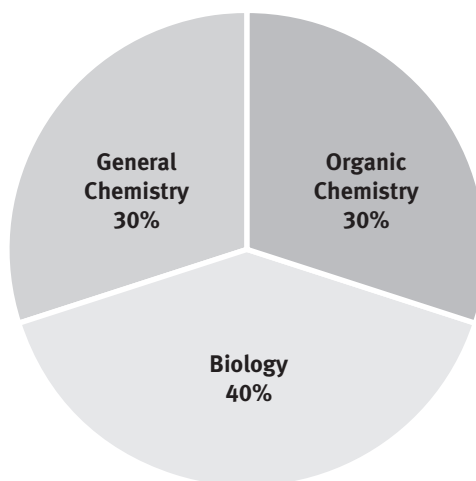


BIOLOGY 1

TOPICS COVERED

- The Survey of Natural Sciences Section
- The Biology Subsection
- Diversity of Life
- Cell and Molecular Biology
- Genetics
- Evolution, Ecology, and Behavior

The Survey of Natural Sciences Section

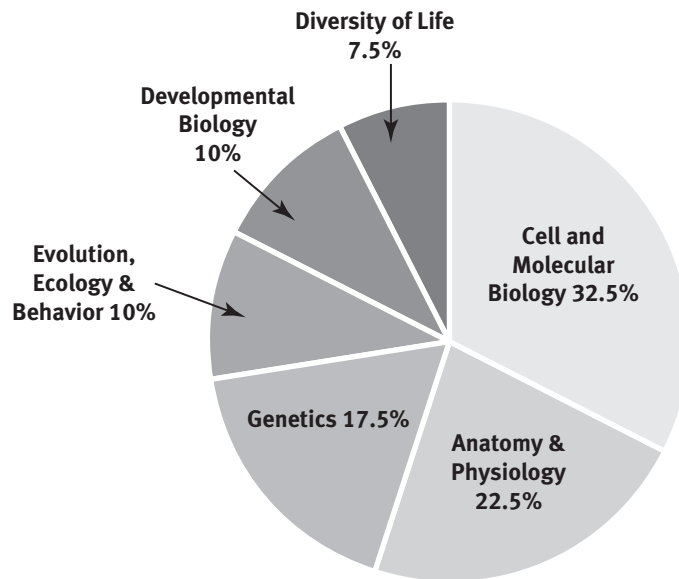


The distribution of Survey of Natural Sciences questions

Overview

- 100 questions in 90 minutes
- Consists of 40 Biology questions, 30 General Chemistry questions, and 30 Organic Chemistry questions
- Allows for use of a Periodic Table of the Elements, accessible by clicking the “Exhibit” button
- No calculator will be available during any part of the Survey of Natural Sciences

The Biology Subsection



The distribution of Biology questions

Overview

- 40 questions (40% of the Survey of Natural Sciences section)

Topics

Cell and Molecular Biology (13)

- Cellular Structure and Processes
- Organelle Structure and Function
- Cell Metabolism
- Thermodynamics
- Photosynthesis
- Mitosis and Meiosis
- Origin of Life
- Experimental Cell Biology

Developmental Biology (4)

- Fertilization
- Descriptive Embryology
- Developmental Mechanisms
- Experimental Embryology

Genetics (7)

- Molecular Genetics
- Human Genetics
- Classical Genetics
- Chromosomal Genetics
- Genetic Technology

Evolution, Ecology, and Behavior (4)

- Natural Selection
- Speciation
- Cladistics
- Population and Community Ecology
- Ecosystems
- Animal Behavior

Diversity of Life (3)

- Monera
- Plantae
- Animalia
- Protista
- Fungi

Anatomy and Physiology (9)

- Integumentary
- Skeletal
- Muscular
- Circulatory
- Immunological
- Digestive
- Respiratory
- Urinary
- Nervous
- Endocrine
- Reproductive

The Kaplan Question Strategy

STOP

- Characterize the answer choices.

THINK

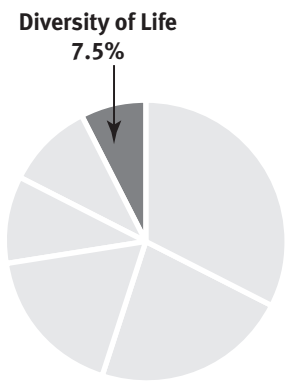
- What is the question really asking?
- What relevant information do you need?

PREDICT

- Formulate a framework or prediction for your answer.

MATCH

- Select the answer that truly meets the requirements of the prediction.



Diversity of Life

Five-Kingdom System

Monera

Protista

Plantae

Fungi

Animalia

Cell and Molecular Biology

Origin of Life

Early Conditions

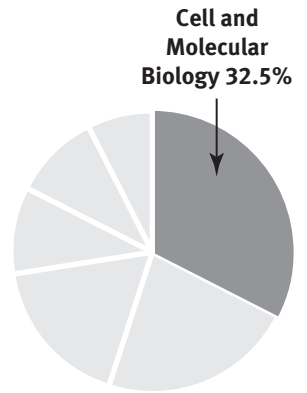
Primordial Soup

First Biological Molecules

Coacervate Droplets

Chemoautotrophs

Aerobes



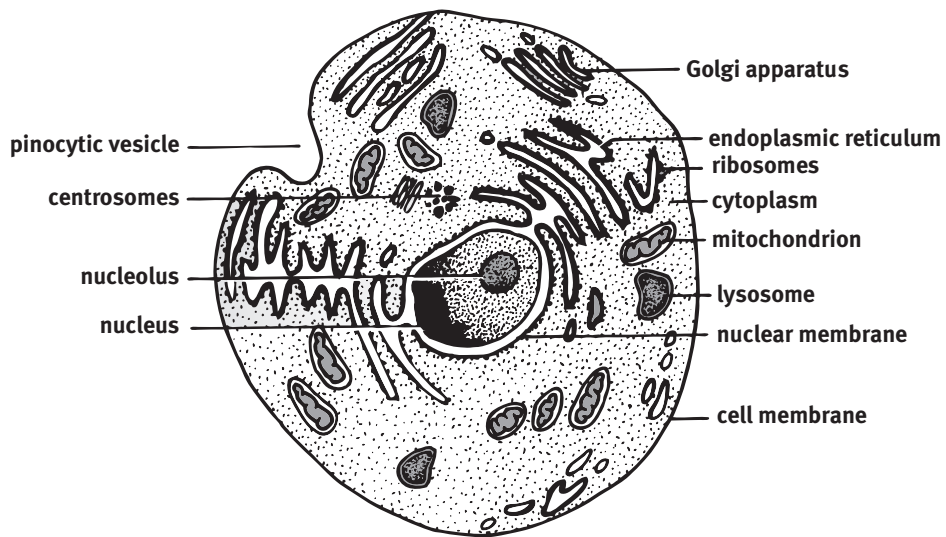
Practice Questions

1. Suppose you find a previously unidentified, multicellular species with cells containing a nucleus, membrane-bound organelles, and a rigid cell wall but no cellulose. Based on this information alone, which kingdom is the best fit for this species?
 - A. Monera
 - B. Plantae
 - C. Animalia
 - D. Protista
 - E. Fungi

2. Platyhelminthes are members of the kingdom
 - A. Monera.
 - B. Plantae.
 - C. Animalia.
 - D. Protista.
 - E. Fungi.

3. Which of the following free elements was likely most essential to the first life on Earth?
 - A. Sulfur
 - B. Iron
 - C. Oxygen
 - D. Phosphorus
 - E. Calcium

Cell Structure



Components

Nucleus

Endoplasmic Reticulum

Ribosome

Golgi Apparatus

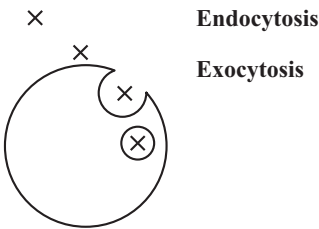
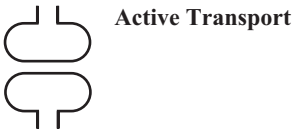
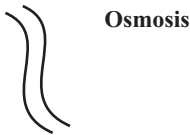
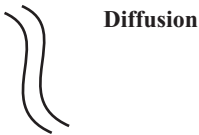
Mitochondrion

Lysosome

Cell Processes

Plasma Membrane

Cellular Transport



Practice Questions

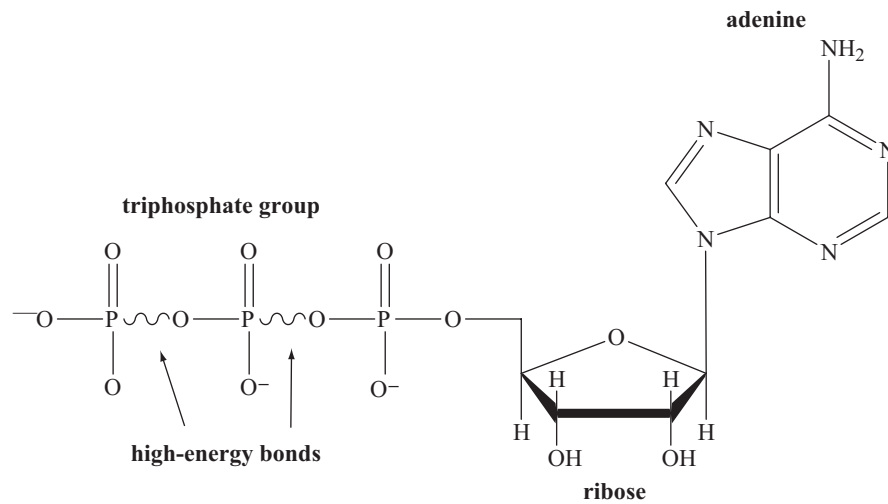
4. Autophagy, the degradation of unnecessary cellular components, is most likely dependent on which organelle?
- A. Ribosome
 - B. Chloroplast
 - C. Lysosome
 - D. Golgi apparatus
 - E. Rough endoplasmic reticulum
5. All of the following statements describe a mitochondrion EXCEPT one. Which statement is the EXCEPTION?
- A. It contains double-stranded, circular DNA.
 - B. It contains its own ribosomes.
 - C. It is a two-membrane structure.
 - D. It is directly involved in carbohydrate synthesis.
 - E. It replicates by binary fission.
6. Which one of the following statements most accurately describes a process of membrane traffic?
- A. Active transport requires energy in the form of NADPH.
 - B. Facilitated diffusion requires a carbohydrate carrier.
 - C. Osmosis is the passive transport of nonpolar molecules.
 - D. Endocytosis is an active transport process that moves large volumes of substances into the cell.
 - E. Diffusion is the movement of molecules from lower to higher concentration.

Practice Questions

7. What happens to an ocean (saltwater) fish after it moves into a river (fresh water)?
- A. Water flows into the fish, causing its cells to lyse.
 - B. Water flows out of the fish, causing its cells to become flaccid.
 - C. Ions flow into the fish, causing the fish to become hypertonic relative to its environment.
 - D. Ions flow out of the fish, causing the fish to become hypertonic relative to its environment.
 - E. No change occurs.
8. You set up a container separated into two compartments by a membrane permeable to water but not ions and then add 1.5 M NaCl to the left compartment and 2.0 M glucose to the right compartment, causing
- A. water to flow into the left compartment.
 - B. water to flow into the right compartment.
 - C. Na^+ and Cl^- to flow into the left compartment.
 - D. Na^+ and Cl^- to flow into the right compartment.
 - E. Na^+ but not Cl^- to flow into the right compartment.
9. The sodium potassium pump is an ATPase that pumps 3 Na^+ out of the cell and 2 K^+ into the cell for each ATP hydrolyzed. Cells can use the pump to help maintain cell volume. Which of the following would most likely happen to the rate of ATP consumption immediately after a cell is moved to a hypotonic environment?
- A. It would increase.
 - B. It would decrease.
 - C. It would increase and then decrease.
 - D. It would decrease and then increase.
 - E. It would remain the same.

Cell Metabolism

ATP



Glycolysis

Anaerobic Metabolism

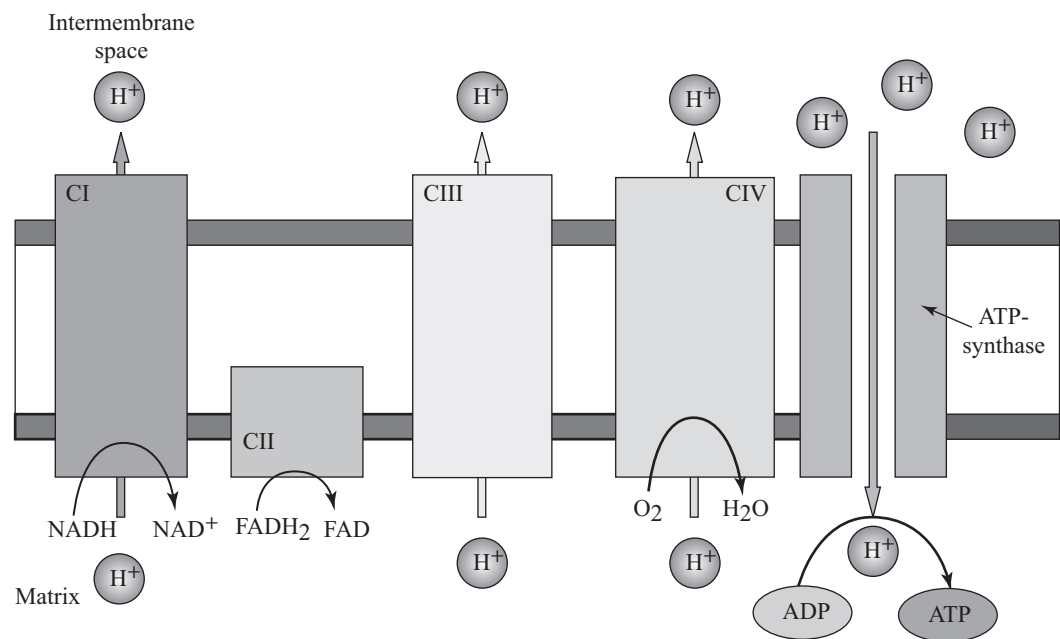
Fermentation

Aerobic Metabolism

Pyruvate Decarboxylation

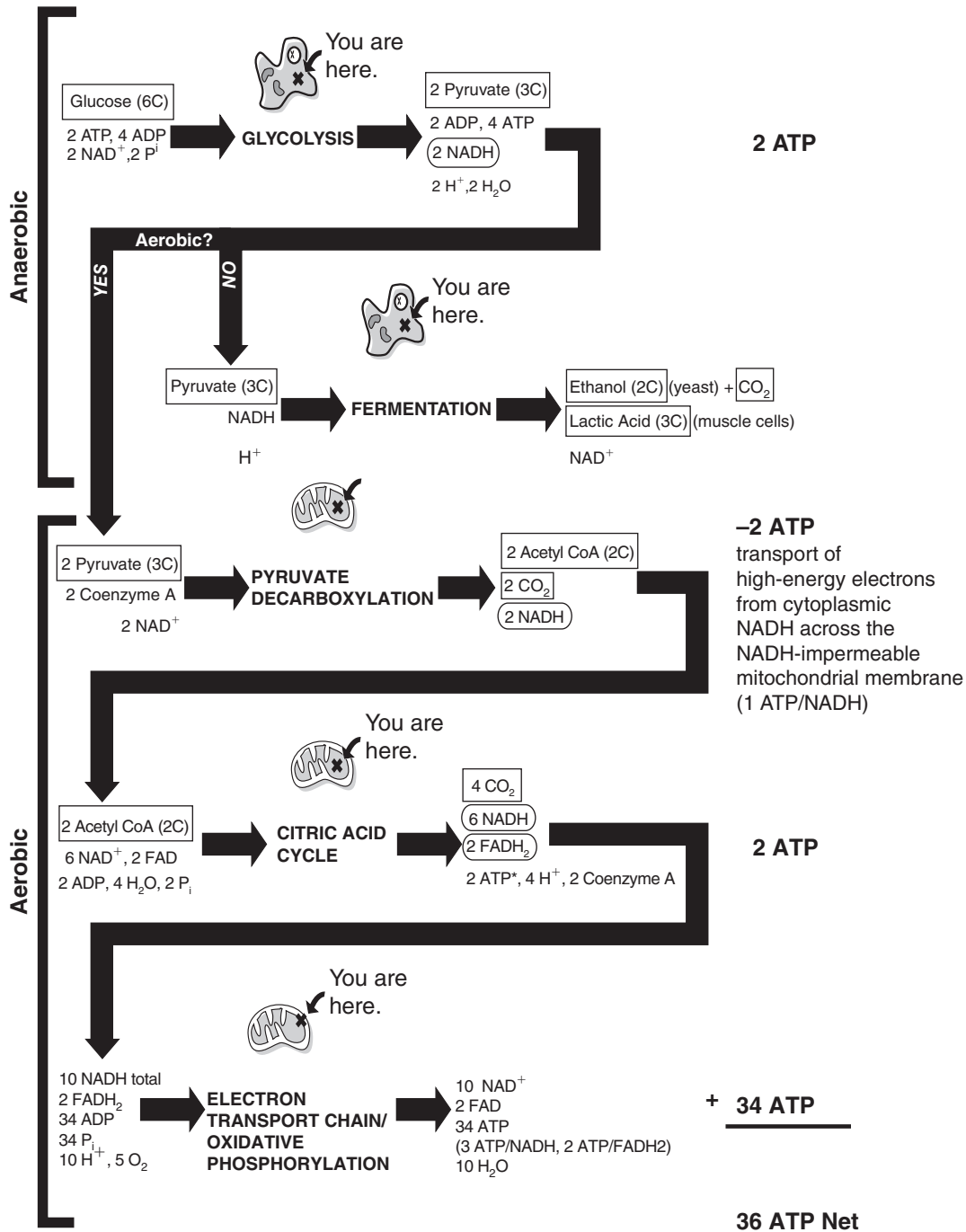
Krebs Cycle (Citric Acid Cycle)

Electron Transport Chain/Oxidative Phosphorylation



Thermodynamics

- denotes carbon-bearing molecules consumed/produced during respiration
 ○ denotes molecules that contribute to the final NADH-FADH₂ total



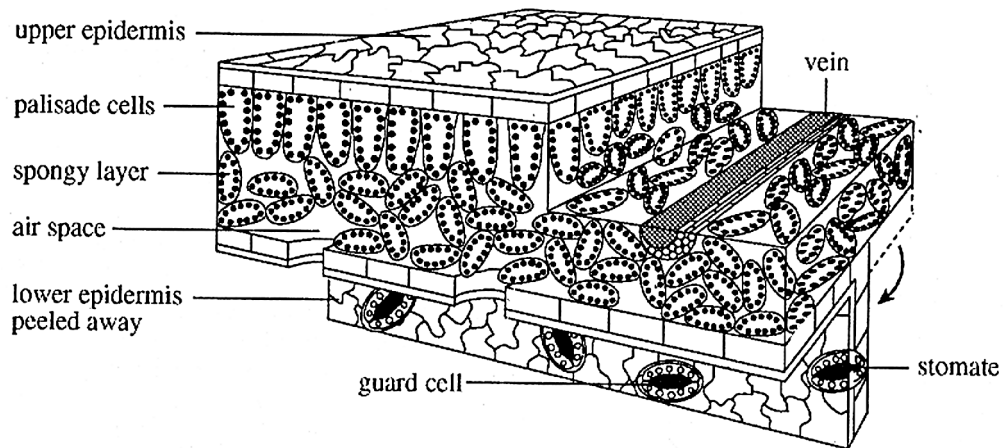
*2 GTP are the direct products of the citric acid cycle. The 2 GTP subsequently donate their phosphate to 2 ADP to form 2 ATP and regenerate the original 2 GDP.

Practice Questions

10. Which one of the following statements accurately describes cellular metabolism?
- A. Alcohol produced during fermentation undergoes glycolysis to produce 2 ATP.
 - B. FADH_2 molecules yield three ATP each during oxidative phosphorylation.
 - C. Pyruvate decarboxylation directly produces 2 net ATP.
 - D. Glycolysis cannot occur in the absence of oxygen.
 - E. Oxidative phosphorylation takes place across the inner mitochondrial membrane.
11. What is the last enzyme used during cellular respiration?
- A. Hexokinase
 - B. Pyruvate decarboxylase
 - C. Alcohol dehydrogenase
 - D. Cytochrome C oxidase
 - E. Phosphoglucose isomerase
12. The complete absence of which of the following substrates would NOT be expected to limit the rate of oxidative phosphorylation?
- A. NAD^+
 - B. H^+
 - C. O_2
 - D. FADH_2
 - E. Inorganic phosphate

Photosynthesis

Leaf Anatomy



Upper Epidermis

Cuticle

Mesophyll

Chloroplasts

Thylakoids

Stroma

Lower Epidermis

Stomata

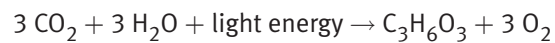
Guard cells

Veins

Xylem

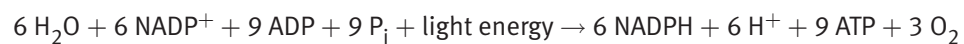
Phloem

Reactions



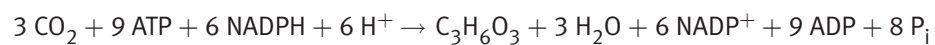
Light Reaction

Chlorophyll captures light energy from the sun to generate high-energy molecules.



Calvin Cycle (Dark Reaction)

RuBisCO captures CO_2 from the environment to generate PGAL.

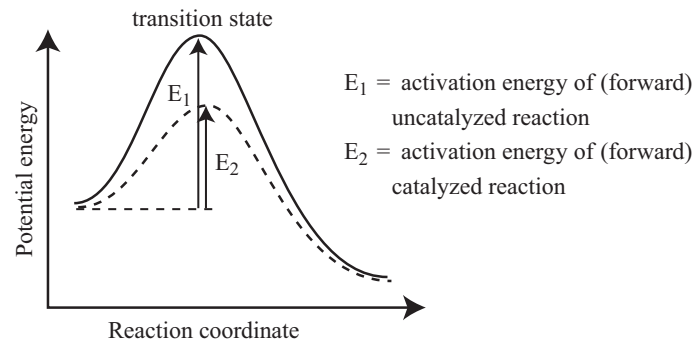


Practice Questions

13. In plants, the Calvin cycle of photosynthesis takes place within the
- A. cuticle.
 - B. grana.
 - C. stroma.
 - D. stomata.
 - E. xylem.
14. How many total PGAL must be produced for a plant to create one sucrose molecule ($C_{12}H_{22}O_{11}$)?
- A. 4
 - B. 6
 - C. 12
 - D. 24
 - E. 30
15. During a drought, a plant may adapt in all of the following ways EXCEPT one. Which is the EXCEPTION?
- A. Allowing its leaves and stems to turn brown
 - B. Expanding its root system
 - C. Changing concentrations of solutes within its phloem
 - D. Slowing or halting its rate of photosynthesis
 - E. Opening additional stomata within its leaves

Enzymology

Enzyme Properties



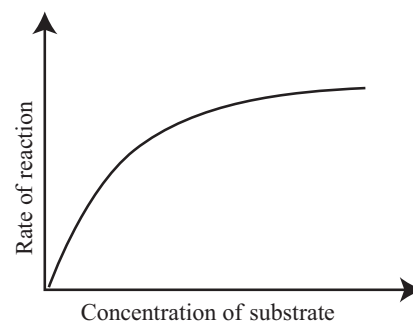
Factors that Affect Enzymes

Temperature

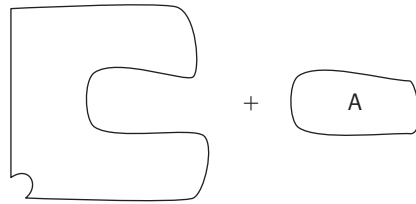
pH

Cofactors/Coenzymes

Concentrations of Substrate and Enzyme



Inhibition



Competitive

Noncompetitive

Negative Feedback

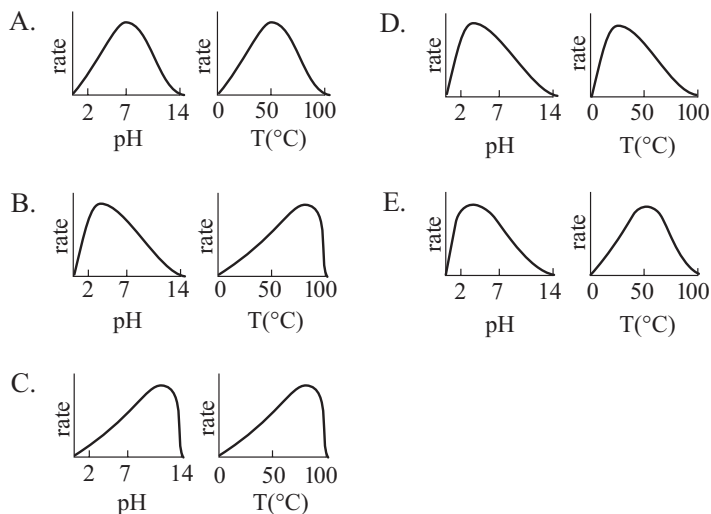
STUDY TIP

Cell and molecular biology have many facts to memorize. Use your flashcards regularly to commit these topics to memory and earn fast points on Test Day.

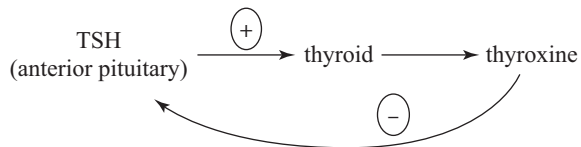


Practice Questions

16. Which set of graphs best depicts the optimal temperature and pH range for pepsin activity?



17. In the diagram below, what role does thyroxine play?

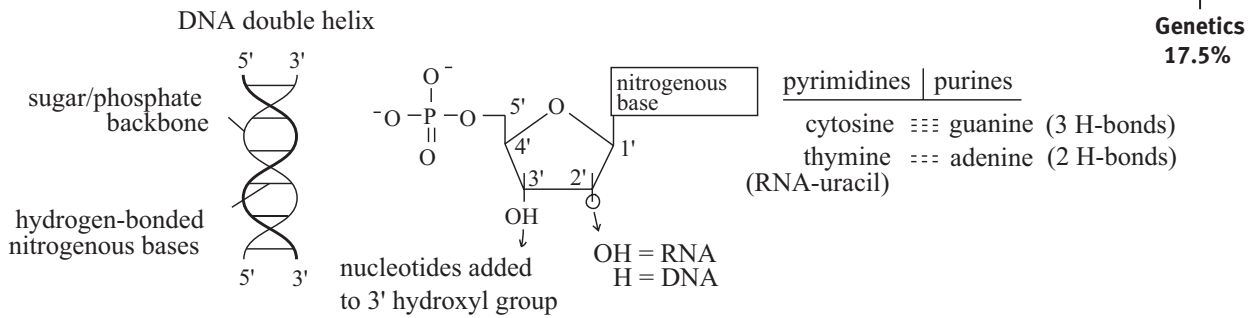


- A. It reduces enzyme specificity.
- B. It triggers a positive feedback loop.
- C. It stimulates catalyst production.
- D. It triggers a negative feedback loop.
- E. It serves as a substrate for further reaction.
18. An enzyme is introduced into a reaction for which the reactants are substrates to that enzyme. Which of the following occurs?
- A. The rate at which the equilibrium is reached is increased.
- B. The equilibrium point is shifted forward.
- C. The activation energy is increased.
- D. The free energy of the reaction is increased.
- E. The equilibrium point is shifted backward.

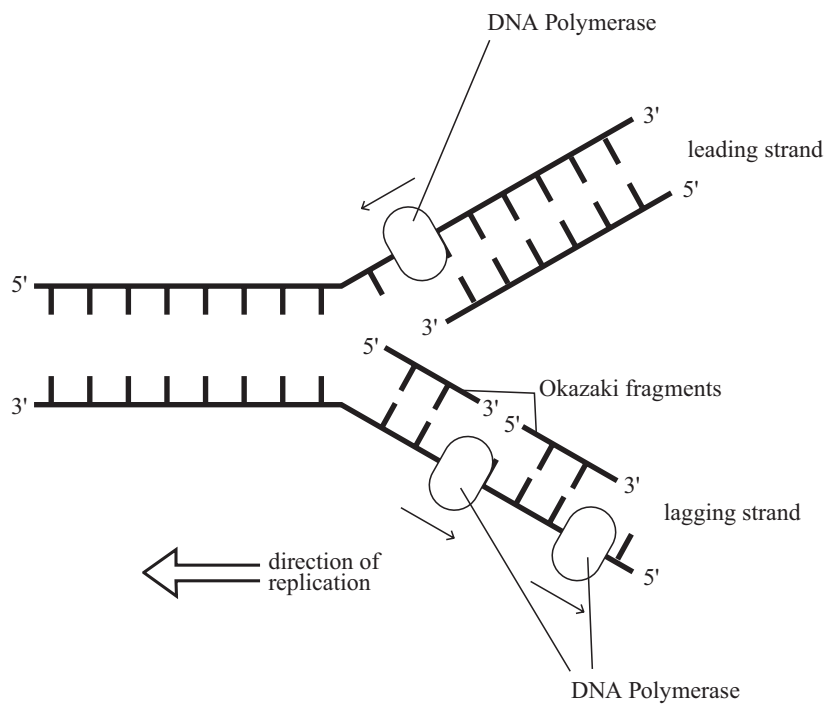
Genetics

Molecular Genetics

DNA Structure



DNA Replication



Practice Questions

19. Which daughter strand is more likely to have a mutation?
- A. The leading strand; more molecules dock and exit during the creation of this strand as compared to the lagging strand.
 - B. The lagging strand; more molecules dock and exit during the creation of this strand as compared to the leading strand.
 - C. The leading strand; fewer molecules dock and exit during the creation of this strand as compared to the lagging strand.
 - D. The lagging strand; fewer molecules dock and exit during the creation of this strand as compared to the leading strand.
 - E. Neither strand; the same number of molecules dock and exit during the creation of both strands.
20. You have two fragments of DNA: Fragment A melts (comes apart) at 97°C, and fragment B melts at 65°C. What can you conclude about the two fragments with respect to their nucleotide composition?
- A. Fragment A contains more guanine than fragment B.
 - B. Fragment B contains more cytosine than fragment A.
 - C. Fragment A contains more thymine than fragment B.
 - D. Fragment B contains less adenine than fragment A.
 - E. Fragment A contains less uracil than fragment B.
21. What gives a molecule of DNA its negative charge?
- A. The nitrogenous bases
 - B. The ribose sugar
 - C. The presence of cytosine or thymine
 - D. The hydroxyl group
 - E. The phosphate group

Transcription

Differences between DNA and RNA in Humans

	DNA	RNA
Base pairs		
Single- or double-stranded		
Functions		

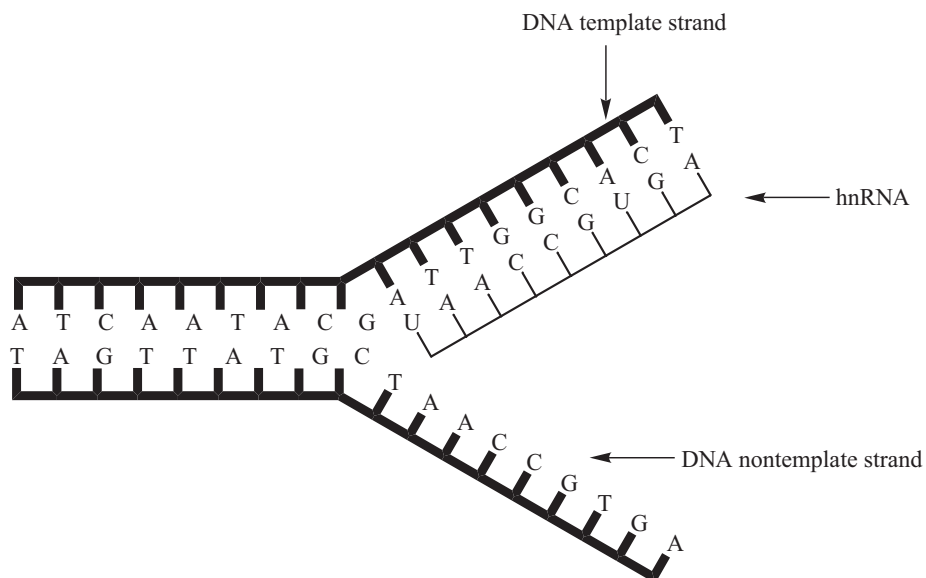
Three Types of RNA

mRNA: messenger RNA; codes for amino acids

tRNA: transfer RNA; brings amino acids to ribosome

rRNA: ribosomal RNA; component of ribosome

Process of Transcription



Post-Transcriptional RNA Processing

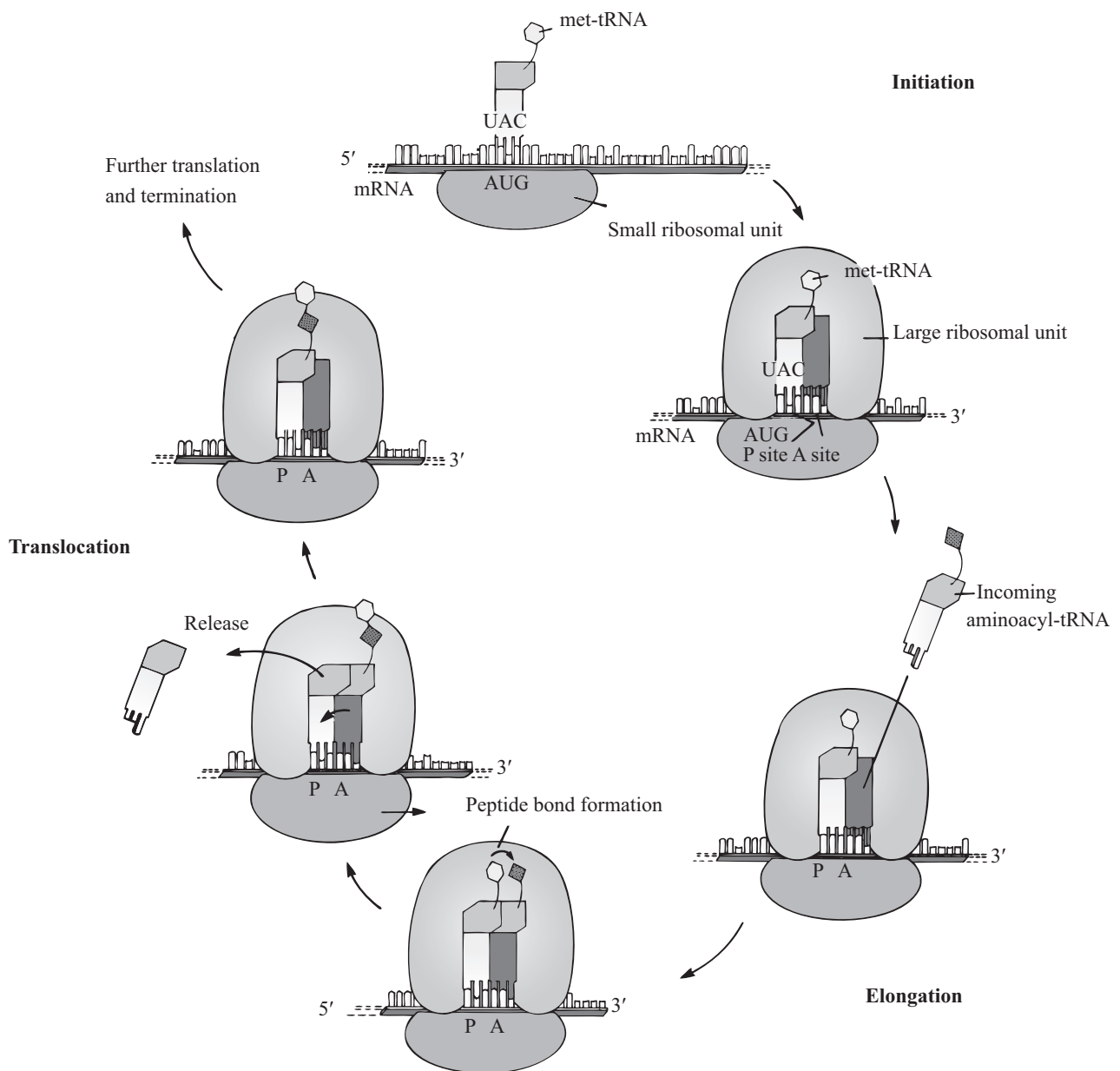
Practice Questions

22. A segment of a DNA strand has the base sequence 5'—GTTTCATTG—3'. What would be the base sequence of the mRNA strand transcribed from this DNA?
- A. 5'—CAATGAAC—3'
 - B. 5'—GTTTCATTG—3'
 - C. 5'—CAAUGAAC—3'
 - D. 5'—ACCGUCCA—3'
 - E. 5'—CAAGUAAC—3'
23. A person has a mutation in the promoter site of the gene for the lactase enzyme, rendering the promoter site nonfunctional. What symptom(s) will occur?
- I. Less digestion of lactose by the person
 - II. More digestion of lactose by the person's symbiotic gut bacteria
 - III. Malnutrition due to glucose deficiency
- A. I
 - B. II
 - C. I and II
 - D. I and III
 - E. I, II, and III
24. Researchers measure the concentration of RNA found in a set of cells for a particular gene and find it to be elevated. What must be occurring in the cells?
- A. The cells are erythrocytes responding to an oxygen deficit.
 - B. The cells are leukocytes responding to an infection.
 - C. A signal has been received by these cells to upregulate the translation of the gene.
 - D. A signal has been received by these cells to downregulate the replication of the gene.
 - E. A signal has been received by these cells to upregulate the transcription of the gene.

Translation

Three Stages

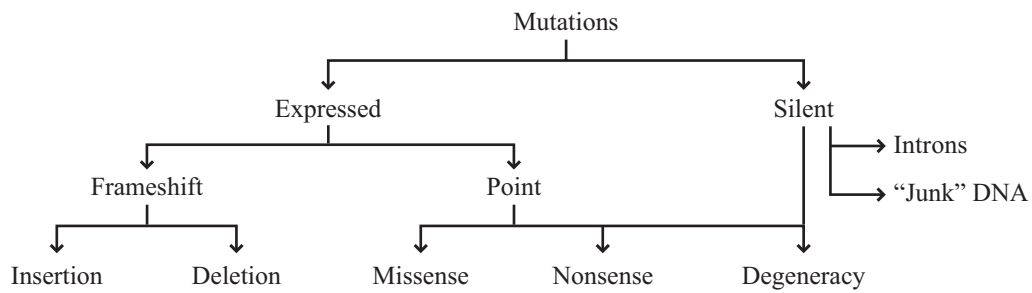
- Initiation
- Elongation
- Termination



Practice Questions

25. What would happen if a tRNA with an anti-codon for alanine was actually carrying the amino acid valine?
- A. An alanine would be added where a valine was coded for during translation.
 - B. A valine would be added where an alanine was coded for during translation.
 - C. No amino acid would be added for that codon during translation.
 - D. Both an alanine and a valine would be added at that codon during translation.
 - E. Translation would immediately stop if the tRNA was to bind to the ribosome complex.
26. A new type of antibiotic targets and destroys bacterial ribosomes. How does this antibiotic work?
- A. Bacteria die because they can no longer synthesize plasmids.
 - B. Bacteria die because they can no longer synthesize lipids.
 - C. Bacteria die because they can no longer synthesize carbohydrates.
 - D. Bacteria die because they can no longer synthesize proteins.
 - E. Bacteria die because they can no longer synthesize nucleic acids.
27. A mutation causes peptidyl transferase to be nonfunctional. What process would this halt?
- A. Ribosome assembly
 - B. tRNA anticodons recognizing mRNA codons
 - C. Peptide bond formation
 - D. Binding between rRNA and mRNA
 - E. None of the above

Mutations



Point Mutation

Silent Mutation

Missense Mutation

Nonsense Mutation

Frameshift Mutation

Chromosomal Mutation

Turner Syndrome

Klinefelter Syndrome

Down Syndrome

Practice Questions

28. What must happen for a mutation to be noticeable in a human?
- A. The mutation is a point mutation.
 - B. The mutation changes one amino acid to another.
 - C. The mutation is in a region of DNA that is transcribed often.
 - D. The mutation is not on a somatic chromosome.
 - E. The mutation causes a change in function of a protein.
29. Which of the following mutations is most likely to cause a fetus to be nonviable?
- A. Nonsense
 - B. Frameshift
 - C. Point
 - D. Silent
 - E. Chromosomal
30. What causes some point mutations NOT to be expressed?
- I. The degeneracy of the amino acid codon code
 - II. If the point mutation is in the second position of the codon
 - III. The concept of “wobble” in the codon code
- A. I
 - B. II
 - C. I and III
 - D. II and III
 - E. I, II, and III

Classical Genetics

Punnett Square

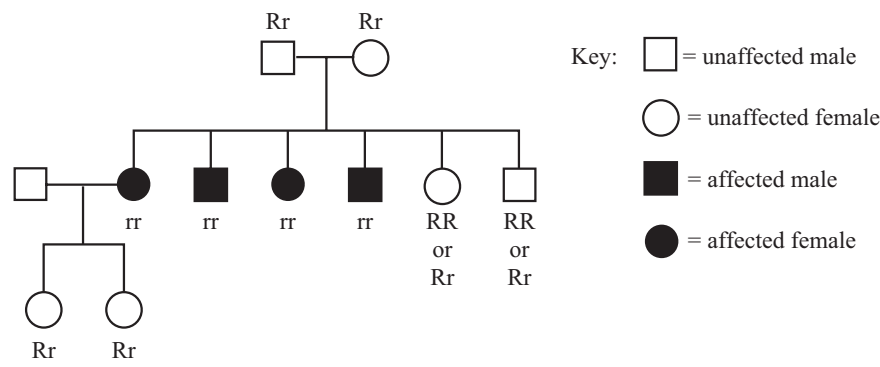
Phenotypic and Genotypic Ratios

Monohybrid Cross

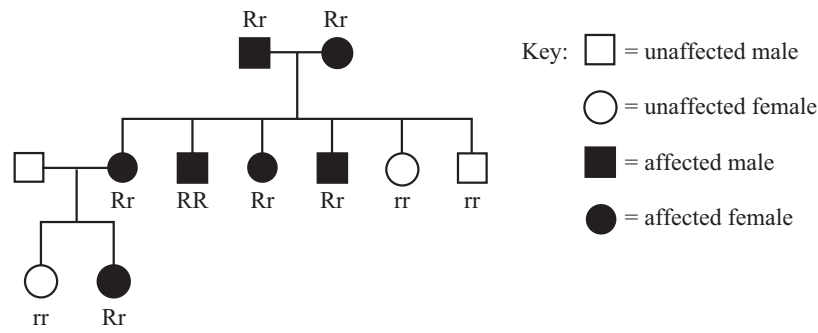
Dihybrid Cross

Human Genetics

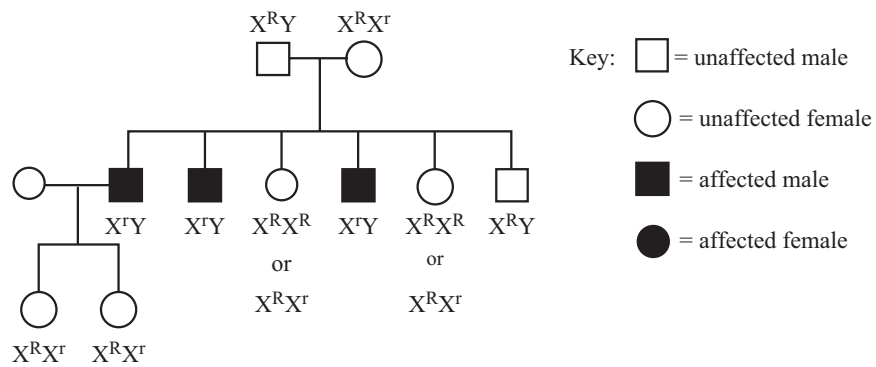
Autosomal Recessive Pedigree



Autosomal Dominant Pedigree



X-Linked Recessive Pedigree



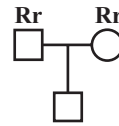
TAKEAWAY

When tackling pedigree questions, focus on the specific patterns rather than wasting time by mapping all of the genotypes.



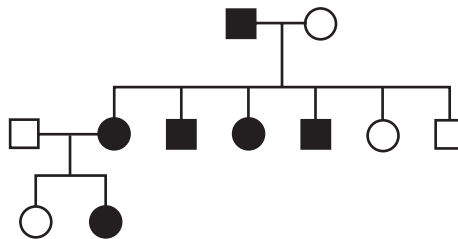
Practice Questions

31. Given the pedigree below, what is the likelihood the offspring is a carrier?



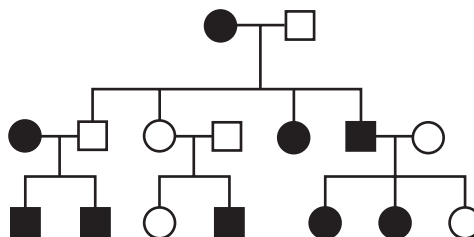
- A. 25%
- B. 50%
- C. 66%
- D. 75%
- E. 100%

32. What is the inheritance pattern of the observed trait indicated by the pedigree below?



- A. Autosomal recessive
- B. Autosomal dominant
- C. X-linked recessive
- D. Y-linked
- E. Cannot be determined

33. What is the inheritance pattern of the observed trait indicated by the pedigree below?



- A. Autosomal recessive
- B. Autosomal dominant
- C. X-linked recessive
- D. X-linked dominant
- E. Cannot be determined

Evolution, Ecology, and Behavior

Evolution

Natural Selection

Cladistics

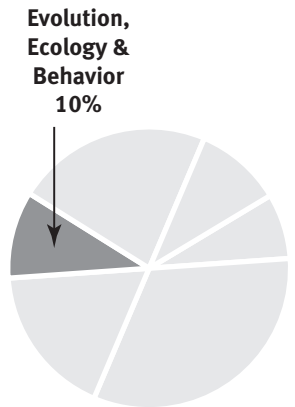
Patterns of Evolution

Divergent

Convergent

Parallel

Coevolution



Population Genetics

Hardy-Weinberg Conditions

1. Random Mating
2. No Natural Selection
3. No Migration or Emigration
4. Large Population
5. No Mutations

Hardy-Weinberg Equations

$$(p + q)^n = 1$$

$$p + q = 1$$

$$p^2 + 2pq + q^2 = 1$$

Practice Questions

34. If 84% of the population has Rh⁺ blood, which is coded for by a dominant allele, then what is the frequency of the recessive allele, assuming Hardy-Weinberg equilibrium?
- A. 8.3%
 - B. 16%
 - C. 40%
 - D. 60%
 - E. 92%
35. Red hair, a recessive trait, appears in only 1% of the world's population. Assuming no source of evolution is occurring, what is the frequency of the allele for red hair?
- A. 0.1%
 - B. 1%
 - C. 2%
 - D. 10%
 - E. 20%
36. Some plants, such as cotton and potatoes, are tetraploid ($4n$). If a recessive allele q has a frequency of 0.20 for a certain population of tetraploid plants in equilibrium, what is the frequency of the homozygous recessive genotype of $qqqq$?
- A. 0.16%
 - B. 0.80%
 - C. 4.0%
 - D. 8.0%
 - E. 16%

Practice Questions

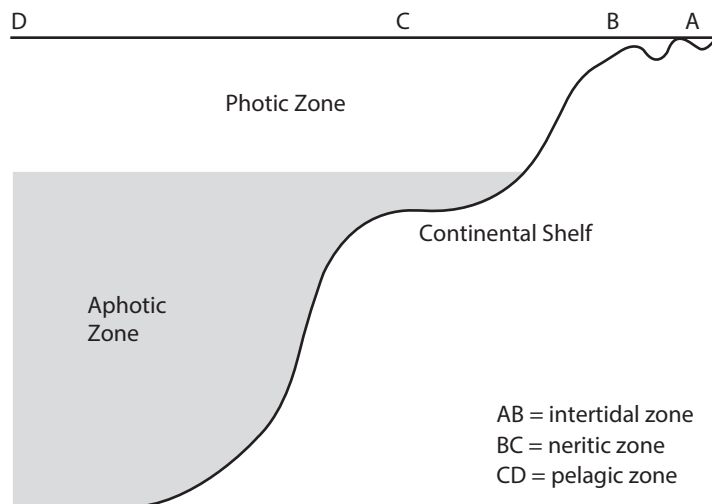
37. Sharks, which are a type of fish, and dolphins, which are a type of mammal, share similar, torpedo-shaped body plans with fins. This is most likely due to
- A. divergent evolution.
 - B. convergent evolution.
 - C. the founder effect.
 - D. speciation.
 - E. vestigial structures.
38. On a certain island, one bird species faces heavy competition for a sole food source. If a mutation is introduced that leads to exploitation of a new food source and eventually speciation, what type of evolution occurred?
- A. Divergent evolution
 - B. Convergent evolution
 - C. Coevolution
 - D. Sexual selection
 - E. Parallel evolution
39. The wings of bats and the wings of birds can be considered
- A. vestigial structures.
 - B. homologous traits.
 - C. analogous traits.
 - D. comparative embryology evidence for evolution.
 - E. comparative biochemistry evidence for evolution.

Ecosystems

Terrestrial Biomes

Freshwater Biomes

Marine Biomes



Ecological Succession

Pioneer Organisms

Climax Community

Community Ecology

Commensalism

Mutualism

Parasitism

Predation

Animal Behavior

Classical Conditioning

Operant Conditioning

Behavioral Displays

Pecking Order

Territoriality

Pheromones

STUDY TIP

Don't neglect studying plants, animals, and the relationships between them. The DAT tests more than just human biology!



Practice Questions

40. A biome with thin soil and that contains significant populations of pines, spruces, bison, and beaver is best characterized as
- A. coniferous forest.
 - B. grassland.
 - C. rainforest.
 - D. taiga.
 - E. tundra.
41. Which of the following species is most likely to be found as a permanent resident of the intertidal zone?
- A. Hammerhead shark
 - B. Stingray
 - C. Seagull
 - D. Tuna
 - E. Mussel
42. After a lichen has settled a barren rock, the next species to settle is most likely to be a
- A. pine tree.
 - B. blueberry shrub.
 - C. mountain moss.
 - D. scrub hare.
 - E. buffalo grass.
43. The human digestive tract is home to hundreds of species of bacteria. The bacteria are provided with a relatively stable environment, while the host benefits from increased immune function and vitamins as a byproduct of the bacteria. This is an example of
- A. commensalism.
 - B. mutualism.
 - C. brood parasitism.
 - D. obligate parasitism.
 - E. predation.

Homework

Required Assignments*	Location
Complete Remaining Lesson Questions	Lesson Book
Biology 1 Review	kaptest.com
Perceptual Ability 1 Preview	Review Notes Book
Perceptual Ability 1 Preview	kaptest.com

Personalized Assignments

Refer to your online resources for additional practice assignments and tools.

*These assignments must be completed in order to fulfill the requirements of the Higher Score Guarantee.

