

Here are 15 questions from each of the chapters (2 – 9) that the exam will cover.

Chapter 2

- 1) Which of the following best explains the distinction between biology and chemistry?
 - A) Chemical systems have emergent properties; biological systems do not.
 - B) Biology has a hierarchy of structural levels, whereas chemistry does not.
 - C) Biologists study living things, whereas chemists study nonliving things.
 - D) Chemists study molecules, whereas biologists do not.
 - E) There is no clear distinction because the two sciences are parts of the same whole.

- 2) Which four elements make up approximately 96% of living matter?
 - A) carbon, oxygen, sulfur, calcium
 - B) carbon, sulfur, phosphorus, hydrogen
 - C) oxygen, hydrogen, calcium, sodium
 - D) carbon, sodium, chlorine, magnesium
 - E) carbon, hydrogen, nitrogen, oxygen

- 3) Which of the following is a trace element that is essential to humans?
 - A) oxygen B) nitrogen C) carbon D) iodine E) calcium

- 4) Which of the following is a trace element that is essential to humans and other living organisms?
 - A) hydrogen B) nitrogen C) carbon D) oxygen E) iron

- 5) Each element is unique and different from other elements because of its
 - A) atomic weight.
 - B) atomic number.
 - C) mass number.
 - D) Only A and B are correct.
 - E) A, B, and C are correct.

- 6) The mass number of an element can be easily approximated by adding together the number of
 - A) neutrons and electrons.
 - B) protons and neutrons.
 - C) electron orbitals in each energy level.
 - D) protons and electrons.
 - E) isotopes of the atom.

- 7) Oxygen has an atomic number of 8. Therefore, it must have
 - A) 8 protons.
 - B) 8 electrons.
 - C) 16 neutrons.
 - D) Only A and B are correct.
 - E) A, B, and C are correct.

- 8) The atomic number of neon is 10. Therefore, it
 - A) has 8 electrons in the outer electron shell.
 - B) is inert.
 - C) has an atomic mass of 10.

- D) Only A and B are correct.
- E) A, B, and C are correct.

9) From its atomic number of 15, it is possible to predict that the phosphorus atom has

- A) 15 neutrons.
- B) 15 protons.
- C) 15 electrons.
- D) Only B and C are correct.
- E) A, B, and C are correct.

10) How does one refer to an atomic form of an element containing the same number of protons but a different number of neutrons?

- A) isomer B) isotope C) ion D) polar atom E) radioactive

11) How do isotopes differ from each other?

- A) ability to form ions
- B) number of protons
- C) valence electron distribution
- D) number of electrons
- E) number of neutrons

12) Which of the following best describes the relationship between the atoms described below?

Atom 1 Atom 2

1 is over 1Eta 3 is over 1Eta

- A) They are isomers.
- B) They are isotopes.
- C) They are polymers.
- D) They are ions.
- E) They are both radioactive.

13) Which of the following best describes the relationship between the atoms described below?

Atom 1 Atom 2

31 is over 15P 32 is over 15P

- A) They are both phosphorous anions.
- B) They are both radioactive.
- C) They are both isotopes of phosphorous.
- D) They contain 31 and 32 protons respectively.
- E) They are both phosphorous cations.

14) One difference between carbon-12 (12 is over 6C) and carbon-14 (14 is over 6C) is that carbon-14 has

- A) 2 more protons than carbon-12.
- B) 2 more electrons than carbon-12.
- C) 2 more neutrons than carbon-12.
- D) Only A and C are correct.
- E) A, B, and C are correct.

15) ^3H is a radioactive isotope of hydrogen. One difference between hydrogen-1

(^1H) and hydrogen-3 (^3H) is that hydrogen-3 has

- A) two more protons than hydrogen-1.
- B) two more neutrons than hydrogen-1.
- C) one more proton and one more electron than hydrogen-1.

- D) one more electron and one more neutron than hydrogen-1.
- E) one more neutron and one more proton than hydrogen-1.

Chapter 3

- 1) In a single molecule of water, the two hydrogen atoms are bonded to a single oxygen atom by
- A) ionic bonds.
 - B) hydrogen bonds.
 - C) nonpolar covalent bonds.
 - D) polar covalent bonds.
 - E) van der Waals interactions.

- 2) The partial negative charge at one end of a water molecule is attracted to the partial positive charge of another water molecule. What is this attraction called?
- A) a hydrophobic bond
 - B) a hydrogen bond
 - C) an ionic bond
 - D) a hydrophilic bond
 - E) a covalent bond

- 3) Which of the following is an example of a hydrogen bond?
- A) the bond between Mg and Cl in $MgCl_2$
 - B) the bond between Na and Cl in salt
 - C) the bond between two hydrogen atoms
 - D) the bond between the H of one water molecule and the O of another water molecule
 - E) the bond between C and H in methane

- 4) Water is able to form hydrogen bonds because
- A) oxygen has a valence of 2.
 - B) the water molecule is polar.
 - C) the hydrogen atoms in a water molecule are weakly negative in charge.
 - D) the water molecule is shaped like a tetrahedron.
 - E) the oxygen atom in a water molecule has a strong positive charge.

- 5) What is the maximum number of hydrogen bonds a water molecule can form with neighboring water molecules?
- A) four B) five C) one D) two E) three

- 6) What determines the cohesiveness of water molecules?
- A) hydrophobic interactions
 - B) hydrogen bonds
 - C) covalent bonds
 - D) ionic bonds
 - E) high specific heat

- 7) What do cohesion, surface tension, and adhesion have in common with reference to water?
- A) All are produced by covalent bonding.
 - B) All are properties related to hydrogen bonding.

- C) All have to do with nonpolar covalent bonds.
- D) All increase when temperature increases.
- E) Both A and C are correct.

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

- A) hydrogen bonding
- B) adhesion
- C) cohesion
- D) two of the above
- E) all of the above

9) Which of the following is possible due to the surface tension of water?

- A) The pH remains neutral.
- B) A waterstrider can walk across a small pond.
- C) Lakes don't freeze solid in the winter, despite low temperatures.
- D) Organisms resist temperature changes although they give off heat due to chemical reactions.
- E) Water can act as a solvent.

10) When an ice cube cools a drink 1degreeC, which of the following is true?

- A) Kinetic energy in the drink decreases.
- B) A kilocalorie of heat is transferred to the water.
- C) Evaporation of the water increases.
- D) A kilocalorie of heat is transferred to the ice.
- E) Molecule collisions in the drink increase.

11) Which of the following is a correct definition of a kilocalorie?

- A) The amount of heat energy required to raise 1 g of water by 1degreeF.
- B) A measure of the average kinetic energy of 1 L of water.
- C) The amount of heat energy required to raise 1 kg of water by 1degreeC.
- D) The amount of heat energy required to raise 1 g of water by 1degreeC.
- E) The amount of energy in 1 kg of glucose.

12) The nutritional information on a cereal box shows that one serving of dry cereal has 90 calories (actually kilocalories). If one were to burn a serving of cereal, the amount of heat given off would be sufficient to raise the temperature of 1 kg of water how many degrees Celsius?

- A) 9.0degreeC B) 9000.0degreeC C) 900.0degreeC D) 90.0degreeC E) 0.9degreeC

13) Water's high specific heat is mainly a consequence of the

- A) small size of the water molecules.
- B) absorption and release of heat when hydrogen bonds break and form.
- C) inability of water to dissipate heat into dry air.
- D) high specific heat of oxygen and hydrogen atoms.
- E) fact that water is a poor heat conductor.

14) Which bonds must be broken for water to vaporize?

- A) hydrogen bonds
- B) ionic bonds
- C) nonpolar covalent bonds
- D) polar covalent bonds
- E) Both C and D are correct.

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

- A) ice melts each autumn afternoon.
- 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) there is less evaporative cooling of lakes.

Chapter 4

1) Which type of molecule would be most abundant in a typical prokaryotic or eukaryotic cell?

- A) hydrocarbon B) carbohydrate C) lipid D) protein E) water

2) Organic chemistry is a science based on the study of

- A) vital forces interacting with matter.
- B) the properties of oxygen.
- C) water and its interaction with other kinds of molecules.
- D) carbon compounds.
- E) functional groups.

3) Early 19th-century scientists believed that living organisms differed from nonliving things as a result of possessing a "life force" that could create organic molecules from inorganic matter. The term given to this belief is

- A) organic evolution.
- B) materialism.
- C) inorganic synthesis.
- D) vitalism.
- E) mechanism.

4) The concept of vitalism is based on a belief in a life force outside the jurisdiction of physical and chemical laws. According to this belief, organic compounds can arise only within living organisms. Which of the following did the most to refute the concept of vitalism?

- A) Berzelius's definition of organic molecules
- B) Rodriguez's studies of phytochemicals
- C) Wohler's synthesis of urea
- D) Kolbe's synthesis of acetic acid
- E) Miller's experiments with ancient atmospheres

5) The experimental approach taken in current biological investigation presumes that

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

6) Which property of the carbon atom gives it compatibility with a greater number of different elements than any other type of atom?

- A) Carbon has a valence of 4.
- B) Carbon forms ionic bonds.
- C) Carbon has six to eight neutrons.
- D) Only A and C are correct.
- E) A, B, and C are correct.

7) How many electron pairs does carbon share in order to complete its valence shell?

- A) 1 B) 3 C) 2 D) 4 E) 5

8) What type of bonds does carbon have a tendency to form?

- A) A, B, and C are correct.
- B) covalent
- C) hydrogen
- D) Only A and B are correct.
- E) ionic

9) The carbon present in all organic molecules

- A) is processed into sugars through photosynthesis.
- B) is incorporated into organic molecules by plants.
- C) is derived from carbon dioxide.
- D) two of the above.
- E) all of the above.

10) What is the reason why hydrocarbons are not soluble in water?

- A) They are hydrophilic.
- B) The C-H bond is nonpolar.
- C) They are lighter than water.
- D) The C-H bond is polar.
- E) They are large molecules.

11) Recent research suggests that side effects from Ritalin, the drug used to treat attention deficit disorder, may be caused by contamination of enantiomers, or molecules that

- A) are mirror images of one another.
- B) differ in the location of their double bonds.
- C) have identical three-dimensional shapes.
- D) lack an asymmetric carbon.
- E) differ in their electrical charge.

12) A compound contains hydroxyl groups as its predominant functional group. Which of the following statements is true concerning this compound?

- A) It should dissolve in water.
- B) It is probably a lipid.
- C) It is hydrophobic.
- D) It won't form hydrogen bonds with water.
- E) It should dissolve in a nonpolar solvent. 1

13) Which is the best description of a carbonyl group?

- A) a sulfur and a hydrogen bonded to a carbon atom
- B) a nitrogen and a hydrogen bonded to a carbon atom

- C) an oxygen double-bonded to a carbon and a hydroxyl group
- D) a carbon and hydrogen atom
- E) a carbon atom joined to an oxygen atom by a double bond

14) Which of the following contains nitrogen in addition to carbon, oxygen, and hydrogen?

- A) an amino acid such as glycine
- B) an alcohol such as ethanol
- C) a monosaccharide such as starch
- D) a steroid such as testosterone
- E) a hydrocarbon such as benzene

15) Which of the following is true of geometric isomers?

- A) They have variations in arrangement around a double bond.
- B) They have an asymmetric carbon that makes them mirror images.
- C) They have different molecular formulas.
- D) Their atoms and bonds are arranged in different sequences.
- E) They have the same chemical properties.

Chapter 5

1) A molecule inside a cell consists of over 3,500 covalently linked atoms weighing about 105,000 daltons. From this description, the molecule can most specifically be described as a

- A) macromolecule.
- B) polysaccharide.
- C) lipid.
- D) polypeptide.
- E) protein.

2) Polymers of polysaccharides, fats, and proteins are all synthesized from monomers by

- A) connecting monosaccharides together.
- B) the formation of disulfide bridges between monomers.
- C) ionic bonding of the monomers.
- D) the addition of water to each monomer.
- E) the removal of water (dehydration reactions).

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

- A) Dehydration reactions occur in plants, and hydrolysis happens in animals.
- B) Hydrolysis occurs during the day, and dehydration reactions happen at night.
- C) Hydrolysis creates monomers, and dehydration reactions destroy them.
- D) Dehydration reactions assemble polymers, and hydrolysis breaks them down.
- E) Dehydration reactions can occur only after hydrolysis.

4) Carbohydrates normally function in animals as

- A) energy-storage molecules.
- B) the functional units of lipids.
- C) sites of protein synthesis.
- D) enzymes in the regulation of metabolic processes.
- E) a component of triglycerides.

- 5) The 20 different amino acids found in polypeptides exhibit different chemical and physical properties because of different
- A) amino groups.
 - B) side chains (R groups).
 - C) tertiary structure.
 - D) carboxyl groups.
 - E) Both A and B are correct.
- 6) The bonding of two amino acid molecules to form a larger molecule requires the
- A) addition of a nitrogen atom.
 - B) release of a water molecule.
 - C) addition of a water molecule.
 - D) release of a carbon dioxide molecule.
 - E) Both C and D are correct.
- 7) Which bonds are created during the formation of the primary structure of a protein?
- A) peptide bonds
 - B) hydrogen bonds
 - C) disulfide bonds
 - D) Only A and C are correct.
 - E) A, B, and C are correct.
- 8) How many different kinds of polypeptides, each composed of 5 amino acids, could be synthesized using the 20 common amino acids?
- A) 5 B) 20 to power of (10) C) 5 to power of (5) D) 20 to power of (5) E) 20
- 9) Consider a polysaccharide consisting of 828 glucose molecules. The total hydrolysis of the polysaccharide would result in the production of
- A) 828 glucose molecules and 828 water molecules.
 - B) 827 glucose molecules.
 - C) 828 glucose molecules and no water molecules.
 - D) 827 water molecules.
 - E) 827 glucose molecules and 827 water molecules.
- 10) Which of the following are polysaccharides?
- A) glycogen and starch
 - B) glucose and sucrose
 - C) uracil and thymine
 - D) RNA and DNA
 - E) cholesterol and triacylglycerol
- 11) Which of the following is true of both starch and cellulose?
- A) They can both be digested by humans.
 - B) They are both structural components of the plant cell wall.
 - C) They are geometric isomers of each other.
 - D) They are both polymers of glucose.
 - E) They are both used for energy storage in plants.
- 12) What is a fat or triacylglycerol?
- A) a lipid made of three fatty acids and glycerol
 - B) a molecule formed from three alcohols

- C) a carbohydrate with three sugars
- D) a protein with tertiary structure
- E) a kind of lipid that makes up much of the plasma membrane

13) Which of the following is true concerning saturated fatty acids?

- A) They are the predominant fatty acid in corn oil.
- B) They have double bonds between the carbon atoms of the fatty acids.
- C) They are usually liquid at room temperature.
- D) They are usually produced by plants.
- E) They have a higher ratio of hydrogen to carbon than do unsaturated fatty acids.

14) The hydrogenation of vegetable oil would result in

- A) an increase in the number of hydrogen atoms in the oil molecule.
- B) a decrease in the number of carbon-carbon double bonds in the oil molecules.
- C) the oil being a solid at room temperature.
- D) two of the above.
- E) all of the above.

15) Which type of lipid is most important in biological membranes?

- A) fat B) oil C) wax D) triglyceride E) phospholipid

Chapter 6

) Metabolism is best described as

- A) control of enzyme activity.
- B) synthesis of macromolecules.
- C) breakdown of macromolecules.
- D) A and B.
- E) A, B, and C.

2) Which term most precisely describes the general process of breaking down large molecules into smaller ones?

- A) catabolism B) catalysis C) anabolism D) dehydration E) metabolism

3) Which of the following is true regarding catabolic pathways?

- A) They consume energy to build up polymers from monomers.
- B) They do not depend on enzymes.
- C) They release energy as they degrade polymers to monomers.
- D) They lead to the synthesis of catabolic compounds.
- E) Both A and B are correct.

4) Anabolic pathways

- A) release energy as they degrade polymers to monomers.
- B) do not depend on enzymes.
- C) depend on enzymes.
- D) consume energy to build up polymers from monomers.
- E) Both B and C are correct.

5) The transfer of free energy from catabolic pathways to anabolic pathways is best called

- A) entropy.
- B) cooperativity.

- C) bioenergetics.
- D) feedback regulation.
- E) energy coupling.

6) Which of the following is part of the first law of thermodynamics?

- A) Energy cannot be created or destroyed.
- B) The entropy of the universe is decreasing.
- C) The entropy of the universe is constant.
- D) Energy cannot be transferred or transformed.
- E) Kinetic energy is stored energy that results from the specific arrangement of matter.

7) Of the following, the structure of ATP is most closely related to

- A) an amino acid with three phosphate groups attached.
- B) an anabolic steroid.
- C) a double helix.
- D) RNA nucleotides.
- E) a phospholipid.

8) According to the first law of thermodynamics,

- A) systems rich in energy are intrinsically unstable.
- B) energy is neither created nor destroyed.
- C) matter can be neither created nor destroyed.
- D) all processes increase the entropy of the universe.
- E) the universe loses energy because of friction.

9) Whenever energy is transformed, there is always an increase in the

- A) enthalpy of the universe.
- B) free energy of the system.
- C) entropy of the universe.
- D) free energy of the universe.
- E) entropy of the system.

10) According to the second law of thermodynamics,

- A) energy can be transferred or transformed, but it can be neither created nor destroyed.
- B) the entropy of the universe is constantly increasing.
- C) every energy transfer requires activation energy from the environment.
- D) for every action there is an equal and opposite reaction.
- E) the total amount of energy in the universe is conserved or constant.

11) All of the following statements are representative of the second law of thermodynamics except

- A) systems tend to rearrange themselves toward greater entropy.
- B) energy transfers are always accompanied by some loss.
- C) highly organized systems require energy for their maintenance.
- D) every time energy changes form, there is a decrease in entropy.
- E) heat energy represents lost energy to most systems.

12) Which of the following is the most randomized form of energy?

- A) chemical potential energy
- B) mechanical energy
- C) electrical energy

- D) thermal (heat) energy
- E) light energy

13) Which of the following would decrease the entropy within a system?

- A) digestion
- B) dehydration reactions
- C) hydrolysis
- D) respiration
- E) catabolism

14) According to the second law of thermodynamics, all of the following statements are true except that

- A) every chemical transformed represents a loss of free energy.
- B) the Earth is an open system.
- C) the synthesis of large molecules from small molecules is exergonic.
- D) entropy increases in a closed system.
- E) life exists at the expense of greater energy than it contains.

15) Evolution of biological order

- A) was based on organisms as closed systems.
- B) violates both the first and second law of thermodynamics.
- C) can be seen in individual organisms but not in the ancestry of plant and animal kingdoms.
- D) is consistent with the second law of thermodynamics.
- E) Both C and D are correct.

Chapter 7

1) What limits the resolving power of a light microscope?

- A) the type of lens used to magnify the object under study
- B) the shortest wavelength of light used to illuminate the specimen
- C) the ratio of an object's image to its real size
- D) the type of lens that focuses a beam of electrons through the specimen
- E) the type of heavy metal or dye that is used to stain the specimen

2) When biologists wish to study the internal ultrastructure of cells, they most likely would use

- A) a transmission electronic microscope.
- B) a light microscope.
- C) a scanning electron microscope.
- D) both A and C.
- E) A, B, and C.

3) A primary objective of cell fractionation is

- A) to view the structure of cell membranes.
- B) to crack the cell wall so the cytoplasmic contents can be released.
- C) to determine the size of various organelles.
- D) to separate the major organelles so their particular functions can be determined.
- E) to identify the enzymes outside the organelles.

4) Which of the following is not a part of the endomembrane system?

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

5) Which type of organelle is primarily involved in the synthesis of oils, phospholipids, and steroids?

- A) lysosomes
- B) mitochondria
- C) contractile vacuoles
- D) ribosomes
- E) smooth endoplasmic reticulum

6) Which structure is the site of the synthesis of proteins that may be exported from the cell?

- A) rough ER
- B) lysosomes
- C) Golgi vesicles
- D) tight junctions
- E) plasmodesmata

7) To which structure would you assign the function of secretion activities leading, for example, to the formation of a new cell wall in plants?

- A) plasmodesmata
- B) tight junctions
- C) lysosomes
- D) Golgi vesicles
- E) smooth ER

8) Of the following, which is probably the most common route for membrane flow in the endomembrane system?

- A) tonoplast → plasma membrane → nuclear envelope → smooth ER
- B) Golgi → lysosome → ER → plasma membrane
- C) nuclear envelope → lysosome → Golgi → plasma membrane
- D) rough ER → vesicles → Golgi → plasma membrane
- E) ER → chloroplasts → mitochondrion → cell membrane

9) Which of the following are prokaryotic cells?

- A) bacteria
 - B) animals
 - C) fungi
 - D) plants
 - E) both B and C
- 10) Which of the following is not found in a prokaryotic cell?
- A) ribosomes
 - B) cell wall
 - C) DNA
 - D) endoplasmic reticulum
 - E) plasma membrane

10) Which of the following pairs is mismatched?

- A) nucleolus → horizontal → DNA replication
- B) nucleolus → horizontal → ribosomal RNA
- C) cytoskeleton → horizontal → microtubules

- D) cell membranehorizontal lipid bilayer
- E) lysosomehorizontalprotein synthesis

For the following questions, use the lettered answers to match the structure to its proper cell type. Choose the most inclusive category. Each answer may be used once, more than once, or not at all.

- A. a feature of all cells
- B. found in prokaryotic cells only
- C. found in eukaryotic cells only
- D. found in plant cells only
- E. found in animal cells only

11) plasma membrane

12) tonoplast

13) nucleoid

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

14) Large numbers of ribosomes are present in cells that specialize in producing which of the following molecules?

- A) starches B) steroids C) proteins D) lipids E) glucose

15) Which of the following does not contain functional ribosomes?

- A) a chloroplast
- B) an animal mitochondrion
- C) a plant mitochondrion
- D) a nucleolus
- E) a prokaryotic cell

Chapter 8

6) Which of the following types of molecules are the major structural components of the cell membrane?

- A) proteins and cellulose
- B) phospholipids and cellulose
- C) phospholipids and proteins
- D) glycoproteins and cholesterol
- E) nucleic acids and proteins

7) What are the elevated regions (particles) seen in electron micrographs of split freeze-fractured membranes?

- A) integral proteins
- B) phospholipids
- C) cholesterol molecules

- D) peripheral proteins
- E) carbohydrates

8) All of the following are functions of integral membrane proteins except

- A) enzyme synthesis.
- B) active transport.
- C) cell adhesion.
- D) cytoskeleton attachment.
- E) hormone reception.

9) All of the following statements about membrane structure and function are true except:

- A) Both sides of a membrane are identical in structure and function.
- B) Special membrane proteins can cotransport two solutes by coupling diffusion with active transport.
- C) Diffusion, osmosis, and facilitated diffusion do not require any energy input from the cell.
- D) Voltage across the membrane depends on an unequal distribution of ions across the plasma membrane.
- E) Diffusion of gases is faster in air than across membranes.

10) Integral proteins

- A) are loosely bound to the bilayer.
- B) lack tertiary structure.
- C) are usually transmembrane proteins.
- D) are not mobile within the bilayer.
- E) have no known functions in membranes.

11) All of the following are functions of membrane proteins except

- A) protein synthesis.
- B) cell-cell recognition.
- C) transport.
- D) intercellular joining.
- E) signal transduction.

12) All of the following molecules are part of the cell membrane except

- A) phosphate group.
- B) protein.
- C) nucleic acids.
- D) lipid.
- E) steroid.

13) The presence of cholesterol in the plasma membranes of some animals

- A) enables the animal to remove hydrogen atoms from saturated phospholipids.
- B) makes the animal more susceptible to circulatory disorders.
- C) makes the membrane less flexible, so it can sustain greater pressure from within the cell.
- D) enables the membrane to stay fluid more easily when cell temperature drops.
- E) enables the animal to add hydrogen atoms to unsaturated phospholipids.

14) According to the fluid mosaic model of cell membranes, which of the following is a true statement about membrane phospholipids?

- A) They have hydrophilic tails in the interior of the membrane.
- B) They can move laterally along the plane of the membrane.
- C) They frequently flip-flop from one side of the membrane to the other.

- D) They are free to depart from the membrane and dissolve in the surrounding solution.
- E) They occur in an uninterrupted bilayer, with membrane proteins restricted to the surface of the membrane.

15) What is one of the ways that the membranes of winter wheat are able to remain fluid when it is extremely cold?

- A) by increasing the percentage of cholesterol molecules in the membrane
- B) by increasing the percentage of unsaturated phospholipids in the membrane
- C) by decreasing the number of hydrophobic proteins in the membrane
- D) A and B
- E) A, B, and C

Chapter 9

1) Which of the following statements concerning the breakdown of glucose to CO₂ and water is (are) true?

- A) The breakdown of glucose is exergonic.
- B) Adding electrons to another substance is known as reduction.
- C) An electron acceptor is called the reducing agent.
- D) A and B only are correct.
- E) A, B, and C are correct.

2) The oxygen consumed during cellular respiration is directly involved in

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

3) All of the following statements about NAD⁺ are true except:

- A) NAD⁺ has more chemical energy than NADH.
- B) NAD⁺ is reduced by the action of dehydrogenases.
- C) NAD⁺ is reduced to NADH during both glycolysis and the Krebs cycle.
- D) In the absence of NAD⁺, glycolysis cannot function.
- E) NAD⁺ can receive electrons for use in oxidative phosphorylation.

4) Glycolysis is believed to be one of the most ancient of metabolic processes. Which statement below least supports this idea?

- A) Glycolysis neither uses nor needs O₂.
- B) Bacteria, the most primitive of cells, make extensive use of glycolysis.
- C) Glycolysis is found in all eukaryotic cells.
- D) If run in reverse, glycolysis will build glucose molecules.
- E) The enzymes of glycolysis are found in the cytosol rather than in a membrane-enclosed organelle.

5) Which kind of metabolic poison would most directly interfere with glycolysis?

- A) an agent that reacts with oxygen and depletes its concentration in the cell
- B) an agent that binds to pyruvate and inactivates it
- C) an agent that inhibits the formation of acetyl coenzyme A
- D) an agent that reacts with NADH and oxidizes it to NAD⁺
- E) an agent that closely mimics the structure of glucose but is not metabolized

- 6) Which process in eukaryotic cells will normally proceed whether O₂ is present or absent?
- A) the Krebs cycle
 - B) oxidative phosphorylation
 - C) glycolysis
 - D) fermentation
 - E) electron transport
- 7) All of the following statements about glycolysis are true except:
- A) Glycolysis makes ATP exclusively through substrate-level phosphorylation.
 - B) The enzymes of glycolysis are located in the cytosol of the cell.
 - C) Glycolysis has steps involving oxidation-reduction reactions.
 - D) Glycolysis can operate in the complete absence of O₂.
 - E) The end products of glycolysis are CO₂ and H₂O.
- 8) All of the following substances are produced in a muscle cell under anaerobic conditions except
- A) pyruvate. B) ATP. C) lactate. D) NADH. E) acetyl CoA.
- 9) In addition to ATP, what are the end products of glycolysis?
- A) CO₂ and ethyl alcohol
 - B) CO₂ and H₂O
 - C) NADH and pyruvate
 - D) H₂O and ethyl alcohol
 - E) CO₂ and NADH
- 10) All of the following are products or intermediaries in glycolysis except
- A) FADH₂.
 - B) ATP.
 - C) phosphoenolpyruvate.
 - D) NADH.
 - E) pyruvate.
- 11) All of the following are functions of the Krebs cycle except
- A) production of NADH.
 - B) production of FADH₂.
 - C) adding electrons and protons to oxygen to form water.
 - D) production of ATP.
 - E) release of carbon dioxide.
- 12) The Krebs cycle produces which of the following molecules that then transfer energy to the electron transport system?
- A) NADH and ATP
 - B) ATP and CO₂
 - C) NADH, FADH₂, and ATP
 - D) CO₂ and FAD
 - E) FADH₂ and NADH
- 13) Which of the following intermediary metabolites enters the Krebs cycle and is formed, in part, by the removal of CO₂ from a molecule of pyruvate?
- A) glyceraldehyde phosphate
 - B) citric acid
 - C) acetyl CoA

- D) oxaloacetic acid
- E) lactate

14) A young relative of yours has never had much energy. He goes to a doctor for help and is sent to the hospital for some tests. There they discover his mitochondria can use only fatty acids and amino acids for respiration, and his cells produce more lactate than normal. Of the following, which is the best explanation of his condition?

- A) His cells cannot move NADH from glycolysis into the mitochondria.
- B) His cells contain something that inhibits oxygen use in his mitochondria.
- C) His mitochondria lack the transport protein that moves pyruvate across the outer mitochondrial membrane.
- D) His cells lack the enzyme in glycolysis that forms pyruvate.
- E) His cells have a defective electron transport chain, so glucose goes to lactate instead of to acetyl CoA.

15) Each time a molecule of glucose is completely oxidized via aerobic respiration, how many oxygen (O₂) molecules are required?

- A) 12 B) 1 C) 2 D) 6 E) 38