

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) Which of the following microscopic methods would have the greatest useful magnification?
 - A) single lens simple video microscopy
 - B) phase-contrast microscopy
 - C) scanning electron microscopy
 - D) fluorescence microscopy
 - E) dark field microscopy

- 2) Which of the following can only be viewed by electron microscopy?
 - A) viruses
 - B) bacteria
 - C) nuclei
 - D) mitochondria
 - E) frog eggs

- 3) The _____ model of DNA structure was proposed by _____.
 - A) gene; Fleming and Pasteur
 - B) one gene-one enzyme; Beadle and Tatum
 - C) double helix; Watson and Crick
 - D) nuclear; Morrison
 - E) chromosome; Hotaling

- 4) Which type of microscopy has the greatest resolving power?
 - A) fluorescence
 - B) phase-contrast
 - C) electron
 - D) confocal scanning
 - E) digital video

- 5) Which of the following is true of a nanometer?
 - A) A nanometer is one millionth of a millimeter.
 - B) A nanometer is one millionth of a meter.
 - C) A nanometer is about the size of a common bacterial cell.
 - D) The nanometer is the most common measurement used in measuring whole cells.
 - E) none of the above

- 6) Which of the following is closest to a micrometer in size?
 - A) the length of a gene
 - B) the width of a mRNA molecule
 - C) a human erythrocyte
 - D) E. coli
 - E) tubulin protofilaments

- 7) Melvin Calvin and his colleagues used which of the following to deduce the steps in the Calvin Cycle?
 - A) radioactive phosphate
 - B) radioactive sulfate
 - C) algae
 - D) SDS PAGE electrophoresis
 - E) ultracentrifugation

- 8) The limit of resolution can best be defined as
 - A) twice the wavelength of light.
 - B) the distance that an object must be moved to be distinguished from its background.

- C) the distance that two objects must be apart in order to be distinguished as separate objects.
- D) the solvent that must be available to remix a solution.
- E) all of the above

9) Which of the following is NOT true of electron microscopy (EM)?

- A) EM can be used to examine the movement of flagella.
- B) The limit of resolution for EM is about 0.1-0.2 nm.
- C) EM came to be used extensively in the early 1950s.
- D) EM uses heavy metals as stains.
- E) Electrons replace light in the electron microscope.

10) When scientists use the scientific method, they use terms to indicate their degree of certainty. Which of the following terms conveys the least degree of certainty?

- A) law
- B) theory
- C) hypothesis
- D) both hypothesis and theory
- E) both theory and law

11) Because membranes usually are not permeable to polysaccharides, nucleic acids, and proteins, how are cells able to make use of these molecules?

- A) These macromolecules are only incorporated into structures outside the membrane.
- B) Macromolecules are broken down extracellularly, and their subunits diffuse through the membrane.
- C) Macromolecules are digested extracellularly, and their subunits move through transport proteins.
- D) Macromolecules are transported via endocytosis and digested within the cell.
- E) both C and D

12) Which of the following units is used to measure energy?

- A) joule
- B) mole
- C) watt
- D) meter
- E) both A and B

13) Which of the following biological polymers is mismatched with its monomer?

- A) DNA - nucleotide
- B) cellulose - amino acid
- C) enzyme - amino acid
- D) protein - amino acid
- E) chitin - monosaccharide

14) While synthesizing a new blue pigment, a chemist notices that the new compound congregates between an aqueous (water) environment and a hydrophobic environment. When added to a mixture of oil and water, the pigment creates a blue ring around droplets of oil. Which of the following statements best describes this new pigment?

- A) The pigment is a polar molecule and is forming hydrogen bonds with both oil and water molecules.
- B) The pigment is hydrophilic and will not form hydrophobic bonds with the oil.
- C) The pigment molecule is neither polar or nonpolar, but is apolar.
- D) The pigment molecule is amphipathic, having polar and nonpolar regions.
- E) The pigment is probably hydrophobic and is attempting to bond with the oil.

15) Which of the following is NOT a structural polysaccharide?

- A) chitin B) glycogen C) cellulose D) peptidoglycan

16) Which of the following is NOT true of hydrocarbons?

- A) Phospholipids have hydrocarbon tails.
- B) Octane is a hydrocarbon.
- C) Many hydrocarbons are used in living systems.
- D) Hydrocarbons are insoluble in water.
- E) Only hydrogen atoms are used to complete the valence requirements of carbon.

17) Many biological molecules have functional groups that alter the chemical reactivity of the molecule. Which of the following is NOT a functional group?

- A) hydroxyl group
- B) ethylene group
- C) aldehyde group
- D) carboxyl group
- E) carbonyl group

18) Which of the following is NOT a fundamental property of carbon?

- A) Carbon-containing molecules are stable.
- B) Carbon-containing molecules form stereoisomers.
- C) Carbon-containing molecules are diverse.
- D) Carbon has a valence of 4.
- E) Carbon atoms are most likely to form ionic bonds with one another.

19) Which of the following sequences correctly illustrates the hierarchical nature of cellular structures, from smallest to largest?

- A) organic molecules, macromolecules, organelles, supramolecular structures, cells
- B) organelles, organic molecules, supramolecular structures, macromolecules, cells
- C) organic molecules, macromolecules, supramolecular structures, organelles, cells
- D) macromolecules, organic molecules, supramolecular structures, organelles, cells
- E) organic molecules, supramolecular structures, macromolecules, organelles, cells

20) Why do polar substances such as sodium chloride (NaCl) dissolve so readily in water?

- A) The sodium ions repel the partial negative end of the water dipole.
- B) NaCl is a very dry powder, and the water is able to soak into the salt.
- C) The partially charged ends of the water molecules are able to surround the oppositely charged salt ion.
- D) Spheres of hydration form between the water and the ions.
- E) both C and D

21) The cell membrane can be characterized most accurately as

- A) permeable to some molecules and impermeable to others.
- B) permeable to only larger molecules.
- C) impermeable to all polar molecules.
- D) permeable to all molecules.
- E) permeable to most small molecules, but impermeable to larger ones.

22) While fishing, a biology student makes the following observations:

-) Water spiders appear to be able to walk on the surface of the water.
-) Flat rocks may be made to skip across the water.

of the following properties of water explain these observations?

- A) Water is an excellent solvent.
- B) Water molecules create spheres of hydration around solute molecules.
- C) Water molecules are cohesive.
- D) Water molecules are often associated via hydrogen bonds.

E) both C and D

23) Which of the following is NOT true of the polymerization of macromolecules?

- A) The polymer chain usually has two ends.
- B) Macromolecules are synthesized by the stepwise addition of a monomer.
- C) The monomer is usually activated by the coupling of the monomer to a carrier.
- D) Often the energy needed for polymerization is supplied by ATP.
- E) Water is used to join the monomers of the macromolecules.

24) Which of the following is true of transfer RNA?

- A) It is responsible for correct positioning of amino acids in a polypeptide.
- B) It serves as the site of protein synthesis.
- C) It functions in transcription, translation and replication.
- D) It is an important component of ribosomes.
- E) It functions in replication only.

25) The term *amphipathic* describes the characteristic of some molecules which have _____.

- A) two polar regions
- B) only a single polar region
- C) both a polar and a nonpolar region
- D) no polar regions
- E) two nonpolar regions

26) Which of the following amino acids is a nonpolar (hydrophobic) amino acid?

- A) lysine B) valine C) aspartate D) tyrosine E) serine

27) Which of the following is a disaccharide?

- A) glucose
- B) lactose
- C) fructose
- D) galactose
- E) none of the above

28) Which of the following is true of purines?

- A) Cytosine is a purine.
- B) Purines bind readily to deoxyribose, but not ribose.
- C) Purines have a double-ringed structure.
- D) Adenine's bonding to thymine is stronger than is guanine's to cytosine.
- E) Both adenine and thymine are purines.

29) Which of the following has the greatest number of glycosidic bonds?

- A) glucose
- B) DNA
- C) amylose
- D) vitamin A
- E) triacylglycerol

30) Skeletal muscle contraction and the action of cilia are similar because

- A) both use the energy of ATP hydrolysis to drive movement.
- B) microtubules slide relative to actin filaments in both cases.
- C) both require actin and myosin for correct function.
- D) the enzymes that catalyze motion are the same in both cases.
- E) all of the above

31) Which of the following is NOT a steroid?

- A) testosterone
- B) cortisol
- C) aldosterone
- D) estradiol
- E) epinephrine

32) Which of the following statements is NOT true of the amino acids?

- A) Only around 20 amino acids are used in protein synthesis.
- B) All amino acids exist in two stereoisomeric forms.
- C) Amino acids have an N-terminus, C-terminus, and R groups.
- D) There are more than 60 different kinds of amino acids present in the cell.
- E) The R group of amino acids differs from one amino acid to another.

33) Which of the following is NOT a base used in DNA replication?

- A) cytosine B) uracil C) thymine D) guanine E) adenine

34) Which of the following three letter symbols represents an amino acid that is a polar and uncharged?

- A) gln B) asp C) ala D) his E) pro

35) Which of the following is most similar to the Watson-Crick helix?

- A) mRNA B) A-DNA C) C-DNA D) Z-DNA E) B-DNA

36) Which of the following processes would be most likely to occur in the Golgi apparatus?

- A) detoxification of drugs
- B) production and packaging of lipids
- C) glycosylation of proteins
- D) synthesis of steroids
- E) synthesis of DNA

37) A(n) _____ is composed of tetrameric protofilaments.

- A) microtubule
- B) extracellular matrix
- C) microfilament
- D) bacteriophage
- E) intermediate filament

38) The cytosol is best described as the

- A) internal contents of organelles.
- B) area of the cell not occupied by the nucleus.
- C) semifluid substance in which organelles are suspended.
- D) three dimensional array of interconnected filaments.
- E) fluid within the nucleus.

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

39) Photosynthesis is to the chloroplast, as _____ is to the mitochondrion.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

40) Which of the following is NOT true of a viroid?

- A) Cadang-cadang is a viroid disease of the coconut palm.
- B) Viroids affect mostly plants.
- C) Its RNA is circular.

- D) Viroids possess about 300-400 nucleotides.
- E) Its capsid is quite small.

41) The smooth endoplasmic reticulum functions in synthesis of

- A) DNA.
- B) lipids.
- C) polysaccharides.
- D) proteins.
- E) all of the above

42) Kuru is a degenerative disease of the central nervous system believed to be caused by which type of agent?

- A) protozoan B) bacterium C) prion D) virus E) viroid

43) Which of the following is an eukaryotic characteristic?

- A) cell fission
- B) little processing of RNA
- C) 70S ribosomes
- D) membrane-bound nucleus
- E) none of the above

44) Lignin is an important component in

- A) bacterial cell walls.
- B) plasmodesmata.
- C) fungal cell walls.
- D) tight junctions.
- E) secondary plant cell walls.

45) Which of the following is true of a plant cell?

- A) Plant cells are often much larger than animal cells.
- B) Plant cells may contain chloroplasts.
- C) Only plant cells have a cell membrane.
- D) Chromosomes are found only in plant cells.
- E) The plant cell has no cell wall.

46) Which organelle has only a single membrane around it?

- A) peroxisome
- B) nucleus
- C) chloroplast
- D) ribosome
- E) mitochondrion

47) Which of the following is a phototroph?

- A) a mushroom
- B) bacteria growing on decomposing matter
- C) an earthworm
- D) a tree
- E) all of the above

48) Muscle contraction is an example of which of the following types of work?

- A) heat
- B) bioluminescence
- C) electrical
- D) concentration
- E) mechanical

- 49) Energy is important to life forms because
- A) it is required to do work.
 - B) it is required to make specific alterations in the cell.
 - C) all life forms require a continuous supply of it.
 - D) both A and B
 - E) choices A, B, and C

- 50) Which of the following statements is NOT true of the value DH ?
- A) DH is change in enthalpy.
 - B) $DH = DE + D(PV)$
 - C) DH is change in heat content.
 - D) A reaction with a positive DH value is exothermic.
 - E) In biology, DH is basically the same as DE .

- 51) Which of the following is defined as "heat content or total energy content ?"
- A) enthalpy
 - B) kcal/kJ multiplied by the K_{eq}
 - C) Gibb's free energy
 - D) entropy
 - E) fluorescence

- 52) The statement "Energy is neither created or destroyed" describes
- A) the first law of thermodynamics.
 - B) the second law of thermodynamics.
 - C) the law of conservation of energy.
 - D) enthalpy.
 - E) both A and C

- 53) Which of the following types of work is performed when there is a change in the position of a cell or of cell structure?
- A) mechanical
 - B) concentration
 - C) synthetic
 - D) bioluminescent
 - E) electrical

MATCHING. Choose the item in column 2 that best matches each item in column 1.

Match the type of work with the example of that type of work.

- 54) Column 1: bioluminescence
Column 2: luminous toadstools

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 55) Fireflies and certain types of bacteria have the ability to convert the energy stored in ATP into light. Which of the following types of work is performed by the firefly?
- A) electrical
 - B) bioluminescence
 - C) mechanical and synthetic
 - D) heat
 - E) concentration

MATCHING. Choose the item in column 2 that best matches each item in column 1.

Match the type of work with the example of that type of work.

56) Column 1: electrical work
Column 2: nerve impulse conduction

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 57) Substrate activation may involve
- A) accepting or donating protons by the enzyme.
 - B) temporary covalent bonds.
 - C) a change in enzyme conformation induced by substrate binding.
 - D) nucleophilic substitution.
 - E) all of the above

MATCHING. Choose the item in column 2 that best matches each item in column 1.
Match the symbol on the left with its description on the right.

58) Column 1: V_{max}
Column 2: maximum velocity

Match the following reactions with the enzyme that would catalyze the reaction.

59) Column 1: $\text{glycerol} + \text{ATP} \rightarrow \text{glycerol phosphate} + \text{ADP}$
Column 2: transferase

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 60) A sick person often runs a fever. Which of the following statements best explains why this occurs?
- A) Enzymes do not function as well at temperatures other than the optimal temperature.
 - B) Sweating removes prosthetic groups from biological systems.
 - C) Bacteria and viruses reproduce more rapidly at higher body temperature.
 - D) The higher temperature increases the activity of lysases.
 - E) both A and B

- 61) The work of James B. Sumner was to
- A) isolate urease.
 - B) disprove "vitalism."
 - C) crystallize a common animal protein.
 - D) originate the term *ferments* to describe enzymes.
 - E) both A and B

MATCHING. Choose the item in column 2 that best matches each item in column 1.
Match the symbol on the left with its description on the right.

62) Column 1: k_{cat}
Column 2: turnover number

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 63) Why is the Lineweaver-Burk plot important in enzyme kinetics?
- A) It reveals the presence of organic prosthetic groups in enzymes.
 - B) It is a single-reciprocal plot.
 - C) It makes it easier to determine V_{max} .
 - D) It illustrates enzyme specificity.
 - E) actually the Lineweaver-Burk plot is not important

- 64) Which of the following variables is NOT part of the Michaelis-Menten equation?
- A) ΔG B) K_m C) $[S]$ D) V_{max} E) v

- 65) The equation $v = V_{max} [S] / (K_m + [S])$ is part of which of the following plots?

- A) Lineweaver-Burk
- B) Michaelis-Menten
- C) Eadie-Hofstee
- D) both A and B
- E) none of the above

MATCHING. Choose the item in column 2 that best matches each item in column 1. Match the following reactions with the enzyme that would catalyze the reaction.

66) Column 1: $AB \rightleftharpoons ABA$
 Column 2: isomerase
 Foil: oxidoreductase

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 67) Which of the following is NOT a function of membranes?
- A) delineation
 - B) compartmentalization
 - C) regulation of transport
 - D) cell-cell communication
 - E) information storage
- 68) A means of detecting the presence of specific carbohydrate moieties on glycoproteins is
- A) photobleaching.
 - B) liposome formation.
 - C) SDS PAGE.
 - D) the freeze fracture technique.
 - E) ferritin conjugated lectins.
- 69) Cholesterol
- A) destabilizes the cell membrane.
 - B) intercalates between the fatty acid chain within the bilayer.
 - C) is found in abundance in prokaryotic cell membranes.
 - D) increases permeability for small cations.
 - E) all of the above
- 70) Starting with shredded spinach leaves, you follow a procedure that allows for separation of cellular organelles. You are specifically looking for the fraction that contains the mitochondria. To identify this fraction you should test for the
- A) general presence of enzymes.
 - B) presence of enzymes associated with cellular respiration.
 - C) polysaccharides that specifically surround the mitochondria.
 - D) phospholipids unique to the mitochondrial membrane.
 - E) phospholipids unique to intracellular membranes.
- 71) You are examining an electron micrograph of cells obtained on the last Martian expedition. Upon closer examination you notice that there are two dark lines separated by a lightly stained region. These results are similar to the observation of which person's or persons' investigation into membrane structure?
- A) Unwin and Henderson.
 - B) Gorter and Grendel.
 - C) Singer and Nicolson.
 - D) Robertson.
 - E) Overton.
- 72) Temperature has a dramatic effect upon cell membranes. This influence can readily make a cell membrane more solid or more fluid in response to the temperature. This is an example of

- A) membrane asymmetry.
- B) liquidation.
- C) phase transition.
- D) membrane flexibility.
- E) none of the above

73) The technique that allows various proteins to be differentiated based on size, once the proteins have been denatured, is

- A) SDS PAGE.
- B) liposome formation.
- C) freeze fracture technique.
- D) ferritin conjugated lectins.
- E) photobleaching.

74) Cell-cell communication in plants takes place via specialized structures called

- A) gap junctions.
- B) plasmodesmata.
- C) desmids.
- D) cell wall pores.
- E) none of the above

75) Which of the following molecules would NOT readily cross an intact cell membrane by simple diffusion?

- A) water B) fatty acids C) ethanol D) glucose E) oxygen

76) The specific movement of a molecule from one side of a cell to another side of the same cell is known as

- A) cellular transport.
- B) intracellular transport.
- C) transcellular transport.
- D) facilitated transport.
- E) passive transport.

77) Cystic fibrosis is the result of a malfunction of the cell in transporting which of the following ions?

- A) Na⁺ B) OH⁻ C) K⁺ D) Cl⁻ E) glucose

For a particular cell, the concentration of sucrose is 10 mM on the inside of the cell and 0.5 mM on the outside, whereas the concentration of sodium ions (Na⁺) is 0.5 mM on the inside of the cell and 10 mM on the outside. The membrane potential is -150 mV, and the temperature is 25°C.

: $R = 1.987 \text{ cal/mol degree}$; $T = 25^\circ\text{C} = 298 \text{ K}$; $F = 23,062 \text{ cal/ mole volt}$

78) What would be the net $\Delta G'$ for the coupling of these two reactions?

- A) +3.459 kcal/mol
- B) -3.459 kcal/mol
- C) -7.007 kcal/mol
- D) -1.774 kcal/mol
- E) +7.007 kcal/mol

79) What is the $\Delta G'$ for the inward transport of sodium ions?

- A) +5.233 kcal/mol; an endergonic reaction
- B) -5.233 kcal/mol; an endergonic reaction
- C) -5.233 kcal/mol; an exergonic reaction
- D) +5.233 kcal/mol; an exergonic reaction
- E) none of the above

80) You wish to dehydrate a piece of meat using solutions of varying salt concentrations. The best concentration to use would be

- A) 0.01%. B) 0.09%. C) 0.9%. D) 1%. E) 10%.

81) Of the following molecules, which would NOT be expected to be moved across a membrane by simple diffusion?

- A) oxygen
B) water
C) fatty acids
D) dimethylurea
E) glucose

82) Ionophores are

- A) the gating mechanisms associated with the transport of ions.
B) intrinsic proteins that passively transport ions.
C) chemicals that form pores in the plasma membrane and allow ions to cross.
D) intrinsic proteins that actively transport ions.
E) membrane proteins that allow for the movement of small-molecular-weight compounds.

**For a particular cell, the concentration of sucrose is 10 mM on the inside of the cell and 0.5 mM on the outside, whereas the concentration of sodium ions (Na⁺) is 0.5 mM on the inside of the cell and 10 mM on the outside. The membrane potential is -150 mV, and the temperature is 25°C.
: $R = 1.987 \text{ cal/mol degree}$; $T = 25^\circ\text{C} = 298 \text{ K}$; $F = 23,062 \text{ cal/ mole volt}$**

83) What is the $\Delta G'$ for the inward transport of sucrose?

- A) +1.774 kcal/mol; an endergonic reaction
B) -1.774 kcal/mol; an endergonic reaction
C) -1.774 kcal/mol; an exergonic reaction
D) +1.774 kcal/mol; an exergonic reaction
E) none of the above

84) Which of the following best describes the special "high-energy" bond of ATP?

- A) hydrogenation
B) phosphoester
C) ionic
D) phosphoanhydride
E) hydrogen

85) Oxidation in biological systems is accompanied by

- A) hydrogenation.
B) resonance stabilization.
C) repulsion.
D) dehydrogenation.
E) all of the above

86) Glucose is transported in the bloodstream to cells in all parts of your body. In body cells, glucose has four main fates. Which of the following is NOT one of those fates?

- A) Glucose is transformed into sucrose.
B) Glucose is used to synthesize glycogen.
C) Glucose is converted to acetyl CoA to make body fat.
D) Glucose is converted to lactate.
E) Glucose is catabolized to carbon dioxide and water.

87) At which enzymatic step of glycolysis is water a product?

A) 3 B) 5 C) 6 D) 9 E) 10

88) During the first phase of glycolysis, ATP is used to form what type of bond with glucose?

- A) dehydrogenation
- B) hydrogenation
- C) phosphoanhydride
- D) substrate-level phosphorylation
- E) phosphoester

89) Within animal cells, glycolysis and gluconeogenesis must not occur at the same time. Therefore, regulation is important. Which of the following molecules is LEAST important in the regulation of glycolysis and gluconeogenesis?

- A) ATP/ADP
- B) acetyl CoA
- C) NADH
- D) fructose-2,6-bisphosphate
- E) phosphofructokinase-2

90) The enzyme used to break down fructose-1,6-bisphosphate into two trioses is called

- A) phosphoglucosomerase.
- B) enolase.
- C) aldolase.
- D) triose phosphate isomerase.
- E) hexokinase.

91) During strenuous exercise, you may notice that your muscles burn. Which of the following statements best explains this phenomenon?

- A) Proteins are being digested to provide energy.
- B) Carbon dioxide is building up in muscle and changing the pH.
- C) ADP is accumulating, which produces a burning sensation.
- D) Without oxygen, pyruvate is being converted to lactic acid.
- E) all of the above

92) β oxidation

- A) is a process used to oxidize fatty acids.
- B) is the second step in the oxidation of glucose.
- C) is a process used to digest some polysaccharides.
- D) occurs in the cytoplasm.
- E) both B and C

93) NADH concentrations serve to regulate oxidative decarboxylation and the TCA cycle. Which of the following enzymes is NOT regulated by NADH?

- A) α -ketoglutarate dehydrogenase
- B) pyruvate dehydrogenase
- C) succinate dehydrogenase
- D) malate dehydrogenase
- E) isocitrate dehydrogenase

94) Of the carrier molecules in the electron transport chain, which has heme as part of its prosthetic group?

- A) flavoproteins
- B) cytochromes
- C) copper containing cytochromes
- D) iron sulfur proteins
- E) coenzyme Q

95) The sequential process of fatty acid catabolism to acetyl CoA is called

- A) oxidative deamination.
- B) β oxidation.
- C) the Cori cycle.
- D) the glyoxylate cycle.
- E) transamination.

96) Carboxypeptidase

- A) is an endopeptidase.
- B) removes amino acids from the amino terminus.
- C) removes amino acids from the carboxy terminus.
- D) is the same as an aminopeptidase.
- E) both A and D

97) Which of the numbered respiratory complexes is NOT correctly paired with its name?

- A) complex II^ssuccinate-coenzyme Q oxidoreductase complex
- B) complex I^NNADH dehydrogenase complex
- C) complex III^ccoenzyme Q-cytochrome *c* oxidoreductase complex
- D) complex IV^ccytochrome *c* reductase complex
- E) none of the above

98) Transamination

- A) can involve only a small number of amino acids.
- B) involves the amination of an alpha keto acid.
- C) liberates a free ammonia molecule.
- D) involves transfer of amino groups from an amino acid to another amino acid.
- E) none of the above

99) Bacteriochlorophyll differs from chlorophyll *a* and *b* in structure and function. Which of the following statements correctly contrasts these types of chlorophyll?

- A) Bacteriochlorophyll has a saturated carbon-carbon bond at one location in the porphyrin ring, whereas chlorophyll does not.
- B) Chlorophyll has a methyl group attached to the porphyrin ring, whereas bacteriochlorophyll has a formyl group.
- C) Chlorophyll has a phytol side chain, but bacteriochlorophyll does not.
- D) Bacteriochlorophyll has a porphyrin ring, whereas chlorophyll does not.
- E) Both A and D correctly contrast these types of chlorophyll.

100) Bacteria do not have organelles. How are they able to carry out photosynthesis?

- A) They use their cell membrane to carry out photosynthesis.
- B) 70S ribosomes function as a photosystem.
- C) They are parasites of plants that do have organelles.
- D) They interact in a symbiotic relationship with eukaryotic plants.
- E) DNA in the nucleoid captures solar energy.

101) In the Calvin Cycle, the enzyme that catalyzes the capture of carbon dioxide and the formation of 3-phosphoglycerate is

- A) phosphoglycerokinase.

- B) glyceraldehyde-3-phosphate dehydrogenase.
- C) ribulose-5-phosphate kinase.
- D) triose phosphate isomerase.
- E) ribulose biphosphate carboxylase/oxygenase (rubisco).

102) The regeneration of what molecule allows for continuous carbon assimilation in the Calvin cycle?

- A) ribulose-1,5-bisphosphate
- B) 3-phosphoglycerate
- C) dihydroxyacetone phosphate
- D) glycerate-1,3-bisphosphate
- E) glyceraldehyde-3-phosphate

103) Which of the following is NOT an essential feature of electron transfer from water to NADP+?

- A) plastocyanin (PC)
- B) coenzyme Q
- C) photosystem II complex
- D) photosystem I complex
- E) cytochrome *b6/f* complex

104) A house plant seems to be growing slowly and lacks its normal bright green color. You call a botanist for advice. She suggests that the plant may be deficient in magnesium (Mg^{++}). Why are these symptoms associated with Mg^{++} deficiency?

- A) Mg^{++} is an important component in chlorophyll.
- B) Lack of Mg^{++} in the soil allows pathogenic bacteria to grow.
- C) Enzymes used in the Calvin cycle require a large amount of Mg^{++} .
- D) Mg^{++} is important in the structure of many amino acids.
- E) Mg^{++} is required before NADPH can function.

105) Which of the following statements correctly characterizes the relationship between NADP+/NADPH and NAD+/NADH?

- A) NADP+/NADPH is used primarily for catabolic reactions.
- B) Only NAD+/NADH is used to transport electrons and protons.
- C) Neither are helpful to oxygenic phototrophs.
- D) NADP+/NADPH has an extra phosphate compared to NAD+/NADH.
- E) Both are used extensively during photosynthesis in oxygenic phototrophs.

106) DNA isolated from cow liver cells contains 28% A; what percent will be C?

- A) 14% B) 22% C) 28% D) 36% E) 56%

107) Restriction enzymes typically recognize

- A) sequences in threefold symmetry.
- B) single stranded DNA only.
- C) several nucleotide sequences simultaneously.
- D) specific palindromic sequences.
- E) all of the above

108) The nuclear membrane functions as a

- A) means of localization of the chromosomes within the cell.
- B) selective barrier, allowing certain substances in or out.
- C) means of sequestering many of the mRNA processing activities from the cytosol.
- D) means of separating nuclear and cytoplasmic constituents.
- E) all of the above

109) DNA isolated from *Aspergillus* has an adenine content of 25%. Based upon this information, what is the %G+C within the *Aspergillus* DNA?

- A) 0%
- B) 25%
- C) 50%
- D) 75%
- E) Answer cannot be determined from this information.

110) A variety of *E. coli* clones have been isolated, the DNA has been extracted, digested with restriction enzymes, denatured, separated by gel electrophoresis, and transferred to nylon membrane by the Southern blot procedure. A radioactive probe is used that hybridizes with a gene of interest. The DNA corresponding to a single clone yields a single DNA band after probing the blot. Based on this information only,

- A) all of the clones tested, except the one described, have the gene of interest.
- B) only the one clone described has the gene of interest.
- C) the gene of interest is located entirely on the DNA band visualized.
- D) the part of the gene recognized by the probe is located on the DNA band visualized.
- E) both B and D

111) You and your neighbor have how much difference in DNA sequence?

- A) 0.01% B) 0.1% C) 1% D) 10% E) 25%

112) The action of a new drug is unknown, so you test various aspects of eukaryotic cell processes looking for an effect. You notice that the survival of cells exposed to this drug is very low. Further analysis shows that some proteins and mRNAs are much longer than they should be. One hypothesis is that the drug interferes with

- A) transcription termination signals.
- B) spliceosome activity.
- C) ribosomes.
- D) nucleoli.
- E) both A and B

113) Transcription of ribosomal RNA is primarily the function of

- A) RNA polymerase II.
- B) RNA polymerase I.
- C) primase.
- D) RNA polymerase III.
- E) mitochondrial RNA polymerase.

114) An agent that would work well as an antibiotic against prokaryotic infection would target the

- A) mitochondria.
- B) 50S large ribosomal subunit.
- C) 40S small ribosomal subunit.
- D) RNA polymerase II.
- E) DNA polymerase.

115) A change in a single nucleotide that results in no change in the amino acid sequence of the polypeptide produced is known as a

- A) frameshift mutation.
- B) silent mutation.
- C) missense mutation.
- D) nonsense mutation.
- E) none of the above

116) If you were designing a method to specifically inhibit prokaryotic transcription, but not eukaryotic transcription, interfering with which of the following would work best?

- A) DNase activity
- B) recognition of the promoter region
- C) an intercalating agent
- D) ribosomal binding
- E) RNA polymerase II activity

117) One reason that prokaryotic genes do not contain introns is that

- A) bacterial proteins are very short and not subject to mutation.
- B) integrated viral DNA is not recognized for transcription.
- C) due to the short time the bacterium is around as a single organism, a 5' cap and poly A tail are added immediately for translation to take place.
- D) as prokaryotes do not have a nucleus, translation sometimes begins before transcription has been completed.
- E) the introns are cut out during binary fission.

118) In studying an *E. coli* strain containing a known frameshift mutation, you isolate a mutant in which this frameshift is suppressed. You therefore expect to find which of the following associated with the suppression? (Assume the frameshift has not been corrected in the coding for the peptide.)

- A) suppressor tRNAs encode an amino acid for a stop signal
- B) suppressor tRNAs encode a two-nucleotide anticodon
- C) suppressor tRNAs encode a four-nucleotide anticodon
- D) both B and C
- E) all of the above

119) The appropriate folding of a newly translated product is essential, and continual misfolding often leads to disease, especially in vertebrates. This misfolding, particularly in the situation of prion diseases, may be due to

- A) chaperone activity.
- B) rearrangements by translocase.
- C) insertion of inappropriate amino acids during translation.
- D) errors facilitated by the enzyme foldase.
- E) errors perpetuated during self-assembly.

120) Which of the following activities is NOT associated with post-translational processing?

- A) addition of lipid groups
- B) specific cleavage of polypeptides
- C) polyadenylation
- D) glycosylation
- E) chaperonin activity

121) With regard to translation in prokaryotes, the gene products are often encoded on polycistronic mRNAs. As a result, the quantities of each of the proteins are often graded, such that the first gene has a great deal of protein translated, whereas the last gene has very little. Which of the following features of prokaryotic translation may account for increased production of some products and decreased production of others?

- A) Feedback regulation of ribosomes tells the cell that enough product is made, and ribosomes from such mRNAs dissociate.
- B) The different messages have sequences with more or less homology to the Shine Delgarno sequence; fewer ribosomes binding results in less product.
- C) Because transcription and translation in prokaryotes are essentially coupled, there is no gradation in the amount of individual proteins made from a polycistronic message.
- D) There is no termination sequence at the end of each gene, so one long protein is made, resulting in equal amounts of products.
- E) all of the above

122) Which of the following statements is NOT true concerning peptidyl transferase?

- A) It requires no outside source of additional energy, such as ATP.

- B) It is a ribozyme, having catalytic activity.
- C) It catalyzes peptide bond formation.
- D) It moves the ribosome, so translation continues.
- E) It is associated with the large subunit of ribosomes.

123) Jacques Monod and Francois Jacob deduced the mechanism responsible for the regulation of bacterial gene expression. They are, therefore, responsible for launching the era of

- A) the scientific method.
- B) light microscopy.
- C) biochemistry.
- D) molecular genetics.
- E) radioisotopes.

124) Scanning electron microscopy (SEM) is especially suited

- A) to creating a sense of depth.
- B) to examining internal cellular structure.
- C) to observing living specimens.
- D) both A and C
- E) choices A, B, and C

125) "Hereditary factors" is an old name for _____.

- A) DNA
- B) transforming units
- C) genes
- D) chromosomes
- E) all of the above

126) Which scientist is credited with coining the term "cell" from the Latin *cellulae*?

- A) Robert Hooke
- B) Robert Brown
- C) Theodor Schwann
- D) Antonie van Leeuwenhoek
- E) Matthias Schleiden

127) Gregor Mendel was most influential in which field of biology?

- A) cytology
- B) genetics
- C) bacterial transformation
- D) chromatography
- E) biochemistry

128) An enzyme synthesized in the laboratory is found to have little activity when compared to the enzyme extracted from a cell culture. Both enzymes were examined and have identical amino acid composition. What is the best explanation for the lack of activity of the synthesized enzyme?

- A) The primary amino acid sequence was altered while the composition was not altered.
- B) The van der Waals radius was altered during laboratory synthesis.
- C) The synthesized enzyme was not folded correctly because molecular chaperones were not present.
- D) The ATP required for self-assembly was present in the cell extract, but not in the laboratory synthesis.
- E) Denaturation of the synthesized enzyme was not complete.

129) Biologically, which of the following is the *least* important characteristic of water?

- A) Water typically contains isotopes of hydrogen.
- B) Water is a good solvent.

- C) Water has a temperature stabilizing capacity.
- D) Water molecules have numerous hydrogen bonds.
- E) Water molecules are polar.

130) Which of the following is true of an asymmetric carbon atom?

- A) Asymmetric carbon atoms create stereoisomers.
- B) Methane has an asymmetric carbon.
- C) Molecules may have only one asymmetric carbon atom.
- D) Only amino acids have asymmetric carbon atoms.
- E) A carbon with hydrogens attached at two locations is usually asymmetric.

131) Ribose has five carbon atoms, of which three are asymmetric. What is the maximum number of stereoisomers that may exist for ribose?

- A) 8 B) 6 C) 10 D) 2 E) 4

132) Which of the following is true of glycolipids?

- A) Glycolipids are usually found on the exterior surface of the plasma membrane.
- B) Usually more than 10 sugar units are attached to the glycolipid.
- C) Fructose and sucrose are often part of glycolipids.
- D) Laurate is a glycolipid.
- E) Thudicum discovered glycolipids in the late sixteenth century.

133) Which of the following does NOT represent the correct pairing of the three-letter abbreviation with the one-letter abbreviation of an amino acid?

- A) Arg-A B) Glu-E C) Met-M D) Pro-P E) Phe-F

134) Which of the following is true of fatty acids?

- A) Fatty acids with 24 carbons are most common.
- B) Saturated fatty acids have no double bonds between carbons.
- C) Fatty acids are synthesized by the stepwise addition of three carbon units.
- D) Unsaturated fatty acids are usually branched.
- E) Laurate is a unsaturated fatty acid.

135) Which of the following is NOT a characteristic of DNA?

- A) antiparallel
- B) composed of nucleotides
- C) complementary
- D) contains ribose
- E) double-stranded

136) Communication between animal cells is facilitated by

- A) tight junctions.
- B) plasmodesmata.
- C) gap junctions.
- D) adhesive junctions.
- E) both B and C.

137) The methanobacteria, halobacteria, and sulfobacteria are included in which bacterial group?

- A) blue-green algae
- B) archaebacteria
- C) eubacteria
- D) cyanobacteria

E) all of the above

138) Intermediate filaments are

- A) smaller than actin filaments.
- B) composed of tubulin.
- C) composed of globular proteins only.
- D) different in different cell types.
- E) none of the above

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

139) Collagen fibers are to the extracellular matrix, as _____ is to the cell wall.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

140) *Aerobic* refers to what property of chemotrophs?

- A) Heat losses occur in the presence of oxygen.
- B) Chemotrophs remove carbon dioxide from the air.
- C) Chemotrophs require oxygen to produce energy.
- D) Chemotrophs use, but do NOT require oxygen.
- E) Fermentation releases great amounts of gas, but only in chemotrophs.

141) Matter and energy flow through the biosphere. The flow of matter, however, differs from the flow of energy. Which of the following statements accurately describes these differences?

- A) Matter flows in cycles, whereas energy flows in one direction.
- B) Energy flows from chemotrophs to phototrophs, whereas matter flows from phototrophs to chemotrophs.
- C) Energy flows as organic molecules are reduced to inorganic molecules, but matter does not.
- D) Matter does not accompany energy as it enters the biosphere, but it does flow with energy from the biosphere.
- E) both A and B

142) In a chemical reaction, the standard free energy change (ΔG^0) is calculated to be -23.67 cal/mol. What can be said of the chemical reaction?

- A) The reaction is not spontaneous under standard conditions.
- B) The reaction violates the second law of thermodynamics.
- C) Products predominate over reactants at equilibrium under standard conditions.
- D) The reaction goes spontaneously to the right under standard conditions.
- E) both C and D

143) Photosynthesis is an important process that

- A) is performed by heterotrophs.
- B) is performed by organisms living near deep-ocean thermal vents.
- C) uses water and carbon dioxide as reactants.
- D) produces oxidized products.
- E) none of the above

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

145) Covalent modification

- A) affects the activity of an enzyme by adding or removing a chemical group.
- B) can involve the addition of phosphate groups.
- C) produces modifications that cannot be reversed.
- D) is a means of regulation like allosteric regulation.
- E) all of the above

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

147) Hopanoids

- A) all of the above
- B) function in signal transduction mechanisms.
- C) are found in eukaryotes only.
- D) none of the above
- E) are examples of sterols.

148) With regard to the semipermeable nature of the plasma membrane, which of the following would readily cross without the aid of a transport protein?

- A) glucose
- B) amino acids
- C) water
- D) calcium ions
- E) DNA

149) You are experimenting with a variety of lipids to determine their efficacy for use as drug delivery system liposomes. What is one feature of the individual lipid that would best ensure the use of a lipid for this purpose?

- A) It should be exclusively hydrophilic.
- B) It must have be composed entirely of unsaturated fatty acids.
- C) It should be exclusively hydrophobic.
- D) It must have a structure similar to cholesterol.
- E) It should be amphipathic.

150) You are wanting to modify plant cells. With the procedure you are using , the plant cells must be in a plasmolyzed state. This means that the plant cells must be placed in a(n)

- A) acid solution.
- B) hypertonic solution.
- C) basic solution.
- D) hypotonic solution.
- E) isotonic solution.

151) In the kidney, the specialized transport proteins that allow for very rapid fluid movement into or out of cells are known as

- A) osmosins.
- B) porins.
- C) ionophores.
- D) anion exchange proteins.
- E) aquaporins.

152) The type of ATPases associated with the integral binding of ATP as part of the transport process is the

- A) ABC type. B) V type. C) F type. D) P type.

153) Which of the following is true of NAD⁺?

- A) It is a coenzyme.
- B) It releases an adenosine to become NADH.
- C) NAD⁺ serves as an electron source for biological oxidation.
- D) It is derived from vitamin E.
- E) all of the above

154) The negatively charged phosphates of ATP influence one another by

- A) dehydrogenation.
- B) charge repulsion.
- C) resonance hybridization.
- D) resonance stabilization.
- E) all of the above

155) The *gross* output of ATP from glycolysis is _____, whereas the *net* output of ATP is _____.
A) 2; 4 B) 4; 2 C) 6; 4 D) 4; 1 E) 2; 1

156) Which of the following statements is NOT true of the TCA cycle?

- A) Acetate enters the TCA cycle and joins a four-carbon acceptor molecule to form citrate.
- B) ATP/GTP is generated at one point by substrate-level phosphorylation.
- C) FAD is an electron acceptor in the cycle.
- D) Decarboxylation occurs at two locations in the TCA cycle.
- E) Oxidation occurs at three steps in the TCA cycle.

157) Which of the following is NOT a product of the TCA cycle?

- A) carbon dioxide (CO₂)
- B) NADH
- C) FADH₂
- D) ATP
- E) acetyl CoA

158) The Hatch-Slack cycle occurs in which of the following types of plants?

- A) CAM plants
- B) C₃ plants
- C) tropical grasses
- D) C₄ plants
- E) both C and D

159) The relationship between photosystem I (PSI) and photosystem II (PSII) is correctly described by which of the following statements?

- A) PSI absorbs only short wavelengths of light.
- B) Electrons are excited by PSI or PSII, but not both.
- C) The absorption maximum of PSII is 700 nm.
- D) PSI is designated P700, whereas PSII is designated P680.
- E) The absorption maximum of PSI is 680 nm.

160) In 1928, Frederick Griffith's experiments with *Streptococcus pneumoniae* suggested that

- A) attenuated R (rough) bacteria easily revert to the wild type (virulent).
- B) heat-killed bacteria could somehow "transform" live bacteria.
- C) bacteria do not incorporate the DNA of other bacteria.
- D) DNA was conclusively the molecule of heredity.
- E) all of the above

161) Eukaryotic-like (possessing a defined nucleus) cells were obtained from a Martian soil sample. The nucleus was carefully isolated and the chromatin obtained. The fibers had a "beads on a string" appearance, suggesting some type of "histones." Following digestion with micrococcal nuclease, protein removal, and gel electrophoresis, DNA fragments were obtained that are multiples of 280 base pairs in length. Longer incubation with micrococcal nuclease prior to protein removal results in fragments 200 base pairs in length. The amount of DNA that is wrapped around the "core histones" is therefore

- A) 80 base pairs in length.
- B) 200 base pairs in length.

- C) 360 base pairs in length.
- D) 480 base pairs in length.
- E) Not enough information is given to determine the answer.

162) In order to examine mRNA transcripts isolated from cells, one needs to convert a RNA template to DNA. Doing this conversion requires which of the following enzymes?

- A) RNA convertase
- B) DNA polymerase
- C) RNA polymerase
- D) RNA transcriptase
- E) DNA transcriptase

Answer the questions below based on this diagram: 5' AUGAUGAUGAUG 3'

This RNA transcript was generated using a synthetic DNA template. The letters B, D, E, F, G, and H have been selected to represent different amino acids. Assume that each different group of codons is a different amino acid.

163) If the genetic code required only two nucleotides for incorporation of amino acids, the amino acid sequence using this transcript would be

- A) B-D-B-D-B-D.
- B) B-B-B-B-B-B.
- C) B-D-E-F-G-H.
- D) B-B-B-D-D-D.
- E) B-D-E-B-D-E.

164) Ribosomes are very old structures, found in all organisms (except viruses) from bacteria to humans. As a result, molecular taxonomists are looking at relationships based upon which rRNA sequences?

- A) 16S
- B) 18S
- C) 30S
- D) both A and B
- E) all of the above

165) Release factors of translation recognize the codon

- A) UGA. B) GGA. C) UUU. D) AUG. E) GUA.

166) The steps of the "scientific method," in the correct order, are

- A) collect data, interpret results, test the hypothesis, make observations, design experiments.
- B) make observations, collect data, interpret results, test the hypothesis, design experiments, draw conclusions.
- C) make observations, formulate the hypothesis, design experiments, collect data, interpret results, draw conclusions.
- D) design experiments, draw conclusions, collect data, interpret results, make observations, test the hypothesis.
- E) none of the above

167) The Latin phrase *omnis cellula e cellula* refers to a cellular principle. Which of the following statements is the best translation of this phrase?

- A) All cells arise only from preexisting cells.
- B) The cell is the basic unit of structure.
- C) Tissues are composed of similar cells.
- D) All organisms consist of one or more cells.
- E) Cells generally are found in clusters.

168) The polymerization of macromolecules is similar in many respects. Which of the following principles below is *least* likely to be common to all methods of polymerization of macromolecules?

- A) The polymer is directional.
- B) As monomers are added to the polymer, water is removed from the macromolecule.
- C) To be added to the polymer, the monomer must be activated.
- D) Macromolecules are synthesized by the addition of monomers.
- E) Polymerization is passive, requiring little ATP.

169) What branch of chemistry deals specifically with living systems?

- A) organic chemistry
- B) inorganic chemistry
- C) biochemistry
- D) biological chemistry
- E) both C and D

170) Which of the following is NOT true of phospholipids?

- A) A basic component in phospholipids is phosphatidic acid.
- B) Sphingolipids are the predominant phospholipid in membranes.
- C) Phospholipids are amphipathic.
- D) Phospholipids are important in membrane structure.
- E) Serine is a molecule that may be part of a phosphoglyceride.

171) The size range of most plant and animal cells is _____.

- A) 1-10 nm
- B) 1-5 mm
- C) 10-50 mm
- D) 0.1-0.5 mm
- E) 50-100 mm

172) A negative free energy change indicates that

- A) the reaction is not possible under any conditions.
- B) the reaction is exergonic
- C) the reaction has no equilibrium under any conditions
- D) enthalpy must be added to the reaction before it can proceed.
- E) the reactant is predominant at equilibrium.

173) The active site for carboxypeptidase

- A) involves only six out of a total of 307 amino acids.
- B) contains a glutamate residue at position 69.
- C) uses iron as the prosthetic group.
- D) contains amino acids that are contiguous to one another along the primary sequence of the protein.
- E) both C and D

174) Based on the composition of cell membranes, the most prominent lipids are

- A) cholesterol.
- B) phospholipids.
- C) sphingolipids.
- D) both B and C
- E) choices A, B, and C

175) In examining glucose transport into a cell, the immediate phosphorylation of glucose following its entry into the cell

- A) allows the cell to maintain higher levels of glucose outside the cell.

- B) puts glucose into a form for use in cellular respiration.
- C) puts glucose into a form to be stored.
- D) keeps the glucose from being transported back out of the cell.
- E) all of the above

176) There are 10 enzymatic reactions that convert glucose to pyruvate. Steps _____ and _____ are the steps in which ATP is consumed, whereas _____ and _____ are the reactions that produce ATP.
 A) 1; 2; 9; 10 B) 1; 5; 6; 8 C) 1; 3; 7; 10 D) 2; 4; 7; 10 E) 2; 3; 7; 8

- 177) In electron transport, which respiratory complex is NOT involved in the flow of electrons from NADH?
- A) complex I
 - B) complex II
 - C) complex III
 - D) complex IV
 - E) all of the above

- 178) Carbon dioxide generally enters the plant through pores called
- A) mesophyll.
 - B) the cuticle.
 - C) connexons.
 - D) bacteriochlorophylls.
 - E) stomata.

- 179) Which of the following is the correct order of the levels of DNA packaging in eukaryotic chromosomes?
- A) chromatin fiber → nucleosome → looped domains → heterochromatin
 - B) heterochromatin → nucleosome → chromatin fiber → looped domains
 - C) nucleosome → looped domains → chromatin fiber → heterochromatin
 - D) nucleosome → chromatin fiber → looped domains → heterochromatin
 - E) chromatin fiber → heterochromatin → nucleosome → looped domains

- 180) An individual has been infected with a particular retrovirus. In order for the latent virus DNA to be inherited by subsequent generations stemming from this individual, it must be found
- A) at a point early in childhood.
 - B) in stem cells.
 - C) in germ line cells.
 - D) in all cells simultaneously.
 - E) in somatic cells.

- 181) Using the techniques of genetic engineering, you design a cytoplasmic protein you want to accumulate within the ER of yeast cells. To accomplish this goal, you need to
- A) incorporate appropriate lipid groups.
 - B) do nothing; all proteins go through the ER.
 - C) incorporate appropriate DNA sequence to create signal sequences into mature peptide.
 - D) incorporate appropriate mannose-6-phosphate groups.
 - E) incorporate radioactive amino acids into the protein.

- 182) Which of the following is true of enzymes?
- A) Enzymes may function separately from cells.
 - B) Enzymes were originally known as "ferments."
 - C) An enzyme is a specific biological catalyst.
 - D) both A and C
 - E) choices A, B, and C

183) A hypothetical automobile has 100 parts that are to be assembled by four workers. During the car's assembly, each worker constructs 25 parts individually, and then the four resulting subcomponents are assembled together. The manner in which the car was assembled is much like which cellular strategy?

- A) assisted self-assembly
- B) electrostatic assembly
- C) renaturation
- D) hierarchical assembly
- E) self-assembly

184) Which of the following is a terpene?

- A) glycerol
- B) phenanthrene
- C) testosterone
- D) vitamin D
- E) dolichol

185) A reduction in surface area relative to the volume of a cell limits its size, but some cells have modifications that allow them to be somewhat larger. Which of the following is NOT one of the modifications that a cell may exhibit in order to overcome a reduction in surface area?

- A) folding of the membrane
- B) organelles
- C) compartmentalization of activities
- D) cytoplasmic streaming
- E) production of the cell wall

MATCHING. Choose the item in column 2 that best matches each item in column 1.

Match the choice on the left with the choice on the right.

186) Column 1: endothermic

Column 2: heat absorbing

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

187) An allosteric inhibitor

- A) increases the rate of substrate binding.
- B) binds at the allosteric site.
- C) is identical to the active site.
- D) binds and activates the high-affinity state of the enzymes.
- E) all of the above

188) Where would you expect to find an organism possessing a cell membrane with the following composition: large proportions of cholesterol and a predominance of unsaturated fatty acids?

- A) equatorial regions
- B) tropical regions
- C) frozen wastelands
- D) upper levels of an aquatic environment
- E) temperate regions

189) Which of the following is NOT a characteristic of active transport?

- A) exclusively move one molecule at a time in a unidirectional manner
- B) sensitive to metabolic poisons
- C) can be coupled with passive transport to generate the energy necessary for active transport
- D) can work as symports or antiports
- E) all of the above

190) In the first step of glycolysis, glucose can be phosphorylated because

- A) the transfer of a phosphate from ATP to glucose is exergonic.
- B) a phosphoanhydride bond has higher energy than a phosphoester bond.
- C) both the number 2 and 3 carbons can be spontaneously phosphorylated.
- D) the ketosugar is rapidly phosphorylated at the carbon 1 hydroxyl group.
- E) both A and B

191) During which of the following stages of the TCA cycle does substrate-level phosphorylation take place?

- A) TCA-2 B) TCA-3 C) TCA-4 D) TCA-5 E) TCA-6

192) The plants referred to as C3 and C4 plants get this designation based on the number of carbons in the first detectable product of carbon dioxide fixation. The C3 product is _____, whereas the C4 product is _____.

- A) 3-phosphoglycerate; malate
- B) glycerol; malate
- C) triose phosphate; oxaloacetate
- D) 3-phosphoglycerate; oxaloacetate
- E) ribose; phosphoenolpyruvate

193) Avery, MacLeod, and McCarty (1944) demonstrated that DNA was the molecule of heredity by treating heat killed *Streptococcus pneumoniae* S (smooth) strain with DNase, thereby preventing transfer of the "transforming substance" from the killed S strain to the live R (rough) strain when the two were mixed together and injected into mice. Another way that one could demonstrate transformation in bacteria would be to extract DNA from

- A) an ampicillin-sensitive strain and mix with cells of an ampicillin-resistant strain.
- B) a R strain and mix with cells of a S strain.
- C) both S and R strains and mix to allow recombination to take place.
- D) a S strain and mix with cells of a R strain.
- E) none of the above

194) In eukaryotic cells, we sometimes find reverse transcriptase activity, even though the cells are not infected with virus. This activity can be attributed to

- A) infection with small bacteria known as mycoplasmas.
- B) the presence of viroids.
- C) the presence of transposons integrating into polymerase genes.
- D) the presence of retrotransposons.
- E) a novel viral infection.

195) Ribosomes that do not anchor on the surface of the rough endoplasmic reticulum during translation *MOST* probably

- A) have a defect in ribosomal proteins that allow attachment to the surface.
- B) are synthesizing cytoplasmic proteins.
- C) do not make the appropriate anchor protein.
- D) have a signal peptidase error.
- E) all of the above

196) Which organelle is round and derives its name from the Latin word for "kernel"?

- A) nucleus
- B) lysosome
- C) Golgi complex
- D) mitochondrion
- E) chloroplast

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) C
- 2) A
- 3) C
- 4) C
- 5) A
- 6) D
- 7) C
- 8) C
- 9) A
- 10) C
- 11) E
- 12) A
- 13) B
- 14) D
- 15) B
- 16) C
- 17) B
- 18) E
- 19) C
- 20) E
- 21) A
- 22) E
- 23) E
- 24) A

25) C

26) B

27) B

28) C

29) C

30) A

31) E

32) B

33) B

34) A

35) E

36) C

37) E

38) C

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

39) respiration

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

40) E

41) B

42) C

43) D

44) E

45) B

46) A

47) D

48) E

49) E

50) D

51) A

52) E

53) A

MATCHING. Choose the item in column 2 that best matches each item in column 1.

54) luminous toadstools

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

55) B

MATCHING. Choose the item in column 2 that best matches each item in column 1.

56) nerve impulse conduction

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

57) E

MATCHING. Choose the item in column 2 that best matches each item in column 1.

58) maximum velocity

59) transferase

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

60) A

61) E

MATCHING. Choose the item in column 2 that best matches each item in column 1.

62) turnover number

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

63) C

64) A

65) B

MATCHING. Choose the item in column 2 that best matches each item in column 1.

66) isomerase

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

67) E

68) E

69) B

70) B

71) D

72) C

73) A

74) B

75) D

76) C

77) D

78) B

79) C

80) E

81) E

82) C

83) A

84) D

85) D

86) A

87) D

88) E

89) C

90) C

91) D

92) A

93) C

94) B

95) B

96) C

97) D

98) B

99) A

100) A

101) E

102) A

103) B

104) A

105) D

106) B

107) D

108) E

109) C

110) E

111) B

112) E

113) B

114) B

115) B

116) B

117) D

118) D

119) A

120) C

121) B

122) D

123) D

124) A

125) C

126) A

127) B

128) C

129) A

130) A

131) A

132) A

133) A

134) B

135) D

136) C

137) B

138) D

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

139) cellulose

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

140) C

141) A

142) A

143) C

MATCHING. Choose the item in column 2 that best matches each item in column 1.

144) substrate concentration

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

145) E

MATCHING. Choose the item in column 2 that best matches each item in column 1.

146) slope of Lineweaver-Burke plot

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

147) E

148) C

149) E

150) B

151) E

152) A

153) A

154) B

155) B

156) E

157) E

158) E

159) D

160) B

161) B

162) D

163) E

164) D

165) A

166) C

167) A

168) E

169) E

170) B

171) C

172) B

173) A

174) E

175) E

176) C

177) B

178) E

179) D

180) C

181) C

182) E

183) D

184) E

185) E

MATCHING. Choose the item in column 2 that best matches each item in column 1.

186) heat absorbing

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

187) B

188) C

189) A

190) E

191) D

192) D

193) D

194) D

195) B

196) A

[Regents Prep: Living Environment](#)

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Graphics are easily downloaded by **right-clicking** on the desired image and selecting either **Save Picture As...** ([Internet Explorer](#)) or **Save Image As...** ([Netscape](#)).

Cell Structure: Question 1 of 8

The diagram below represents a freshwater protist. Which letter indicates a structure that prevents the accumulation of excess water in the protist?

1. A
2. B
3. C
4. D

Correct Answer Number: 2

Explanation: This is the contractile vacuole which pumps excess water out of the protist. Since there is more pure water outside of the protist, water tends to move in by osmosis. Therefore, the protist must spend energy getting rid of the excess water.

Cell Structure: Question 2 of 8

Which diagram represents an organelle that contains the enzymes needed to synthesize ATP in the presence of oxygen?

1. 1
2. 2
3. 3
4. 4

Correct Answer Number: 1

Explanation: Picture 1 is a mitochondria, the powerhouse of the cell, where respiration occurs. The second picture is the Golgi body to package proteins, the third is the endoplasmic reticulum for transport of materials, and the fourth picture is showing the nucleus of a cell that controls all cell activities and contains the DNA.

Cell Structure: Question 3 of 8

Which structure includes all of the others?

1. nucleolus
2. nucleus
3. chromosomes
4. genes

Correct Answer Number: 2

Explanation: The nucleus is the large dark spot in cells. Inside are the chromosomes (pieces of DNA) which contain genes (pieces of chromosomes which correspond to our traits), as well as nucleoli (which are the sites of ribosome synthesis).

Cell Structure: Question 4 of 8

Most cell membranes are composed principally of

1. DNA and ATP

2. proteins and lipids
3. chitin and starch
4. nucleotides and amino acids

Correct Answer Number: 2

Explanation: Singer proposed the fluid mosaic model of the cell membrane in which the cell membrane consists of a double lipid layer with proteins embedded in it to act as name tags or to aid in movement of larger molecules across the membrane. DNA is the hereditary information stored in the nucleus and ATP is the energy capturing molecule found throughout the cell. Chitin and starch are large carbohydrates and nucleotides make up DNA while amino acids are the tiniest proteins.

Cell Structure: Question 5 of 8

Which statement best describes a difference between cell division in plant and animal cells?

1. In animal cells, cytoplasmic division is accomplished by a
2. In plant cells, cytoplasmic division is accomplished by a
3. In plant cells, centrosomes have a distinct role in spindle formation, while in animal cells centrosomes do not function during cell division.
4. In animal cells, replication of chromosomes occurs during the nondividing phase, while in plant cells replication occurs when the nuclear membrane disintegrates.

Correct Answer Number: 1

Explanation: Since plant cells have a rigid cell wall, they can not pinch in. Therefore, a cell plate forms between the two newly forming cells. A centriole is an animal organelle that directs the movement of chromosomes during mitosis and is involved in spindle formation.

Cell Structure: Question 6 of 8

Which structure is usually present only in animal cells?

1. vacuole
2. cell wall
3. nucleus

4. centriole

Correct Answer Number: 4

Explanation: Animal cells contain centrioles, cylindrical organelles that direct the movement of the chromosomes during mitosis. Plant cells tend to have bigger vacuoles and they also have rigid cell walls. Both have nuclei to control the cell.

Cell Structure: Question 7 of 8

Normally, in the process of osmosis, the net flow of water molecules into or out of the cell depends upon differences in the

1. concentration of water molecules inside and outside the cell
2. concentration of enzymes on either side of the cell membrane
3. rate of molecular motion on either side of the cell membrane
4. rate of movement of insoluble molecules inside the cell

Correct Answer Number: 1

Explanation: Osmosis is the diffusion of water across a membrane and is a passive process. Therefore, movement occurs due to a concentration gradient set up on either side of the membrane. If there is more water inside the cell than outside, water tends to move out.

Cell Structure: Question 8 of 8

Sodium ions are "pumped" from a region of lower concentration to a region of higher concentration in the nerve cells of humans. This process is an example of

1. diffusion
2. passive transport
3. osmosis
4. active transport

Correct Answer Number: 4

Explanation: Diffusion, passive transport and osmosis are examples of movement that does not require cellular energy. Since sodium ions are pumped against the concentration gradient, it requires work and is called active transport.

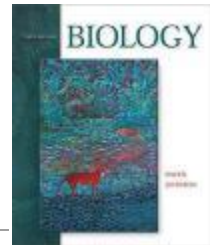
Biology, 6/e

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Cell Structure

Multiple Choice Quiz

Please answer all questions

The arrangement of microtubules in eukaryotic flagella is referred to as

- ☐ undulating
- A)**
- ☐ basal
- B)**
- ☐ 9+2
- C)**
- ☐ ciliary
- D)**

Which of the following is not a characteristic of prokaryotes?

- ☐ DNA
- A)**
- ☐ cell membrane
- B)**
- ☐ cell wall
- C)**
- ☐ endoplasmic reticulum
- D)**

The term "nuclear envelope" is more correct than the term "nuclear membrane" because

- ☐ the enclosure has pores which membranes do not
- A)**
- ☐ the enclosure is made up of two membranes
- B)**
- ☐ the chemical composition is inconsistent with cellular membranes
- C)**
- ☐ None of the above. The two terms are perfect synonyms.
- D)**

Oxidative metabolism is carried out ____ of mitochondria.

- ☐ in the intermembrane space
- A)**
- ☐ on the surface of the inner membrane
- B)**
- ☐ in the inside of the outer membrane
- C)**
- ☐ in the matrix
- D)**

Ribosomes are made up of ____ subunits.

- ☐ 0 (They are whole.)
- A)**
- ☐ 2
- B)**
- ☐ 3
- C)**
- ☐ 4
- D)**

Proteins synthesized by the rough ER are

- ☐ for internal storage
- A)**
- ☐ to build more membranes in the cell
- B)**
- ☐ to digest food in lysosomes
- C)**
- ☐ for internal regulation
- D)**
- ☐ exported from the cell
- E)**

Plants differ from animals in that plants have

- ☐ an endoplasmic reticulum
- A)**

- ☐ a central vacuole
- B)** ☐ Golgi complexes
- C)** ☐ vesicles
- D)** ☐ organelles
- E)** ☐

Passage through pores in the nuclear envelope is restricted primarily to

- ☐ proteins, RNA, and protein-RNA complexes
- A)** ☐ lipids and glycolipids
- B)** ☐ DNA and RNA
- C)** ☐ RNA and protein-carbohydrate complexes
- D)** ☐ marker proteins for the plasma membrane
- E)** ☐

In bacteria, some of the functions of eukaryotic cells are performed by

- ☐ vesicles
- A)** ☐ lysosomes
- B)** ☐ mitochondria
- C)** ☐ nucleoli
- D)** ☐ the plasma membrane
- E)** ☐

Glycoproteins and glycolipids assembled in Golgi bodies are packaged for distribution in

- ☐ cisternae
- A)** ☐ lysosomes
- B)** ☐ peroxisomes
- C)** ☐ liposomes
- D)** ☐ glyoxysomes
- E)** ☐

Within chloroplasts, light is captured by

- ☐ grana within cisternae
- A)** ☐ thylakoids within grana
- B)** ☐ cisternae within grana
- C)** ☐ grana within thylakoids
- D)** ☐ none of the above
- E)**

The rough ER is so named because it has an abundance of _____ on it.

- ☐ mitochondria
- A)** ☐ lysosomes
- B)** ☐ Golgi bodies
- C)** ☐ ribosomes
- D)** ☐ vesicles
- E)**

With which of the following are basal bodies not associated?

- ☐ animal cells
- A)** ☐ centrioles
- B)** ☐ plant cells
- C)** ☐ tubulin
- D)** ☐ microtubules
- E)**

Depolymerization of microtubules is inhibited by

- ☐ kinesin
- A)** ☐ dyneins
- B)** ☐ actin
- C)**

- ☐ guanosine triphosphate
- D)**
- ☐ vimentin
- E)**

Bacteria may be propelled by

- ☐ rotating thread-like flagellum
- A)**
- ☐ cilia
- B)**
- ☐ undulating 9+2 type flagellum
- C)**
- ☐ gel-sol changes in the cytoplasm
- D)**
- ☐ an undulating thread-like flagellum
- E)**

The bacterial cell wall is composed of

- ☐ a phospholipid matrix
- A)**
- ☐ a lipoprotein
- B)**
- ☐ a polymer of sugars
- C)**
- ☐ chitin
- D)**
- ☐ a structural protein
- E)**

Unlike those of prokaryotes, eukaryotic cell walls are composed of

- ☐ a carbohydrate matrix cross-linked by short polypeptides
- A)**
- ☐ glycolipids and protein fibers
- B)**
- ☐ cellulose fibers embedded in a matrix
- C)**
- ☐ chitin
- D)**
- ☐ proteins and histones
- E)**

A gram-negative bacterium is enclosed by

- ☐ a single thick wall
- A)**

- ☐ a single thin wall
- B)** ☐ a double thick wall
- C)** ☐ a double thin wall
- D)** ☐ no wall, just a plasma membrane
- E)**

The cytoplasm of a bacterium

- ☐ is supported by the cytoskeleton
- A)** ☐ is supported by microtubules
- B)** ☐ is supported by keratin
- C)** ☐ has no internal support structure
- D)** ☐ is supported by folds in the interstitial membrane
- E)**

A gram-positive bacterium is stained _____ by the gram stain

- ☐ pink
- A)** ☐ purple
- B)** ☐ blue
- C)** ☐ green
- D)** ☐ red
- E)**

Clusters of rRNA where ribosomes are assembled are called

- ☐ nuclei
- A)** ☐ cisternae
- B)** ☐ nucleoli
- C)** ☐ Golgi complexes
- D)** ☐ centrioles
- E)**

Mitochondrial enzymes for oxidative metabolism are

- ☐ on or within the surface of cristae
- A)** ☐ located on the outer membrane
- B)** ☐ in the matrix
- C)** ☐ floating freely in intermembrane space
- D)** ☐ in mitochondrial lysosomes
- E)**

The smooth ER is especially abundant in cells that synthesize extensive amounts of

- ☐ toxins
- A)** ☐ proteins
- B)** ☐ enzymes
- C)** ☐ lipids
- D)** ☐ nucleic acids
- E)**

Enzymes embedded in the membrane of the smooth ER

- ☐ synthesize lipids
- A)** ☐ may be used for detoxification
- B)** ☐ synthesize carbohydrates
- C)** ☐ mostly are active only when associated with a membrane
- D)** ☐ all of the above
- E)**

Which of the following organelles is found in plant cells but not in animal cells?

- ☐ ribosomes
- A)** ☐ endoplasmic reticulum
- B)** ☐ mitochondria
- C)**

- ☐ peroxisomes
- D)**
- ☐ None of the above
- E)**

Most cells are very small. A typical eukaryotic cell, both plant and animal, will occur in which of the following size ranges?

- ☐ 1 mm to 100 μm
- A)**
- ☐ 100 μm to 10 μm
- B)**
- ☐ 10 μm to 1 μm
- C)**
- ☐ 1 μm to 100 nm
- D)**
- ☐ 100 nm to 10 nm
- E)**

A cell that measures 200 μm in diameter compared to a cell that measures 20 μm will have 100 times the surface area but 1000 times the volume.

- ☐ True
- A)**
- ☐ False
- B)**

Because they have chloroplasts for energy production, plant cells lack mitochondria.

- ☐ True
- A)**
- ☐ False
- B)**

Assuming all other factors to be the same, electron microscopes have greater resolving power than light microscopes because.

- ☐ the wavelength of electrons is much longer than the wavelength of visible light
- A)**
- ☐ electron microscopes have more lenses
- B)**
- ☐ because the beams in electron microscopes overlap creating a clearer picture
- C)**
- ☐ because the wavelengths in visible light are longer than with electrons
- D)**
- ☐ because electron microscopes are compound microscopes
- E)**

Bacterial flagella propel the cell by using

- ☐ a whipping-like motion
- A)** ☐ two flagella that move in opposite directions, like a flutter kick
- B)** ☐ a rotating motion
- C)** ☐ a flicking motion
- D)** ☐ none of the above
- E)**

Which characteristic do eukaryotic and prokaryotic flagella have in common?

- ☐ chemical composition
- A)** ☐ structure
- B)** ☐ location in the cell
- C)** ☐ function
- D)** ☐ source of energy
- E)**

The microtubules of cilia and flagella are organized in a characteristic $9 + 2$ pattern, and they slide past one another.

- ☐ True
- A)** ☐ False
- B)**

Proteins lacking a signal peptide sequence will probably be secreted from the cell.

- ☐ True
- A)** ☐ False
- B)**

According to the endosymbiotic theory, the infoldings and specializations of the plasma membrane led to the evolution of the endomembrane system.

- ☐ True
- A)** ☐ False
- B)**

The cytoskeleton includes all of the following except

- ☐ microtubules
- A)** ☐ intermediate filaments
- B)** ☐ myosin filaments
- C)** ☐ actin filaments
- D)** ☐ all of the above are included
- E)**

Ribosomes are found

- ☐ only in the nucleus
- A)** ☐ in the cytoplasm
- B)** ☐ attached to the smooth endoplasmic reticulum
- C)** ☐ only in eukaryotic cells
- D)** ☐ both b and c
- E)**

The Golgi apparatus is involved in

- ☐ transporting proteins that are to be released from the cell
 - A)** ☐ packaging proteins into vesicles
 - B)** ☐ altering or modifying proteins
 - C)** ☐ producing lysosomes
 - D)** ☐ all of the above
 - E)**
-