more species of mammals and birds
- C) identify more of the yet unknown species of organisms on Earth
- D) use the average extinction rates of vertebrates as a baseline

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 56.1

13) Loss of biodiversity matters not only with regard to mammals or other vertebrates, but also microbes. Why are microbes worthy of discovery and protection from extinction?

- A) Microbes play a role in digestion.
- B) Microbes may produce unique proteins useful in genetic research.
- C) Microbes are much greater in species number than any other taxa on Earth.
- D) Microbes may be the most sensitive to the next large extinction event.

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.1

14) Which of the following threats to biodiversity is targeted at specific species rather than groups of species?

- A) introduced species
- B) habitat destruction
- C) increased levels of atmospheric carbon dioxide, a cause of global warming
- D) overharvesting

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.1

15) Introduced species can have deleterious effects on biological communities by _____.

- A) competing with native species for resources and displacing them
- B) spreading rapidly in their new region
- C) reducing erosion
- D) increasing the biodiversity in their new region

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.1

16) Overharvesting encourages extinction and is most likely to affect _____.

- A) animals that occupy a broad ecological niche
- B) large animals with low intrinsic reproductive rates
- C) most organisms that live in the oceans' coral reefs
- D) edge-adapted species

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 56.1

17) Of the following ecosystem types, which have been impacted the most by humans?

- A) wetland and riparian
- B) desert and high alpine
- C) taiga and second-growth forests
- D) tundra and arctic

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.1

18) Burning fossil fuels releases oxides of sulfur and nitrogen. These air pollutants can be responsible for _____.

- A) the death of fish in lakes
- B) precipitation with a pH as high as 8.0
- C) eutrophication of lakes
- D) global temperature decrease

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.1

19) Suppose you attend a town meeting at which some experts tell the audience that they have performed a cost-benefit analysis of a proposed transit system that would probably reduce overall air pollution and fossil fuel consumption. The analysis, however, reveals that ticket prices will not cover the cost of operating the system when fuel, wages, and equipment are taken into account. As a biologist, you know that if ecosystem services had been included in the analysis, the experts might have arrived at a different answer. Why are ecosystem services rarely included in economic analyses?

- A) Federal laws of the United States exclude their inclusion in any cost benefit analysis.
- B) They have a low value and are usually not cost effective.
- C) Ecosystem services only take into account abiotic factors that affect local environments.
- D) Their cost is difficult to estimate, and people take them for granted.

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 56.1

20) Researchers have been studying a rare population of 87 voles in an isolated area. Ten voles from a larger population were added to this isolated population. Besides having ten additional animals, what benefits are there to importing individuals?

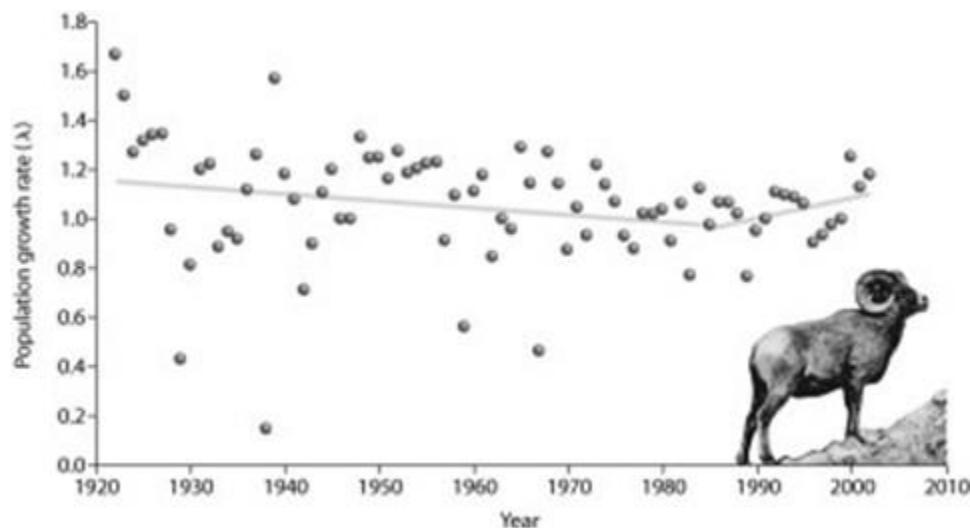
- A) There is no benefit other than increasing the overall population size.
- B) Additional voles will strengthen competition and increase the survival of the fittest.
- C) Additional animals would increase beneficial genetic drift.
- D) Additional voles from a distant population will likely increase genetic diversity and reduce inbreeding.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 56.2

21) Use the following figure to answer the question.



Five new individuals were added to a small population of bighorn sheep in 1986, and ten more were added between 1990 and 1994. According to the figure, what occurred in this population after these additions?

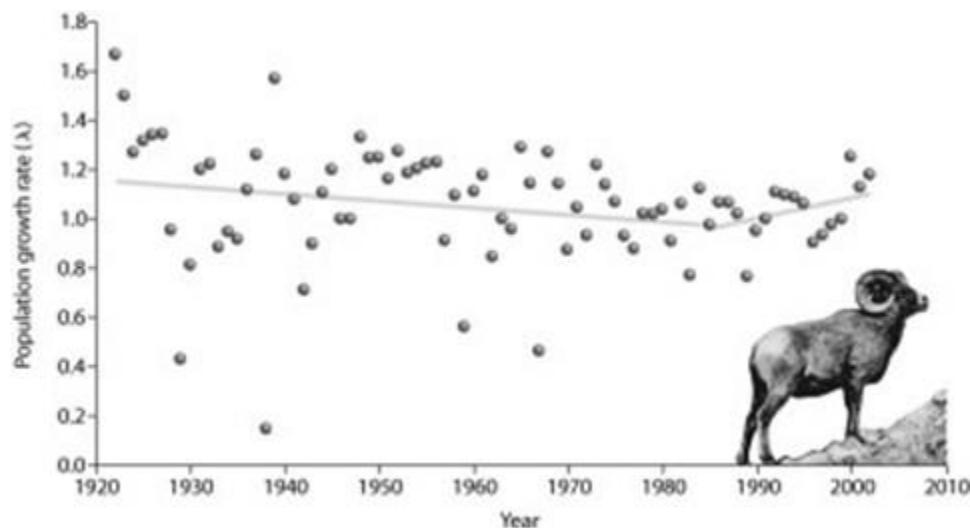
- A) The population increased exponentially.
- B) The population increased in overall numbers.
- C) The population growth rate increased.
- D) The population continued to decline.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 56.2

22) Use the following figure to answer the question.



According to the figure, what is the most accurate explanation for the data after 1985?

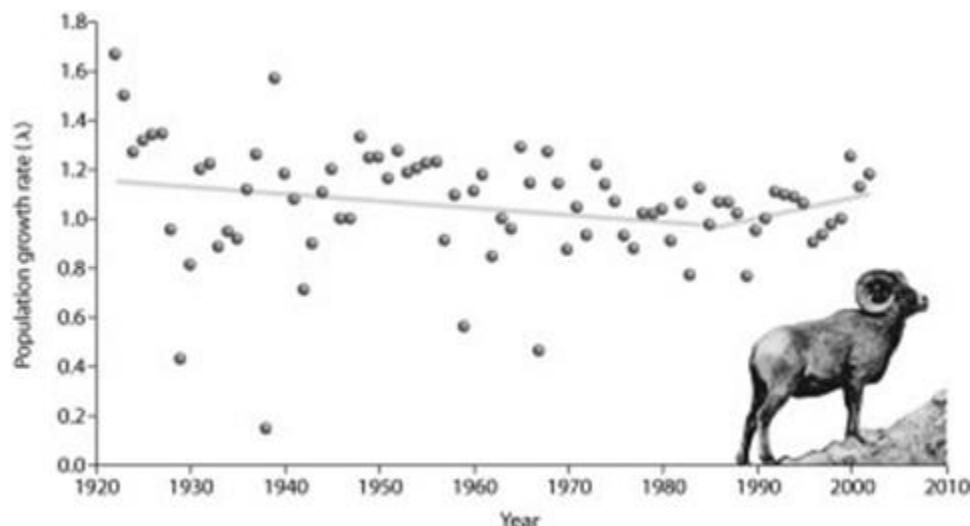
- A) emigration
- B) immigration
- C) introduction of new alleles into the population
- D) increased resources in the area

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 56.2

23) Use the following figure to answer the question.



According to the figure, which two consecutive years had the largest change in the population growth rate?

- A) 1967-1968
- B) 1922-1923
- C) 1938-1939
- D) 1985-1986

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 56.2

24) Easter Island is an extremely isolated island in the Pacific, about 3,500 km from South America. Although there are no forests on the island now, archeological studies, fossil pollen, and other data show that Easter Island was once home to forests containing giant palms and other trees. Some scientists think that the removal of the giant palms caused the forest ecosystem to collapse. Which of the following factors might have caused this collapse?

- A) Shade-tolerant species increased in diversity in the absence of the palm.
- B) Soil erosion decreased in the absence of the palm.
- C) The absence of the palm trees may have reduced habitat quality for many other species.
- D) Productivity increased, thereby increasing competition, in the palms' absence.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 56.2

25) Which of the following criteria have to be met for a species to qualify as invasive?

- A) endemic to the area, spreads rapidly, and displaces foreign species
- B) introduced to a new area, spreads rapidly, and displaces native species
- C) introduced to a new area, spreads rapidly, and displaces other invasive species
- D) endemic to the area, spreads slowly, and displaces native species

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.1

26) Which of the following conditions is the most likely indicator of a population in an extinction vortex?

- A) The species in question is found only in small, stable pockets of its former range.
- B) The effective population size of the species falls below 1,000.
- C) Genetic measurements indicate a loss of genetic variation over time.
- D) The population is permanently small.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.2

27) What strategy was used to rescue Illinois prairie chickens from a recent extinction vortex?

- A) determining the minimum viable population size by taking into account the effective population size
- B) establishing a nature reserve to protect its habitat nesting grounds
- C) introducing individuals from other populations to increase genetic variation
- D) reducing the population size of its predators and competitors

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.2

28) If the sex ratio in a population is significantly different from 50:50, then which of the following statements will always be accurate?

- A) The population will enter the extinction vortex.
- B) The genetic variation in the population will increase over time.
- C) Modeling of the minimum viable population size will underestimate the actual population size.
- D) The effective population size will be less than the actual population size.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 56.2

29) Which of the following factors could cause the largest increase in the effective population size of a species?

- A) an increased number of males
- B) an increase in the total population size
- C) an increase in the number of breeding males and females
- D) an increased number of females

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.2

30) The primary difference between the small-population approach and the declining-population approach to biodiversity recovery is that _____.

- A) small-population approach is interested in bolstering the genetic diversity of a threatened population rather than the environmental factors that caused the population's decline
- B) small-population approach applies for conservation biologists when population numbers fall below 500
- C) declining-population approach would likely involve bringing together individuals from scattered small populations to interbreed in order to promote genetic diversity
- D) small-population approach would investigate and eliminate all of the human impacts on the habitat of the species being studied for recovery

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 56.2

31) Which of the following statements is accurate with respect to the red-cockaded woodpecker populations in the southeastern United States?

- A) The bird requires feeding grounds in and around mature pine forest that are uninterrupted by the structure of other vegetation.
- B) The mature pine forests in which they live should continue to be protected from forest fire.
- C) All of the appropriate red-cockaded woodpecker habitats have already been logged or converted to agricultural land.
- D) The red-cockaded woodpecker relies on dense forest to hide their nests from ground-dwelling predators.

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.2

32) Managing southeastern forests specifically for the red-cockaded woodpecker _____.

- A) required periodic forest burning to reduce the growth of a dense understory of trees and shrubs
- B) contributed to greater abundance and diversity of other forest plant species
- C) required the construction of nest boxes in the forest to promote successful nesting
- D) focused on the removal of standing dead longleaf pine to promote growth of young longleaf pine

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.2

33) Which of the following strategies would most rapidly increase the genetic diversity of a population in an extinction vortex?

- A) Capture all remaining individuals in the population for captive breeding followed by reintroduction to the wild.
- B) Establish a reserve that protects the population's habitat.
- C) Introduce new individuals transported from other populations of the same species.
- D) Sterilize the least fit individuals in the population.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 56.2

34) Which one of the following is most likely to be a hot spot of biodiversity for birds?

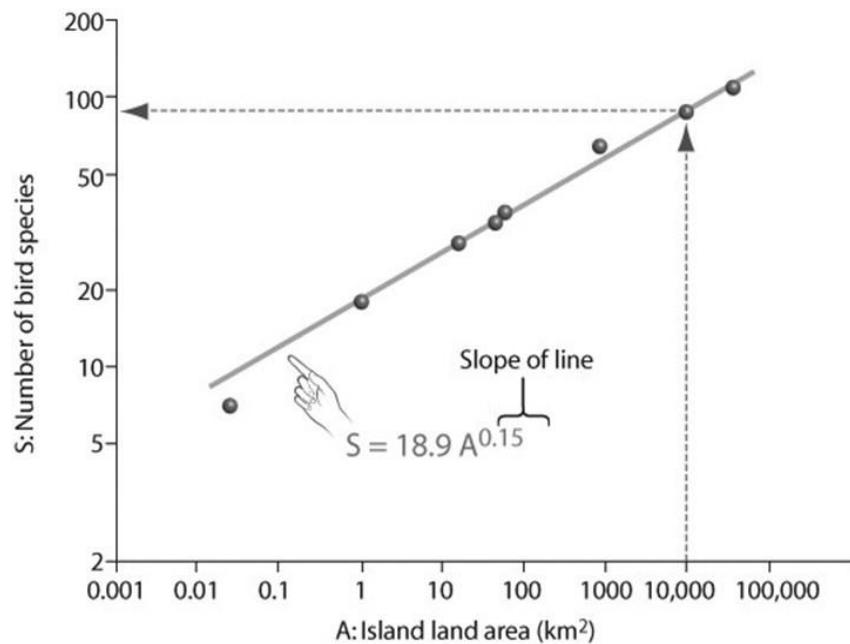
- A) Central America
- B) Northern Europe
- C) Central Australia
- D) Eastern North America

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.3

35) Use the following figure to answer the question.



In looking at the species-area plot in the figure, what can be concluded?

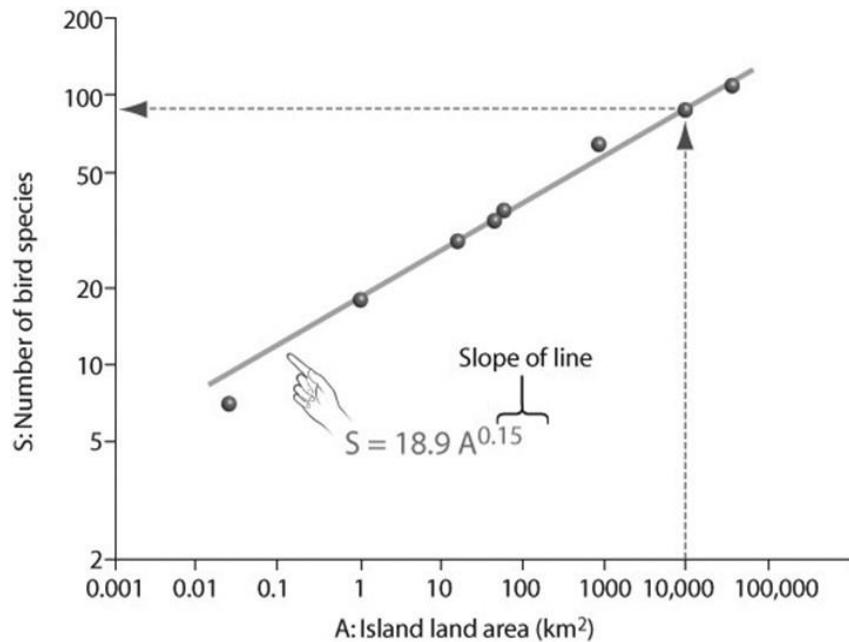
- A) The number of bird species increases linearly with island area.
- B) Two island land areas do not correlate to the number of bird species
- C) Diversity is independent from island area.
- D) The number of bird species increases exponentially with island area.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 56.3

36) Use the following figure to answer the question.



Based on the species-area plot in the figure, if habitable area on an island were reduced from 10,000 square kilometers (km^2) to 1,000 km^2 , roughly what percentage of the species would disappear?

- A) 0.3 percent
- B) 3 percent
- C) 30 percent
- D) 60 percent

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 56.3

37) The main purpose of movement corridors is to _____.

- A) slow down the introduction of new individuals of a species
- B) slowly introduce a species to a new reserve
- C) create more edge habitat
- D) connect two otherwise isolated populations

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.3

38) A land developer and several ecologists are discussing how a parcel of private land should be developed with housing while saving 20 hectares as natural habitat. The land developer suggests that the 20 hectares be divided into 20 separate 1-hectare areas, spread out across the area. The ecologists suggest that it would be better to have one intact parcel of 20 hectares on one side of the larger area. What is the significance of these different arrangements of the 20 hectares?

- A) The single intact parcel would have a smaller amount of edge than the 20 separate parcels.
- B) The isolated hectare plots increase the ability of individuals to disperse from one habitat to another.

C) The separate 1-hectare plots are less vulnerable to edge effects.

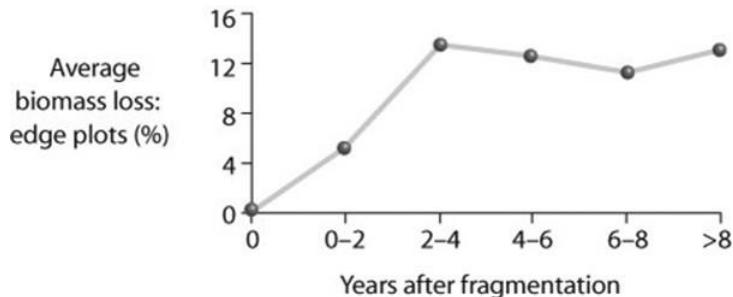
D) The large plot will create more inbreeding in many species.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 56.3

39) Use the following figure to answer the question.



Looking at the figure showing the results of forest fragmentation, what can be said about edge effects?

- A) Biomass declines along edges of forest fragments.
- B) Biomass increases along the edges of forest fragments.
- C) Species diversity decreases along the edges of forest fragments.
- D) Fragmentation does not affect biomass.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 56.3

40) Which of the following is a generally accurate statement about the current research regarding forest fragmentation?

- A) Fragmented forests promote biodiversity because they result in the combination of forest-edge species and forest-interior species.
- B) In fragmented forests, the number of forest-adapted species tend to decline and the number of edge species tend to increase.
- C) Fragmented forests are the goal of conservation biologists who design wildlife reserves.
- D) The disturbance of timber extraction causes the species diversity to increase because of the new habitats created.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 56.3

- 41) Brown-headed cowbirds utilize fragmented forests effectively by _____.
A) feeding on the fruits of shrubs that tend to grow at the forest/open-field interface
B) parasitizing the nests of forest birds and feeding on open-field insects
C) consuming the eggs of other species as well as insects and seeds in open fields
D) outcompeting other songbird species for access to nesting holes in old-growth trees

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.3

- 42) Movement corridors can be harmful to certain species because they _____.
A) increase inbreeding
B) spread disease and parasites
C) increase genetic diversity
D) allow seasonal migration

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.3

- 43) Establishing new nature reserves in biodiversity hot spots may not necessarily be the best choice because _____.
A) hot spots are situated in remote areas not accessible to the public
B) their ecological importance makes land purchase very expensive
C) a hot spot helps conserve only a few species
D) changing environmental conditions may shift the location of the hot spot

Answer: D

Bloom's Taxonomy: Synthesis/Evaluation

Section: 56.3

- 44) What is the biggest problem with selecting a site for a reserve?
A) Making a proper selection is difficult because currently the environmental conditions of almost any site can change quickly.
B) Keystone species are difficult to identify in potential reserve sites.
C) Only lands that are not useful to human activities are available for reserves.
D) Most of the best sites are inaccessible by land transportation, so making roads to them is often prohibitively expensive.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 56.3

45) What is a critical load?

- A) the amount of nutrient augmentation necessary to bring a depleted habitat back to its former level
- B) the level of a given toxin in an ecosystem that is lethal to 50 percent of the species present
- C) the amount of added nutrient that can be absorbed by plants without damaging ecosystem integrity
- D) the number of predators an ecosystem can support that effectively culls prey populations to healthy levels

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.4

46) Agricultural lands frequently require nutrient augmentation because _____.

- A) nitrogen-fixing bacteria are not as plentiful in agricultural soils because of the use of pesticides
- B) the nutrients that become the biomass of plants are not cycled back to the soil on lands where they are harvested
- C) land that is available for agriculture tends to be nutrient-poor
- D) cultivation of agricultural land inhibits the decomposition of organic matter

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 56.4

47) Which of the following outcomes is caused by excessive nutrient runoff into aquatic ecosystems?

- A) depletion of ozone layer
- B) acid precipitation
- C) biological magnification
- D) eutrophication

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.4

48) Which of the following factors causes extremely high levels of toxic chemicals in fish-eating birds?

- A) acid precipitation
- B) biological magnification
- C) greenhouse effect
- D) eutrophication

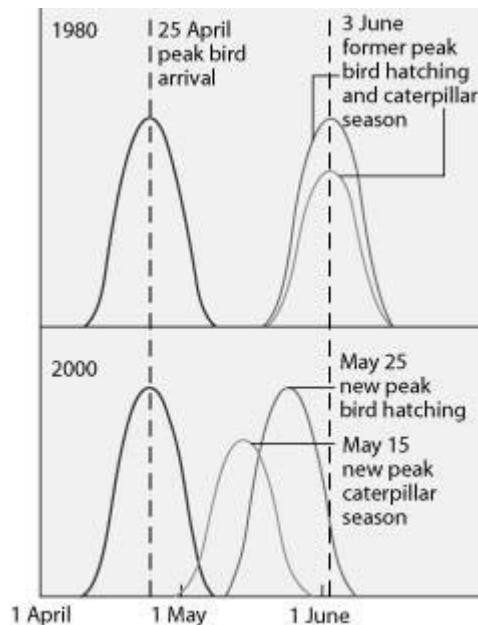
Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.4

49) Use the following graph and information to answer the question.

Flycatcher birds that migrate from Africa to Europe feed their chicks a diet that is almost exclusively moth caterpillars. The graph shows the peak dates of flycatcher arrival in Europe, bird hatching, and peak caterpillar season for the years 1980 and 2000. The y-axis is a measure of the abundance of birds, hatching chicks, and caterpillars.



The shift in the peak of caterpillar season is most likely due to _____.

- A) earlier migration returns of flycatchers
- B) an innate change in the biological clock of the caterpillars
- C) global warming
- D) acid precipitation in Europe

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 56.4

50) Your friend is wary of environmentalists' claims that global warming could lead to major biological change on Earth. Which of the following statements can you use in response to your friend's suspicions?

- A) We know that atmospheric carbon dioxide has decreased over the past 150 years.
- B) Through measurements and observations, we know that carbon dioxide levels and temperature fluctuations are indirectly correlated.
- C) Global warming could have minor effects on agriculture in the United States.
- D) Scientist have evidence that climate change has already altered primary production, as well as ecosystem services.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 56.4

51) The main cause of the increase in the amount of carbon dioxide in Earth's atmosphere over the past 150 years is _____.

- A) increased worldwide primary production
- B) an increase in the amount of infrared radiation absorbed by the atmosphere
- C) the burning of larger amounts of wood and fossil fuels
- D) additional respiration by the rapidly growing human population

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.4

52) Which of the following is a consequence of biological magnification?

- A) Toxic chemicals in the environment pose greater risk to top-level predators than to primary consumers.
- B) Populations of top-level predators are generally smaller than populations of primary consumers.
- C) Only a small portion of the energy captured by producers is transferred to consumers.
- D) The amount of biomass in the producer level of an ecosystem decreases if the producer turnover time increases.

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 56.4

53) Why are changes in the global carbon cycle important?

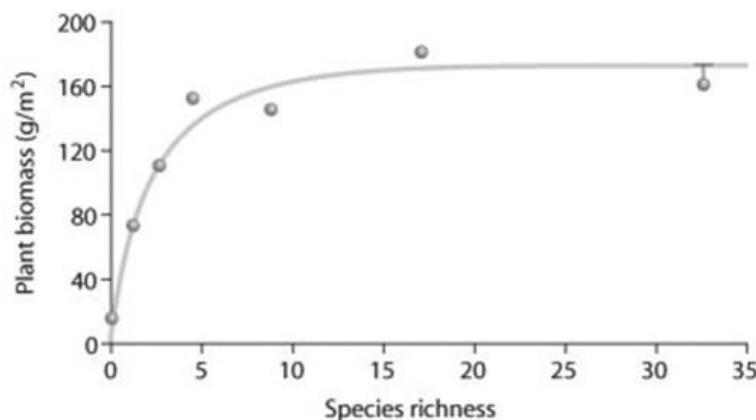
- A) Burning increases available carbon for primary producers and, therefore, primary consumers.
- B) Deforestation and suburbanization increase an area's net primary productivity.
- C) Increasing atmospheric concentrations of carbon dioxide are altering Earth's climate.
- D) By using fossil fuels, we are replenishing a nonrenewable resource.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.4

54) Use the following figure to answer the question.



Looking at the figure, what can you conclude about the data?

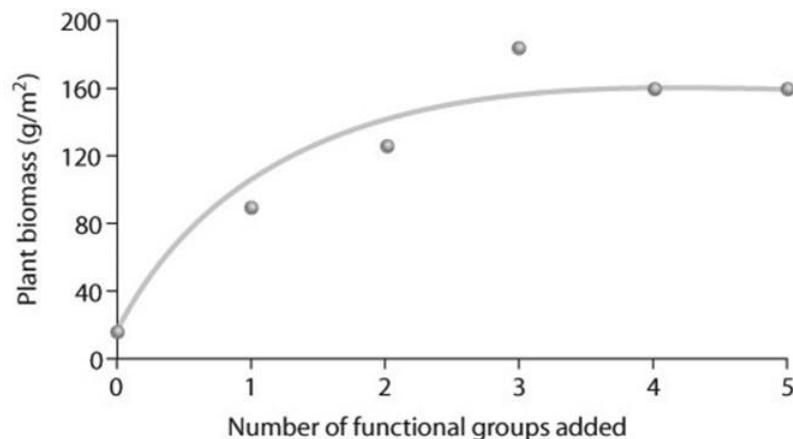
- A) As species richness changes, plant biomass remains consistent.
- B) As species richness increases, plant biomass increases.
- C) As species richness increases, plant biomass increases and then levels off.
- D) As species richness decreases, plant biomass increases.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 56.4

55) Use the following figure to answer the question.



Examine the figure and consider this hypothesis: Plant biomass increases with species richness. Functional groups are categories of plants each containing numerous species, such as grasses and wildflowers, or trees and shrubs. In looking at the data in the figure, how would you relate it to this hypothesis? The hypothesis is _____.

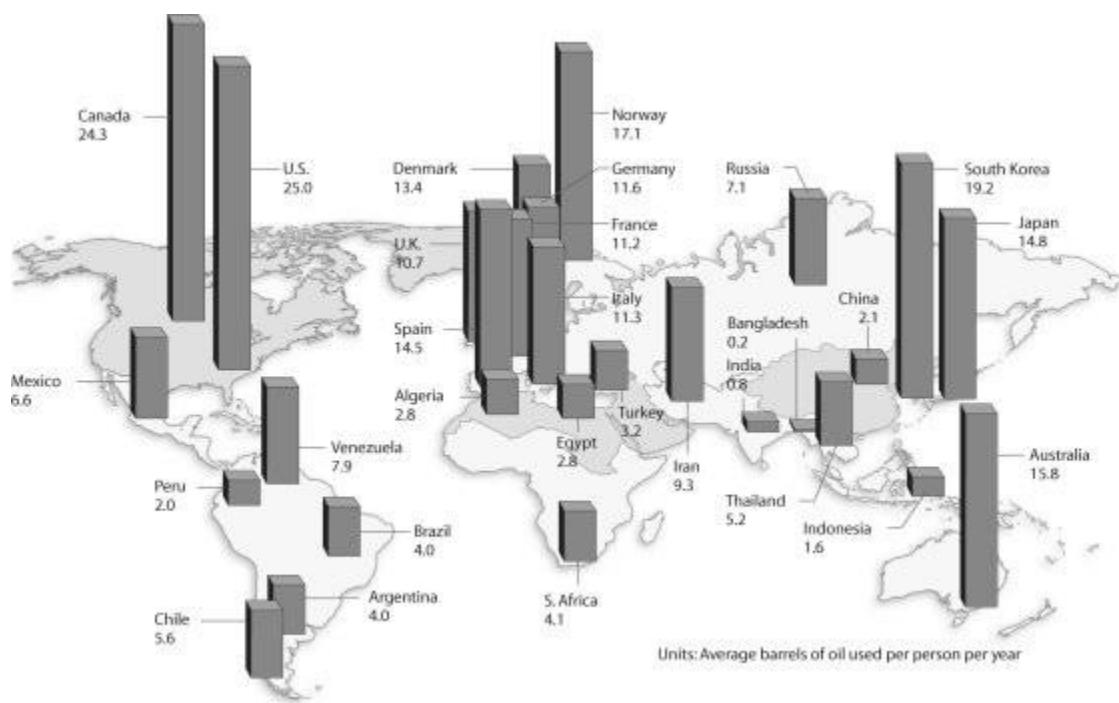
- A) partially supported
- B) supported
- C) rejected
- D) neither rejected nor supported

Answer: A

Bloom's Taxonomy: Application/Analysis

Section: 56.4

56) Use the following figure to answer the question.



Examine the figure, which notes the average barrels of oil used per person per year in different countries. What can be concluded?

- A) Residents in warmer climates use more energy per person.
- B) Residents of more affluent, industrialized countries use more energy per person.
- C) Residents of more populated countries use more energy per person.
- D) English-speaking countries tend to use more energy per person.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 56.4

57) The main goal of sustainable development is to _____.

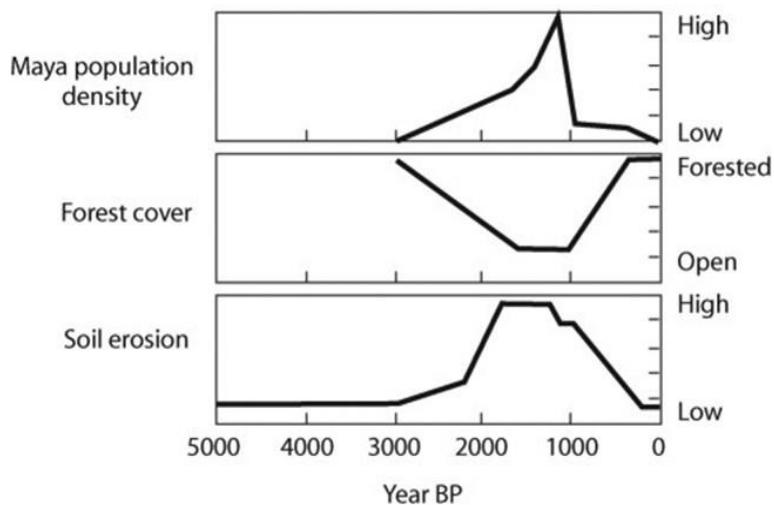
- A) involve more countries in conservation efforts
- B) use only natural resources in the construction of new buildings
- C) use natural resources such that they do not decline over time
- D) reevaluate and re-implement management plans over time

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.5

58) Use the graphs to answer the question.



Copyright © 2003 American Institute of Biological Sciences. (Foster, D.R., F. Swanson, J. Aber, D. Tilman, N. Brokaw, I. Burke and A. Knapp. 2003. The importance of land-use and its legacies to ecology and environmental management. *BioScience* 53:77-88.)

Archeological, fossil, and geological data provide information on the Mayan populations and their environment in Mexico, in the Caribbean state of Yucatán. The graphs depict population size, percentage of the land that was forested, and the amount of soil erosion. Based on the figure, what can you conclude about the history of land use in the southern Yucatán?

- A) Massive soil erosion caused the Mayan population to crash.
- B) Reduction in forest cover caused the Mayan population to crash.
- C) As Mayan population increased, deforestation increased, probably leading to increased soil erosion.
- D) This Mayan population practiced sustainable development.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 56.5

59) Which of the following nations has become a world leader in the establishment of zoned reserves?

- A) Costa Rica
- B) China
- C) United States
- D) Mexico

Answer: A

Bloom's Taxonomy: Knowledge/Comprehension

Section: 56.3

- 60) Which of the following statements about protected areas that have been established to preserve biodiversity is correct?
- A) About 25 percent of Earth's land area is now protected.
 - B) Developing nations have a larger ecological footprint than developed nations, thus protected areas should be primarily established in developing nations.
 - C) Management of a protected area should be coordinated with management of the land surrounding the area.
 - D) It is only important to protect land within biodiversity hot spots.

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 56.5

61) Eutrophication is often caused by excess limiting-nutrient runoff from agricultural fields into aquatic ecosystems. This process results in massive algal blooms that eventually die and decompose, ultimately depleting the dissolved oxygen, killing large numbers of fish and other aquatic organisms. Predict which of the following human actions would best address the problem of eutrophication near agricultural areas?

- A) After each eutrophication event, remove the dead fish and invertebrates to place on agricultural fields instead of fertilizer.
- B) Determine which limiting nutrient is responsible for the algal bloom, and use other fertilizers to apply to crops.
- C) Remove the algae before it dies and decomposes to prevent eutrophication from occurring.
- D) Determine critical nutrient loads required for certain crops, and do not exceed this amount during fertilizer application.

Answer: D

Bloom's Taxonomy: Application/Analysis

Section: 56.4

62) Elevated carbon dioxide levels have been shown to contribute to the greenhouse effect, resulting in an increase in mean global temperature. Ecosystems where the largest warming has already occurred include snow-covered northern coniferous forests, tundra, and arctic sea ice habitats. Which statement best explains how the elimination of ice-covered ecosystems affects the rise or fall in global temperature?

- A) Melting ice releases dissolved ozone gas, which adds to the greenhouse effect.
- B) More reflective surfaces of ice are replaced with darker, more absorptive surfaces, thereby contributing to the warming trend.
- C) Large-scale ice melts actually contribute toward lowering global temperatures by decreasing salinity of the oceans.
- D) Carbon dioxide levels are lowered as a result of the greater volume of water to accommodate greater levels of dissolved gas.

Answer: B

Bloom's Taxonomy: Application/Analysis

Section: 56.4

63) A parasitic fungus, *Geomycetes destructans*, has decimated millions of bats in the United States since it was first observed in upstate New York in 2006. The disease has been named white-nose syndrome because of the white fungal hyphae that cover the bat upon infection. It is believed that this fungus was introduced from Europe by tourists entering into caves with hibernating bat populations. Which prediction most likely reflects changes that will occur in natural communities as a result of massive bat mortality?

- A) increased animal populations as a result of niche availability
- B) increased rodent populations as a result of an increase in flying insect populations
- C) increased flying insect populations
- D) decreased bird populations as the spread of the fungus infects other closely related species

Answer: C

Bloom's Taxonomy: Application/Analysis

Section: 56.1

56.2 Student Edition End-of-Chapter Questions

- 1) One characteristic that distinguishes a population in an extinction vortex from most other populations is that
- A) it is a rare, top-level predator.
 - B) its effective population size is lower than its total population size.
 - C) its genetic diversity is very low.
 - D) it is not well adapted to edge conditions.

Answer: C

Bloom's Taxonomy: Knowledge/Comprehension

- 2) The main cause of the increase in the amount of CO₂ in Earth's atmosphere over the past 150 years is
- A) increased worldwide primary production.
 - B) increased worldwide standing crop.
 - C) an increase in the amount of infrared radiation absorbed by the atmosphere.
 - D) the burning of larger amounts of wood and fossil fuels.

Answer: D

Bloom's Taxonomy: Knowledge/Comprehension

- 3) What is the single greatest threat to biodiversity?
- A) overharvesting of commercially important species
 - B) habitat alteration, fragmentation, and destruction
 - C) introduced species that compete with native species
 - D) novel pathogens

Answer: B

Bloom's Taxonomy: Knowledge/Comprehension

- 4) Which of the following is a consequence of biological magnification?
- A) Toxic chemicals in the environment pose greater risk to top-level predators than to primary consumers.
 - B) Populations of top-level predators are generally smaller than populations of primary consumers.
 - C) The biomass of producers in an ecosystem is generally higher than the biomass of primary consumers.
 - D) Only a small portion of the energy captured by producers is transferred to consumers.

Answer: A

Bloom's Taxonomy: Application/Analysis

- 5) Which of the following strategies would most rapidly increase the genetic diversity of a population in an extinction vortex?
- A) Establish a reserve that protects the population's habitat.
 - B) Introduce new individuals transported from other populations of the same species.
 - C) Sterilize the least fit individuals in the population.
 - D) Control populations of the endangered population's predators and competitors.

Answer: B

Bloom's Taxonomy: Application/Analysis

- 6) Of the following statements about protected areas that have been established to preserve biodiversity, which one is *not* correct?
- A) About 25% of Earth's land area is now protected.
 - B) National parks are one of many types of protected areas.
 - C) Management of a protected area should be coordinated with management of the land surrounding the area.
 - D) It is especially important to protect biodiversity hot spots.

Answer: A

Bloom's Taxonomy: Application/Analysis