Ju Test Bank Biology (1)

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CHAPTER 3
Water and Life

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

A. hydrogen bonds.
B. nonpolar covalent bonds.
C. polar covalent bonds.
D. ionic bonds.
E. van der Waals interactions.

2. In a group of water molecules, hydrogen bonds form between?

A. the oxygen atoms in different water molecules
B. Two hydrogen atoms in different water molecules
C. **the oxygen atom in one water molecule and a hydrogen atom in another water molecule**
D. the hydrogen atoms in a single water molecule
E. None of the listed responses is Correct

3. Life on Earth is dependent on all the properties of water as well as the abundance of water. Which property of water is probably most important for the functioning of organisms at the molecular level?

A. high specific heat
B. cohesion and high surface tension
C. versatility as a solvent
D. expansion upon freezing
E. high heat of vaporization

4. Some substances, such as oil and gasoline, will not dissolve in water because?

A. oil and gasoline are organic compounds,
B. **their molecules have no charges or partial charges to which water molecules can adhere**
C. their electrons are so stable that they do not exchange atoms with water molecules
D. they do not ionize
E. their molecules are so large

5. The partial charges on a water molecule occur because of?

A. widespread ionization
B. **the unequal sharing of electrons between the hydrogen and the oxygen atoms of a water molecule**
C. the high electronegativity of hydrogen
D. covalent bonding
E. the achievement of a stable configuration by one atom of a bond but not by the other partner

6. Water molecules have _____ than molecules of similar size, such as ammonia and methane, reflecting its capacity to absorb large amounts of heat.

A. less surface tension
B. **a higher boiling point**
C. a lower capacity for forming
D. lower specific heat hydrogen bonds
E. a lower melting point

7. Most of water's unique features (for example, its versatility as a solvent, ability to moderate temperature, and cohesive behavior) result from the fact that?

A. hydrogen is the only element without any neutrons.
B. oxygen attracts electrons more than hydrogen does.
C. oxygen has only one stable isotope, but hydrogen has three.
D. oxygen has two unfilled electron shells.
E. More than one of the above is Correct.

8. The slight negative charge at one end of one water molecule is attracted to the slight positive charge of another water molecule. What is this attraction called?

A. a covalent bond
B. **a hydrogen bond**
C. an ionic bond
D. a hydrophilic bond
E. a van der Waals interaction

9. Sulfur is in the same column of the periodic table as oxygen, but has electronegativity similar to carbon. Compared to water molecules, molecules of H_2S?

A. will ionize more readily.
B. will have greater cohesion to other molecules of H_2S.
C. will have a greater tendency to form hydrogen bonds with each other.
D. will have a higher capacity to absorb heat for the same change in temperature.
E. will not form hydrogen bonds with each other.

10. Water molecules are able to form hydrogen bonds with?

A. **compounds that have polar covalent bonds**.
B. oils.
C. oxygen gas (O_2. molecules.
D. chloride ions.
E. any compound that is not soluble in water.

11. The partial negative charge in a molecule of water occurs because?

A. the oxygen atom acquires an additional electron.
B. the electrons shared between the oxygen and hydrogen atoms spend more time around the oxygen atom nucleus than around the hydrogen atom nucleus.
C. the oxygen atom has two pairs of electrons in its valence shell that are not neutralized by hydrogen atoms.
D. the oxygen atom forms hybrid orbitals that distribute electrons unequally around the oxygen nucleus.
E. one of the hydrogen atoms donates an electron to the oxygen atom.

12. Which type of bond must be broken for water to vaporize?

A. ionic bonds
B. both hydrogen bonds and ionic bonds
C. polar covalent bonds
D. **hydrogen bonds**
E. both polar covalent bonds and hydrogen bonds

13. Temperature usually increases when water condenses. Which behavior of water is most directly responsible for this phenomenon?

A. the change in density when it condenses to form a liquid or solid
B. reactions with other atmospheric compounds
C. the release of heat by the formation of hydrogen bonds
D. the release of heat by the breaking of hydrogen bonds
E. the high surface tension of water

14. The tendency of water molecules to stay close to each other as a result of hydrogen bonding?

A. keeps water moving through the vessels in a tree trunk
B. acts to moderate temperature
C. provides the surface tension that allows leaves to float on water
D. is called cohesion
E. All of the listed responses are Correct.

15. What property of water is responsible for water transport in plants?

A. moderation of temperature
B. insulation
C. its versatility as a solvent
D. **cohesion**
E. its role as a buffer

16. Adhesion is best described as?

A. **the clinging of one substance to another substance**
B. the process that contributes to the transport of water and dissolved nutrients in plants by causing water molecules to tug on other water molecules
C. a property of water that helps moderate Earth's temperature
D. the process by which a crystalline lattice forms
E. None of the listed responses is Correct.

17. The phenomenon responsible for maintaining the upward movement of water through a vessel is?

A. **cohesion**
B. evaporation
C. adhesion
D. heat of vaporization
E. surface tension

18. Water is transported in plant tissues against gravity due to which of the following properties?

A. adhesion
B. hydrogen bonding
C. cohesion
D. two of the above
E. **all of the above**

19. Sweating has a cooling effect because of water's high?

A. surface tension
B. density
C. **heat of vaporization**
D. buffering capacity
E. specific heat

20. Which of the following effects is produced by the high surface tension of water?

A. Lakes don't freeze solid in winter, despite low temperatures.
B. A water strider can walk across the surface of a small pond.
C. Organisms resist temperature changes, although they give off heat due to chemical reactions.
D. Evaporation of sweat from the skin helps to keep people from overheating.
E. Water flows upward from the roots to the leaves in plants.

21. Which of the following takes place as an ice cube cools a drink?

A. Molecular collisions in the drink increase.
B. Kinetic energy in the drink decreases.
C. A calorie of heat energy is transferred from the ice to the water of the drink.
D. The specific heat of the water in the drink decreases.
E. Evaporation of the water in the drink increases.

22. The reason that coastal climates are more moderate than inland climates is due primarily to water's high?

A. heat of fusion
B. surface tension
C. **specific heat**
D. density
E. heat of vaporization

23. The amount of heat required to change the temperature of 1 g of any substance by one C is defined as?

A. 1 kilocalorie
B. 1 calorie
C. molecular cohesion
D. the heat of vaporization of that Substance
E. the specific heat of that substance

24. Liquid water's high specific heat is mainly a consequence of the?

A. small size of the water molecules.
B. high specific heat of oxygen and hydrogen atoms.
C. absorption and release of heat when hydrogen bonds break and form.
D. fact that water is a poor heat conductor.
E. higher density of liquid water than solid water (ice).

25. Why does evaporation of water from a surface cause cooling of the surface?

A. The breaking of bonds between water molecules absorbs heat.
B. The water molecules with the most heat energy evaporate more readily.
C. The solute molecules left behind absorb heat.
D. Water molecules absorb heat from the surface in order to acquire enough energy to evaporate.
E. The expansion of water vapor extracts heat from the surface.

26. A dietary Calorie equals 1 kilocalorie. Which of the following statements correctly defines 1 kilocalorie?

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

27. Why does ice float in liquid water?

A. The high surface tension of liquid water keeps the ice on top.
B. The ionic bonds between the molecules in ice prevent the ice from sinking.
C. Ice always has air bubbles that keep it afloat.
D. Hydrogen bonds stabilize and keep the molecules of ice farther apart than the water molecules of liquid water.
E. The crystalline lattice of ice causes it to be denser than liquid water.

28. Many mammals control their body temperature by sweating. Which property of water is most directly responsible for the ability of sweat to lower body temperature?

A. water's change in density when it condenses
B. water's ability to dissolve molecules in the air
C. the release of heat by the formation of hydrogen bonds
D. the absorption of heat by the breaking of hydrogen bonds
E. water's high surface tension

29. An example of a hydrogen bond is the bond between?

A. C and H in methane (CH_4).
B. the H of one water molecule and the O of another water molecule.
C. Na^+ and Cl^- in salt.
D. the two hydrogen atoms in a molecule of hydrogen gas (H_2).
E. Mg^+ and Cl^- in $MgCl_2$.

30. Water is able to form hydrogen bonds because?

A. oxygen has a valence of 2.
B. the water molecule is shaped like a tetrahedron.
C. the bonds that hold together the atoms in a water molecule are polar covalent bonds.
D. the oxygen atom in a water molecule has a weak positive charge.
E. each of the hydrogen atoms in a water molecule is weakly negative in charge.

31. What do cohesion, surface tension, and adhesion have in common with reference to water?

A. All increase when temperature increases.
B. All are produced by ionic bonding.
C. All are properties related to hydrogen bonding.
D. All have to do with nonpolar covalent bonds.
E. C and D only

32. Water's surface tension and heat storage capacity is accounted for by its?

A. size
B. orbitals
C. weight
D. mass
E. **hydrogen bonds.**

33. Ice is lighter and floats in water because it is a crystalline structure in which each water molecule is bonded to a maximum of four other water molecules by which kind of bond?

A. ionic
B. **hydrogen**
C. covalent
D. A and C only
E. A, B, and C

34. The formation of ice during colder weather helps temper the seasonal transition to winter. This is mainly because?

A. there is less evaporative cooling of lakes.
B. ice is warmer than the winter air.
C. the formation of hydrogen bonds absorbs heat.
D. the formation of hydrogen bonds releases heat.
E. ice melts each autumn afternoon.

35. Hydrophobic substances such as vegetable oil are?

A. nonpolar substances that repel water molecules.
B. nonpolar substances that have an attraction for water molecules.
C. polar substances that repel water molecules.
D. polar substances that have an affinity for water.
E. charged molecules that hydrogen-bond with water molecules.

36. Nonpolar molecules that cluster away from water molecules are called molecules?

A. hydrophilic
B. saponified
C. **hydrophobic**
D. ionic
E. None of the listed responses is Correct.

37. Hydrophobic molecules are _____ water.

A. neutralized by
B. **repelled by**
C. absorbed by
D. polarized by
E. attracted to

38. A molecule that has all nonpolar covalent bonds would be?

A. ionic
B. acidic
C. **hydrophobic**
D. hydrophilic
E. basic (alkaline)

39. Hydrophilic substances, but not hydrophobic substances, _____.

A. have a higher bond energy than water
B. accept electrons from solvents
C. **have charges and partial charges to which water molecules can adhere**
D. are repelled by water
E. give up electrons to solvents

40. Which of the following is a hydrophobic material?

A. paper
B. table salt
C. **wax**
D. sugar
E. pasta

41. A strong acid like HCl?

A. ionizes completely in an aqueous solution.
B. increases the pH when added to an aqueous solution.
C. reacts with strong bases to create a buffered solution.
D. is a strong buffer at low pH.
E. both ionizes completely in aqueous solutions and is a strong buffer at low pH.

CHAPTER 5

Biological Macromolecules and Lipids

1. Molecules with which functional groups may form polymers via dehydration reactions?

A. hydroxyl groups
B. carbonyl groups
C. carboxyl groups
D. either carbonyl or carboxyl groups
E. either hydroxyl or carboxyl groups

2. Which of these molecules is not formed by dehydration reactions?

A. fatty acids
B. disaccharides
C. DNA
D. protein
E. amylose

3. In animal metabolism, most of the monomers released by digestion of food macromolecules are metabolized to provide energy. Only a small portion of these monomers are used for synthesis of new macromolecules. The net result is that

A. water is generated by animal metabolism.
B. water is consumed by animal metabolism.
C. the water consumed is exactly balanced by the water generated, to maintain homeostasis.
D. water is consumed during homeostasis, but water is generated during periods of growth.
E. water is generated during homeostasis, but water is consumed during periods of growth.

4. Which of these classes of biological molecules consist of both small molecules and macromolecular polymers?

A. lipids
B. carbohydrates
C. proteins
D. nucleic acids
E. lipids, carbohydrates, proteins, and nucleic acids all consist of only macromolecular polymers

5. Which of the following is not a polymer?

A. glucose
B. starch
C.. cellulose
D. chitin
E. DNA

6. What is the chemical reaction mechanism by which cells make polymers from monomers?

A. phosphodiester linkages
B. hydrolysis
C. dehydration reactions
D. ionic bonding of monomers
E. the formation of disulfide bridges between monomers

7. How many molecules of water are needed to completely hydrolyze a polymer that is 11 Monomers long?

A. 12
B. 11
C. 10
D. 9
E. 8

8. Which of the following best summarizes the relationship between dehydration reactions and hydrolysis?

A. **Dehydration reactions assemble polymers, and hydrolysis reactions break down polymers**.
B. Dehydration reactions eliminate water from lipid membranes, and hydrolysis makes lipid membranes water permeable.
C. Dehydration reactions can occur only after hydrolysis.
D. Hydrolysis creates monomers, and dehydration reactions break down polymers.
E. Dehydration reactions ionize water molecules and add hydroxyl groups to polymers; hydrolysis reactions release hydroxyl groups from polymers.

9. Which of the following polymers contain nitrogen?

A. starch
B. glycogen
C. cellulose
D. **chitin**
E. amylopectin

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

A. C18H36O18
B. C18H32O16
C. C6H10O5
D. C18H10O15
E. C3H6O3

11. The enzyme amylase can break glycosidic linkages between glucose monomers only if the monomers are the α form. Which of the following could amylase break down?

A. glycogen
B. cellulose
C. chitin
D. glycogen and chitin only
E. glycogen, cellulose, and chitin

12. On food packages, to what does the term insoluble fiber refer?

A. cellulose
B. polypeptides
C. starch
D. amylopectin
E. chitin

13. A molecule with the chemical formula C6H12O6 is probably a

A. carbohydrate.
B. lipid.
C. monosaccharide
D. carbohydrate and lipid only.
E. carbohydrate and monosaccharide only.

14. Lactose, a sugar in milk, is composed of one glucose molecule joined by a glycosidic linkage to one galactose molecule. How is lactose classified?

A. as a pentose
B. as a hexose
C. as a monosaccharide
D. as a disaccharide
E. as a polysaccharide

15. All of the following are polysaccharides except

A. lactose.
B. glycogen.
C. chitin.
D. cellulose.
E. amylopectin.

16. Which of the following is true of both starch and cellulose?

A. They are both polymers of glucose.
B. They are cis-trans isomers of each other.
C. They can both be digested by humans.
D. They are both used for energy storage in plants.
E. They are both structural components of the plant cell wall.

17. Which of the following is true of cellulose?

A. It is a polymer composed of enantiomers of glucose.
B. It is a storage polysaccharide for energy in plant cells.
C. It is digestible by bacteria in the human gut.
D. It is a major structural component of plant cell walls.
E. It is a polymer composed of enantiomers of glucose, it is a storage polysaccharide for energy in plant cells, it is digestible by bacteria in the human gut, and it is a major structural component of plant cell walls.

18. Humans can digest starch but not cellulose because

A. the monomer of starch is glucose, while the monomer of cellulose is galactose.
B. humans have enzymes that can hydrolyze the β glycosidic linkages of starch but not the α glycosidic linkages of cellulose.
C. humans have enzymes that can hydrolyze the α glycosidic linkages of starch but not the β glycosidic linkages of cellulose.
D. humans harbor starch-digesting bacteria in the digestive tract.
E. the monomer of starch is glucose, while the monomer of cellulose is glucose with a nitrogen-containing group.

19. Which of the following statements concerning saturated fats is not true?

A. They are more common in animals than in plants.
B. They have multiple double bonds in the carbon chains of their fatty acids.
C. They generally solidify at room temperature.
D. They contain more hydrogen than unsaturated fats having the same number of carbon atoms.
E. They are one of several factors that contribute to atherosclerosis.

20. A molecule with the formula $C_{18}H_{36}O_2$ is probably a

A. carbohydrate.
B. fatty acid.
C. protein.
D. nucleic acid.
E. hydrocarbon.

21. Which of the following statements is true for the class of biological molecules known as lipids?

A. They are insoluble in water.
B. They are made from glycerol, fatty acids, and phosphate.
C. They contain less energy than proteins and carbohydrates.
D. They are made by dehydration reactions.
E. They contain nitrogen.

22. The label on a container of margarine lists "hydrogenated vegetable oil" as the major ingredient. What is the result of adding hydrogens to vegetable oil?

A. The hydrogenated vegetable oil has a lower melting point.
B. The hydrogenated vegetable oil stays solid at room temperature.
C. The hydrogenated vegetable oil has more "kinks" in the fatty acid chains.
D. The hydrogenated vegetable oil has fewer trans fatty acids.
E. The hydrogenated vegetable oil is less likely to clog arteries.

23. Which of the following is true regarding saturated fatty acids?

A. They are the predominant fatty acid in corn oil.
B. They have double bonds between carbon atoms of the fatty acids.
C. They are the principal molecules in lard and butter.
D. They are usually liquid at room temperature.
E. They are usually produced by plants.

24. Large organic molecules are usually assembled by polymerization of a few kinds of simple subunits. Which of the following is an exception to this statement?

A. a steroid
B. cellulose
C. DNA
D. an enzyme
E. a contractile protein

25. Which modifications of fatty acids will best keep triglycerides solid at warmer temperatures?

A. creating cis double bonds to the fatty acids
B. adding hydrogens to the fatty acids
C. creating trans double bonds to the fatty acids
D. adding hydrogens and trans double bonds to the fatty acids
E. adding cis double bonds and trans double bonds to the fatty acids

26. Why are human sex hormones considered to be lipids?

A. They are essential components of cell membranes.
B. They are not soluble in water.
C. They are made of fatty acids.
D. They are hydrophilic compounds.
E. They contribute to atherosclerosis.

27. All of the following contain amino acids except

A. hemoglobin.
B. cholesterol.
C. antibodies.
D. enzymes.
E. insulin.

28. The bonding of two amino acid molecules to form a larger molecule requires

A. the release of a water molecule.
B. the release of a carbon dioxide molecule.
C. the addition of a nitrogen atom.
D. the addition of a water molecule.
E. the release of a nitrous oxide molecule.

29. There are 20 different amino acids. What makes one amino acid different from another?

A. Different side chains (R groups) attached to a carboxyl carbon
B. Different side chains (R groups) attached to the amino groups
C. Different side chains (R groups) attached to an α carbon
D. Different structural and optical isomers
E. Different asymmetric carbons

30. The bonding of two amino acid molecules to form a larger molecule requires which of the following?

A. removal of a water molecule
B. addition of a water molecule
C. formation of a glycosidic bond
D. formation of a hydrogen bond
E. both removal of a water molecule and formation of a hydrogen bond

31. Polysaccharides, triacylglycerides, and proteins are similar in that they

A. are synthesized from monomers by the process of hydrolysis.
B. are synthesized from subunits by dehydration reactions.
C. are synthesized as a result of peptide bond formation between monomers.
D. are decomposed into their subunits by dehydration reactions.
E. all contain nitrogen in their monomer building blocks.

32. Dehydration reactions are used in forming which of the following compounds?

A. triacylglycerides
B. polysaccharides
C. proteins
D. triacylglycerides and proteins only
E. triacylglycerides, polysaccharides, and proteins

33. Upon chemical analysis, a particular polypeptide was found to contain 100 amino acids. How many peptide bonds are present in this protein?

A. 101
B. 100
C. 99
D. 98
E. 97

34. What aspects of protein structure are stabilized or assisted by hydrogen bonds?

A. primary structure
B. secondary structure
C. tertiary structure
D. quaternary structure
E. secondary, tertiary, and quaternary structures, but not primary structure

35. Which bonds are created during the formation of the primary structure of a protein?

A. peptide bonds
B. hydrogen bonds
C. disulfide bonds
D. phosphodiester bonds
E. peptide bonds, hydrogen bonds, and disulfide bonds

36. What maintains the secondary structure of a protein?

A. peptide bonds
B. hydrogen bonds between the amino group of one peptide bond and the carboxyl group of another peptide bond
C. disulfide bonds
D. hydrophobic interactions
E. hydrogen bonds between the R groups

37. Which type of interaction stabilizes the α helix and the β pleated sheet structures of proteins?

A. hydrophobic interactions
B. disulfide bonds
C. ionic bonds
D. hydrogen bonds
E. peptide bonds

38. Which level of protein structure do the α helix and the β pleated sheet represent?

A. primary
B. secondary
C. tertiary
D. quaternary
E. primary, secondary, tertiary, and quaternary

39. The amino acids of the protein keratin are arranged predominantly in an α helix. This secondary structure is stabilized by

A. covalent bonds.
B. peptide bonds.
C. ionic bonds.
D. polar bonds.
E. hydrogen bonds.

40. The tertiary structure of a protein is the

A. bonding together of several polypeptide chains by weak bonds.
B. order in which amino acids are joined in a polypeptide chain.
C. unique three-dimensional shape of the fully folded polypeptide.
D. organization of a polypeptide chain into an α helix or β pleated sheet.
E. overall protein structure resulting from the aggregation of two or more polypeptide subunits.

41. What type of covalent bond between amino acid side chains (R groups) functions in maintaining a polypeptide's specific three-dimensional shape?

A. ionic bond
B. hydrophobic interaction
C. van der Waals interaction
D. disulfide bond
E. hydrogen bond

42. At which level of protein structure are interactions between the side chains (R groups) most important?

A. primary
B. secondary
C. tertiary
D. quaternary
E. all of the above

43. The structural level of a protein least affected by a disruption in hydrogen bonding is the

A. primary level.
B. secondary level.
C. tertiary level.
D. quaternary level.
E. All structural levels are equally affected.

44. The lipids that form the main structural component of cell membranes are

A. **phospholipids**
B. cholesterol
C. proteins
D. triacylglycerols
E. carbohydrates

45. The enzyme amylase can break glycosidic linkages between glucose. monomers only if the monomers are in the a form. Which of the following could amylase breakdown?

A. glycogen and cellulose
B. starch and chitin
C. **glycogen, starch, and amylopectin**
D. starch, amylopectin, and cellulose
E. cellulose and chitin

46. Which of the following carbohydrate molecules has the lowest molecular weight?

A. cellulose
B. chitin
C. glucose
D. sucrose
E. lactose

47. Which of the following components of a tossed salad will pass through the human digestive tract and be digested the least?

A. starch (in the croutons)
B. **cellulose (in the lettuce**)
C. oil (in the dressing)
D. protein (in the bacon bits)
E. sugar (in the dressing)

48. A polysaccharide that is used for storing energy in human muscle and liver Cells is

A. **glycogen**
B. glucose
C. starch
D. chitin
E. cellulose

49. Some lipids are formed when fatty acids are linked to glycerol. These subunits are linked together by

A. **ester linkages**
B. glycosidic linkages
C. ionic bonds
D. phosphodiester linkages
E. peptide bonds

50. When a protein is denatured, why does it lose its functionality?

A. Different amino acids are substituted into the sequence, so the protein's properties change
B. The protein's pH changes, causing it to lose its functionality.
C. **Denaturation breaks the weak bonds, such as hydrogen bonds and van der Waals interactions, that hold the protein in its three dimensional shape. Without the proper shape, the protein cannot function.**
D. Denaturation destroys the primary structure of the protein, and the protein breaks down to monomers
E. Denaturation breaks the covalent bonds that hold the protein in its three-dimensional shape. Without the proper shape, the protein cannot function.

51. Protein molecules are polymers (chains) of .

A. purines and pyrimidines
B. DNA molecules
C. sucrose molecules
D. **amino acid molecules**
E. fatty acid molecules

52. A nucleotide is made of which of the following chemical components?

A. **a nitrogenous base, a phosphate group, and a pentose sugar**
B. a nitrogenous base, a fatty acid, and an amino acid
C. a nitrogenous base, an amino acid, and a phosphate group
D. a series of nitrogenous bases, a nucleic acid backbone, and a hexose sugar
E. a nitrogenous base, an amino acid, and a pentose sugar

53. Which of the following is a true statement comparing phospholipids and triacylglycerols (fats and oils)?

A. Both molecules contain a phosphate group.
B. Phospholipids are the primary storage form for fats in our bodies
C. **Phospholipid molecules have a distinctly polar "head" and a distinctly nonpolar "tail," whereas triacylglycerols are predominantly nonpolar.**
D. Triacylglycerols may be saturated or unsaturated, but all phospholipids are saturated.
E. In nature, phospholipids occur in fused rings (sterol form), whereas triacylglycerols maintain a straight chain form.

54. Nutritionally, saturated triacylglycerols are considered to be less healthful than unsaturated triacylglycerols. What is the difference between them?

A. Saturated triacylglycerols are liquid at room temperature.
B. Saturated triacylglycerols have more double bonds than unsaturated triacylglycerols,
C. All of the listed responses are Correct.
D. Saturated triacylglycerols are fats, unsaturated triacylglycerols are carbohydrates,
E. Saturated triacylglycerols have more hydrogen atoms than unsaturated triacylglycerols,

55. Enzymes that breakdown DNA catalyze the hydrolysis of the covalent bonds that join nucleotides together. What would happen to DNA molecules treated with these enzymes?

A. The phosphodiester linkages of the polynucleotide backbone would be broken.
B. All bases would be separated from the deoxyribose sugars.
C. The pyrimidines would be separated from the deoxyribose Sugars,
D. The two strands of the double helix would separate.
E. The purines would be separated from the deoxyribose sugars.

56. Carbohydrates can function in which of the following ways?

A. structural support
B. information storage
C. **structural support and energy storage**
D. energy storage
E. enzymatic catalysis

57. High cholesterol levels are considered a major risk factor for heart disease. If it is so bad for humans, why does the body make cholesterol in the first place?

A. Cholesterol is an important energy storage molecule.
B. Cholesterol aids in the formation of amino acids that are used to build proteins
C. Cholesterol is not important for humans any more. It is a holdover from hunter-gatherer days when food was scarce.
D. Cholesterol is an important constituent of nucleotides.
E. Cholesterol is the basis for many important molecules such as sex hormones

58. Which of the following molecules is a monosaccharide?

A. C25H43O8
B. C22H49010N5
C. **C6H12O6**
D. C45H8408PN
E. C51H9806

59. Which of the following is a polymer?

A. testosterone, a steroid hormone
B. **cellulose, a plant cell wall component**
C. triacylglycerol, or sat
D. glucose, an energy-rich molecule
E. fructose, a component of sucrose

60. At a conference, the speaker's grand finale was saut & eacute;ing mealworms (insect larvae) in butter and serving them to the audience. They were crunchy (like popcorn hulls) because their exoskeletons contain the polysaccharide.

A. cellulose
B. glycogen
C. **chitin**
D. linoleic acid
E. collagen

61. Manufacturers make vegetable oils solid or semisolid at room temperature by

A. removing hydrogen atoms and forming additional double bonds in the fatty acid hydrocarbon chains
B. adding hydrogen atoms to the single bonds of the fatty acid hydrocarbon chains
C. None of the listed responses is Correct.
D. removing hydrogen atoms and forming additional single bonds in the fatty acid hydrocarbon chains
E. adding hydrogen atoms to the double bonds in the fatty acid hydrocarbon chains

62. The sex hormones estrogen, progesterone, and testosterone belong to which class of molecules?

A. carbohydrates
B. proteins
C. **lipids**
D. amino acids
E. nucleic acids

63. Which of the following statements concerning unsaturated fats is true?

A. They contain more hydrogen than do saturated fats having the same number of carbon atoms
B. They are more common in animals than in plants.
C. They generally solidify at room temperature.
D. **They have double bonds in the carbon chains of their fatty acids.**
E. They have sewer fatty acid molecules per fat molecule,

64. What is the process by which monomers are linked together to form polymers?

A. hydrolysis
B. monomerization
C. coiling
D. **dehydration or condensation reactions**
E. protein formation

65. A glucose molecule is to starch as

A. a protein is to an amino acid
B. a nucleic acid is to a polypeptide
C. **a nucleotide is to a nucleic acid**
D. a steroid is to a lipid
E. an amino acid is to a nucleic acid

66. Lipids differ from other large biological molecules in that they .

A. **are not truly polymers**
B. are much larger
C. do not contain carbon
D. do not have specific shapes
E. do not contain nitrogen and phosphorus atoms

67. The fatty acid tails of a phospholipid are because they .

A. **hydrophobic ... have no charges to which water molecules can adhere**
B. hydrophobic ... dissolve easily in water
C. hydrophilic... are easily hydrolyzed into their monomers
D. hydrophobic ... consist of units assembled by dehydration reactions
E. hydrophilic... consist of units assembled by dehydration reactions

68. The overall three-dimensional shape of a single polypeptide is called the

A. primary structure
B. double helix
C. secondary structure
D. quaternary structure
E. tertiary structure

69. In what polysaccharide form do plants store glucose to be available later as an energy source?

A. protein
B. glycogen
C. cellulose
D. **starch**
E. fatly acids

70. Which of the following categories includes all others in the list?

A. disaccharide
B. **carbohydrate**
C. polysaccharide
D. starch
E. monosaccharide

71. hich of the following is the major energy storage compound of plant seeds?

A. glycogen
B. lipids
C. cellulose
D. amylose
E. **oils**

72. In a hydrolysis reaction,---------, and in this process water is------- .

A. a monomer is broken up into its constituent polymers... produced
B. monomers are assembled to produce a polymer... produced
C. **a polymer is broken up into its constituent monomers ... consumed**
D. a polymer is broken up into its constituent monomers... produced
E. monomers are assembled to produce a polymer... consumed

73. The "primary structure" of a protein refers to

A. coiling due to hydrogen bonding between amino acids
B. **the sequence of amino acids**
C. the alpha helix or beta pleated sheets
D. interactions among the side chains or R groups of the amino acids
E. the weak aggregation of two or more polypeptide chains into one functional macromolecule

74. In a 1-4 glycosidic linkage,

A. there are four possible isomers of the structure
B. **the number 1 carbon in one monosaccharide is bound to the number 4 carbon in another monosaccharide**
C. the number 1 carbon in one nucleotide is bound to the number 4 carbon in another nucleotide
D. one monosaccharide is bound to four others
E. one glycerol molecule is bound to four fatty acids

75. The structural level of a protein least affected by a disruption in hydrogen bonding is the

A. All structural levels are equally affected.
B. secondary level.
C. **primary level.**
D. quaternary level.
E. tertiary level

76. The alpha helix and beta pleated sheet represent which level of protein structure?

A. tertiary structure
B. quaternary structure
C. pentiary structure
D. primary structure
E. secondary structure

77. Which of the following describes a difference between DNA and RNA?

A. RNA molecules consist of a single polynucleotide chain, whereas DNA molecules consist of two polynucleotide chains organized into a double helix.
B. They contain different sugars.
C. **The first three listed responses all describe differences.**
D. One of their nitrogenous bases is different.
E. The first and second listed responses are correct differences

78. The type of bond that forms to join monomers (such as sugars and amino acids) into polymers (such as starch and proteins is as(n) bond)

A. hydrogen
B. **covalent**
C. ionic
D. peptide
E. van der Waals

79. The peptide bond is

A. a hydrogen bond joining nucleotides together to form a nucleic acid
B. a covalent bond joining nucleotides together to form a nucleic acid
C. a covalent bond joining simple sugars together to form a polypeptide
D. a hydrogen bond joining amino acids together to form a polypeptide
E. a covalent bond joining amino acids together to form a polypeptide

80. Which of the following pairs of base sequences could form a short stretch of a normal double helix of DNA?

A. 5'-GCGC-3, with 5-TATA-3'
B. **5-ATGC-3 with 5'-GCAT-3'**
C. All of these pairs are correct.
D. 5-AGCT-3 with 5-TCGA-3'
E. 5'-purine-pyrimidine-purine

81. What do Alzheimer's, Parkinson's, and mad cow disease have in common?

A. **All have been associated with the buildup of misfolded proteins in cells,**
B. They all cause the misfolding of nucleicacids.
C. They all associated with plaque buildup in arteries (atherosclerosis).
D. All are caused by the buildup of misfolded proteins in cells.
E. All are associated with the buildup of lipids in brain cells due to faulty lysosome activity

82. **If a small droplet of triacylglycerol molecules is suspended in water, the sat molecules form a "ball of spaghetti" with no particular orientation. But if a droplet of phospholipid molecules is put in water, all the molecules point outward, toward the water. Phospholipids are forced into this orientation because phospholipids have**

A. two charged ends
B. three fatty acid molecules, all pointing in different directions
C. **a charged end and a non charged end**
D. both a saturated fatty acid and an unsaturated fatty acid
E. two fatty acid molecules pointing in different directions

83. **Which type of protein shields a newly forming protein from cytoplasmic influences while it is folding into its functional form?**

A. enzymes
B. **chaperonins**
C. receptor proteins
D. fibrous proteins
E. antibodies

84. **Carbohydrates are used in our bodies mainly for .**

A. **energy storage and release**
B. membrane construction
C. structural molecules, such as hair and fingernails
D. building genetic material
E. lipid storage

85. **On the basis of the principle of complementary base pairing, you would expect the percentage of to be equal to the percentage of**

A. **adenine ... thymine**
B. thymine ... guanine
C. adenine ... cytosine
D. adenine ... guanine
E. thymine ... cytosine

86. Misfolding associated with an accumulation of misfolded polypeptides?

A. Alzheimer's only
B. Parkinson's only
C. diabetes mellitus only
D. Alzheimer's and Parkinson's only
E. Alzheimer's, Parkinson's, and diabetes mellitus

87. Changing a single amino acid in a protein consisting of 325 amino acids would

A. alter the primary structure of the protein, but not its tertiary structure or function.
B. cause the tertiary structure of the protein to unfold.
C. always alter the biological activity or function of the protein.
D. always alter the primary structure of the protein and disrupt its biological activity.
E. always alter the primary structure of the protein, sometimes alter the tertiary structure of the protein, and affect its biological activity.

88. In a normal cellular protein, where would you expect to find a hydrophobic amino acid like valine?

A. in the interior of the folded protein, away from water
B. on the exterior surface of the protein, interacting with water
C. in the transmembrane portion interacting with lipid fatty acid chains
D. in the interior of the folded protein, away from water, or in a transmembrane portion interacting with lipid fatty acid chains
E. anywhere in the protein, with equal probability

89. What is the term used for a protein molecule that assists in the proper folding of other proteins?

A. tertiary protein
B. chaperonin
C. enzyme protein
D. renaturing protein
E. denaturing protein

90. DNAase is an enzyme that catalyzes the hydrolysis of the covalent bonds that join nucleotides together. What would first happen to DNA molecules treated with DNAase?

A. The two strands of the double helix would separate.
B. The phosphodiester bonds between deoxyribose sugars would be broken.
C. The purines would be separated from the deoxyribose sugars.
D. The pyrimidines would be separated from the deoxyribose sugars.
E. All bases would be separated from the deoxyribose sugars.

91. Which of the following statements about the 5' end of a polynucleotide strand of DNA is correct?

A. The 5' end has a hydroxyl group attached to the number 5 carbon of ribose.
B. The 5' end has a phosphate group attached to the number 5 carbon of ribose.
C. The 5' end has phosphate attached to the number 5 carbon of the nitrogenous base.
D. The 5' end has a carboxyl group attached to the number 5 carbon of ribose.
E. The 5' end is the fifth position on one of the nitrogenous bases.

92. One of the primary functions of RNA molecules is to

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

93. If 14C-labeled uridine triphosphate is added to the growth medium of cells, what macromolecules will be labeled?

A. phospholipids
B. DNA
C. RNA
D. both DNA and RNA
E. proteins

94. Which of the following descriptions best fits the class of molecules known as nucleotides?

A. a nitrogenous base and a phosphate group
B. a nitrogenous base and a pentose sugar
C. a nitrogenous base, a phosphate group, and a pentose sugar
D. a phosphate group and an adenine or uracil
E. a pentose sugar and a purine or pyrimidine

95. Which of the following are nitrogenous bases of the pyrimidine type?

A. guanine and adenine
B. cytosine and uracil
C. thymine and guanine
D. ribose and deoxyribose
E. adenine and thymine

96. Which of the following are nitrogenous bases of the purine type?

A. cytosine and guanine
B. guanine and adenine
C. adenine and thymine
D. thymine and uracil
E. uracil and cytosine

97. If a DNA sample were composed of 10% thymine, what would be the percentage of guanine?

A. 10
B. 20
C. 40
D. 80
E. impossible to tell from the information given

98. A double-stranded DNA molecule contains a total of 120 purines and 120 pyrimidines. This DNA molecule could be composed of

A. 120 adenine and 120 uracil molecules.
B. 120 thymine and 120 adenine molecules.
C. 120 cytosine and 120 thymine molecules.
D. 120 adenine and 120 cytosine molecules.
E. 120 guanine and 120 thymine molecules.

99. The difference between the sugar in DNA and the sugar in RNA is that the sugar in DNA

A. is a six-carbon sugar and the sugar in RNA is a five-carbon sugar.
B. can form a double-stranded molecule.
C. is an aldehyde sugar and the sugar in RNA is a keto sugar.
D. is in the α configuration and the sugar in RNA is in the β configuration.
E. contains one less oxygen atom.

100. Which of the following statements best summarizes the differences between DNA and RNA?

A. DNA encodes hereditary information, whereas RNA does not.
B. The bases in DNA form base-paired duplexes, whereas the bases in RNA do not.
C. DNA nucleotides contain a different sugar than RNA nucleotides.
D. DNA contains the base uracil, whereas RNA contains the base thymine.

101. If one strand of a DNA molecule has the sequence of bases 5'ATTGCA3', the other complementary strand would have the sequence

A. 5'TAACGT3'.
B. 5'TGCAAT3'.
C. 5'UAACGU3'.
D. 3'UAACGU5'.
E. 5'UGCAAU3'.

102. What is the structural feature that allows DNA to replicate?

A. sugar-phosphate backbone
B. complementary pairing of the nitrogenous bases
C. disulfide bonding (bridging) of the two helixes
D. twisting of the molecule to form an α helix
E. three-component structure of the nucleotides

103. Which of the following is an example of hydrolysis?

A. the reaction of two monosaccharides, forming a disaccharide with the release of water
B. the synthesis of two amino acids, forming a peptide with the release of water
C. the reaction of a fat, forming glycerol and fatty acids with the release of water
D. the reaction of a fat, forming glycerol and fatty acids with the consumption of water
E. the synthesis of a nucleotide from a phosphate, a pentose sugar, and a nitrogenous base with the production of a molecule of water

104. Which of the following is not a monomer/polymer pairing?

A. monosaccharide/polysaccharide
B. amino acid/protein
C. triglyceride/phospholipid bilayer
D. deoxyribonucleotide/DNA
E. ribonucleotide/RNA

Art Questions

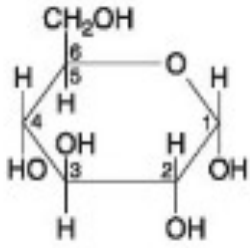


Figure 5.1

105. If two molecules of the general type shown in Figure 5.1 were linked together, carbon-1 of one molecule to carbon-4 of the other, the single molecule that would result would be

A. maltose.
B. fructose.
C. glucose.
D. galactose.
E. sucrose.

106. Which of the following descriptors is true of the molecule shown in Figure 5.1?

A. hexose
B. fructose
C. glucose
D. hexose and fructose only
E. hexose and glucose only

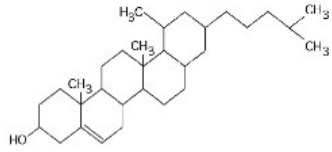


Figure 5.2

107. What is the structure shown in Figure 5.2?

A. pentose molecule
B. fatty acid molecule
C. steroid molecule
D. oligosaccharide molecule
E. phospholipid molecule

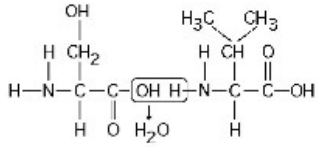
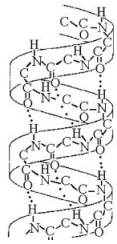


Figure 5.3

108. Which of the following statements is/are true regarding the chemical reaction illustrated in Figure 5.3?

A. It is a hydrolysis reaction.
B. It results in a peptide bond.
C. It joins two fatty acids together.
D. It is a hydrolysis reaction and it results in a peptide bond.
E. It is a hydrolysis reaction, it results in a peptide bond, and it joins two fatty acids together.

Figure 5.4



109. The structure depicted in Figure 5.4 shows the

A. 1-4 linkage of the α glucose monomers of starch.
B. 1-4 linkage of the β glucose monomers of cellulose.
C. double-helical structure of a DNA molecule.
D. α helix secondary structure of a polypeptide.
E. β pleated sheet secondary structure of a polypeptide.

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

A. glycogen, starch, and amylopectin
B. glycogen and cellulose
C. cellulose and chitin
D. starch and chitin
E. starch, amylopectin, and cellulose

111. Enzymes that break down DNA catalyze the hydrolysis of the covalent bonds that join nucleotides together. What would happen to DNA molecules treated with these enzymes?

A. The two strands of the double helix would separate.
B. The phosphodiester linkages of the polynucleotide backbone would be broken.
C. The purines would be separated from the deoxyribose sugars.
D. The pyrimidines would be separated from the deoxyribose sugars.
E. All bases would be separated from the deoxyribose sugars.

CHAPTER 7

Cell Structure and Function

1. When biologists wish to study the internal ultrastructure of cells, they can achieve the finest resolution by using

A. a phase-contrast light microscope.
B. a scanning electron microscope.
C. **a transmission electronic microscope**.
D. a confocal fluorescence microscope.
E. a super-resolution fluorescence microscope.

2. The advantage of light microscopy over electron microscopy is that

A. light microscopy provides for higher magnification than electron microscopy.
B. light microscopy provides for higher resolving power than electron microscopy.
C. **light microscopy allows one to view dynamic processes in living cells**.
D. light microscopy provides higher contrast than electron microscopy.
E. specimen preparation for light microcopy does not produce artifacts.

3. A primary objective of cell fractionation is to

A. view the structure of cell membranes.
B. sort cells based on their size and weight.
C. determine the size of various organelles.
D. separate the major organelles so that their particular functions can be determined.
E. separate lipid-soluble from water-soluble molecules.

4. In the fractionation of homogenized cells using centrifugation, the primary factor that determines whether a specific cellular component ends up in the supernatant or the pellet is

A. the relative solubility of the component.
B. the size and weight of the component.
C. the percentage of carbohydrates in the component.
D. the presence or absence of nucleic acids in the component.
E. the presence or absence of lipids in the component.

5. Which of the following correctly lists the order in which cellular components will be found in the pellet when homogenized cells are treated with increasingly rapid spins in a centrifuge?

A. ribosomes, nucleus, mitochondria
B. chloroplasts, ribosomes, vacuoles
C. nucleus, ribosomes, chloroplasts
D. vacuoles, ribosomes, nucleus
E. nucleus, mitochondria, ribosomes

6. What is the reason that a modern electron microscope (TEM) can resolve biological images to the subnanometer level, as opposed to tens of nanometers achievable for the best super-resolution light microscope?

A. The focal length of the electron microscope is significantly longer.
B. Contrast is enhanced by staining with atoms of heavy metal.
C. **Electron beams have much shorter wavelengths than visible light**.
D. The electron microscope has a much greater ratio of image size to real size.
E. The electron microscope cannot image whole cells at one time.

7. Green fluorescent protein (GFP) can be used to fluorescently label a specific protein in cells by genetically engineering cells to synthesize the target protein fused to GFP. What is the advantage of using GFP fusions to visualize specific proteins, instead of staining cells with fluorescently labeled probes that bind to the target protein?

A. GFP fusions enable one to track changes in the location of the protein in living cells; staining usually requires preserved cells.
B. GFP fusions enable higher resolution than staining with fluorescent probes.
C. GFP permits the position of the protein in the cell more precisely than fluorescent probes.
D. GFP permits visualization of protein-protein interactions; fluorescent probes do not.
E. GFP fusions are not subject to artifacts; fluorescent probes may introduce background artifacts.

8. All of the following are part of a prokaryotic cell except

A. DNA.
B. a cell wall.
C. a plasma membrane.
D. ribosomes.
E. an endoplasmic reticulum.

9. Prokaryotes are classified as belonging to two different domains. What are the domains?

A. Bacteria and Eukarya
B. Bacteria and Archaea
C. Archaea and Protista
D. Bacteria and Protista
E. Bacteria and Fungi

10. The volume enclosed by the plasma membrane of plant cells is often much larger than the corresponding volume in animal cells. The most reasonable explanation for this observation is that

A. plant cells are capable of having a much higher surface-to-volume ratio than animal cells.
B. plant cells have a much more highly convoluted (folded) plasma membrane than animal cells.
C. plant cells contain a large vacuole that reduces the volume of the cytoplasm.
D. animal cells are more spherical, whereas plant cells are elongated.
E. plant cells can have lower surface-to-volume ratios than animal cells because plant cells synthesize their own nutrients.

11. A mycoplasma is an organism with a diameter between 0.1 and 1.0 μm. What does the organism's size tell you about how it might be classified?

A. It must be a single-celled protist.
B. It must be a single-celled fungus.
C. It could be almost any typical bacterium.
D. It could be a typical virus.
E. It could be a very small bacterium.

12. If radioactive deoxythymidine triphosphate (dTTP) is added to a culture of rapidly growing bacterial cells, where in the cell would you expect to find the greatest concentration of radioactivity?

A. nucleus
B. cytoplasm
C. endoplasmic reticulum
D. nucleoid
E. ribosomes

13. Which organelle or structure is absent in plant cells?

A. mitochondria
B. Golgi vesicles
C. microtubules
D. centrosomes
E. peroxisomes

14. The nuclear lamina is an array of filaments on the inner side of the nuclear membrane. If a method were found that could cause the lamina to fall into disarray, what would you expect to be the most likely consequence?

A. the loss of all nuclear function
B. the inability of the nucleus to divide during cell division
C. a change in the shape of the nucleus
D. failure of chromosomes to carry genetic information
E. inability of the nucleus to keep out destructive chemicals

15. A cell with a predominance of free ribosomes is most likely

A. producing primarily proteins for secretion.
B. producing primarily cytoplasmic proteins.
C. constructing an extensive cell wall or extracellular matrix.
D. digesting large food particles.
E. enlarging its vacuole.

16. Which type of organelle or structure is primarily involved in the synthesis of oils, phospholipids, and steroids?

A. ribosome
B. lysosome
C. smooth endoplasmic reticulum
D. mitochondrion
E. contractile vacuole

17. Which structure is the site of the synthesis of proteins that may be exported from the cell?

A. rough ER
B. lysosomes
C. plasmodesmata
D. Golgi vesicles
E. free cytoplasmic ribosomes

18. The Golgi apparatus has a polarity or sidedness to its structure and function. Which of the following statements correctly describes this polarity?

A. Transport vesicles fuse with one side of the Golgi and leave from the opposite side.
B. Proteins in the membrane of the Golgi may be sorted and modified as they move from one side of the Golgi to the other.
C. Lipids in the membrane of the Golgi may be sorted and modified as they move from one side of the Golgi to the other.
D. Soluble proteins in the cisternae (interior) of the Golgi may be sorted and modified as they move from one side of the Golgi to the other.
E. All of the above correctly describe polar characteristics of the Golgi function.

19. Tay-Sachs disease is a human genetic abnormality that results in cells accumulating and becoming clogged with very large and complex lipids. Which cellular organelle must be involved in this condition?

A. the endoplasmic reticulum
B. the Golgi apparatus
C. the lysosome
D. mitochondria
E. membrane-bound ribosomes

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

A. rough ER
B. smooth ER
C. Golgi apparatus
D. nuclear envelope
E. transport vesicles

21. Which of the following produces and modifies polysaccharides that will be secreted?

A. lysosome
B. vacuole
C. mitochondrion
D. Golgi apparatus
E. peroxisome

22. Which organelle often takes up much of the volume of a plant cell?

A. lysosome
B. vacuole
C. mitochondrion
D. Golgi apparatus
E. peroxisome

23. Thylakoids, DNA, and ribosomes are all components found in

A. vacuoles.
B. chloroplasts.
C. mitochondria.
D. lysosomes.
E. nuclei.

24. Which type of organelle is found in plant cells but not in animal cells?

A. ribosomes
B. mitochondria
C. nuclei
D. plastids
E. none of these

25. Why isn't the mitochondrion classified as part of the endomembrane system?

A. It is a static structure.
B. Its structure is not derived from the ER or Golgi.
C. It has too many vesicles.
D. It is not involved in protein synthesis.
E. It is not attached to the outer nuclear envelope.

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

A. combine the hydrogen with water molecules to generate hydrogen peroxide.
B. use the hydrogen to break down hydrogen peroxide.
C. transfer the hydrogen to the mitochondria.
D. transfer the hydrogen to oxygen molecules to generate hydrogen peroxide.

27. How does the cell multiply its peroxisomes?

A. They bud off from the Golgi.
B. They are brought into the cell from the environment.
C. They are built de novo from cytosol materials.
D. They split in two after they become sufficiently large.
E. The cell synthesizes hydrogen peroxide and encloses it in a membrane.

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

A. sites of energy production in cellular respiration
B. membrane proteins
C. ribosomes
D. cytoskeletal structures
E. cellulose fibers in the cell wall

29. The chemical reactions involved in respiration are virtually identical between prokaryotic and eukaryotic cells. In eukaryotic cells, ATP is synthesized primarily on the inner membrane of the mitochondria. In light of the endosymbiont theory for the evolutionary origin of mitochondria, where is most ATP synthesis likely to occur in prokaryotic cells?

A. in the cytoplasm
B. on the inner mitochondrial membrane
C. on the endoplasmic reticulum
D. on the plasma membrane
E. on the inner nuclear envelope

30. Recent evidence shows that signals from the extracellular matrix (ECM) can regulate the expression of genes in the cell nucleus. A likely mechanism is that

A. **mechanical signals of the ECM can alter the cytoskeleton, which can alter intracellular signaling**.
B. intracellular signals might cause changes in the fibronectin binding to the cell surface.
C. orientation of microtubules to the ECM can change gene activity.
D. integrins that receive signals from the ECM migrate to the nucleus.
E. proteoglycans in the ECM undergo endocytosis and produce intracellular signaling molecules.

31. When a potassium ion (K+) moves from the soil into the vacuole of a cell on the surface of a root, it must pass through several cellular structures. Which of the following correctly describes the order in which these structures will be encountered by the ion?

A. plasma membrane → primary cell wall → cytoplasm → vacuole
B. secondary cell wall → plasma membrane → primary cell wall → cytoplasm → vacuole
C. primary cell wall → plasma membrane → cytoplasm → vacuole
D. primary cell wall → plasma membrane → lysosome → cytoplasm → vacuole
E. primary cell wall → plasma membrane → cytoplasm → secondary cell wall → vacuole

32. The extracellular matrix is thought to participate in the regulation of animal cell behavior by communicating information from the outside to the inside of the cell via which of the following?

A. gap junctions
B. the nucleus
C. DNA and RNA
D. integrins
E. plasmodesmata

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

A. plasmodesmata.
B. intermediate filaments.
C. tight junctions.
D. desmosomes.
E. **gap junctions**.

34. What types of proteins are not synthesized in the rough ER?

A. endoplasmic reticulum proteins
B. extracellular matrix proteins
C. secreted proteins
D. mitochondrial proteins
E. plasma membrane proteins

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

A. The ad agency is misrepresenting the ability of the toy microscope to magnify.
B. The toy microscope does not have the same fine control for focus of the specimen.
C. The toy microscope magnifies a good deal, but has low resolution and therefore poor quality images.
D. The college microscope produces greater contrast in the specimens.
E. The toy microscope usually uses a different wavelength of light source.

36. A biologist ground up some plant leaf cells and then centrifuged the mixture to fractionate the organelles. Organelles in one of the heavier fractions could produce ATP in the light, whereas organelles in the lighter fraction could produce ATP in the dark. The heavier and lighter fractions are most likely to contain, respectively,

A. mitochondria and chloroplasts.
B. chloroplasts and peroxisomes.
C. peroxisomes and chloroplasts.
D. chloroplasts and mitochondria.
E. mitochondria and peroxisomes.

37. Which structure is not part of the endomembrane system?

A. nuclear envelope
B. chloroplast
C. Golgi apparatus
D. plasma membrane
E. ER

38. Which structure is common to plant and animal cells?

A. chloroplast
B. wall made of cellulose
C. central vacuole
D. mitochondrion
E. centriole

39. Which of the following is present in a prokaryotic cell?

A. mitochondrion
B. ribosome
C. nuclear envelope
D. chloroplast
E. ER

40. Which structure-function pair is mismatched?

A. nucleolus; production of ribosomal subunits
B. lysosome; intracellular digestion
C. ribosome; protein synthesis
D. Golgi; protein trafficking
E. microtubule; muscle contraction

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

A. mitochondria.
B. ribosomes.
C. peroxisomes.
D. lysosomes.
E. endoplasmic reticulum.

42. What is the most likely pathway taken by a newly synthesized protein that will be secreted by a cell?

A. ER → Golgi → nucleus
B. Golgi →ER →lysosome
C. nucleus →ER →Golgi
D. ER →Golgi →vesicles that fuse with plasma membrane
E. ER →lysosomes →vesicles that fuse with plasma membrane

43. Which cell would be best for studying lysosomes?

A. muscle cell
B. nerve cell
C. phagocytic white blood cell
D. leaf cell of a plant
E. bacterial cell

44. Your intestine is lined with individual cells. No fluids leak between these cells from the gut into your body. Why?

A. The intestinal cells are bound together by plasmodesmata.
B. The intestinal cells are bound together by tight junctions
C. The intestinal cells are bound together by gap junctions.
D. The intestinal cells are fused together into one giant cell
E. The intestinal cells are bound together by the extracellular matrix

45. Consider a protein that is made in the rough endoplasmic reticulum. You observe that when the synthesis of the protein is completed, the protein is located in the ER membrane. Where else in the cell might this protein be found?

A. in the cytoplasm functioning as an enzyme in carbohydrate synthesis
B. embedded in the plasma membrane functioning in the transport of molecules into the cell
C. in the internal space of the Golgi apparatus, being modified before the protein is excreted
D. in the aqueous interior of a lysosome functioning as a digestive enzyme
E. in a mitochondrion functioning in ATP synthesis

46. A protein that ultimately functions in the plasma membrane of a cell is most likely to have been synthesized .

A. on free cytoplasmic ribosomes
B. in the rough endoplasmic reticulum
C. in the smooth endoplasmic reticulum
D. in the ribosomes of the mitochondria
E. in the plasma membrane

47. Chloroplasts and mitochondria are thought to be of prokaryotic origin. One piece of evidence that supports this hypothesis is that these organelles contain prokaryotic-like ribosomes. These ribosomes are probably most similar to ribosomes found

A. free in the cytoplasm of eukaryotes
B. in bacterial cells
C. The first three answers are correct.
D. on the rough ER
E. The first two answers are correct.

48. What is the functional connection between the nucleolus, nuclear pores, and the nuclear membrane?

A. The nucleolus contains messenger RNA (mRNA), which crosses the nuclear envelope through the nuclear pores.
B. Subunits of ribosomes are assembled in the nucleolus and pass through the nuclear membrane via the nuclear pores.
C. None of the listed responses is Correct.
D. Endoplasmic reticulum membrane is produced in the nucleolus and leaves the nucleus through the nuclear pores.
E. The nuclear pores are connections between the nuclear membrane and the endoplasmic reticulum that permit ribosomes to assemble on the Surface of the ER.

49. Which of the following is a possible reason for grouping the peroxisomes with chloroplasts and mitochondria?

A. They are all involved in ATP synthesis.
B. They are all part of the plastid family of organelles.
C. None of these organelles are part of the endomembrane system.
D. They all contain DNA and make some of their own proteins,
E. They all contain two or more membranes.

50. A researcher wants to film the movement of chromosomes during cell division Which type of microscope should she choose and why is it the best choice?

A. transmission electron microscope, because of its high resolving power
B. scanning electron microscope, because of its ability to visualize the surface of subcellular objects
C. light microscope, because the specimen is alive
D. light microscope, because of its high resolving power
E. transmission electron microscope, because of its high magnifying power

51. Which of the following is false?

A. Mitochondria contain ribosomes in the intermembrane space.
B. The mitochondria possess their own DNA.
C. The folds of the inner mitochondrial membrane are called cristae.
D. Mitochondria have more than one membrane.
E. Mitochondria are involved in energy metabolism.

52. Which type of cell is most likely to have the most mitochondria?

A. **muscle cells in the legs of a marathon runner**
B. bacterial cells that are growing on Sugars
C. inactive yeast cells that are stored for future use
D. photosynthetic cells in the leaves of a tree
E. nondividing cells in the skin on your finger

53. Which structure-function pair is mismatched?

A. microtubule, muscle contraction
B. nucleolus, production of ribosomal subunits
C. ribosome, protein synthesis
D. Golgi, protein trafficking
E. lysosome, Intracellular digestion

54. Which of the following features do prokaryotes and eukaryotes have in common?

A. ribosomes, nucleus, plasma membrane
B. mitochondria, ribosomes, cytoplasm
C. nucleus, plasma membrane, ribosomes
D. ribosomes, plasma membrane, cytoplasm
E. mitochondria, cytoplasm, plasma membrane

55. Which of the following organelles might be found inside other organelles?

A. the nucleolus
B. mitochondria
C. No organelles are found inside of other organelles.
D. transport vesicles
E. ribosomes

56. Which of the following organelles is unlikely to show enhanced abundance in pancreatic cells that secrete large amounts of digestive enzymes?

A. Golgi apparatus
B. transport vesicles
C. All of the listed responses will increase in pancreatic cells secreting digestive enzymes
D. rough endoplasmic reticulum
E. free cytoplasmic ribosomes

57. Which of the following structures is found in animal cells but NOT plant cells?

A. mitochondria
B. rough endoplasmic reticulum
C. Golgi apparatus
D. centrioles
E. plasma membrane

58. Which statement about the cytoskeleton is true?

A. Microfilaments are more permanent structures in cells compared to intermediate filaments and microtubules.
B. Components of the cytoskeleton often mediate the movement of organelles within the cytoplasm,
C. Plant cells lack a cytoskeleton because they have a rigid cell wall.
D. Microtubules are chains of proteins that resist stretching.
E. Intermediate filaments are hollow tubes of protein that provide structural support

59. You would expect a cell with an extensive Golgi apparatus to .

A. store large quantities of ions
B. absorb nutrients in the GI tract
C. move rapidly
D. make a lot of ATP
E. secrete a lot of protein

60. Which of the following sequences represents the order in which a protein made in the rough endoplasmic reticulum might move through the endomembrane system?

A. nuclear envelope#&8594;lysosome
B. plasma membranešić8594 nuclear envelope
C. Golgi apparatus#&8594;mitochondria
D. lysosome#&8594;plasma membrane
E. Golgi apparatus#&8594;lysosome

61. The observation that chloroplasts and mitochondria each contain their own DNA and synthesize some of the proteins that function in these organelles suggests that chloroplasts and mitochondria

A. are produced by the nucleus of the cell
B. contain two or more membranes
C. are part of the endomembrane system
D. must divide each time the cell containing them divides
E. are involved in energy metabolism of the cell

62. Which of the following is are possible site(s) of protein synthesis in a typical eukaryotic cell?

A. the cytoplasm
B. in mitochondria
C. the rough endoplasmic reticulum
D. The first three answers are correct
E. The first two answers are correct

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

A. endoplasmic reticulum.
B. mitochondria.
C. lysosomes.
D. ribosomes
E. peroxisomes.

64. Which structure is not part of the endomembrane system?

A. chloroplast
B. Golgi apparatus
C. ER
D. nuclear envelope
E. plasma membrane

65. Which structure is common to plant and animal cells?

A. mitochondrion
B. Centriole
C. wall made of cellulose
D. central vacuole
E. chloroplast

66. Which of the following is are most likely to be involved in the process of producing proteins for a chloroplast or mitochondrion?

A. free cytoplasmic ribosomes
B. transport vesicles
C. rough endoplasmic reticulum
D. the Golgi apparatus
E. smooth endoplasmic reticulum

67. Which of the following structures is found in eukaryotic but not prokaryotic cells?

A. mitochondria
B. cytosol
C. DNA
D. ribosomes
E. plasma membrane

68. Dye injected into a plant cell might be able to enter an adjacent cell through

A. a gap junction
B. a tight junction
C. a cell wall
D. a microtubule
E. plasmodesmata

69. Cilia and flagella move due to the interaction of the cytoskeleton with which of the following?

A. pseudopodia
B. motor proteins
C. mitochondria
D. tubulin
E. actin

70. Consider two cells with the same volume but with very different surface areas due to differences in their shapes. The cell with the larger surface area is likely to

A. have a very high metabolic rate
B. be nearly spherical in shape
C. be buried deep in the interior of an organism
D. be a prokaryotic cell
E. be involved in the rapid uptake of compounds from the cell's environment

71. Which of the following is the simplest collection of matter that can live?

A. organ
B. cell
C. None of the listed responses is Correct.
D. molecules
E. tissue

72. Bacterial cells are prokaryotic. Unlike a typical eukaryotic cell they

A. have no ribosomes
B. lack a plasma membrane
C. have no membrane-bounded organelles in their cytoplasm
D. have a smaller nucleus
E. lack chromosomes

73. Which cell would be best for studying lysosomes?

A. muscle cell
B. leaf cell of a plant
C. nerve cell
D. phagocytic white blood cell
E. bacterial cell

74. Which of the following statements correctly describes a common characteristic of a plant cell wall and an animal cell extracellular matrix?

A. Both are permeable to water and Small solutes.
B. Both Are synthesized in the ER and Golgi apparatus.
C. Both are composed primarily of carbohydrates.
D. The first three answers are correct.
E. The first two answers are correct

75. In addition to the fundamental structures required to be defined as a cell, a particular cell also has a nucleus and chloroplasts. Based on this information, this cell could be

A. a cell from a pine tree
B. a yeast (fungus) cell
C. a bacterium
D. a cell from the intestinal lining of a cow
E. a protistal cell and a plant cell

76. Where would you expect to find proteins involved with movement of structures within a cell?

A. cytoskeleton
B. transport vesicles moving from the ER to the Golgi
C. muscles
D. plasma membrane
E. ribosomes

77. A dish of animal cells was grown in the presence of radioactive phosphorous. | The phosphorous largely ended up in nucleotides inside the actively growing animal cells. In which cellular structure(s) would you predict the majority of the radioactive phosphorous to accumulate?

A. the Golgi apparatus
B. rough endoplasmic reticulum and Golgi apparatus
C. **the nucleus**
D. rough endoplasmic reticulum
E. the Golgi apparatus and the nucleus

78. Which of the following is are likely to limit the maximum size of a cell?

A. the shape of the cell
B. the time it takes a molecule to diffuse across a cell
C. None of the choices is correct
D. the cell's surface-to-volume ratio
E. All of the choices are correct.

79. Which of the following lack membranes as part of their structure?

A. peroxisomes
B. mitochondria
C. mitochondria and peroxisomes
D. ribosomes
E. ribosomes and mitochondria

80. What is the most likely pathway taken by a newly synthesized protein that will be secreted by a cell?

A. Golgi → ER → lysosome
B. ER → Golgi → nucleus
C. ER → Golgi → vesicles that fuse with plasma membrane
D. nucleus → ER → Golgi
E. ER → lysosomes → vesicles that fuse with plasma membrane

81. Which of the following categories best describes the function of the rough endoplasmic reticulum?

A. information storage
B. structural support of cells
C. energy processing
D. manufacturing
E. breakdown of complex foods

82. Which of the following groups is primarily involved in synthesizing molecules needed by the cell?

A. smooth endoplasmic reticulum, ribosome, vacuole
B. ribosome, rough endoplasmic reticulum, smooth endoplasmic reticulum
C. lysosome, vacuole, ribosome
D. vacuole, rough endoplasmic reticulum, smooth endoplasmic reticulum
E. rough endoplasmic reticulum, lysosome, vacuole

83. Basal bodies are most closely associated with which of the following cell components?

A. cilia
B. mitochondria
C. Golgi apparatus
D. nucleus
E. the central vacuole

84. Which of the following statements about chloroplasts and mitochondria is true?

A. Chloroplasts and mitochondria have three sets of membranes
B. Mitochondria but not chloroplasts contain a small amount of DNA.
C. Chloroplasts but not mitochondria are completely independent of the cell of which they are a part
D. Chloroplasts and mitochondria are components of the endomembrane system.
E. Chloroplasts and mitochondria synthesize some of their own proteins

85. Which of the following correctly compares the extracellular matrix (ECM) of animal cells to cell walls of plant cells?

A. Cell walls and ECMs provide for tight contact between adjacent cells,
B. The structures that are external to the plasma membrane are essentially independent of the plasma membrane in both groups.
C. Both the ECM and plant cell walls provide rigid structures that determine the shape of their respective cells.
D. Both the ECM and the plant cell wall are composed of varying mixtures of proteins and carbohydrates.
E. The ECM and plant cell walls completely cover the plasma membrane of their respective cells,

86. Which of the following five membranes is most likely to have a lipid composition that is distinct from the other four?

A. endoplasmic reticulum
B. mitochondrial outer membrane
C. Golgi apparatus
D. plasma membrane
E. lysosome membrane

CHAPTER 8
Cell Membranes

1. **What kinds of molecules pass through a cell membrane most easily?**

   A. large and hydrophobic
   B. small and hydrophobic
   C. large polar
   D. ionic
   E. monosaccharides such as glucose

2. **Which of the following is a characteristic feature of a carrier protein in a plasma membrane?**

   A. It is a peripheral membrane protein.
   B. It exhibits a specificity for a particular type of molecule.
   C. It requires the expenditure of cellular energy to function.
   D. It works against diffusion.
   E. It has few, if any, hydrophobic amino acids.

3. **Nitrous oxide gas molecules diffusing across a cell's plasma membrane is an example of**

   A. diffusion across the lipid bilayer.
   B. facilitated diffusion.
   C. active transport.
   D. osmosis.
   E. cotransport.

4. **Which of the following would likely move through the lipid bilayer of a plasma membrane most rapidly?**

   A. CO_2
   B. an amino acid
   C. glucose
   D. K^+
   E. Starch

5. Which of the following statements is correct about diffusion?

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

6. Water passes quickly through cell membranes because

A. the bilayer is hydrophilic.
B. it moves through hydrophobic channels.
C. water movement is tied to ATP hydrolysis.
D. it is a small, polar, charged molecule.
E. it moves through aquaporins in the membrane.

7. Celery stalks that are immersed in fresh water for several hours become stiff and hard. Similar stalks left in a 0.15 M salt solution become limp and soft. From this we can deduce that the cells of the celery stalks are

A. hypotonic to both fresh water and the salt solution.
B. hypertonic to both fresh water and the salt solution.
C. hypertonic to fresh water but hypotonic to the salt solution.
D. hypotonic to fresh water but hypertonic to the salt solution.
E. isotonic with fresh water but hypotonic to the salt solution.

8. Mammalian blood contains the equivalent of 0.15 M NaCl. Seawater contains the equivalent of 0.45 M NaCl. What will happen if red blood cells are transferred to seawater?

A. Water will leave the cells, causing them to shrivel and collapse.
B. NaCl will be exported from the red blood cells by facilitated diffusion.
C. The blood cells will take up water, swell, and eventually burst.
D. NaCl will passively diffuse into the red blood cells.
E. The blood cells will expend ATP for active transport of NaCl into the cytoplasm.

9. Which of the following statements correctly describes the normal tonicity conditions for typical plant and animal cells?

A. The animal cell is in a hypotonic solution, and the plant cell is in an isotonic solution.
B. The animal cell is in an isotonic solution, and the plant cell is in a hypertonic solution.
C. The animal cell is in a hypertonic solution, and the plant cell is in an isotonic solution.
D. The animal cell is in an isotonic solution, and the plant cell is in a hypotonic solution.
E. The animal cell is in a hypertonic solution, and the plant cell is in a hypotonic solution.

10. In which of the following would there be the greatest need for osmoregulation?

A. an animal connective tissue cell bathed in isotonic body fluid
B. cells of a tidepool animal such as an anemone
C. a red blood cell surrounded by plasma
D. a lymphocyte before it has been taken back into lymph fluid
E. a plant being grown hydroponically (in a watery mixture of designated nutrients)

11. When a plant cell, such as one from a peony stem, is submerged in a very hypotonic solution, what is likely to occur?

A. The cell will burst.
B. The cell membrane will lyse.
C. Plasmolysis will shrink the interior.
D. The cell will become flaccid.
E. The cell will become turgid.

12. Which of the following membrane activities require energy from ATP hydrolysis?

A. facilitated diffusion of chloride ions across the membrane through a chloride channel
B. movement of water into a cell
C. Na+ ions moving out of a mammalian cell bathed in physiological saline
D. movement of glucose molecules into a bacterial cell from a medium containing a higher concentration of glucose than inside the cell
E. movement of carbon dioxide out of a paramecium

13. The phosphate transport system in bacteria imports phosphate into the cell even when the concentration of phosphate outside the cell is much lower than the cytoplasmic phosphate concentration. Phosphate import depends on a pH gradient across the membrane–more acidic outside the cell than inside the cell. Phosphate transport is an example of

A. passive diffusion.
B. facilitated diffusion.
C. active transport.
D. osmosis.
E. **cotransport**.

14. Glucose diffuses slowly through artificial phospholipid bilayers. The cells lining the small intestine, however, rapidly move large quantities of glucose from the glucose-rich food into their glucose-poor cytoplasm. Using this information, which transport mechanism is most probably functioning in the intestinal cells?

A. simple diffusion
B. phagocytosis
C. active transport pumps
D. exocytosis
E. facilitated diffusion

15. What is the voltage across a membrane called?

A. water potential
B. chemical gradient
C. membrane potential
D. osmotic potential
E. electrochemical gradient

16. In most cells, there are electrochemical gradients of many ions across the plasma membrane even though there are usually only one or two electrogenic pumps present in the membrane. The gradients of the other ions are most likely accounted for by

A. **cotransport proteins.**
B. ion channels.
C. carrier proteins.
D. passive diffusion across the plasma membrane.
E. cellular metabolic reactions that create or destroy ions.

17. The sodium-potassium pump is called an electrogenic pump because it

A. pumps equal quantities of Na+and K+ across the membrane.
B. pumps hydrogen ions out of the cell.
C. contributes to the membrane potential.
D. ionizes sodium and potassium atoms.
E. is used to drive the transport of other molecules against a concentration gradient.

18. Which of the following is most likely true of a protein that cotransports glucose and sodium ions into the intestinal cells of an animal?

A. The sodium ions are moving down their electrochemical gradient while glucose is moving up.
B. Glucose entering the cell along its concentration gradient provides energy for uptake of sodium ions against the electrochemical gradient.
C. Sodium ions can move down their electrochemical gradient through the cotransporter whether or not glucose is present outside the cell.
D. The cotransporter can also transport potassium ions.
E. A substance that blocks sodium ions from binding to the cotransport protein will also block the transport of glucose.

19. The movement of potassium into an animal cell requires

A. low cellular concentrations of sodium.
B. high cellular concentrations of potassium.
C. an energy source such as ATP.
D. a cotransport protein.
E. a potassium channel protein.

20. Ions diffuse across membranes through specific ion channels

A. down their chemical gradients.
B. down their concentration gradients.
C. down the electrical gradients.
D. **down their electrochemical gradients**.
E. down the osmotic potential gradients.

21. Which of the following would increase the electrochemical potential across a membrane?

A. a chloride channel
B. a sucrose-proton cotransporter
C. a proton pump
D. a potassium channel
E. both a proton pump and a potassium channel

22. The sodium-potassium pump in animal cells requires cytoplasmic ATP to pump ions across the plasma membrane. When the proteins of the pump are first synthesized in the rough ER, what side of theER membrane will the ATP binding site be on?

A. It will be on the cytoplasmic side of the ER.
B. It will be on the side facing the interior of the ER.
C. It could be facing in either direction because proteins are properly reoriented in the Golgi apparatus.
D. It doesn't matter, because the pump is not active in the ER.

23. Proton pumps are used in various ways by members of every domain of organisms: Bacteria, Archaea, and Eukarya. What does this most probably mean?

A. Proton pumps must have evolved before any living organisms were present on Earth.
B. Proton gradients across a membrane were used by cells that were the common ancestor of all three domains of life.
C. The high concentration of protons in the ancient atmosphere must have necessitated a pump mechanism.
D. Cells of each domain evolved proton pumps independently when oceans became more acidic.
E. Proton pumps are necessary to all cell membranes.

24. Several epidemic microbial diseases of earlier centuries incurred high death rates because they resulted in severe dehydration due to vomiting and diarrhea. Today they are usually not fatal because we have developed which of the following?

A. antiviral medications that are efficient and work well with all viruses
B. antibiotics against the viruses in question
C. intravenous feeding techniques
D. medication to prevent blood loss
E. hydrating drinks that include high concentrations of salts and glucose

25. White blood cells engulf bacteria through what process?

A. exocytosis
B. phagocytosis
C. pinocytosis
D. osmosis
E. receptor-mediated exocytosis

26. Familial hypercholesterolemia is characterized by which of the following?

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

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

A. on the outside of vesicles
B. on the inside surface of the cell membrane
C. on the inside surface of the vesicle
D. on the outer surface of the nucleus
E. on the ER

28. Which of the following statements about the role of phospholipids in the structure and function of biological membranes is correct?

A. Phospholipids are completely insoluble in water.
B. **Phospholipids form a selectively permeable structure.**
C. Phospholipids form a single sheet in water.
D. Phospholipids form a structure in which the hydrophobic portion faces outward
E. They are triacylglycerols, which are commonly available in foods.

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

A. diffusion.
B. osmosis.
C. active transport.
D. phagocytosis.
E. facilitated diffusion.

30. Which of the following statements concerning carbohydrates associated with the plasma membrane is correct?

A. **Membrane carbohydrates function primarily in cell-cell recognition.**
B. Carbohydrates are only found associated with the membranes of prokaryotic cells.
C. Carbohydrates associated with the plasma membrane are located on both surfaces of the membrane
D. The carbohydrate composition of most eukaryotic plasma membranes is quite similar
E. Carbohydrates on the plasma membrane are typically short chains of between two and five monosaccharides.

31. The internal solute concentration of a plant cell is about 0.8 M. To demonstrate plasmolysis, it would be necessary to suspend the cell in what solution?

A. Distilled water
B. **1.0 M**
C. 150 mM.
D. 0.4 M
E. 0.8 M

32. A selectively permeable membrane separates two solutions. Water is able to pass through this membrane; however, sucrose (a disaccharide) and glucose (a monosaccharide) cannot pass. The membrane separates a 0.2-molar sucrose solution from a 0.2-molar glucose solution. With time, how will the solutions change?

A. **Nothing happens because the two solutions are isotonic to one another**
B. The sucrose solution is hypertonic and will gain water because the total mass of sucrose is greater than that of glucose.
C. Water leaves the sucrose solution because the sucrose molecule is a disaccharide and thus larger than the monosaccharide glucose.
D. Water enters the sucrose solution because the sucrose molecule is a disaccharide and thus larger than the monosaccharide glucose.
E. After the sucrose dissociates into two monosaccharides, water will move via osmosis to the side of the membrane that contains the dissociated sucrose.

33. Which of the following is false in regard to facilitated diffusion?

A. **Facilitated diffusion requires the hydrolysis of ATP.**
B. Facilitated diffusion can occur through protein channels.
C. Facilitated diffusion can move ions across membranes
D. Facilitated diffusion can occur using transport proteins.
E. Facilitated diffusion requires a concentration gradient.

34. Which of the following molecules is most likely to passively diffuse across the plasma membrane?

A. **carbon dioxide**
B. hemoglobin
C. glucose
D. sodium ion
E. DNA

35. Which of the following functional processes is not a consequence of the association of proteins with biological membranes?

A. enzymatic activity
B. cell-cell recognition
C. **energy, carbon, and nitrogen storage**
D. intercellular joining
E. cell-cell communication

36. Which of the following statements about diffusion is true?

A. It occurs when molecules move from a region of lower concentration to a region of higher concentration.
B. It is very rapid over long distances
C. It requires expenditure of energy by the cell.
D. **It is a passive process.**
E. It always requires integral proteins of the cell membrane.

37. Which of the following statements about diffusion is true?

A. It occurs when molecules move from a region of lower concentration to a region of higher concentration.
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C. It requires expenditure of energy by the cell.
D. **It is a passive process.**
E. It always requires integral proteins of the cell membrane.

38. Which of the following types of information is/are most likely to be derived from freeze-fracture of biological samples?

A. patterns of movement in living cells
B. **proteins embedded in membrane bilayers**
C. the structure of pili
D. number of ribosomes associated with the rough endoplasmic reticulum
E. the information coded for by DNA

39. Which of the following cell structures exhibits selective permeability between a cell and its external environment?

A. mitochondria
B. chloroplasts
C. lysosomes
D. **the plasma membrane**
E. endoplasmic reticulum

40. Which of the following pairs correctly matches a membrane transport process to its primary function?

A. osmosis... passive diffusion of water and small solutes across membrane
B. **pinocytosis... the uptake of water and small solutes into the cell by formation of vesicles at the plasma membrane**
C. None of the above is correct
D. exocytosis... the movement of water and solutes out of the cell by vesicle fusion with the plasma membrane
E. phagocytosis... secretion of large particles from the cell by fusion of vesicles with the plasma membrane

41. Which of the following statements about cotransport of solutes across a membrane is correct?

A. In cotransport, both solutes that art being transported are moving down their chemical gradients.
B. **Cotransport proteins allow a single ATP-powered pump to drive the active transport of many different solutes.**
C. The sodium-potassium pump is an example of a cotransport protein.
D. Cotransport involves the hydrolysis of ATP by the transporting protein.
E. A cotransport protein is most commonly an ion channel

42. Which of the following statements about the sodium-potassium pump is correct?

A. The sodium-potassium pump transports Na+ and K+ across the plasma membrane in the same direction at the expense of ATP hydrolysis
B. The sodium-potassium pump moves sodium out of the cell and co-transports protons into the cell, which is the source of energy for the movement of the potassium into the cell.
C. **The sodium-potassium pump is an antiporter that results in a net negative charge inside the cell.**
D. The sodium-potassium pump uses an existing proton gradient to drive the movement of sodium and potassium ions.
E. The sodium-potassium pump is a symporter that results in a net negative charge outside the cell

43. The plasma membrane is referred to as a "fluid mosaic" structure. Which of the following statements about that model is true?

A. The fluid aspect of the membrane describes its structure at normal temperatures, and the mosaic aspect describes the behavior of the membrane as the temperature is lowered.
B. The mosaic aspect of the membrane is due to the glycosylation of inner leaflet phospholipids.
C. The fluid aspect of the membrane is due to the behavior of phospholipids, and the mosaic aspect is due to the presence of carbohydrates.
D. **The fluid aspect of the membrane is due to the lateral and rotational movement of phospholipids, and embedded proteins account for the mosaic aspect**
E. Only phospholipids are capable of moving in the membrane.

44. A single plant cell is placed in an isotonic solution. Salt is then added to the solution. Which of the following would occur as a result of the salt addition?

A. Water would enter the cell by osmosis, and the cell would swell.
B. There would be no osmotic movement of water in response to the added salt.
C. The added salt would enter the cell. causing the cell to take up water and swell.
D. **Water would leave the cell by osmosis, causing the volume of the cytoplasm to decrease**
E. The added salt makes the solution hypotonic compared to the cell. Water will enter the cell by osmosis

45. Glucose can be moved into cells via two mechanisms. An active transport mechanism can be used when the concentration of glucose inside the cell is higher than the concentration of glucose outside of the cell. This active transport mechanism moves glucose and sodium into the cell at the same time. The glucose moves up its gradient and the sodium moves down its gradient. Which of the following statements about this mechanism is most true?

A. The protein that moves the sodium and glucose into the cell is an antiporter.
B. The sodium forms an electrochemical gradient in this mechanism
C. **The second and third responses are correct.**
D. To pump glucose up its concentration gradient, sodium is moving down its concentration gradient.
E. The first two responses are correct.

46. Which of the following statements about cotransport of solutes across a membrane is correct?

A. In cotransport, both solutes that art being transported are moving down their chemical gradients.
B. **Cotransport proteins allow a single ATP-powered pump to drive the active transport of many different solutes.**
C. The sodium-potassium pump is an example of a cotransport protein.
D. Cotransport involves the hydrolysis of ATP by the transporting protein.
E. A cotransport protein is most commonly an ion channel

47. Cells A and B are the same size, shape, and temperature, but cell A is metabolically less active than cell B; cell B is actively converting oxygen to water in cellular respiration. Oxygen will diffuse more rapidly into cell because

A. A... the diffusion gradient there is shallower
B. A... its membrane transport proteins will not be saturated
C. **B ... the diffusion gradient in cell B is steeper**
D. B... the oxygen molecules inside cell B have a higher kinetic energy
E. B... the gradient of oxygen is oriented in the opposite direction compared to cell A

48. Which of the following structural arrangements of the components in biological membranes is most consistent with membrane's property of selective permeability?

A. proteins sandwiched between two layers of phospholipid
B. a phospholipid bilayer with proteins scattered on the surfaces of the membranes
C. a layer of protein coating a layer of phospholipid
D. phospholipids sandwiched between two layers of protein
E. proteins embedded in two layers of phospholipid

49. Which of the following statements about passive transport is correct?

A. **Passive transport permits the solute to move in either direction, but the net movement of the population of solute occurs down the concentration gradient of the molecule**
B. Passive transport operates independently of the concentrations of the moving solute.
C. Passive transport operates independently of diffusion.
D. Passive transport does not occur in the human body.
E. In passive transport, solute movement stops when the solute concentration is the same on both sides of the membrane.

50. Which of these statements describes some aspect of facilitated diffusion?

A. Facilitated diffusion of solutes occurs through phospholipid pores in the membrane.
B. There is only one kind of protein pore for facilitated diffusion.
C. Facilitated diffusion is another name for osmosis.
D. Facilitated diffusion requires energy to drive a concentration gradient
E. Facilitated diffusion of solutes may occur through channel or transport proteins in the membrane

51. Which of the following correctly describes a general property of all electrogenic pumps?

A. **create a voltage difference across the membrane**
B. a cell with an interior that is positively charged relative to the outside of the cell
C. a cell with a high internal concentration of protons
D. can pump a large variety of solutes across a membrane against their concentration gradient
E. pump sodium out of the cell and potassium into the cell

52. Which of the following processes includes all others?

A. **passive transport**
B. diffusion of a solute across a membrane
C. facilitated diffusion
D. transport of an ion down its electrochemical gradient
E. osmosis

53. Which of the following processes and organelle(s) accounts for the replacement of lipids and proteins lost from the plasma membrane?

A. active transport and the rough endoplasmic reticulum
B. receptor-mediated endocytosis and smooth ER and Golgi endocytosis and Golgi
C. **exocytosis and smooth and rough ER**
D. flip-flop of phospholipids from one
E. side of the plasma membrane to the other and the Golgi

54. Which statement(s) about the sidedness of the plasma membrane is are correct?

A. The asymmetrical distribution of membrane proteins, lipids, and carbohydrates across the plasma membrane is determined as the membrane is being constructed.
B. Parts of proteins that are exposed on the cytoplasmic side of the endoplasmic reticulum are also exposed on the cytoplasmic side of the plasma membrane.
C. **All of the listed responses are Correct.**
D. The two lipid layers may differ in specific lipid composition.
E. Every integral membrane protein has a specific orientation in the plasma membrane.

55. Consider the transport of protons and sucrose into a plant cell by the sucroseproton cotransport protein. Plant cells continuously produce a proton gradient by using the energy of ATP hydrolysis to pump protons out of the cell. Why, in the absence of sucrose, don't protons move back into the cell through the sucrose-proton cotransport protein?

A. **The movement of protons through the cotransport protein cannot occur unless sucrose also moves a the same time.**
B. Protons are freely permeable through the phospholipid bilayer, sc no transport protein is needed for protons.
C. Protons cannot move through membrane transport proteins.
D. In the absence of sucrose, the ATP -powered proton pump does not function, so there is no proton gradient.
E. Protons, unlike other substances, do not diffuse down their concentration gradient

56. Which of the following is a function of membrane proteins and also facilitates tissue formation during embryogenesis?

A. Membrane proteins provide receptors for chemical messengers.
B. Membrane proteins form channels, which move substances across the membrane.
C. All of the listed responses are Correct.
D. **Membrane proteins with short sugar chains form identification tags that are recognized by other cells.**
E. Membrane proteins attach the membrane to the cytoskeleton.

57. In what way do the membranes of a eukaryotic cell wary?

A. Phospholipids are found only in certain membranes.
B. Only certain membranes are constructed from amphipathic molecules.
C. **Certain proteins are unique to each membrane.**
D. Some membranes have hydrophobic surfaces exposed to the cytoplasm, while others have hydrophilic surfaces facing the cytoplasm.
E. Only certain membranes of the cell are selectively permeable.

58. Active transport requires an input of energy and can also generate voltages across membranes. Based on this information, which of the following statements is true?

A. **The sodium/potassium pump hydrolyzes ATP and results in a net charge of +1 outside the cell membrane.**
B. Active transport moves solutes down their concentration gradients and always uses ATP as the source of energy to do this.
C. The source of energy for active transport of a solute up its gradient can be ATP ora concentration gradient of a second solute. This second gradient of solutes maintains no net difference in voltage across the membrane
D. Active transport can use ATP as its energy source and ensures that there is no voltage across the cell membrane.
E. Active transport uses channel proteins and ensures that the interior of the cell is always positive compared to the exterior of the cell.

59. Which of the following is a correct difference between active transport and facilitated diffusion?

A. Active transport involves transport proteins, and facilitated diffusion does not.
B. **Active transport requires energy from ATP, and facilitated diffusion does not.**
C. Facilitated diffusion can move solutes against concentration gradient, and active transport cannot
D. Active transport can move solutes in either direction across a membrane, but facilitated diffusion can only move in one direction
E. Facilitated diffusion involves transport proteins, and active transport does not

60. According to the fluid mosaic model of membrane structure, proteins of the membrane are mostly.

A. embedded in a lipid bilayer.
B. randomly oriented in the membrane, with no fixed inside outside polarity
C. spread in a continuous layer over the inner and outer surfaces of the membrane.
D. confined to the hydrophobic interior of the membrane.
E. free to depart from the fluid membrane and dissolve in the surrounding solution.

61. Which of the following would be least likely to diffuse through a plasma membrane without the help of a transport protein?

A. dissolved gases such as oxygen or Carbon dioxide
B. a small nonpolar molecule
C. Any of the above would easily diffuse through the membrane
D. **a large polar molecule**
E. a large nonpolar molecule

62. Green olives may be preserved in brine, which is a 30% salt solution. How does this method of preservation prevent microorganisms from growing in the olives?

A. Bacterial cells shrivel up in high salt solutions, causing the cell to burst.
B. A 30% salt solution is hypotonic to the bacteria, so they gain too much water and burst.
C. High salt concentration raises the pH, thus inhibiting bacterial metabolism.
D. High salt concentration lowers the pH, thus inhibiting bacterial metabolism.
E. A 30% salt solution is hypertonic to the bacteria, so they lose too much water and plasmolyze.

63. If a red blood cell and a plant cell were placed in seawater, what would happen to the two types of cells?

A. The red blood cell would shrink, and the plant cell would gain water.
B. The red blood cell would burst, and the plant cell would shrink.
C. Both cells would gain water by osmosis; the red blood cell would burst, and the plant cell would increase in turgor pressure.
D. **Both cells would lose water, the red blood cell would shrivel, and the plant plasma membrane would pull away from the cell wall.**
E. Seawater is isotonic to both cells, therefore, neither cell will change as there will be no movement of water into or out of the cells.

64. The concentration of solutes in a red blood cell is about 2%, but red blood cells contain almost no sucrose or urea. Sucrose cannot pass through the membrane, but water and urea can. Osmosis would cause red blood cells to shrink the most when immersed in which of the following solutions?

A. a hypertonic urea solution
B. a hypotonic sucrose solution
C. a hypotonic urea solution
D. **a hypertonic sucrose solution**
E. pure water

65. Which of the following factors would tend to increase membrane fluidity?

A. **a greater proportion of unsaturated phospholipids**
B. a lower temperature
C. a relatively high protein content in the membrane
D. a greater proportion of saturated phospholipids
E. a greater proportion of relatively large glycolipids compared with lipids having smaller molecular masses

66. Consider the currently accepted fluid mosaic model of the plasma membrane Where in the plasma membrane would cholesterol most likely be found?

A. in the interior and on the inside surface, but not on the outside surface
B. on the outside (external) surface of the membrane
C. on either surface of the membrane, but not in the interior of the membrane
D. on the inside (cytoplasmic) surface
E. **in the interior of the membrane**

CHAPTER 6
Energy and life

1. A system at chemical equilibrium

A. consumes energy at a steady rate.
B. releases energy at a steady rate.
C. consumes or releases energy, depending on whether it is exergonic or endergonic.
D. has zero kinetic energy.
E. can do no work.

2. Which of the following is true for all exergonic reactions?

A. The products have more total energy than the reactants.
B. The reaction proceeds with a net release of free energy.
C. The reaction goes only in a forward direction: all reactants will be converted to products, but no
D. products will be converted to reactants.
E. A net input of energy from the surroundings is required for the reactions to proceed.
F. The reactions are rapid.

3. When glucose monomers are joined together by glycosidic linkages to form a cellulose polymer, the changes in free energy, total energy, and entropy are as follows:

A. +ΔG, +ΔH, +ΔS.
B. +ΔG, +ΔH, -ΔS.
C. +ΔG, -ΔH, -ΔS.
D. -ΔG, +ΔH, +ΔS.
E. -ΔG, -ΔH, -ΔS.

4. A chemical reaction that has a positive ΔG is correctly described as

A. endergonic.
B. endothermic.
C. enthalpic.
D. spontaneous.
E. exothermic.

5. Which of the following best describes enthalpy (H)?

A. the total kinetic energy of a system
B. the heat content of a chemical system
C. the system's entropy
D. the cell's energy equilibrium
E. the condition of a cell that is not able to react

6. Why is ATP an important molecule in metabolism?

A. Its hydrolysis provides an input of free energy for exergonic reactions.
B. It provides energy coupling between exergonic and endergonic reactions.
C. Its terminal phosphate group contains a strong covalent bond that, when hydrolyzed, releases free energy.
D. Its terminal phosphate bond has higher energy than the other two.
E. It is one of the four building blocks for DNA synthesis.

7. Which of the following is most similar in structure to ATP?

A. a pentose sugar
B. a DNA nucleotide
C. an RNA nucleotide
D. an amino acid with three phosphate groups attached
E. a phospholipid

8. Which of the following statements is true concerning catabolic pathways?

A. They combine molecules into more energy-rich molecules.
B. They supply energy, primarily in the form of ATP, for the cell's work.
C. They are endergonic.
D. They are spontaneous and do not need enzyme catalysis.
E. They build up complex molecules such as protein from simpler compounds.

9. When chemical, transport, or mechanical work is done by an organism, what happens to the heat generated?

A. It is used to power yet more cellular work.
B. It is used to store energy as more ATP.
C. It is used to generate ADP from nucleotide precursors.
D. It is lost to the environment.
E. It is transported to specific organs such as the brain.

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13. Reactants capable of interacting to form products in a chemical reaction must first overcome a thermodynamic barrier known as the reaction's

A. entropy.
B. activation energy.
C. endothermic level.
D. equilibrium point.
E. free-energy content.

14. A solution of starch at room temperature does not readily decompose to form a solution of simple sugars because

A. the starch solution has less free energy than the sugar solution.
B. the hydrolysis of starch to sugar is endergonic.
C. the activation energy barrier for this reaction cannot be surmounted.
D. starch cannot be hydrolyzed in the presence of so much water.
E. starch hydrolysis is nonspontaneous.

15. Which of the following statements regarding enzymes is true?

A. Enzymes increase the rate of a reaction by making the reaction more exergonic.
B. Enzymes increase the rate of a reaction by lowering the activation energy barrier.
C. Enzymes increase the rate of a reaction by reducing the rate of reverse reactions.
D. Enzymes change the equilibrium point of the reactions they catalyze.
E. Enzymes make the rate of a reaction independent of substrate concentrations.

16. The active site of an enzyme is the region that

A. binds allosteric regulators of the enzyme.
B. is involved in the catalytic reaction of the enzyme.
C. binds noncompetitive inhibitors of the enzyme.
D. is inhibited by the presence of a coenzyme or a cofactor.

17. Mutations that result in single amino acid substitutions in an enzyme

A. can have no effect on the activity or properties of the enzyme.
B. will almost always destroy the activity of the enzyme.
C. will often cause a change in the substrate specificity of the enzyme.
D. may affect the physicochemical properties of the enzyme such as its optimal temperature and pH.
E. may, in rare cases, cause the enzyme to run reactions in reverse.

18. Increasing the substrate concentration in an enzymatic reaction could overcome which of the following?

A. denaturization of the enzyme
B. allosteric inhibition
C. competitive inhibition
D. saturation of the enzyme activity
E. insufficient cofactors

19. Which of the following is true of enzymes?

A. Nonprotein cofactors alter the substrate specificity of enzymes.
B. Enzyme function is increased if the 3-D structure or conformation of an enzyme is altered.
C. Enzyme function is independent of physical and chemical environmental factors such as pH and temperature.
D. Enzymes increase the rate of chemical reaction by lowering activation energy barriers.
E. Enzymes increase the rate of chemical reaction by providing activation energy to the substrate.

20. Protein kinases are enzymes that transfer the terminal phosphate from ATP to an amino acid residue on the target protein. Many are located on the plasma membrane as integral membrane proteins or peripheral membrane proteins. What purpose may be served by their plasma membrane localization?

A. ATP is more abundant near the plasma membrane.
B. They can more readily encounter and phosphorylate other membrane proteins.
C. Membrane localization lowers the activation energy of the phosphorylation reaction.
D. They flip back and forth across the membrane to access target proteins on either side.
E. They require phospholipids as a cofactor.

21. When you have a severe fever, what grave consequence may occur if the fever is not controlled?

A. destruction of your enzymes' primary structure
B. removal of amine groups from your proteins
C. change in the tertiary structure of your enzymes
D. removal of the amino acids in active sites of your enzymes
E. binding of your enzymes to inappropriate substrates

22. How does a noncompetitive inhibitor decrease the rate of an enzyme reaction?

A. by binding at the active site of the enzyme
B. by changing the shape of the enzyme's active site
C. by changing the free energy change of the reaction
D. by acting as a coenzyme for the reaction
E. by decreasing the activation energy of the reaction

23. The mechanism in which the end product of a metabolic pathway inhibits an earlier step in the pathway is most precisely described as

A. metabolic inhibition.
B. feedback inhibition.
C. allosteric inhibition.
D. noncooperative inhibition.
E. reversible inhibition.

24. Which of the following statements describes enzyme cooperativity?

A. A multienzyme complex contains all the enzymes of a metabolic pathway.
B. A product of a pathway serves as a competitive inhibitor of an early enzyme in the pathway.
C. A substrate molecule bound to an active site of one subunit promotes substrate binding to the active site of other subunits.
D. Several substrate molecules can be catalyzed by the same enzyme.
E. A substrate binds to an active site and inhibits cooperation between enzymes in a pathway.

25. Allosteric enzyme regulation is usually associated with

A. lack of cooperativity.
B. feedback inhibition.
C. activating activity.
D. an enzyme with more than one subunit.
E. the need for cofactors.

26. Besides turning enzymes on or off, what other means does a cell use to control enzymatic activity?

A. cessation of cellular protein synthesis
B. localization of enzymes into specific organelles or membranes
C. exporting enzymes out of the cell
D. connecting enzymes into large aggregates
E. hydrophobic interactions

27. An important group of peripheral membrane proteins are enzymes such as the phospholipases that cleave the head groups of phospholipids. What properties must these enzymes exhibit?

A. resistance to degradation
B. independence from cofactor interaction
C. water solubility
D. lipid solubility
E. membrane-spanning domains

28. How might an amino acid change at a site distant from the active site of the enzyme alter the enzyme's substrate specificity?

A. by changing the enzyme's stability
B. by changing the enzyme's location in the cell
C. by changing the shape of the protein
D. by changing the enzyme's pH optimum
E. an amino acid change away from the active site cannot alter the enzyme's substrate specificity

29. Much of the suitability of ATP as an energy intermediary is related to the instability of the bonds between the phosphate groups. These bonds are unstable because

A. the valence electrons in the phosphorus atom have less energy on average than those of other atoms
B. the bonds between the phosphate groups are unusually strong and breaking them releases free energy
C. they are hydrogen bonds, which are only about 10% as strong as covalent bonds
D. the phosphate groups are polar and are attracted to the water in the cell's interior
E. **the negatively charged phosphate groups vigorously repel one another and the terminal phosphate group is more stable in water than it is in ATP**

30. Which part of the equation DeltaG = Deltah - TDeltaS tells you if a process is spontaneous?

A. DeltaS
B. All of these values reveal the direction in which a reaction will go.
C. DeltaH
D. TDeltaS
E. DeltaG

31. When 1 mole of ATP is hydrolyzed in a test tube without an enzyme, about twice as much heat is given off as when 1 mole of ATP is hydrolyzed in a cell Which of the following best explains these observations?

A. In cells, ATP is hydrolyzed to ADP and Pi, but in the test tube it is hydrolyzed to carbon dioxide and water.
B. Cells have the ability to store heat, this cannot happen in a test tube.
C. In the cell, the hydrolysis of ATP is coupled to other endergonic reactions
D. Cells are less efficient at energy metabolism than reactions that are optimized in a test tube,
E. The amount of heat released by a reaction has nothing to do with the free energy change of the reaction

32. A chemical reaction is designated as exergonic rather than endergonic when ---- and

A. the products are less complex than the reactants
B. **the potential energy of the products is less than the potential energy of the reactants**
C. activation energy exceeds net energy release
D. activation energy is required
E. it absorbs more energy

33. Which is the most abundant form of energy in a cell?

A. mechanical energy
B. **chemical energy**
C. kinetic energy
D. heat
E. electrochemical gradients

34. In general, the hydrolysis of ATP drives cellular work by

A. **releasing free energy that can be coupled to other reactions**
B. changing to ADP and phosphate
C. lowering the free energy of the reaction
D. releasing heat
E. acting as a catalyst

35. The formation of glucose-6-phosphate from glucose is an endergonic reaction and is coupled to which of the following reactions or pathways?

A. the active transport of a phosphate ion into the cell
B. **the hydrolysis of ATP**
C. the conversion of glucose + fructose to make sucrose
D. the contraction of a muscle cell
E. the formation of ATP from ADP + Pi

36. How do enzymes lower activation energy?

A. by harnessing heat energy to drive the breakage of bonds between atoms
B. **by locally concentrating the reactants**
C. The second and third choices above are correct.
D. The first two responses above are Correct.
E. by increasing reactivity of products

37. Which of the following statements correctly describe(s) the role(s) of heat in biological reactions?

A. The kinetic energy of the substrates is increased as the amount of heat in the system is increased.
B. Heat from the environment is necessary for substrates to get over the activation energy barrier,
C. Increasing the amount of heat in a system will increase the rate of enzyme-catalyzed reactions
D. The second and third choices are correct
E. The first and second choices are Correct.

38. Which of the following determines the sign of Delta G for a reaction?

A. the enzyme catalyzing the reaction having a low affinity for the products
B. the free energy of the reactants
C. the enzyme catalyzing the reaction having a high affinity (strength of binding) for the reactants
D. **the free energy of the reactants and the free energy of the products**
E. the free energy of the products

39. Which of the following statements correctly describes some aspect of ATP hydrolysis being used to drive the active transport of an ion into the cell against the ion's concentration gradient? And

A. Neither ATP hydrolysis nor active transport is spontaneous.
B. The hydrolysis of ATP is endergonic, and the active transport is exergonic
C. Both ATP hydrolysis and active transport are spontaneous because they result in an increase in entropy of the system.
D. **This is an example of energy coupling.**
E. ATP is acting as a transport protein to facilitate the movement of the ion across the plasma membrane

40. Which of the following is changed by the presence of an enzyme in a reedom and

A. **the activation energy**
B. the magnitude of DeltaG.
C. the G value for the products
D. the G value for the reactants
E. The sign of DeltaG

41. Which of these statements about enzyme inhibitors is true?

A. A noncompetitive inhibitor does not change the shape of the active site.
B. A competitive inhibitor binds to the enzyme at a place that is separate from the active site
C. Inhibition of enzyme function by compounds that are not substrates is something that only occurs under controlled conditions in the laboratory,
D. When the product of an enzyme or an enzyme sequence acts as its inhibitor, this is known as positive feedback.
E. The action of competitive inhibitors may be reversible or irreversible.

42. The binding of an allosteric inhibitor to an enzyme causes the rate of product formation by the enzyme to decrease. Which of the following best explains why this decrease occurs?

A. **The allosteric inhibitor causes a structural change in the enzyme that prevents the substrate from binding at the active site.**
B. The allosteric inhibitor binds to the substrate and prevents it from binding at the active site,
C. The allosteric inhibitor binds to the active site, preventing the substrate from binding
D. The allosteric inhibitor causes free energy change of the reaction to increase.
E. The allosteric inhibitor lowers the temperature of the active site.

43. A plot of reaction rate (velocity) against temperature for an enzyme indicates little activity at 10°C and 45°C, with peak activity at 35°C. The most reasonable explanation for the low velocity at 10°C is that

A. the hydrogen bonds that define the structure of the enzyme's active site are unstable
B. the enzyme was denatured
C. the cofactors required by the enzyme system lack the thermal energy required to activate the enzyme
D. **there is too little activation energy available**
E. the substrate becomes a competitive inhibitor at lower temperature

44. Molecules A and B contain 110 kcal/mol of free energy and molecules B and C contain 150 kcal/mol of energy. A and B are converted to C and D. What can be concluded?

A. **The reaction that proceeds to convert A and B to C and D is endergonic, the products are more organized than the reactants.**
B. The conversion of A and B to C and D is exergonic; the products are less organized than the reactants.
C. The entropy in the products, C and D, is higher than in the reactants, A and B.
D. A and B will be converted to C and D with a net release of energy.
E. The conversion of A and B to C and D is spontaneous.

45. Which of the following statements about enzymes is incorrect?

A. Most enzymes are proteins
B. An enzyme is very specific in terms of which substrate it binds to.
C. An enzyme lowers the activation energy of a chemical reaction.
D. **An enzyme is consumed during the reaction it catalyzes**
E. Enzymes can be used to accelerate both anabolic and catabolic reactions

46. Which of the following statements about the active site of an enzyme is correct?

A. **The active site may resemble a groove or pocket in the surface of a protein into which the substrate fits,**
B. The active site has a fixed structure (shape).
C. Coenzymes are rarely found in the active site of an enzyme.
D. The active site allows the reaction to occur under the same environmental conditions as the reaction without the enzyme.
E. The structure of the active site is not affected by changes in temperature

47. If an enzyme in solution is saturated with substrate, the most effective way to obtain a faster yield of products is to

A. **add more of the enzyme.**
B. add a noncompetitive inhibitor.
C. add more substrate.
D. add an allosteric inhibitor.
E. heat the solution to 90&deg:C.

48. Which of the following statements about enzyme function is correct?

A. **Enzymes can lower the activation energy of reactions, but they cannot change the equilibrium point because they cannot change the net energy output.**
B. Enzymes can greatly speed up reactions, but they cannot change the activation energy because they cannot change the net energy output.
C. None of the listed responses is correct.
D. Enzymes can greatly speed up reactions, but they cannot change the net energy output because they cannot change the activation energy.
E. Enzymes can change the equilibrium point of reactions, but they cannot speed up reactions because they cannot change the net energy output.

49. What is meant by the "induced fit" of an enzyme?

A. The enzyme structure is altered so that it can be induced to fit many different types of substrate,
B. The presence of the substrate in solution induces the enzyme to slightly change its structure,
C. The substrate can be altered so that it is induced to fit into the enzyme's active site.
D. The shape of the active site is nearly perfect for specifically binding the enzyme's substrate(s)
E. The enzyme changes its shape slightly as the substrate binds to it.

50. Most cells cannot harness heat to perform work because

A. cells do not have much heat; they are relatively cool.
B. heat can never be used to do work.
C. **temperature is usually uniform throughout a cell.**
D. heat must remain constant during work.
E. heat is not a form of energy.

51. An exergonic (spontaneous) reaction is a chemical reaction that

A. is common in anabolic pathways
B. **releases energy when proceeding in the forward direction**
C. cannot occur outside of a living cell
D. occurs only when an enzyme or other catalyst is present
E. leads to a decrease in the entropy of the universe

52. What do the sign and magnitude of the DeltaG of a reaction tell us about the speed of the reaction? and

A. Neither the sign nor the magnitude of DeltaG have anything to do with the speed of a reaction
B. The sign does not matter, but the smaller the magnitude of DeltaG, the faster the reaction
C. The sign determines whether the reaction is spontaneous, and the magnitude determines the speed.
D. The sign does not matter, but the Larger the magnitude of DeltaG, the faster the reaction.
E. The more negative the DeltaG, the faster the reaction is.

53. Which of the following correctly states the relationship between anabolic and catabolic pathways?

A. Energy derived from catabolic pathways is used to drive the breakdown of organic molecules in anabolic pathways.
B. The slow of energy between catabolic and anabolic pathways is reversible,
C. Degradation of organic molecules by anabolic pathways provides the energy to drive catabolic pathways
D. Catabolic pathways produce usable cellular energy by synthesizing more complex organic molecules,
E. Anabolic pathways synthesize more complex organic molecules using the energy derived from catabolic pathways.

54. Above a certain substrate concentration, the rate of an enzyme-catalyzed reaction drops as the enzymes become saturated. Which of the following would lead to a faster conversion of substrate into product under these saturated conditions?

A. an increase in concentration of enzyme
B. increasing the temperature by a few degrees
C. increasing the substrate concentration
D. The first, second, and third listed responses are correct
E. The first and second listed responses are correct

55. Some bacteria are metabolically active in hot springs because

A. they use molecules other than proteins or RNAs as their main catalysts
B. high temperatures make catalysis unnecessary.
C. they are able to maintain a lower internal temperature.
D. **their enzymes have high optimal temperatures**
E. their enzymes are completely insensitive to temperature.

56. Metabolic pathways in cells are typically far from equilibrium. Which of the following processes tend(s) to keep these pathways away from equilibrium?

A. the continuous removal of the products of a pathway to be used in other reactions
B. an input of free energy from outside the pathway
C. an input of heat from the environment
D. The first, second, and third listed responses are correct
E. The first and second listed responses are correct

57. If an enzyme is added to a solution where its substrate and product are in equilibrium, what will occur?

A. **Nothing, the reaction will stay at equilibrium.**
B. Additional product will be formed.
C. The reaction will change from endergonic to exergonic.
D. The free energy of the system will change.
E. Additional substrate will be formed.

58. Choose the pair of terms that correctly completes this sentence: Catabolism is to anabolism as is to .

A. exergonic, spontaneous
B. entropy, enthalpy
C. free energy, entropy
D. **exergonic, endergonic**
E. work, energy

59. Which of the following statements about enzymes is true?

A. Enzymes react with their substrate (form chemical bonds), forming an enzyme-substrate complex, which irreversibly alters the enzyme.
B. **Enzymes speed up the rate of the reaction without changing the DG for the reaction**
C. All of the listed responses are Correct
D. The more heat that is added to a reaction, the faster the enzymes will function.
E. Enzymes increase the rate of a reaction by raising the activation energy for reactions.

60. The process of stabilizing the structure of an enzyme in its active form by the binding of a molecule is an example of

A. **allosteric regulation**
B. competitive inhibition
C. noncompetitive inhibition
D. feedback inhibition
E. cooperativity

61. Which of the following is an example of the cellular work accomplished with the free energy derived from the hydrolysis of ATP, involved in the production of electrochemical gradients?

A. facilitated diffusion
B. chromosome movement on microtubules
C. the beating of cilia
D. **proton movement against a gradient of protons**
E. the chemical synthesis of ATP

Chapter 10
Cellular Respiration

1. **What is the term for metabolic pathways that release stored energy by breaking down complex molecules?**

   A. anabolic pathways
   B. catabolic pathways
   C. fermentation pathways
   D. thermodynamic pathways
   E. bioenergetic pathways

2. **When electrons move closer to a more electronegative atom, what happens?**

   A. The more electronegative atom is reduced, and energy is released.
   B. The more electronegative atom is reduced, and energy is consumed.
   C. The more electronegative atom is oxidized, and energy is consumed.
   D. The more electronegative atom is oxidized, and energy is released.
   E. The more electronegative atom is reduced, and entropy decreases.

3. **Why does the oxidation of organic compounds by molecular oxygen to produce CO_2 and water release free energy?**

   A. The covalent bonds in organic molecules and molecular oxygen have more kinetic energy than the covalent bonds in water and carbon dioxide.
   B. Electrons are being moved from atoms that have a lower affinity for electrons (such as C) to atoms with a higher affinity for electrons (such as O).
   C. The oxidation of organic compounds can be used to make ATP.
   D. The electrons have a higher potential energy when associated with water and CO_2 than they do in organic compounds.
   E. The covalent bond in O_2 is unstable and easily broken by electrons from organic molecules.

4. Which of the following statements describes the results of this reaction?
$C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O + Energy$

A. $C_6H_{12}O_6$ is oxidized and O_2 is reduced.
B. O_2 is oxidized and H_2O is reduced.
C. CO_2 is reduced and O_2 is oxidized.
D. $C_6H_{12}O_6$ is reduced and CO_2 is oxidized.
E. O_2 is reduced and CO_2 is oxidized.

5. When a molecule of NAD^+ (nicotinamide adenine dinucleotide) gains a hydrogen atom (not a proton), the molecule becomes

A. dehydrogenated.
B. oxidized.
C. reduced.
D. redoxed.
E. hydrolyzed.

6. Where does glycolysis take place in eukaryotic cells?

A. mitochondrial matrix
B. mitochondrial outer membrane
C. mitochondrial inner membrane
D. mitochondrial intermembrane space
E. cytosol

7. The ATP made during glycolysis is generated by

A. substrate-level phosphorylation.
B. electron transport.
C. photophosphorylation.
D. chemiosmosis.
E. oxidation of NADH to NAD^+.

8. The oxygen consumed during cellular respiration is involved directly in which process or event?

A. glycolysis
B. accepting electrons at the end of the electron transport chain
C. the citric acid cycle
D. the oxidation of pyruvate to acetyl CoA
E. the phosphorylation of ADP to form ATP

9. Why are carbohydrates and fats considered high energy foods?

A. They have a lot of oxygen atoms.
B. They have no nitrogen in their makeup.
C. They can have very long carbon skeletons.
D. They have a lot of electrons associated with hydrogen.
E. They are easily reduced.

10. Starting with one molecule of glucose, the energy-containing products of glycolysis are

A. 2 NAD^+, 2 pyruvate, and 2 ATP.
B. 2 NADH, 2 pyruvate, and 2 ATP.
C. 2 $FADH_2$, 2 pyruvate, and 4 ATP.
D. 6 CO_2, 2 ATP, and 2 pyruvate.
E. 6 CO_2, 30 ATP, and 2 pyruvate.

11. The transport of pyruvate into mitochondria depends on the proton-motive force across the inner mitochondrial membrane. How does pyruvate enter the mitochondrion?

A. active transport
B. diffusion
C. facilitated diffusion
D. through a channel
E. through a pore

12. Which of the following intermediary metabolites enters the citric acid cycle and is formed, in part, by the removal of a carbon (CO_2) from one molecule of pyruvate?

A. lactate
B. glyceraldehydes-3-phosphate
C. oxaloacetate
D. acetyl CoA
E. citrate

13. How many carbon atoms are fed into the citric acid cycle as a result of the oxidation of one molecule of pyruvate?

A. two
B. four
C. six
D. eight
E. ten

14. Carbon dioxide (CO_2) is released during which of the following stages of cellular respiration?

A. glycolysis and the oxidation of pyruvate to acetyl CoA
B. oxidation of pyruvate to acetyl CoA and the citric acid cycle
C. the citric acid cycle and oxidative phosphorylation
D. oxidative phosphorylation and fermentation
E. fermentation and glycolysis

15. Where are the proteins of the electron transport chain located?

A. cytosol
B. mitochondrial outer membrane
C. mitochondrial inner membrane
D. mitochondrial intermembrane space
E. mitochondrial matrix

16. During aerobic respiration, which of the following directly donates electrons to the electron transport chain at the lowest energy level?

A. NAD^+
B. NADH
C. ATP
D. ADP + Ⓟi
E. $FADH_2$

17. Inside an active mitochondrion, most electrons follow which pathway?

A. glycolysis → NADH → oxidative phosphorylation → ATP → oxygen
B. citric acid cycle → $FADH_2$ → electron transport chain → ATP
C. electron transport chain → citric acid cycle → ATP → oxygen
D. pyruvate → citric acid cycle → ATP → NADH → oxygen
E. citric acid cycle → NADH → electron transport chain → oxygen

18. When hydrogen ions are pumped from the mitochondrial matrix across the inner membrane and into the intermembrane space, the result is the

A. formation of ATP.
B. reduction of NAD^+.
C. restoration of the Na^+/K^+ balance across the membrane.
D. creation of a proton-motive force.
E. lowering of pH in the mitochondrial matrix.

19. Where is ATP synthase located in the mitochondrion?

A. cytosol
B. electron transport chain
C. outer membrane
D. inner membrane
E. mitochondrial matrix

20. How many oxygen molecules (O_2) are required each time a molecule of glucose ($C_6H_{12}O_6$) is completely oxidized to carbon dioxide and water via aerobic respiration,?

A. 1
B. 3
C. 6
D. 12
E. 30

21. Which of the following produces the most ATP when glucose ($C_6H_{12}O_6$) is completely oxidized to carbon dioxide (CO_2) and water?

A. glycolysis
B. fermentation
C. oxidation of pyruvate to acetyl CoA
D. citric acid cycle
E. oxidative phosphorylation (chemiosmosis)

22. Chemiosmotic ATP synthesis (oxidative phosphorylation) occurs in

A. all cells, but only in the presence of oxygen.
B. only eukaryotic cells, in the presence of oxygen.
C. only in mitochondria, using either oxygen or other electron acceptors.
D. all respiring cells, both prokaryotic and eukaryotic, using either oxygen or other electron acceptors.
E. all cells, in the absence of respiration.

23. If a cell is able to synthesize 30 ATP molecules for each molecule of glucose completely oxidized by carbon dioxide and water, how many ATP molecules can the cell synthesize for each molecule of pyruvate oxidized to carbon dioxide and water?

A. 0
B. 1
C. 12
D. 14
E. 15

24. What is proton-motive force?

A. the force required to remove an electron from hydrogen
B. the force exerted on a proton by a transmembrane proton concentration gradient
C. the force that moves hydrogen into the intermembrane space
D. the force that moves hydrogen into the mitochondrion
E. the force that moves hydrogen to NAD^+

25. In prokaryotes, the respiratory electron transport chain is located

A. in the mitochondrial inner membrane.
B. in the mitochondrial outer membrane.
C. in the plasma membrane.
D. in the cytoplasm.
E. in the bacterial outer membrane.

26. The ATP made during fermentation is generated by which of the following?

A. the electron transport chain
B. substrate-level phosphorylation
C. chemiosmosis
D. oxidative phosphorylation
E. aerobic respiration

27. In the absence of oxygen, yeast cells can obtain energy by fermentation, resulting in the production of

A. ATP, CO_2, and ethanol (ethyl alcohol).
B. ATP, CO_2, and lactate.
C. ATP, NADH, and pyruvate.
D. ATP, pyruvate, and oxygen.
E. ATP, pyruvate, and acetyl CoA.

28. When an individual is exercising heavily and when the muscle becomes oxygen-deprived, muscle cells convert pyruvate to lactate. What happens to the lactate in skeletal muscle cells?

A. It is converted to NAD^+.
B. It produces CO_2 and water.
C. It is taken to the liver and converted back to pyruvate.
D. It reduces $FADH_2$ to FAD^+.
E. It is converted to alcohol.

29. A mutation in yeast makes it unable to convert pyruvate to ethanol. How will this mutation affect these yeast cells?

A. The mutant yeast will be unable to grow anaerobically.
B. The mutant yeast will grow anaerobically only when given glucose.
C. The mutant yeast will be unable to metabolize glucose.
D. The mutant yeast will die because they cannot regenerate NAD^+ from NAD.
E. The mutant yeast will metabolize only fatty acids.

30. What is the purpose of beta oxidation in respiration?

A. oxidation of glucose
B. oxidation of pyruvate
C. feedback regulation
D. control of ATP accumulation
E. breakdown of fatty acids

31. Where do the catabolic products of fatty acid breakdown enter into the citric acid cycle?

A. pyruvate
B. malate or fumarate
C. acetyl CoA
D. α-ketoglutarate
E. succinyl CoA

32. During intense exercise, as skeletal muscle cells go into anaerobiosis, the human body will increase its catabolism of

A. fats only.
B. carbohydrates only.
C. proteins only.
D. fats, carbohydrates, and proteins.
E. fats and proteins only.

33. Yeast cells that have defective mitochondria incapable of respiration will be able to grow by catabolizing which of the following carbon sources for energy?

A. glucose
B. proteins
C. fatty acids
D. glucose, proteins, and fatty acids
E. Such yeast cells will not be capable of catabolizing any food molecules, and will therefore die.

Art Questions

Figure 10.1 illustrates some of the steps (reactions) of glycolysis in their proper sequence. Each step is lettered. Use these letters to answer the questions.

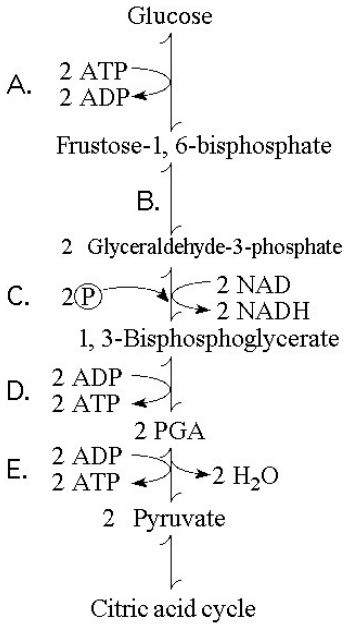

Figure 10.1

34. Which step in Figure 10.1 shows a split of one molecule into two smaller molecules?

A. A
B. B
C. C
D. D
E. E

35. In which step in Figure ١٠.1 is an inorganic phosphate added to the reactant?

A. A
B. B
C. **C**
D. D
E. E

36. Which step in Figure ١٠.1 is a redox reaction?

A. A
B. B
C. C
D. D
E. E

37. Which portion of the pathway in Figure ١٠.1 involves an endergonic reaction?

A. A
B. B
C. C
D. D
E. E

38. Which portion of the pathway in Figure ١٠.1 contains a phosphorylation reaction in which ATP is the phosphate source?

A. A
B. B
C. C
D. D
E. E

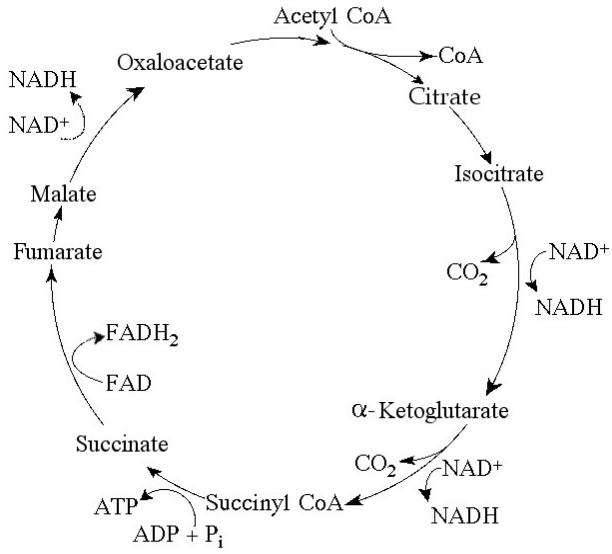

Figure ١٠.2 The citric acid cycle.

39. Starting with one molecule of isocitrate and ending with fumarate, how many ATP molecules can be made through substrate-level phosphorylation (see Figure ١٠.2)?

A. 1
B. 2
C. 11
D. 12
E. 24

40. Starting with citrate, which of the following combinations of products would result from three acetyl CoA molecules entering the citric acid cycle (see Figure ١٠.2)?

A. 1 ATP, 2 CO_2, 3 NADH, and 1 $FADH_2$
B. 2 ATP, 2 CO_2, 3 NADH, and 3 $FADH_2$
C. 3 ATP, 3 CO_2, 3 NADH, and 3 $FADH_2$
D. 3 ATP, 6 CO_2, 9 NADH, and 3 $FADH_2$
E. 38 ATP, 6 CO_2, 3 NADH, and 12 $FADH_2$

41. For each molecule of glucose that is metabolized by glycolysis and the citric acid cycle (see Figure ١٠.2), what is the total number of NADH + $FADH_2$ molecules produced?

A. 4
B. 5
C. 6
D. 10
E. 12

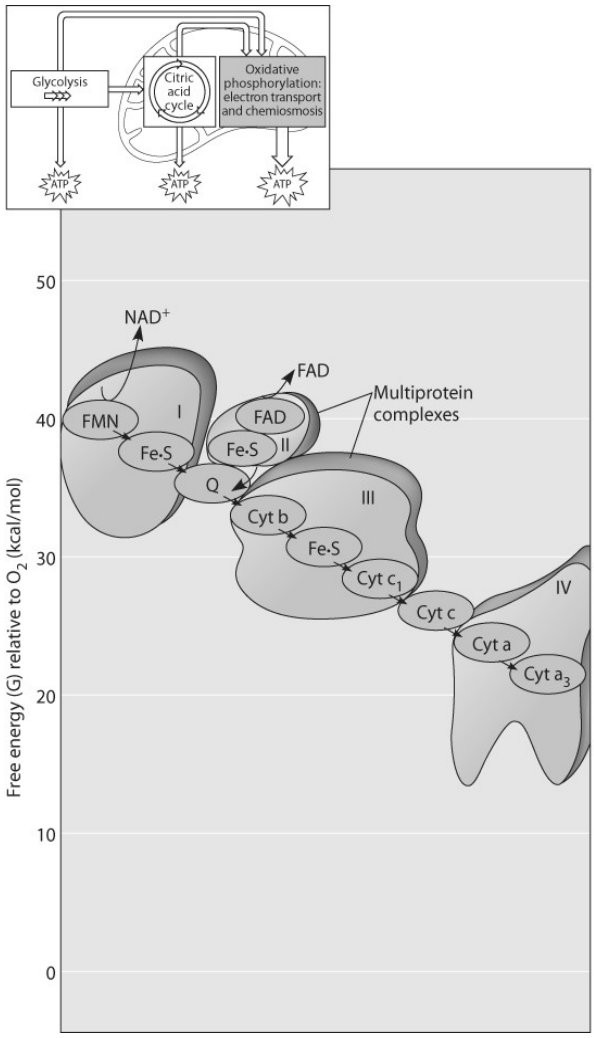

Figure ١٠.3

42. Figure ١٠.3 shows the electron transport chain. Which of the following is the combination of substances that is initially added to the chain?

A. oxygen, carbon dioxide, and water
B. NAD^+, FAD, and electrons
C. NADH, $FADH_2$, and protons
D. NADH, $FADH_2$, and O_2
E. oxygen and protons

43. Which of the following most accurately describes what is happening along the electron transport chain in Figure ١٠.3?

A. Chemiosmosis is coupled with electron transfer.
B. Each electron carrier alternates between being reduced and being oxidized.
C. ATP is generated at each step.
D. Energy of the electrons increases at each step.
E. Molecules in the chain give up some of their potential energy.

44. Which of the protein complexes labeled with Roman numerals in Figure ١٠.3 will transfer electrons to O_2?

A. complex I
B. complex II
C. complex III
D. complex IV
E. All of the complexes can transfer electrons to O_2.

45. What happens at the end of the chain in Figure ١٠.3?

A. 2 electrons combine with a proton and a molecule of NAD^+.
B. 2 electrons combine with a molecule of oxygen and two hydrogen atoms.
C. 4 electrons combine with a molecule of oxygen and 4 protons.
D. 4 electrons combine with four hydrogen and two oxygen atoms.
E. 1 electron combines with a molecule of oxygen and a hydrogen atom.

46. The *immediate* energy source that drives ATP synthesis by ATP synthase during oxidative phosphorylation is the

A. oxidation of glucose and other organic compounds.
B. flow of electrons down the electron transport chain.
C. affinity of oxygen for electrons.
D. H^+ concentration across the membrane holding ATP synthase.
E. transfer of phosphate to ADP.

47. Which metabolic pathway is common to both fermentation and cellular respiration of a glucose molecule?

A. the citric acid cycle
B. the electron transport chain
C. glycolysis
D. synthesis of acetyl CoA from pyruvate
E. reduction of pyruvate to lactate

48. In mitochondria, exergonic redox reactions

A. are the source of energy driving prokaryotic ATP synthesis.
B. are directly coupled to substrate-level phosphorylation.
C. provide the energy that establishes the proton gradient.
D. reduce carbon atoms to carbon dioxide.
E. are coupled via phosphorylated intermediates to endergonic processes.

49. The final electron acceptor of the electron transport chain that functions in aerobic oxidative phosphorylation is

A. oxygen.
B. water.
C. NAD^+.
D. pyruvate.
E. ADP.

50. What is the oxidizing agent in the following reaction?

Pyruvate + NADH + H^+ → Lactate + NAD^+

A. oxygen
B. NADH
C. NAD^+
D. lactate
E. pyruvate

51. When electrons flow along the electron transport chains of mitochondria, which of the following changes occurs?

A. The pH of the matrix increases.
B. ATP synthase pumps protons by active transport.
C. The electrons gain free energy.
D. The cytochromes phosphorylate ADP to form ATP.
E. NAD^+ is oxidized.

52. Most CO_2 from catabolism is released during

A. glycolysis.
B. the citric acid cycle.
C. lactate fermentation.
D. electron transport.
E. oxidative phosphorylation

53. Where do the reactions of glycolysis occur in a eukaryotic cell?

A. the matrix of the mitochondrion
B. across the inner membrane of the mitochondrion
C. **the cytosol**
D. the inner membrane of the mitochondrion
E. in the intermembrane space of the mitochondrion

54. Which of the following represents the major (but not the only) energy accomplishment of the citric acid cycle?

A. completion of substrate-level phosphorylation
B. formation of ATP
C. **formation of NADH and FADH2**
D. formation of CO_2
E. utilization of O_2

55. The overall efficiency of respiration (the percentage of the energy released that is saved in ATP) is approximately

A. 94%
B. 100%
C. 2%
D. 0.5%
E. 35%

56. During respiration in eukaryotic cells, the electron transport chain is located in or on the

A. cytosol
B. intermembrane space of the mitochondrion
C. None of the listed responses is Correct.
D. matrix of the mitochondrion
E. inner membrane of the mitochondrion

57. In brewing beer, maltose (a disaccharide of glucose) is

A. one of the enzymes for alcoholic fermentation
B. a sweetener
C. a substitute for pyruvate that cannot be made in yeast
D. **the substrate for alcoholic fermentation**
E. the substrate for aerobic respiration

58. In glycolysis, there is no production of carbon dioxide as a product of the pathway. Which of the following is the best explanation for this?

A. There are no oxidation or reduction reactions in glycolysis to produce CO2
B. There is very little ATP produced in glycolysis
C. Glucose contains more carbons than the number of carbons found in the pyruvate products that are produced by glycolysis.
D. **The products of glycolysis contain the same total number of carbon atoms as in the starting material**
E. The initial steps of glycolysis require an input of energy in the form of ATP (two per glucose)

59. A chemist has discovered a drug that blocks phosphoglucoisomerase, an enzyme that catalyzes the second reaction in glycolysis. He wants to use the drug to kill bacteria in people with infections. However, he cannot do this because

A. bacteria are prokaryotes, they usually don't need to perform glycolysis
B. glycolysis can occur without the action of enzymes
C. glycolysis produces so little ATP that the drug will have little effect
D. this step in the pathway of glycolysis can be skipped in bacteria, but not in humans
E. human cells must also perform glycolysis; the drug might also poison them

60. After completion of the citric acid cycle, most of the usable energy from the original glucose molecule is in the form of

A. FADH2
B. CO2
C. acetyl CoA
D. **NADH**
E. ATP

61. Of the metabolic pathways listed below, which is the only pathway found in all organisms?

A. the electron transport chain
B. fermentation
C. **glycolysis**
D. the citric acid cycle
E. cellular respiration

62. In glycolysis in the absence of oxygen, cells need away to regenerate which compound?

A. glucose
B. ethanol
C. carbon dioxide
D. lactate
E. NAD+

63. Which of the following accompanies the conversion of pyruvate to acetyl CoA before the citric acid cycle?

A. regeneration of NAD+
B. removal of coenzyme A
C. release of CO_2 and release of coenzyme A
D. formation of CO_2 and synthesis of ATP
E. release of CO_2 and synthesis of NADH

64. Where do the reactions of the citric acid cycle occur in eukaryotic cells?

A. the cytosol
B. the intermembrane space of the mitochondrion
C. **the matrix of the mitochondrion**
D. the cristae of the mitochondrion
E. across the inner membrane of the mitochondrion

65. The energy given up by electrons as they move through the electron transport chain is used in which of the following processes?

A. the breakdown of glucose
B. the production of NADH and FADH2
C. the oxidation of water
D. **pumping H+ across a membrane**
E. the production of CO2

66. The function of cellular respiration is to

A. synthesize macromolecules from monomers
B. extract CO2 from the atmosphere
C. produce carbohydrates
D. reduce CO2
E. extract usable energy from glucose

67. When a poison such as cyanide blocks the electron transport chain, glycolysis and the citric acid cycle also eventually stop working. Which of the following is the best explanation for this?

A. They run out of ADP.
B. A high level of NADH is present in the cell.
C. **NAD+ and FAD are not available for glycolysis and the citric acid cycle to continue,**
D. Electrons are no longer available from the electron transport chain to power glycolysis and the citric acid cycle.
E. The uptake of oxygen stops because electron transport was inhibited

68. If muscle cells in the human body consume O2 faster than it can be supplied, which of the following is likely to result?

A. The muscle cells will have more trouble making enough ATP to meet their energy requirements,
B. The cells will consume glucose at an increased rate
C. **The first three answers are correct.**
D. The cells will not be able to carry out oxidative phosphorylation.
E. Only the first two answers are Correct.

69. In mitochondria, exergonic redox reactions

A. reduce carbon atoms to carbon dioxide.
B. **provide the energy that establishes the proton gradient.**
C. are directly coupled to substrate level phosphorylation
D. are the source of energy driving prokaryotic ATP synthesis.
E. are coupled via phosphorylated intermediates to endergonic processes

70. A gram of fat oxidized by respiration produces approximately twice as much ATP as a gram of carbohydrate. Which of the following best explains this observation?

A. Fats are less soluble in water than Sugars.
B. **Fats are better electron donors to oxygen than are sugars.**
C. Fats are produced when cells take in more food than they need.
D. Fats are closely related to lipid molecules, the basic building blocks of cellular membranes,
E. Fats do not form true macromolecules as sugars do.

71. Which part of the catabolism of glucose by cellular respiration requires molecular oxygen (O2) and produces CO2?

A. glycolysis
B. the combination of glycolysis and the citric acid cycle
C. **the combination of the citric acid cycle and electron transport**
D. the electron transport chain
E. the citric acid cycle

72. Which part of the catabolism of glucose by cellular respiration requires molecular oxygen (O2) and produces CO2?

A. glycolysis
B. the combination of glycolysis and the citric acid cycle
C. **the combination of the citric acid cycle and electron transport**
D. the electron transport chain
E. the citric acid cycle

73. Most of the electrons removed from glucose by cellular respiration are used for which of the following processes?

A. reducing NAD+ to NADH in glycolysis and the citric acid cycle
B. driving substrate-level phosphorylation in glycolysis
C. The second and third answers are Correct.
D. producing a proton gradient for ATP synthesis in the mitochondria
E. The first two choices are correct.

74. Most CO2 from catabolism is released during

A. lactate fermentation.
B. oxidative phosphorylation.
C. **the citric acid cycle.**
D. electron transport.
E. Glycolysis

75. Which of the following best describes the electron transport chain?

A. Glucose is broken down to a three carbon compound in preparation for the citric acid cycle
B. Acetyl CoA is fully oxidized to CO2.
C. Electrons are pumped across a membrane by active transport.
D. **Electrons are passed from one carrier to another, releasing a little energy at each step,**
E. Hydrogen atoms are added to CO2 to make an energy-rich compound.

76. During the reaction C6H12O6 + 6 O2→ 6 CO2 + 6 H2O, which compound is reduced as a result of the reaction?

A. carbon dioxide
B. **oxygen**
C. both glucose and carbon dioxide
D. water
E. glucose

77. Oxygen gas (O2) is one of the strongest oxidizing agents known. The explanation for this is that

A. oxygen acts as the final electron acceptor in cellular respiration
B. oxygen gas contains a double bond
C. oxygen is so abundant in the atmosphere
D. **oxygen gas is composed of two atoms of oxygen**
E. the oxygen atom is very electronegative

78. A small amount of ATP is made in glycolysis by which of the following processes?

A. **transfer of a phosphate group from a fragment of glucose to ADP by substrate-level phosphorylation**
B. transport of electrons through a series of carriers
C. harnessing energy from the sun
D. transfer of electrons and hydrogen atoms to NAD+
E. attachment of a free inorganic phosphate (Pi) group to ADP to make ATP

79. Of the following molecules in the glycolytic pathway (the process of glycolysis) the one with the most chemical energy

A. fructose-6-phosphate
B. pyruvate
C. glucose
D. glyceraldehyde-3-phosphate
E. fructose-1,6-bisphosphate

80. When protein molecules are used as fuel for cellular respiration,---------- are produced as waste.

A. sugar molecules
B. **amino groups**
C. molecules of lactate
D. fatty acids
E. ethanol and CO2

81. How many molecules of ATP are gained by substrate-level phosphorylation from the complete breakdown of a single molecule of glucose in the presence of oxygen?

A. about 16 ATP
B. **four**
C. about 32 ATP
D. three
E. two

82. Most of the ATP produced in cellular respiration comes from which of the following processes?

A. glycolysis
B. **oxidative phosphorylation**
C. substrate-level phosphorylation
D. reduction of NADH
E. the citric acid cycle

83. Why is the citric acid cycle called a cycle?

A. The acetyl CoA that enters the cycle is regenerated in the last step of the pathway.
B. NADH is cycled down the electron transport chain.
C. **The four-carbon acid that accepts the acetyl CoA in the first step of the cycle is regenerated by the last step of the cycle.**
D. NAD+ and FAD are recycled.
E. All of the carbon from glucose is cycled back into the atmosphere as carbon dioxide,

84. A molecule becomes more oxidized when it

A. gains a hydrogen (H+) ion
B. gains an electron
C. loses a hydrogen (H+) ion
D. **loses an electron**
E. changes shape

85. In the citric acid cycle, for each pyruvate that enters the cycle, one ATP, three NADH, and one FADH2 are produced. For each glucose molecule that enters glycolysis, how many ATP, NADH, and FADH2 are produced in the citric acid cycle?

A. about 38 ATP
B. one ATP, three NADH, one FADH2
C. four ATP, six NADH, two FADH2
D. three ATP, three NADH, one FADH2
E. two ATP, six NADH, two FADH2

86. Each ATP molecule contains about 1% of the amount of chemical energy available from the complete oxidation of a single glucose molecule. Cellular respiration produces about 32 ATP from one glucose molecule. What happens to the rest of the energy in glucose?

A. It is used to make water from hydrogen ions and oxygen.
B. It is released as carbon dioxide and water
C. **It is converted to heat**
D. It is stored as fat
E. It is converted to starch

87. In an experiment, mice were fed glucose ($C_6H_{12}O_6$) containing a small amount of radioactive oxygen. The mice were closely monitored, and after a few minutes radioactive oxygen atoms showed up in

A. NADH
B. oxygen gas
C. **carbon dioxide**
D. ATP
E. Water

88. Which of the following is a correct description of the events of cellular respiration and the sequence of events in cellular respiration?

A. glycolysis, reduction of pyruvate, TCA cycle; oxidative phosphorylation
B. oxidation of pyruvate, TCA cycle, oxidation of glucose to pyruvate, oxidative phosphorylation
C. **oxidation of glucose to pyruvate, oxidation of pyruvate; oxidation of acetyl-CoA oxidative phosphorylation**
D. oxidation of glucose to pyruvate, reduction of pyruvate, TCA cycle; oxidative phosphorylation
E. glycolysis, oxidative phosphorylation; TCA cycle; oxidation of pyruvate

89. The immediate energy source that drives ATP synthesis by ATP synthase during oxidative phosphorylation is the

A. transfer of phosphate to ADP.
B. affinity of oxygen for electrons.
C. slow of electrons down the electron transport chain.
D. **H+ concentration across the membrane holding ATP synthase.**
E. oxidation of glucose and other organic compounds.

Chapter 11

photosynthetic process

1. Which of the following are products of the light reactions of photosynthesis that are utilized in the Calvin cycle?

A. CO_2 and glucose
B. H_2 and O_2
C. ADP, ip, and NADP+
D. electrons and H+
E. ATP and NADPH

2. Photosynthesis is not responsible for

A. oxygen in the atmosphere.
B. the ozone layer.
C. most of the organic carbon on Earth's surface.
D. atmospheric CO_2.
E. fossil fuels.

3. Where does the Calvin cycle take place?

A. stroma of the chloroplast
B. thylakoid membrane
C. cytoplasm surrounding the chloroplast
D. interior of the thylakoid (thylakoid space)
E. outer membrane of the chloroplast

4. In any ecosystem, terrestrial or aquatic, what group(s) is (are) always necessary?

A. autotrophs and heterotrophs
B. producers and primary consumers
C. photosynthesizers
D. autotrophs
E. green plants

5. In autotrophic bacteria, where are the enzymes located that can carry on carbon fixation (reduction of carbon dioxide to carbohydrate)?

A. in chloroplast membranes
B. in chloroplast stroma
C. in the cytosol
D. in the nucleoid
E. in the infolded plasma membrane

6. When oxygen is released as a result of photosynthesis, it is a direct by-product of

A. reducing NADP+.
B. splitting water molecules.
C. chemiosmosis.
D. the electron transfer system of photosystem I.
E. the electron transfer system of photosystem II.

7. A plant has a unique photosynthetic pigment. The leaves of this plant appear to be reddish yellow. What wavelengths of visible light are being absorbed by this pigment?

A. red and yellow
B. blue and violet
C. green and yellow
D. blue, green, and red
E. green, blue, and yellow

8. Which of the events listed below occurs in the light reactions of photosynthesis?

A. NADP is produced.
B. NADPH is reduced to NADP+.
C. Carbon dioxide is incorporated into PGA.
D. ATP is phosphorylated to yield ADP.
E. Light is absorbed and funneled to reaction-center chlorophyll a.

9. Which statement describes the functioning of photosystem II?

A. Light energy excites electrons in the thylakoid membrane electron transport chain.
B. Photons are passed along to a reaction-center chlorophyll.
C. The P680 chlorophyll donates a pair of protons to NADP+, which is thus converted to NADPH.
D. The electron vacancies in P680+ are filled by electrons derived from water.
E. The splitting of water yields molecular carbon dioxide as a by-product.

10. Which of the following are directly associated with photosystem I?

A. harvesting of light energy by ATP
B. receiving electrons from the thylakoid membrane electron transport chain
C. generation of molecular oxygen
D. extraction of hydrogen electrons from the splitting of water
E. passing electrons to the thylakoid membrane electron transport chain

11. Some photosynthetic organisms contain chloroplasts that lack photosystem II, yet are able to survive. The best way to detect the lack of photosystem II in these organisms would be

A. to determine if they have thylakoids in the chloroplasts.
B. to test for liberation of O_2 in the light.
C. to test for CO_2 fixation in the dark.
D. to do experiments to generate an action spectrum.
E. to test for production of either sucrose or starch.

12. What are the products of linear photophosphorylation?

A. heat and fluorescence
B. ATP and P700
C. ATP and NADPH
D. ADP and NADP
E. P700 and P680

13. Assume a thylakoid is somehow punctured so that the interior of the thylakoid is no longer separatedfrom the stroma. This damage will have the most direct effect on which of the following processes?

A. the splitting of water
B. the absorption of light energy by chlorophyll
C. the flow of electrons from photosystem II to photosystem
D. the synthesis of ATP
E. the reduction of NADP+

14. Suppose the interior of the thylakoids of isolated chloroplasts were made acidic and then transferred in the dark to a pH 8 solution. What would be likely to happen?

A. The isolated chloroplasts will make ATP.
B. The Calvin cycle will be activated.
C. Cyclic photophosphorylation will occur.
D. The isolated chloroplasts will generate oxygen gas.
E. The isolated chloroplasts will reduce NADP+ to NADPH.

15. In a plant cell, where are the ATP synthase complexes located?

A. thylakoid membrane only
B. plasma membrane only
C. inner mitochondrial membrane only
D. thylakoid membrane and inner mitochondrial membrane
E. thylakoid membrane and plasma membrane

16. In mitochondria, chemiosmosis translocates protons from the matrix into the intermembrane space, whereas in chloroplasts, chemiosmosis translocates protons from

A. the stroma to the photosystem II.
B. the matrix to the stroma.
C. **the stroma to the thylakoid space**.
D. the intermembrane space to the matrix.
E. the thylakoid space to the stroma.

17. Which of the following statements best describes the relationship between photosynthesis and respiration?

A. Respiration runs the biochemical pathways of photosynthesis in reverse.
B. Photosynthesis stores energy in complex organic molecules, whereas respiration releases it.
C. Photosynthesis occurs only in plants and respiration occurs only in animals.
D. ATP molecules are produced in photosynthesis and used up in respiration.
E. Respiration is anabolic and photosynthesis is catabolic.

18. Where are the molecules of the electron transport chain found in plant cells?

A. thylakoid membranes of chloroplasts
B. stroma of chloroplasts
C. outer membrane of mitochondria
D. matrix of mitochondria
E. cytoplasm

19. In photosynthetic cells, synthesis of ATP by the chemiosmotic mechanism occurs during

A. photosynthesis only.
B. respiration only.
C. both photosynthesis and respiration.
D. neither photosynthesis nor respiration.
E. photorespiration only.

20. The splitting of carbon dioxide to form oxygen gas and carbon compounds occurs during

A. photosynthesis.
B. respiration.
C. both photosynthesis and respiration.
D. neither photosynthesis nor respiration.
E. photorespiration.

21. Generation of proton gradients across membranes occurs during

A. photosynthesis.
B. respiration.
C. both photosynthesis and respiration.
D. neither photosynthesis nor respiration.
E. photorespiration.

22. What is the relationship between wavelength of light and the quantity of energy per photon?

A. They have a direct, linear relationship.
B. They are inversely related.
C. They are logarithmically related.
D. They are separate phenomena.
E. They are only related in certain parts of the spectrum.

23. P680+ is said to be the strongest biological oxidizing agent. Why?

A. It is the receptor for the most excited electron in either photosystem.
B. It is the molecule that transfers electrons to plastoquinone (Pq) of the electron transfer system.
C. It transfers its electrons to reduce NADP + to NADPH.
D. This molecule has a stronger attraction for electrons than oxygen, to obtain electrons from water.
E. It has a positive charge.

24. Carotenoids are often found in foods that are considered to have antioxidant properties in human nutrition. What related function do they have in plants?

A. They serve as accessory pigments to increase light absorption.
B. They protect against oxidative damage from excessive light energy.
C. They shield the sensitive chromosomes of the plant from harmful ultraviolet radiation.
D. They reflect orange light and enhance red light absorption by chlorophyll.
E. They take up and remove toxins from the groundwater.

25. In thylakoids, protons travel through ATP synthase from the thylakoid space to the stroma. Therefore, the catalytic "knobs" of ATP synthase would be located

A. on the side facing the thylakoid space.
B. on the ATP molecules themselves.
C. on the pigment molecules of photosystem I and photosystem II.
D. on the stromal side of the membrane.
E. built into the center of the thylakoid stack (granum).

26. In metabolic processes of cell respiration and photosynthesis, prosthetic groups such as heme and iron-sulfur complexes are encountered in components of the electron transport chain. What do they do?

A. donate electrons
B. act as reducing agents
C. act as oxidizing agents
D. transport protons within the mitochondria and chloroplasts
E. both oxidize and reduce during electron transport

27. In a cyanobacterium, the reactions that produce NADPH occur in

A. the light reactions alone.
B. the Calvin cycle alone.
C. both the light reactions and the Calvin cycle.
D. neither the light reactions nor the Calvin cycle.
E. the chloroplast, but is not part of photosynthesis.

28. The reactions that produce molecular oxygen (O_2) take place in

A. the light reactions alone.
B. the Calvin cycle alone.
C. both the light reactions and the Calvin cycle.
D. neither the light reactions nor the Calvin cycle.
E. the chloroplast, but are not part of photosynthesis.

29. Where do the enzymatic reactions of the Calvin cycle take place?

A. stroma of the chloroplast
B. thylakoid membranes
C. matrix of the mitochondria
D. cytosol around the chloroplast
E. thylakoid space

30. What is the primary function of the Calvin cycle?

A. use ATP to release carbon dioxide
B. use NADPH to release carbon dioxide
C. split water and release oxygen
D. transport RuBP out of the chloroplast
E. synthesize simple sugars from carbon dioxide

31. In C3 photosynthesis, the reactions that require ATP take place in

A. the light reactions alone.
B. the Calvin cycle alone.
C. both the light reactions and the Calvin cycle.
D. neither the light reactions nor the Calvin cycle.
E. the chloroplast, but is not part of photosynthesis.

32. In a plant leaf, the reactions that produce NADH occur in

A. the light reactions alone.
B. the Calvin cycle alone.
C. both the light reactions and the Calvin cycle.
D. neither the light reactions nor the Calvin cycle.
E. the chloroplast, but is not part of photosynthesis.

33. The NADPH required for the Calvin cycle comes from

A. reactions initiated in photosystem I.
B. reactions initiated in photosystem II.
C. the citric acid cycle.
D. glycolysis.
E. oxidative phosphorylation.

34. Reactions that require CO_2 take place in

A. the light reactions alone.
B. the Calvin cycle alone.
C. both the light reactions and the Calvin cycle.
D. neither the light reactions nor the Calvin cycle.
E. the chloroplast, but is not part of photosynthesis.

35. Which of the following statements best represents the relationships between the light reactions and the Calvin cycle?

A. The light reactions provide ATP and NADPH to the Calvin cycle, and the cycle returns ADP, pi, and NADP+ to the light reactions.
B. The light reactions provide ATP and NADPH to the carbon fixation step of the Calvin cycle, and the cycle provides water and electrons to the light reactions.
C. The light reactions supply the Calvin cycle with CO2 to produce sugars, and the Calvin cycle supplies the light reactions with sugars to produce ATP.
D. The light reactions provide the Calvin cycle with oxygen for electron flow, and the Calvin cycle provides the light reactions with water to split.
E. There is no relationship between the light reactions and the Calvin cycle.

36. In the process of carbon fixation, RuBP attaches a CO2 to produce a six-carbon molecule, which is then split to produce two molecules of 3-phosphoglycerate. After phosphorylation and reduction produces glyceraldehyde 3-phosphate (G3P), what more needs to happen to complete the Calvin cycle?

A. addition of a pair of electrons from NADPH
B. inactivation of RuBP carboxylase enzyme
C. regeneration of ATP from ADP
D. regeneration of RuBP
E. regeneration of NADP+

37. The phylogenetic distribution of the enzyme rubisco is limited to

A. C3 plants only.
B. C3 and C4 plants.
C. all photosynthetic eukaryotes.
D. all known photoautotrophs, both bacterial and eukaryotic.
E. all living cells.

Art Questions

Use the following figure and the compounds labeled A, B, C, D, and E to answer the following questions.

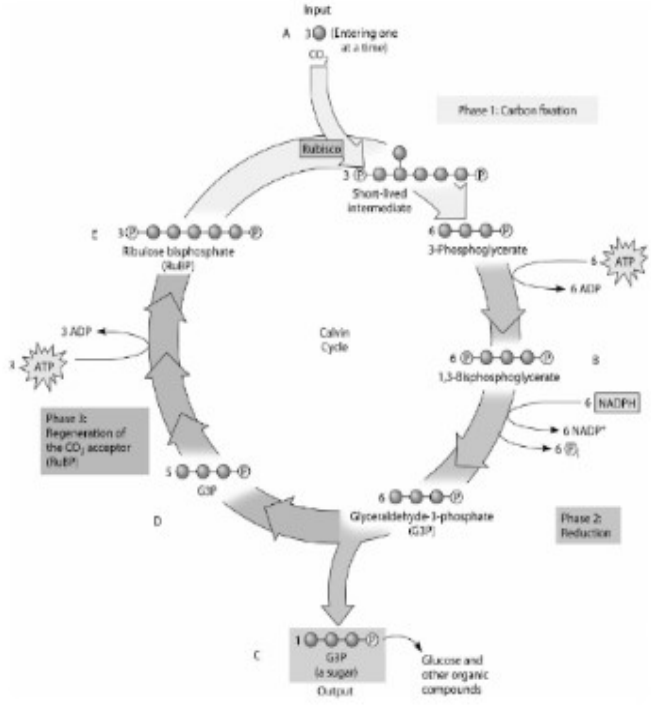

Figure 11.2

38. If ATP used by this plant is labeled with radioactive phosphorus, which molecule or molecules of the Calvin cycle will be radioactively labeled first?

A. B only
B. B and C only
C. B, C, and D only
D. B and E only
E. B, C, D, and E

39. If the carbon atom of the incoming CO_2 molecule is labeled with a radioactive isotope of carbon, which organic molecules will be radioactively labeled after one cycle?

A. C only
B. B, C, D, and E
C. C, D, and E only
D. B and C only
E. B and D only

40. Which molecule(s) of the Calvin cycle is (are) also found in glycolysis?

A. B, C, E, and 3-phosphoglycerate
B. B, C, and E only
C. 3-phosphoglycerate only
D. B, C, D, and 3-phosphoglycerate only
E. E only

41. Which of the following sequences correctly represents the flow of electrons during photosynthesis?

A. NADPH → O_2 → CO_2
B. H_2O → NADPH → Calvin cycle
C. NADPH → chlorophyll → Calvin cycle
D. H_2O → photosystem I → photosystem II
E. NADPH → electron transport chain → O_2

42. When chloroplast pigments absorb light

A. they become reduced
B. the Calvin cycle is triggered
C. **their electrons become excited**
D. their photons become excited
E. they lose potential energy

43. What structure is formed by the reaction center, light-harvesting complexes, and primary electron acceptors that cluster, and is located in the thylakoid membrane?

A. the fluorescence center
B. **the photosystem**
C. ATP synthase
D. the electron transport chain
E. NADP+ reductase

44. Molecular oxygen is produced during

A. glycolysis
B. re-energization of electrons by PSI
C. the Calvin cycle
D. **noncyclic electron flow during the light reactions**
E. cyclic electron flow during the light reactions

45. In a rosebush, chlorophyll is located in

A. mesophyll cells, found within the thylakoids of a leaf's chloroplasts
B. thylakoids, which are in mesophyll cells in the chloroplasts of a leaf
C. chloroplasts, which are in thylakoids in the mesophyll cells of a leaf
D. chloroplasts, which are in mesophyll cells in the thylakoids of a leaf
E. thylakoids, which are in chloroplasts in the mesophyll cells of a leaf

46. Based on the work of Engelmann, the wavelengths of light most effective in driving photosynthesis are referred to as

A. a visible light spectrum
B. an absorption spectrum
C. an effective spectrum
D. an electromagnetic spectrum
E. an action spectrum

47. The reactions of the Calvin cycle are not directly dependent on light, but they usually do not occur at night. Why?

A. Plants usually open their stomata at night.
B. At night, no water is available for the Calvin cycle.
C. It is often too cold at night for these reactions to take place.
D. Carbon dioxide concentrations decrease at night.
E. The Calvin cycle requires products only produced when the photosystems are illuminated.

48. Which of the following is cycled in the cyclic variation of the light reactions?

A. ATP
B. protons
C. **electrons**
D. ribulose bisphosphate
E. NADPH

49. The energy used to produce ATP in the light reactions of photosynthesis comes from

A. the oxidation of sugar molecules
B. carbon fixation
C. **movement of H+ through a membrane**
D. fluorescence
E. splitting water

50. You could distinguish a granum from a crista because the granum, but not the Crista, would

A. **have photosynthetic pigments**
B. function in energy transformation
C. Two of the listed responses are Correct.
D. contain protein but not lipids
E. be inside a mitochondrion

51. The light reactions of photosynthesis generate high-energy electrons, which end up in ------- The light reactions also produce ------- and ------- .

A. ATP ... NADPH ... oxygen
B. chlorophyll... ATP ... NADPH
C. water... sugar... oxygen
D. oxygen ... sugar... ATP
E. NADPH ... ATP ... oxygen

52. In photosynthesis, plants use carbon from to make sugar and other organic molecules.

A. **carbon dioxide**
B. soil
C. chlorophyll
D. the sun
E. water

53. Which of the following sequences correctly represents the flow of electrons during photosynthesis?

A. NADPH → O2→ CO2
B. NADPH → electron transport chain → C2
C. **H2O → NADPH → Calvin cycle**
D. NADPH → chlorophyll → Calvin cycle
E. H2O &rarr, photosystem I&rarr, photosystem II

54. Rubisco is -------

A. the enzyme responsible for splitting H2O to produce O2 in photosynthesis
B. **the enzyme in plants that first captures CO2 to begin the Calvin cycle**
C. the 5-carbon sugar molecule that reacts with CO2 to begin the Calvin cycle
D. the enzyme that forms a 4-carbon
E. compound in CAM photosynthesis

55. What is the role of NADP+ in photosynthesis?

A. It forms part of photosystem II.
B. It absorbs light energy.
C. **It forms NADPH to be used in the Calvin cycle.**
D. It is the primary electron acceptor
E. It helps produce ATP from the light reaction

56. During photosynthesis in chloroplasts, O2 is produced from ------- via a series of reactions associated with -------

A. **H2O... photosystem II**
B. CO2 ... the Calvin cycle
C. CO2 ... both photosystem I and the Calvin cycle
D. H2O ... photosystem I
E. CO2... photosystem II

57. Chlorophyll molecules are in which part of the chloroplast?

A. Stroma
B. **thylakoid membranes**
C. thylakoid lumen
D. stomata
E. plasma membrane

58. A photon of which of these colors would carry the most energy?

A. red
B. **blue**
C. yellow
D. orange
E. green

59. Of the following, which occurs during the Calvin cycle?

A. Photons are absorbed
B. **CO2 is reduced.**
C. Excited electrons are conveyed from chlorophyll to an electron acceptor.
D. ATP and NADPH are synthesized.
E. Light energy is converted to chemical energy.

60. In photosynthesis, what is the fate of the oxygen atoms present in CO2? They end up.

A. as molecular oxygen
B. as molecular oxygen and in sugar molecules
C. in water
D. in sugar molecules
E. in sugar molecules and in water

61. What is the role of NADP+ in photosynthesis?

A. It acts as the primary electron acceptor for the photosystems.
B. **It is reduced and then carries electrons to the Calvin cycle.**
C. As part of the electron transport chain, it manufactures ATP.
D. As a component of photosystem II, it catalyzes the hydrolysis of water.
E. It assists chlorophyll in capturing light.

62. During photosynthesis, an electron transport chain is used to

A. transport excited electrons from P700 to an electron acceptor
B. transport NADPH from the light reactions to the Calvin cycle
C. **transport electrons from photosystem II to photosystem I**
D. transport excited electrons from P700 to an electron acceptor and transport excited electrons from P680 to an electron acceptor
E. transport excited electrons from P680 to an electron acceptor

63. The most important role of pigments in photosynthesis is to

A. screen out harmful ultraviolet rays
B. store energy
C. catalyze the synthesis of ATP
D. **capture light energy**
E. catalyze the hydrolysis of water

64. The source of the oxygen produced by photosynthesis has been identified through experiments using radioactive tracers. The oxygen comes from

A. glucose
B. radioisotopes
C. carbon dioxide
D. **water**
E. light

65. Which of the following does not occur during the Calvin cycle?

A. regeneration of the CO2 acceptor
B. carbon fixation
C. oxidation of NADPH
D. **release of oxygen**
E. consumption of ATP

66. Of the following, which occurs during the Calvin cycle?

A. ATP is reduced and NADPH is oxidized.
B. **ATP is hydrolyzed and NADPH is oxidized.**
C. Noncyclic electron flow produces the materials required for the fixation of carbon from carbon dioxide.
D. Light energy is converted to chemical energy.
E. ATP is oxidized and NADPH is reduced

67. How does carbon dioxide enter the leaf ?

A. through the vascular system
B. through the thylakoids
C. **through the stomata**
D. through the roots
E. through the chloroplasts

68. In the Calvin cycle, CO2 is combined with

A. a 7-carbon compound to form two 4 -carbon compounds
B. a 5-carbon compound to form a stable 6-carbon compound that can be converted directly to glucose
C. two 2-carbon compounds to form a 5-carbon compound
D. **a 5-carbon compound to form an unstable 6-carbon compound, which decomposes into two 3-carbon compounds**
E. a 2-carbon compound to form a 3-carbon compound

69. In mechanism, photophosphorylation is most similar to

A. reduction of NADP+
B. the Calvin cycle.
C. **oxidative phosphorylation in cellular respiration.**
D. carbon fixation.
E. substrate-level phosphorylation in glycolysis

70. Which of the following statements correctly describes the relationship between the light reactions and the Calvin cycle?

A. The light reactions produce ADP and NADP+, both of which are used in the Calvin cycle.
B. **The light reactions produce ATP and NADPH, both of which are used in the Calvin cycle.**
C. The light reactions produce carbon dioxide and water, all of which are used in the Calvin cycle
D. The light reactions produce carbon dioxide, ATP, NADPH, all of which are used in the Calvin cycle.
E. The light reactions produce water, ATP, NADPH, all of which are used in the Calvin cycle

71. The Calvin cycle occurs in the

A. thylakoid lumen
B. **stroma**
C. stomata
D. thylakoid membrane
E. matrix

72. Which process is most directly driven by light energy?

A. reduction of NADP+ molecules
B. carbon fixation in the stroma
C. creation of a pH gradient by pumping protons across the thylakoid membrane
D. ATP synthesis
E. removal of electrons from chlorophyll molecules

73. Where do the electrons entering photosystem II come from?

A. chlorophyll molecules in the antenna complex
B. the electron transport chain
C. ATP
D. light
E. water

74. Glyceraldehyde-3-phosphate (G3P) is produced in the stroma of chloroplasts. Which of the following statements is most true about this compound?

A. For every three molecules of CO2, six molecules of G3P are formed but only one molecule exits the cycle to be used by the plant cell.
B. It is a 3-carbon sugar.
C. **All of the listed responses are correct**
D. For every three molecules of CO2, six molecules of G3P are formed but five molecules must be recycled to regenerate three molecules of RuBP
E. It is produced from glucose during glycolysis.

75. What is the range of wavelengths of light that are absorbed by the pigments in the thylakoid membranes?

A. the infrared
B. the range absorbed by carotenoids
C. **blue-violet and red-orange**
D. the entire spectrum of white light
E. green, which is why plants are greeп

Chapter 16

Nucleic acids and Inheritance

1. How do we describe transformation in bacteria?

A. the creation of a strand of DNA from an RNA molecule
B. the creation of a strand of RNA from a DNA molecule
C. the infection of cells by a phage DNA molecule
D. the type of semiconservative replication shown by DNA
E. assimilation of external DNA into a cell

2. In trying to determine whether DNA or protein is the genetic material, Hershey and Chase made use of which of the following facts?

A. DNA contains sulfur, whereas protein does not.
B. DNA contains phosphorus, whereas protein does not.
C. DNA contains nitrogen, whereas protein does not.
D. DNA contains purines, whereas protein includes pyrimidines.
E. RNA includes ribose, whereas DNA includes deoxyribose sugars.

3. Which of the following investigators was/were responsible for the following discovery?
In DNA from any species, the amount of adenine equals the amount of thymine, and the amount of guanine equals the amount of cytosine.

A. Frederick Griffith
B. Alfred Hershey and Martha Chase
C. Oswald Avery, Maclyn McCarty, and Colin MacLeod
D. Erwin Chargaff
E. Matthew Meselson and Franklin Stahl

4. Cytosine makes up 42% of the nucleotides in a sample of DNA from an organism. Approximately what percentage of the nucleotides in this sample will be thymine?

A. 8%
B. 16%
C. 31%
D. 42%
E. It cannot be determined from the information provided.

5. It became apparent to Watson and Crick after completion of their model that the DNA molecule couldcarry a vast amount of hereditary information in which of the following?

A. **sequence of bases**
B. phosphate-sugar backbones
C. complementary pairing of bases
D. side groups of nitrogenous bases
E. different five-carbon sugars

6. In an analysis of the nucleotide composition of DNA, which of the following will be found?

A. A = C
B. A = G and C = T
C. A + C = G + T
D. G + C = T + A

7. Replication in prokaryotes differs from replication in eukaryotes for which of the following reasons?

A. Prokaryotic chromosomes have histones, whereas eukaryotic chromosomes do not.
B. Prokaryotic chromosomes have a single origin of replication, whereas eukaryotic chromosomes have many.
C. The rate of elongation during DNA replication is slower in prokaryotes than in eukaryotes.
D. Prokaryotes produce Okazaki fragments during DNA replication, but eukaryotes do not.
E. Prokaryotes have telomeres, and eukaryotes do not.

8. Suppose you are provided with an actively dividing culture of E. coli bacteria to which radioactive thymine has been added. What would happen if a cell replicates once in the presence of this radioactive base?

A. One of the daughter cells, but not the other, would have radioactive DNA.
B. Neither of the two daughter cells would be radioactive.
C. All four bases of the DNA would be radioactive.
D. Radioactive thymine would pair with nonradioactive guanine.
E. DNA in both daughter cells would be radioactive.

9. The enzyme telomerase solves the problem of replication at the ends of linear chromosomes by which method?

A. adding a single 5' cap structure that resists degradation by nucleases
B. causing specific double-strand DNA breaks that result in blunt ends on both strands
C. causing linear ends of the newly replicated DNA to circularize
D. adding numerous short DNA sequences such as TTAGGG, which form a hairpin turn
E. adding numerous GC pairs which resist hydrolysis and maintain chromosome integrity

10. The DNA of telomeres has been found to be highly conserved throughout the evolution of eukaryotes. What does this most probably reflect?

A. the inactivity of this DNA
B. the low frequency of mutations occurring in this DNA
C. that new evolution of telomeres continues
D. that mutations in telomeres are relatively advantageous
E. that the critical function of telomeres must be maintained

11. 19. At a specific area of a chromosome, the sequence of nucleotides below is present where the chain opens to form a replication fork:
3' C C T A G G C T G C A A T C C 5'
An RNA primer is formed starting at the underlined T (T) of the template. Which of the following represents the primer sequence?

A. 5' G C C T A G G 3'
B. 3' G C C T A G G 5'
C. 5' A C G T T A G G 3'
D. 5' A C G U U A G G 3'
E. 5' G C C U A G G 3'

12. To repair a thymine dimer by nucleotide excision repair, in which order do the necessary enzymes act?

A. exonuclease, DNA polymerase III, RNA primase
B. helicase, DNA polymerase I, DNA ligase
C. DNA ligase, nuclease, helicase
D. DNA polymerase I, DNA polymerase III, DNA ligase
E. endonuclease, DNA polymerase I, DNA ligase

13. What is the function of DNA polymerase III?

A. to unwind the DNA helix during replication
B. to seal together the broken ends of DNA strands
C. to add nucleotides to the 3' end of a growing DNA strand
D. to degrade damaged DNA molecules
E. to rejoin the two DNA strands (one new and one old) after replication

14. A new DNA strand elongates only in the 5' to 3' direction because

A. DNA polymerase begins adding nucleotides at the 5' end of the template.
B. Okazaki fragments prevent elongation in the 3' to 5' direction.
C. the polarity of the DNA molecule prevents addition of nucleotides at the 3' end.
D. replication must progress toward the replication fork.
E. DNA polymerase can only add nucleotides to the free 3' end.

15. What is the function of topoisomerase?

A. relieving strain in the DNA ahead of the replication fork
B. elongating new DNA at a replication fork by adding nucleotides to the existing chain
C. adding methyl groups to bases of DNA
D. unwinding of the double helix
E. stabilizing single-stranded DNA at the replication fork

16. What is the role of DNA ligase in the elongation of the lagging strand during DNA replication?

A. It synthesizes RNA nucleotides to make a primer.
B. It catalyzes the lengthening of telomeres.
C. It joins Okazaki fragments together.
D. It unwinds the parental double helix.
E. It stabilizes the unwound parental DNA.

17. Which of the following help(s) to hold the DNA strands apart while they are being replicated?

A. primase
B. ligase
C. DNA polymerase
D. single-strand binding proteins
E. exonuclease

18. Individuals with the disorder xeroderma pigmentosum are hypersensitive to sunlight. This occurs because their cells are impaired in what way?

A. They cannot replicate DNA.
B. They cannot undergo mitosis.
C. They cannot exchange DNA with other cells.
D. They cannot repair thymine dimers.
E. They do not recombine homologous chromosomes during meiosis.

19. Which of the following would you expect of a eukaryote lacking telomerase?

A. a high probability of somatic cells becoming cancerous
B. production of Okazaki fragments
C. inability to repair thymine dimers
D. a reduction in chromosome length in gametes
E. high sensitivity to sunlight

20. Which of the following help(s) to hold the DNA strands apart while they are being replicated?

A. primase
B. ligase
C. DNA polymerase
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21. Which of the following would you expect of a eukaryote lacking telomerase?

A. a high probability of somatic cells becoming cancerous
B. production of Okazaki fragments
C. inability to repair thymine dimers
D. a reduction in chromosome length in gametes
E. high sensitivity to sunlight

22. Which of the following sets of materials are required by both eukaryotes and prokaryotes for replication?

A. double-stranded DNA, four kinds of dNTPs, primers, origins
B. topoisomerases, telomerases, polymerases
C. G-C rich regions, polymerases, chromosome nicks
D. nucleosome loosening, four dNTPs, four rNTPs
E. ligase, primers, nucleases

23. In a linear eukaryotic chromatin sample, which of the following strands is looped into domains by scaffolding?

A. DNA without attached histones
B. DNA with H1 only
C. the 10-nm chromatin fiber
D. the 30-nm chromatin fiber
E. the metaphase chromosome

24. Which of the following statements describes the eukaryotic chromosome?

A. It is composed of DNA alone.
B. The nucleosome is its most basic functional subunit.
C. The number of genes on each chromosome is different in different cell types of an organism.
D. It consists of a single linear molecule of double-stranded DNA plus proteins.
E. Active transcription occurs on heterochromatin but not euchromatin.

25. If a cell were unable to produce histone proteins, which of the following would be a likely effect?

A. There would be an increase in the amount of "satellite" DNA produced during centrifugation.
B. The cell's DNA couldn't be packed into its nucleus.
C. Spindle fibers would not form during prophase.
D. Amplification of other genes would compensate for the lack of histones.
E. Pseudogenes would be transcribed to compensate for the decreased protein in the cell.

26. Which of the following statements is true of histones?

A. Each nucleosome consists of two molecules of histone H1.
B. Histone H1 is not present in the nucleosome bead; instead, it draws the nucleosomes together.
C. The carboxyl end of each histone extends outward from the nucleosome and is called a "histone tail."
D. Histones are found in mammals, but not in other animals or in plants or fungi.
E. The mass of histone in chromatin is approximately nine times the mass of DNA.

27. Why do histones bind tightly to DNA?

A. Histones are positively charged, and DNA is negatively charged.
B. Histones are negatively charged, and DNA is positively charged.
C. Both histones and DNA are strongly hydrophobic.
D. Histones are covalently linked to the DNA.
E. Histones are highly hydrophobic, and DNA is hydrophilic.

28. Which of the following represents the order of increasingly higher levels of organization chromatin?

A. nucleosome, 30-nm chromatin fiber, looped domain
B. looped domain, 30-nm chromatin fiber, nucleosome
C. looped domain, nucleosome, 30-nm chromatin fiber
D. nucleosome, looped domain, 30-nm chromatin fiber
E. 30-nm chromatin fiber, nucleosome, looped domain

29. Which of the following statements describes chromatin?

A. Heterochromatin is composed of DNA, whereas euchromatin is made of DNA and RNA.
B. Both heterochromatin and euchromatin are found in the cytoplasm.
C. Heterochromatin is highly condensed, whereas euchromatin is less compact.
D. Euchromatin is not transcribed, whereas heterochromatin is transcribed.
E. Only euchromatin is visible under the light microscope.

30. What is the basis for the difference in how the leading and lagging strands of DNA molecules are synthesized?

A. The origins of replication occur only at the 5' end.
B. Helicases and single-strand binding proteins work at the 5' end.
C. DNA polymerase can join new nucleotides only to the 3' end of a growing strand.
D. DNA ligase works only in the 3' → 5' direction.
E. Polymerase can work on only one strand at a time.

31. The incorporation of an incorrect base into the DNA during replication

A. will trigger the cell to destroy the new strand, and replication will begin again
B. **can be repaired by the mismatch repair system**
C. will almost certainly lead to the death of the cell
D. is virtually impossible, as the accuracy of DNA polymerase is such that errors almost never occur
E. cannot be repaired, and a new mutation will invariably result

32. What technique was most helpful to Watson and Crick in developing their model for the structure of DNA?

A. radioactive labeling
B. **X-ray crystallography**
C. transgenic animals
D. electrophoresis
E. cloned DNA

33. Once the DNA at the replication fork is unwound by helicases, what prevents the two strands from coming back together to re-form a double helix?

A. The helicase pushes the two strands so far apart that they have no chance of finding each other,
B. The helicase modifies the DNA in such away as to eliminate the affinity between the two strands
C. DNA polymerase follows the helicase so closely that there is no chance for the strands to come back together.
D. One of the strands is rapidly degraded, preventing the double helix from re-forming
E. Single-strand binding proteins bind the unwound DNA and prevent the double helix from re-forming.

34. The information in DNA is contained in

A. the types of sugars used in making the DNA molecule
B. the sequence of amino acids that makes up the DNA molecule
C. All of the listed responses are Correct.
D. the variation in the structure of nucleotides that make up the DNA molecule
E. the sequence of nucleotides along the length of the two strands of the DNA molecule

35. The overall error rate in the completed DNA molecule is approximately

A. 1 error per 1,000 nucleotides
B. **1 error per 10,000,000,000 nucleotides**
C. 1 error per 1,000,000,000 nucleotides
D. 1 error per 100 nucleotides
E. 1 error per 1,000,000 nucleotides

36. Which set of enzymes is involved in nucleotide excision repair?

A. **nuclease, DNA polymerase, and ligase**
B. DNA polymerase, helicase, primase
C. hydrolase, nuclease, and ligase
D. ligase, nuclease, and primase
E. nuclease, DNA polymerase, primase

37. Which of the following attributes of DNA is most crucial to its accurate duplication?

A. its phosphodiester linkages and complementary strands
B. its helical nature and hydrogen bonding
C. its specific sequence of bases
D. **its specific base pairing and hydrogen bonding**
E. its deoxyribose sugar and phosphate groups

38. E. coli cells grown on 15N medium are transferred to 14N medium and allowed to grow for two more generations (two rounds of DNA replication). DNA extracted from these cells is centrifuged. What density distribution of DNA would you expect in this experiment?

A. one intermediate-density band
B. one low-density band
C. **one low-density and one intermediate-density band**
D. one high-density and one intermediate-density band
E. one high-density and one low density band

39. What enzyme joins Okazaki fragments?

A. helicase
B. DNA polymerase
C. topoisomerase
D. primase
E. DNA ligase

40. Which of the following is correct?

A. Adenine forms two covalent bonds with thymine; guanine forms three covalent bonds with cytosine
B. **Adenine forms two hydrogen bonds with thymine; guanine forms three hydrogen bonds with cytosine**
C. Adenine forms three hydrogen bonds with thymine; guanine forms two hydrogen bonds with cytosine,
D. Adenine forms three covalent bonds with thymine; guanine forms two covalent bonds with cytosine.
E. Adenine forms two hydrogen bonds with guanine; thymine forms three hydrogen bonds with cytosine

41. The DNA structures of prokaryotes and eukaryotes are different in several ways, but one way in which they are the same is that

A. the DNA is packaged into several linear chromosomes
B. **both have a sugar-phosphate backbone**
C. most of the DNA is in the form of plasmids
D. both have a single circular chromosome
E. histones are present in the nucleosomes

42. Who is credited with explaining the structure of the DNA double helix?

A. Avery, McCarty, and MacLeod
B. Griffith
C. Jacob and Monod
D. **Watson and Crick**
E. Hershey and Chase

43. During the replication of DNA.

A. **both strands of a molecule act as templates**
B. the reaction is catalyzed by RNA polymerase
C. the cell undergoes mitosis
D. errors never occur
E. only one strand of the molecule acts as a template

44. What is the basis for the difference in how the leading and lagging strands of DNA molecules are synthesized?

A. The origins of replication occur only at the 59 end.
B. Helicases and single-strand binding proteins work at the 59 end.
C. **DNA polymerase can join new nucleotides only to the 39 end of a growing strand**
D. Polymerase can work on only one strand at a time.
E. DNA ligase works only in the 39 S59 direction.

45. Why were many of the early experiments on DNA carried out on viruses and bacteria?

A. Their chromosomes have a simpler structure.
B. They can interact with each other.
C. **All of the responses are true**
D. They have short generation times.
E. They have relatively small genomes.

46. Unlike prokaryotic DNA replication, replication of eukaryotic chromosomes

A. **cannot be completed by DNA polymerase**
B. has a single origin
C. involves two leading strands and no lagging strands
D. is semiconservative
E. is error free

47. DNA polymerase adds nucleotides to the of the -------- leading strands, and to the ---------- of the lagging strands (Okazaki fragments).

A. 3' end... 5' end
B. sugar group ... phosphate group
C. **3' end... 3' end**
D. 5' end... 3' end
E. 5' end... 5' end

48. In his work with pneumonia-causing bacteria and mice, Griffith found that

A. the protein coat from pathogenic cells was able to transform nonpathogenic cells
B. heat-killed pathogenic cells caused pneumonia
C. **some substance from pathogenic cells was transferred to nonpathogenic cells, making them pathogenic.**
D. bacteriophages injected DNA into bacteria.
E. the polysaccharide coat of bacteria caused pneumonia.

49. In DNA, the two purines are -------- , and the two pyrimidines are ---------

A. **adenine and guanine ... cytosine and thymine**
B. adenine and cytosine ... guanine and thymine
C. cytosine and guanine ... adenine and thymine
D. cytosine and thymine ... adenine and guanine
E. adenine and thymine ... cytosine and guanine

50. Which of the following components is required for DNA replication?

A. sucrases
B. proteases
C. transfer RNA
D. ribosomes
E. RNA primer

51. Up until Hershey and Chase showed that DNA was the genetic molecule, what molecule was considered the best candidate for carrying genetic information and why?

A. sterols because of the different variations on their ring structure
B. amino acids because of all the ways they can join together
C. **proteins because they were thought to be the only molecule with both the variety and specificity of function to account for the array of heritable traits observed**
D. carbohydrates because they are found in abundance in all organisms
E. nucleoside triphosphates because of the ability to add and remove phosphate groups

52. What is the major difference between bacterial chromosomes and eukaryotic chromosomes?

A. Eukaryotes have a single circular chromosome whereas bacteria have several linear chromosomes,
B. The DNA of bacterial chromosomes has a slightly different structure,
C. There is no difference between bacterial and eukaryotic chromosomes,
D. **Bacteria have a single circular chromosome whereas eukaryotes have several linear chromosomes**
E. Bacterial chromosomes have much more protein associated with the DNA than eukaryotes.

53. Monomers for the synthesis of DNA are called

A. amino acids
B. fatty acids
C. disaccharides
D. monosaccharides
E. nucleotides

54. In what way(s) is our traditional representation of DNA polymerase molecules moving like locomotives along a track inaccurate?

A. The proteins involved in replication do not move; instead, DNA is drawn through the complex,
B. Like a train on a track. DNA polymerase must add nucleotides sequentially. It cannot jump around
C. DNA polymerase completes replication of one strand and then begins the other.
D. DNA polymerase acts as part of a large complex of proteins, not like a single locomotive,
E. Both the first and second answers are correct.

55. Chargaff found that for DNA

A. **the ratio of A to T is close to 1:1 and the ratio of G to C is close to 1:1**
B. A + T = G + C
C. the ratio of A to G is close to 1:1 and the ratio of T to C is close to 1:1
D. A + T = 50% of the total bases
E. the ratio of A to C is close to 1:1 and the ratio of G to T is close to 1:1

56. Put the following DNA-containing entities in order according to the amount of DNA found in their genomes.

A. bacteria, virus, eukaryote
B. bacteria, eukaryote , virus
C. They all have about the same amount of DNA.
D. eukaryote , virus, bacteria
E. wings, bacteria, eukaryote

57. A biochemist isolates, purifies, and combines in a test tube a variety of molecules needed for DNA replication. When she adds some DNA to the mixture, replication occurs, but each DNA molecule consists of a normal strand paired with numerous segments of DNA a few hundred nucleotides long. What has she probably left out of the mixture?

A. **DNA ligase**
B. primase
C. Okazaki fragments
D. nucleotides
E. DNA polymerase

58. The two strands of a DNA double helix are antiparallel. This means that

A. they both run in the 3' to 5’ direction
B. the two strands are mirror images
C. one strand is actually composed of RNA
D. only one of the two strands can be used as a template for replication, because DNA polymerase only works in One direction
E. one strand runs in the 5' to 3' direction. and the other runs in the 3’to 5’ direction

59. In a nucleosome, the DNA is wrapped around

A. ribosomes
B. a thymine dimer.
C. satellite DNA.
D. polymerase molecules.
E. Histones

60. One strand of a DNA molecule has the base sequence 5'-ATAGGT-3". The complementary base sequence on the other strand of DNA will be 3'----------5".

A. TGGAUA
B. TGGATA
C. **TATCCA**
D. ATAGGT
E. UAUCCA

61. Which of the following statements about replication origins is correct?

A. The two strands of DNA at the origin are separated, allowing the formation of a replication bubble,
B. Bacterial chromosomes have a single origin, but eukaryotic chromosomes have many origins
C. **All of the listed responses are Correct.**
D. In both prokaryotes and eukaryotes, replication proceeds in both directions from each origin
E. In bacteria, the DNA sequence at the origin is recognized by specific proteins that then bind to the origin.

62. The two sugar-phosphate strands that form the rungs of a DNA double helix are joined to each other through

A. ionic bonds between guanine and cytosine
B. covalent bonds between nitrogen atoms in adenine and in thymine
C. 5' deoxyribose and phosphate bonds
D. **hydrogen bonds between nucleotide bases**
E. covalent bonds between carbon atoms in deoxyribose molecules

Chapter 17
Expersion Of Genes

1. **Which of the following variations on translation would be most disadvantageous for a cell?**

   A. translating polypeptides directly from DNA
   B. using fewer kinds of tRNA
   C. having only one stop codon
   D. lengthening the half-life of mRNA
   E. having a second codon (besides AUG) as a start codon

2. **Garrod hypothesized that "inborn errors of metabolism" such as alkaptonuria occur because**

   A. metabolic enzymes require vitamin cofactors, and affected individuals have significant nutritional deficiencies.
   B. enzymes are made of DNA, and affected individuals lack DNA polymerase.
   C. many metabolic enzymes use DNA as a cofactor, and affected individuals have mutations that prevent their enzymes from interacting efficiently with DNA.
   D. certain metabolic reactions are carried out by ribozymes, and affected individuals lack key splicing factors.
   E. genes dictate the production of specific enzymes, and affected individuals have genetic defects that cause them to lack certain enzymes.

3. **The nitrogenous base adenine is found in all members of which group?**

   A. proteins, triglycerides, and testosterone
   B. proteins, ATP, and DNA
   C. ATP, RNA, and DNA
   D. α glucose, ATP, and DNA
   E. proteins, carbohydrates, and ATP

4. A particular triplet of bases in the template strand of DNA is 5' AGT 3'. The corresponding codon for the mRNA transcribed is

A. 3' UCA 5'.
B. 3' UGA 5'.
C. 5' TCA 3'.
D. 3' ACU 5'.
E. either UCA or TCA, depending on wobble in the first base.

5. The genetic code is essentially the same for all organisms. From this, one can logically assume which of the following?

A. A gene from an organism can theoretically be expressed by any other organism.
B. All organisms have experienced convergent evolution.
C. DNA was the first genetic material.
D. The same codons in different organisms translate into the different amino acids.
E. Different organisms have different numbers of different types of amino acids.

6. Which of the following provides some evidence that RNA probably evolved before DNA?

A. RNA polymerase uses DNA as a template.
B. RNA polymerase makes a single-stranded molecule.
C. RNA polymerase does not require localized unwinding of the DNA.
D. DNA polymerase uses primer, usually made of RNA.
E. DNA polymerase has proofreading function.

7. The "universal" genetic code is now known to have exceptions. Evidence for this can be found if which of the following is true?

A. If UGA, usually a stop codon, is found to code for an amino acid such as tryptophan (usually coded for by UGG only).
B. If one stop codon, such as UGA, is found to have a different effect on translation than another stop codon, such as UAA.
C. If prokaryotic organisms are able to translate a eukaryotic mRNA and produce the same polypeptide.
D. If several codons are found to translate to the same amino acid, such as serine.
E. If a single mRNA molecule is found to translate to more than one polypeptide when there are two or more AUG sites.

8. Which of the following nucleotide triplets best represents a codon?

A. a triplet separated spatially from other triplets
B. a triplet that has no corresponding amino acid
C. a triplet at the opposite end of tRNA from the attachment site of the amino acid
D. a triplet in the same reading frame as an upstream AUG
E. a sequence in tRNA at the 3' end

9. Which of the following provides some evidence that RNA probably evolved before DNA?

A. RNA polymerase uses DNA as a template.
B. RNA polymerase makes a single-stranded molecule.
C. RNA polymerase does not require localized unwinding of the DNA.
D. DNA polymerase uses primer, usually made of RNA.
E. DNA polymerase has proofreading function.

10. Which of the following is a function of a poly-A signal sequence?

A. It adds the poly-A tail to the 3' end of the mRNA.
B. It codes for a sequence in eukaryotic transcripts that signals enzymatic cleavage ~10□35 nucleotides away.
C. It allows the 3' end of the mRNA to attach to the ribosome.
D. It is a sequence that codes for the hydrolysis of the RNA polymerase.
E. It adds a 7-methylguanosine cap to the 3' end of the mRNA.

11. In eukaryotes there are several different types of RNA polymerase. Which type is involved in transcription of mRNA for a globin protein?

A. ligase
B. RNA polymerase I
C. RNA polymerase II
D. RNA polymerase III
E. primase

12. Which of the following is a function of a poly-A signal sequence?

A. It adds the poly-A tail to the 3' end of the mRNA.
B. It codes for a sequence in eukaryotic transcripts that signals enzymatic cleavage ~10□35 nucleotides away.
C. It allows the 3' end of the mRNA to attach to the ribosome.
D. It is a sequence that codes for the hydrolysis of the RNA polymerase.
E. It adds a 7-methylguanosine cap to the 3' end of the mRNA.

13. Which of the following statements best describes the termination of transcription in prokaryotes?

A. RNA polymerase transcribes through the polyadenylation signal, causing proteins to associate with the transcript and cut it free from the polymerase.
B. RNA polymerase transcribes through the terminator sequence, causing the polymerase to separate from the DNA and release the transcript.
C. RNA polymerase transcribes through an intron, and the snRNPs cause the polymerase to let go of the transcript.
D. Once transcription has initiated, RNA polymerase transcribes until it reaches the end of the chromosome.
E. RNA polymerase transcribes through a stop codon, causing the polymerase to stop advancing throughthe gene and release the mRNA.

14. Which of the following does not occur in prokaryotic eukaryotic gene expression, but does in eukaryotic gene expression?

A. mRNA, tRNA, and rRNA are transcribed.
B. RNA polymerase binds to the promoter.
C. A poly-A tail is added to the 3' end of an mRNA and a cap is added to the 5' end.
D. Transcription can begin as soon as translation has begun even a little.
E. RNA polymerase requires a primer to elongate the molecule.

15. In eukaryotes there are several different types of RNA polymerase. Which type is involved in transcription of mRNA for a globin protein?

A. ligase
B. RNA polymerase I
C. RNA polymerase II
D. RNA polymerase III
E. primase

16. Transcription in eukaryotes requires which of the following in addition to RNA polymerase?

A. the protein product of the promoter
B. start and stop codons
C. ribosomes and tRNA
D. several transcription factors (TFs)
E. aminoacyl synthetase

17. A part of the promoter, called the TATA box, is said to be highly conserved in evolution. Which of the following might this illustrate?

A. The sequence evolves very rapidly.
B. The sequence does not mutate.
C. Any mutation in the sequence is selected against.
D. The sequence is found in many but not all promoters.
E. The sequence is transcribed at the start of every gene.

18. The TATA sequence is found only several nucleotides away from the start site of transcription. This most probably relates to which of the following?

A. the number of hydrogen bonds between A and T in DNA
B. the triplet nature of the codon
C. the ability of this sequence to bind to the start site
D. the supercoiling of the DNA near the start site
E. the 3-D shape of a DNA molecule

19. What is a ribozyme?

A. an enzyme that uses RNA as a substrate
B. an RNA with enzymatic activity
C. an enzyme that catalyzes the association between the large and small ribosomal subunits
D. an enzyme that synthesizes RNA as part of the transcription process
E. an enzyme that synthesizes RNA primers during DNA replication

20. A transcription unit that is 8,000 nucleotides long may use 1,200 nucleotides to make a protein consisting of approximately 400 amino acids. This is best explained by the fact that

A. many noncoding stretches of nucleotides are present in mRNA.
B. there is redundancy and ambiguity in the genetic code.
C. many nucleotides are needed to code for each amino acid.
D. nucleotides break off and are lost during the transcription process.
E. there are termination exons near the beginning of mRNA.

21. During splicing, which molecular component of the spliceosome catalyzes the excision reaction?

A. protein
B. DNA
C. RNA
D. lipid
E. sugar

22. Alternative RNA splicing

A. is a mechanism for increasing the rate of transcription.
B. can allow the production of proteins of different sizes from a single mRNA.
C. can allow the production of similar proteins from different RNAs.
D. increases the rate of transcription.
E. is due to the presence or absence of particular snRNPs.

23. In the structural organization of many eukaryotic genes, individual exons may be related to which of the following?

A. the sequence of the intron that immediately precedes each exon
B. the number of polypeptides making up the functional protein
C. the various domains of the polypeptide product
D. the number of restriction enzyme cutting sites
E. the number of start sites for transcription

24. A particular triplet of bases in the coding sequence of DNA is AAA. The anticodon on the tRNA that binds the mRNA codon is

A. TTT.
B. UUA.
C. UUU.
D. AAA.
E. either UAA or TAA, depending on first base wobble.

25. Accuracy in the translation of mRNA into the primary structure of a polypeptide depends on specificity in the

A. binding of ribosomes to mRNA.
B. shape of the A and P sites of ribosomes.
C. bonding of the anticodon to the codon.
D. attachment of amino acids to tRNAs.
E. bonding of the anticodon to the codon and the attachment of amino acids to tRNAs.

26. What is the function of GTP in translation?

A. GTP energizes the formation of the initiation complex, using initiation factors.
B. GTP hydrolyzes to provide phosphate groups for tRNA binding.
C. GTP hydrolyzes to provide energy for making peptide bonds.
D. GTP supplies phosphates and energy to make ATP from ADP.
E. GTP separates the small and large subunits of the ribosome at the stop codon.

27. A mutant bacterial cell has a defective aminoacyl synthetase that attaches a lysine to tRNAs with the anticodon AAA instead of the normal phenylalanine. The consequence of this for the cell will be that

A. none of the proteins in the cell will contain phenylalanine.
B. proteins in the cell will include lysine instead of phenylalanine at amino acid positions specified by the codon UUU.
C. the cell will compensate for the defect by attaching phenylalanine to tRNAs with lysine-specifying anticodons.
D. the ribosome will skip a codon every time a UUU is encountered.
E. none of the options will occur; the cell will recognize the error and destroy the tRNA.

28. Which of the following is the first event to take place in translation in eukaryotes?

A. elongation of the polypeptide
B. base pairing of activated methionine-tRNA to AUG of the messenger RNA
C. binding of the larger ribosomal subunit to smaller ribosomal subunits
D. covalent bonding between the first two amino acids
E. the small subunit of the ribosome recognizes and attaches to the 5' cap of mRNA

29. Which of the following is a function of a signal peptide?

A. to direct an mRNA molecule into the cisternal space of the ER
B. to bind RNA polymerase to DNA and initiate transcription
C. to terminate translation of the messenger RNA
D. to translocate polypeptides across the ER membrane
E. to signal the initiation of transcription

30. When translating secretory or membrane proteins, ribosomes are directed to the ER membrane by

A. a specific characteristic of the ribosome itself, which distinguishes free ribosomes from bound ribosomes.
B. a signal-recognition particle that brings ribosomes to a receptor protein in the ER membrane.
C. moving through a specialized channel of the nucleus.
D. a chemical signal given off by the ER.
E. a signal sequence of RNA that precedes the start codon of the message.

31. An experimenter has altered the 3' end of the tRNA corresponding to the amino acid methionine in such a way as to remove the 3' AC. Which of the following hypotheses describes the most likely result?

A. tRNA will not form a cloverleaf.
B. The nearby stem end will pair improperly.
C. The amino acid methionine will not bind.
D. The anticodon will not bind with the mRNA codon.
E. The aminoacylsynthetase will not be formed.

32. The process of translation, whether in prokaryotes or eukaryotes, requires tRNAs, amino acids, ribosomal subunits, and which of the following?

A. polypeptide factors plus ATP
B. polypeptide factors plus GTP
C. polymerases plus GTP
D. SRP plus chaperones
E. signal peptides plus release factor

33. What is the function of the release factor (RF)?

A. It separates tRNA in the A site from the growing polypeptide.
B. It binds to the stop codon in the A site in place of a tRNA.
C. It releases the amino acid from its tRNA to allow the amino acid to form a peptide bond.
D. It supplies a source of energy for termination of translation.
E. It releases the ribosome from the ER to allow polypeptides into the cytosol.

34. When the function of the newly made polypeptide is to be secreted from the cell where it has been made, what must occur?

A. It must be translated by a ribosome that remains free of attachment to the ER.
B. Its signal sequence must target it to the ER, from which it goes to the Golgi.
C. It has a signal sequence that must be cleaved off before it can enter the ER.
D. It has a signal sequence that targets it to the cell's plasma membrane where it causes exocytosis.
E. Its signal sequence causes it to be encased in a vesicle as soon as it is translated.

35. Why might a point mutation in DNA make a difference in the level of protein's activity?

A. It might result in a chromosomal translocation.
B. It might exchange one stop codon for another stop codon.
C. It might exchange one serine codon for a different serine codon.
D. It might substitute an amino acid in the active site.
E. It might substitute the N-terminus of the polypeptide for the C-terminus.

36. Which of the following types of mutation, resulting in an error in the mRNA just after the AUG start of translation, is likely to have the most serious effect on the polypeptide product?

A. a deletion of a codon
B. a deletion of two nucleotides
C. a substitution of the third nucleotide in an ACC codon
D. a substitution of the first nucleotide of a GGG codon
E. an insertion of a codon

37. What is the effect of a nonsense mutation in a gene?

A. It changes an amino acid in the encoded protein.
B. It has no effect on the amino acid sequence of the encoded protein.
C. It introduces a premature stop codon into the mRNA.
D. It alters the reading frame of the mRNA.
E. It prevents introns from being excised.

38. A frameshift mutation could result from

A. a base insertion only.
B. a base deletion only.
C. a base substitution only.
D. deletion of three consecutive bases.
E. either an insertion or a deletion of a base.

39. Which small-scale mutation would be most likely to have a catastrophic effect on the functioning of a protein?

A. a base substitution
B. a base deletion near the start of a gene
C. a base deletion near the end of the coding sequence, but not in the terminator codon
D. deletion of three bases near the start of the coding sequence, but not in the initiator codon
E. a base insertion near the end of the coding sequence, but not in the terminator codon

40. The most commonly occurring mutation in people with cystic fibrosis is a deletion of a single codon.This results in

A. a base-pair substitution.
B. a nucleotide mismatch.
C. a frameshift mutation.
D. a polypeptide missing an amino acid.
E. a nonsense mutation.

41. Which of the following mutations is most likely to cause a phenotypic change?

A. a duplication of all or most introns
B. a large inversion whose ends are each in intergenic regions
C. a nucleotide substitution in an exon coding for a transmembrane domain
D. a single nucleotide deletion in an exon coding for an active site
E. a frameshift mutation one codon away from the 3' end of the nontemplate strand

42. In comparing DNA replication with RNA transcription in the same cell, which of the following is true only of replication?

A. It uses RNA polymerase.
B. It makes a new molecule from its 5' end to its 3' end.
C. The process is extremely fast once it is initiated.
D. The process occurs in the nucleus of a eukaryotic cell.
E. The entire template molecule is represented in the product.

43. In order for a eukaryotic gene to be engineered into a bacterial colony to be expressed, what must be included in addition to the coding exons of the gene?

A. the introns
B. eukaryotic polymerases
C. a bacterial promoter sequence
D. eukaryotic ribosomal subunits
E. eukaryotic tRNAs

44. When the genome of a particular species is said to include 20,000 protein-coding regions, what does this imply?

A. There are 20,000 genes.
B. Each gene codes for one protein.
C. Any other regions are "junk" DNA.
D. There are also genes for RNAs other than mRNA.
E. The species is highly evolved.

45. Which component is not directly involved in translation?

A. mRNA
B. DNA
C. tRNA
D. ribosomes
E. GTP

46. Genetic information of eukaryotic cells is transferred from the nucleus to the cytoplasm in the form of

A. carbohydrates
B. **RNA**
C. lipids
D. DNA
E. Proteins

47. Which of the following catalyzes the linkage between ribonucleotides to form RNA during gene expression?

A. **RNA polymerase**
B. RNA ligase
C. a ribozyme
D. tRNA
E. reverse transcriptase

48. When genes are expressed, they produce

A. enzymes
B. phenotypic traits
C. **The second and fourth responses are correct.**
D. RNA molecules
E. Polypeptides

49. Which of the following statements is true?

A. Each DNA base codes for three amino acids.
B. It takes three genes to code for one protein
C. Each triplet has many different meanings
D. Each gene codes for three proteins.
E. Each amino acid in a protein is coded for by three bases in the DNA

50. The anticodon of a particular tRNA molecule is

A. changeable, depending on the amino acid that attaches to the tRNA.
B. catalytic, making the tRNA a ribozyme.
C. complementary to the corresponding triplet in rRNA.
D. **complementary to the corresponding mRNA codon.**
E. the part of tRNA that bonds to a specific amino acid.

51. The mRNA codons 5'-CAA-3' or 5'-CAG-3' are translated as the amino acid glutamine by

A. the tRNA with an anticodon 5'GUU-3' and glutamine at its other end
B. by tPNA molecules that have been charged with glutamine by two different aminoacyl-tRNA synthetases
C. **the same tRNA with the anticodon 3'-GUU-5"**
D. separate tRNA molecules with anticodons 3'-GUU-5' and 3'-GUC5, respectively
E. the small and large ribosomal units

52. In many cases, more than one codon codes for the same amino acid. Because of this, we say that the code is

A. **redundant**
B. tricky
C. incomplete
D. not specific
E. inaccurate

53. During the transcription of a given portion of a DNA molecule

A. mRNA is synthesized on both chains of the DNA molecule once
B. **mRNA is synthesized on only one of the chains**
C. Any of the listed patterns may be found.
D. half of the mRNA is synthesized on half of one chain; then the other half of the mRNA is made on the other half of the DNA
E. mRNA is synthesized on both chains of the DNA molecule, but first on one side and then the other

54. During translation in a eukaryotic cell

A. tRNA carries amino acid molecules to the nucleus, where they are added to a growing polypeptide chain
B. ribosomes move into the nucleus
C. **polypeptides are synthesized at ribosomes, according to instructions carried by mRNA**
D. ribosomes move out of the nucleus
E. mRNA is synthesized by the bonding of free nucleotides to the bases on the template strand of DNA

55. Which of the following mutations would be most likely to have a harmful effect on an organism?

A. **a single nucleotide insertion downstream of, and close to, the start of the coding sequence**
B. a single nucleotide deletion near the end of the coding sequence
C. a single nucleotide deletion in the middle of an intron
D. a deletion of three nucleotides near the middle of a gene
E. a nucleotide-pair substitution

56. Which of the following statements regarding the structure and function of tRNA is false?

A. Each type of tRNA molecule translates a particular mRNA codon into a particular amino acid,
B. The nucleotide sequence at both the amino acid attachment and the anticodon ends of each tRNA is instrumental in specifying which amino acid is attached to the tRNA by aminoacyl-tRNA synthetase
C. The second and third listed responses are false
D. **Although each tRNA consists of a relatively short, single RNA strand, this single strand can achieve a three-dimensional structure by folding back upon itself and forming covalent bonds between complementary bases.**
E. Although there are 61 codons that code for amino acids, there are only 45 different tRNA molecules,

57. Which of the following types of mutation is least likely to affect the function of the protein corresponding to the gene in which the mutation occurs?

A. addition of single bases
B. **base-pair substitution**
C. nonsense mutation
D. deletion of single bases
E. transposition

58. A base-pair substitution mutation in a germ cell line is likely to have no effect on phenotype if the substitution

A. prevents the initiation of transcription of the DNA sequence that codes for ATP synthase
B. **occurs in an intron**
C. forms a new stop codon changes a stop codon to a codon
D. specifying an amino acid
E. changes the structure of an enzyme

59. During translation, amino acid chain elongation occurs until

A. **the ribosome encounters a "stop" codon**
B. the ribosome runs off the end of the mRNA strand
C. no further amino acids are needed by the cell
D. all tRNAs are empty
E. the polypeptide is long enough

60. Which of the following statements correctly describes mRNA processing?

A. Introns are cut out of the primary transcript and spliced together at the end of the transcript
B. Exons are cut out of the primary transcript and transported to the endoplasmic reticulum,
C. **Introns are cut out of the primary transcript, and the resulting exons are spliced together,**
D. Exons are cut out of the primary transcript, and the introns are spliced together
E. Introns are cut out of the primary transcript and transported to the ribosomes

61. The first amino acid inserted into a new polypeptide chain in eukaryotic cells is usually

A. glycine
B. adenosine monophosphate
C. serine
D. alanine
E. methionine

62. The function of tRNA during protein synthesis is to

A. **deliver amino acids to their proper site during protein synthesis**
B. attach mRNA to the small subunit of the ribosome
C. guide ribosome subunits out of the nucleus through nuclear pores
D. process mRNA
E. transcribe mRNA

63. Who formulated the one gene-one enzyme hypothesis?

A. **Beadle and Tatum**
B. Watson and Crick
C. None of the listed responses is Correct.
D. Franklin
E. Hershey and Chase

64. At one point, as a cell carried out its day-to-day activities, the nucleotides GAT were paired with the nucleotides CUA. This pairing occurred

A. **during transcription**
B. when an mRNA codon paired with a tRNA anticodon
C. It is impossible to say, given this information.
D. in a double-stranded DNA molecule
E. during translation

65. What is a key difference in gene expression between eukaryotic and prokaryotic cells?

A. In prokaryotes, proteins are assembled directly from DNA.
B. In eukaryotic cells, transcribed RNA sequences function as termination signals
C. RNA polymerases are involved only in initiation in eukaryotes.
D. **In prokaryotic cells, the mRNA transcript is immediately available as mRNA without processing**
E. Prokaryotes do not contain ribosomes.

66. The P site of a ribosome does which of the following?

A. It holds the tRNA that is carrying the next amino acid to be added to the growing polypeptide chain,
B. **It holds the tRNA carrying the growing polypeptide chain.**
C. It helps "unzip" DNA during transcription,
D. It catalyzes the addition of amino acids to the tRNAs.
E. It recognizes the promoter during transcription initiation.

67. When RNA is being made, the RNA base …….. always pairs with the base …….. in DNA.

A. A...U
B. T...A
C. T...G
D. U...T
E. **U...A**

68. Which of the following summaries of protein synthesis is correct?

A. DNA strands separate in the nucleus to form mRNA. mRNA leaves the nucleus and is transcribed into tRNA on ribosomes.
B. DNA transposons leave the nucleus, are transported to a ribosome, and catalyze the polymerization of amino acids in a protein.
C. **Messenger RNA is made on a DNA template, and then amino-acid-bearing transfer RNAs bind to it through codon-anticodon pairing.**
D. Transfer RNAs line up on a ribosome, and amino acids bind to them with hydrogen bonds
E. DNA exchanges its thymine units with uracil in polymerase. This activates polymerase, and it starts joining amino acids together.

69. What is the proper order of the following events in the expression of a eukaryotic gene?

1. translation

2. RNA processing

3. transcription

4, modification of protein

A. 1, 2, 3, 4
B. **3, 2, 1.4**
C. 1, 2, 4, 3
D. 4, 2, 3, 1
E. 2, 3, 4, 1

70. Which of the following accurately describes the usual process of transcription for eukaryotic genes?

A. **Exons are transcribed, but the RNA transcribed from introns does not leave the nucleus,**
B. Both introns and exons are transcribed, but the RNA transcribed from them does not leave the nucleus.
C. Exons and introns are transcribed, and the RNA transcribed from them leaves the nucleus,
D. Exons are not transcribed.
E. Introns are not transcribed.

71. Nuclei of eukaryotic cells contain spliceosomes that are made up of

A. DNA and protein
B. snRNA and tRNA
C. snRNA
D. **snRNA and protein**
E. snRNA and DNA

72. A point mutation in which a single base pair is inserted or deleted from DNA is called a(n)

A. **frame-shift mutation**
B. translocation mutation
C. missense mutation
D. inversion mutation
E. nonsense mutation

73. How many nucleotides are needed to code for a protein with 450 amino acids?

A. at least 150
B. at least 450
C. **at least 1,350**
D. at least 300
E. at least 900

74. In transcription,

A. the promoter region acts as an initial binding site for RNA polymerase
B. the RNA nucleotides used are produced by the cell
C. None of the listed responses is Correct.
D. only one of the DNA strands is used as the template
E. All of the listed responses are Correct.

75. In eukaryotic cells, transcription cannot begin until

A. the two DNA strands have completely separated and exposed the promoter,
B. the 59 caps are removed from the mRNA.
C. the DNA introns are removed from the template.
D. **several transcription factors have bound to the promoter.**
E. DNA nucleases have isolated the transcription unit.

76. One strand of a DNA molecule has the following sequence: 3' AGTACAAACTATCCACCGTC-5". In order for transcription to occur in that strand, there would have to be a specific recognition sequence, called a(n) ---------- to the left of the DNA sequence indicated.

A. **promoter**
B. centromere on
C. exon
D. AUG codon
E. Intron

77. Which of the following is a post-translational modification of a polypeptide?

A. removal of introns and splicing of exons
B. complementary base pairing of mRNA and tRNA in the ribosome
C. formation of a polysome that allows simultaneous formation of many polypeptides from one mRNA transcript
D. **cleavage of a polypeptide into two or more chains**
E. The growing polypeptide signals the ribosome to attach to the ER.

78. The number of nucleotide bases "read" together on the mRNA to designate each amino acid is ; this unit is called a(n)

A. two ... anticodon
B. **three ... codon**
C. three ... triose
D. two ... dipeptide
E. one ... amino acid

79. Which of the following is not true of a codon?

A. **It extends from one end of a tRNA molecule.**
B. It never codes for more than one amino acid.
C. It is the basic unit of the genetic code,
D. It consists of three nucleotides.
E. It may code for the same amino acid as another codon