***Becker's The World of the Cell, 9e* (Hardin/Bertoni/Kleinsmith)**
Chapter 2 The Chemistry of the Cell

2.1 Multiple-Choice Questions

1) What atom forms the backbone of almost all biological molecules?
A) hydrogen
B) nitrogen
C) carbon
D) sulfur
E) phosphorus
Answer: C
Chapter Section: 2.1
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

2) Ribose has five carbon atoms, of which three are asymmetric. What is the maximum number of stereoisomers that may exist for ribose?
A) 2
B) 4
C) 6
D) 8
E) 10
Answer: D
Chapter Section: 2.1
Bloom's Taxonomy: Application
Learning Outcome: 2.1
Global LO: G2, G7

3) Which of the following is *not* a fundamental property of carbon?
A) Carbon-containing molecules are diverse.
B) Carbon-containing molecules may form stereoisomers.
C) Carbon-containing molecules are stable.
D) Carbon has a valence of 4.
E) Carbon atoms are most likely to form ionic bonds with one another.
Answer: E
Chapter Section: 2.1
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.1
Global LO: G7

4) Which of the following is *true* of an asymmetric carbon atom?
A) Only amino acids have asymmetric carbon atoms.
B) A carbon with hydrogens attached at two locations is usually asymmetric.
C) A carbon with hydrogens attached at three locations is usually asymmetric.
D) Asymmetric carbon atoms create stereoisomers.
E) Molecules may have only one asymmetric carbon atom.
Answer: D
Chapter Section: 2.1
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.1
Global LO: G2, G7

5) Carbon can form _____ covalent bonds.
A) single
B) double
C) triple
D) single and double
E) single, double, and triple
Answer: E
Chapter Section: 2.1
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.1
Global LO: G2, G7

6) Which of the following is a unit of energy?
A) calorie
B) bond
C) watt
D) mole
E) both A and B
Answer: A
Chapter Section: 2.1
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

7) Biologically, which of the following is the *least* important characteristic of water?
A) Water molecules are polar.
B) Water molecules form numerous hydrogen bonds.
C) Water is a good solvent.
D) Water typically contains isotopes of hydrogen.
E) Water has a temperature-stabilizing capacity.
Answer: D
Chapter Section: 2.2
Bloom's Taxonomy: Synthesis
Learning Outcome: 2.1
Global LO: G7

8) While fishing, you make the following observations:

a. Water spiders appear to be able walk on the surface of the water.
b. Flat rocks may be made to skip across the water.
Which of the following properties of water can explain these observations?
A) Water is an excellent solvent.
B) Water molecules are heavy.
C) Water molecules are cohesive.
D) Water molecules are polar.
E) Both B and C
Answer: C
Chapter Section: 2.2
Bloom's Taxonomy: Application
Learning Outcome: 2.1
Global LO: G7

9) The moon lacks life and varies dramatically in temperature. If we could keep a layer of water spread on the surface of the moon, what effect would it have?
A) Physical conditions would remain the same.
B) Because water has a high heat of vaporization, the temperatures would rise to the upper extremes.
C) The temperatures would drop to the lower extremes.
D) Water would absorb and hold heat and moderate the temperature extremes.
E) Life would be possible, but it would have to withstand these extremes in temperature.
Answer: D
Chapter Section: 2.2
Bloom's Taxonomy: Application
Learning Outcome: 2.1
Global LO: G7

10) Why do ionic substances such as NaCl dissolve so readily in water?
A) NaCl is a very dry powder, and the water is able to soak into the salt.
B) The sodium ions repel the negative end of the water molecule.
C) Water molecules form spheres of hydration around the sodium and chloride ions.
D) The charged ends of the water molecules are able to surround the oppositely charged salt ion.
E) Both C and D
Answer: E
Chapter Section: 2.2
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.1
Global LO: G7

11) In the lab, you choose to design a simple experiment to distinguish between hydrophilic and hydrophobic substances. You start by adding equal amounts of vinegar and oil to a container. After shaking, the vinegar and oil levels separate, based upon polarity and density. To this you add glucose and sodium citrate and shake again. Where do you expect to find the glucose and sodium citrate in greatest quantities?
A) Both will concentrate in the oil layer.
B) The glucose will concentrate in the vinegar, sodium citrate in the oil.
C) Both will concentrate in the vinegar layer.
D) Sodium citrate will concentrate in the vinegar, glucose in the oil.
E) Both will be uniform throughout both layers.
Answer: C
Chapter Section: 2.3
Bloom's Taxonomy: Synthesis
Learning Outcome: 2.1
Global LO: G7

12) Which of the following is *false* regarding water's specific heat?
A) The specific heat of water is 1.0 calorie per gram.
B) Heat applied to water must initially break a number of hydrogen bonds.
C) Water's high specific heat has a temperature-buffering effect.
D) Water gains and loses heat more slowly than most other liquids do.
E) The specific heat of water is similar to that of most liquids.
Answer: E
Chapter Section: 2.2
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.1
Global LO: G7

13) Why is a selectively permeable membrane so important to living things?
A) It allows cells to attach to adjacent tissues.
B) It provides a good barrier between the inside and outside of the cell.
C) Proteins will avoid a selectively permeable membrane.
D) The membrane may absorb several times its weight in cholesterol.
E) All of the above.
Answer: B
Chapter Section: 2.3
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.1
Global LO: G7

14) The term *amphipathic* refers to those molecules that are
A) hydrophilic.
B) hydrophobic.
C) charged at both ends but with opposite charges.
D) nonpolar at both ends.
E) charged at one end and nonpolar at the other.
Answer: E
Chapter Section: 2.3
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

15) Which of the following molecules is most likely to cross the cell membrane directly by passive diffusion?
A) Na^+
B) fructose (a sugar)
C) a steroid hormone (a hydrocarbon)
D) insulin (a polypeptide)
E) fructose and insulin
Answer: C
Chapter Section: 2.3
Bloom's Taxonomy: Analysis
Learning Outcome: 2.1
Global LO: G7

16) How do large polar and charged molecules cross biological membranes?
A) Large polar and charged molecules can't cross biological membranes.
B) Large polar and charged molecules cross biological membranes via diffusion through the hydrophilic core of the membrane.
C) Large polar and charged molecules must be hydrolyzed before they can cross a biological membrane.
D) Large polar and charged molecules cross biological membranes via transport proteins that form hydrophilic channels through the membrane.
E) Both A and C
Answer: D
Chapter Section: 2.3
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.1
Global LO: G7

17) The cell membrane can be described most accurately as
A) permeable to all small molecules and ions.
B) impermeable to larger molecules independent of their chemical characteristics.
C) permeable to some molecules and impermeable to others.
D) impermeable to all polar molecules.
E) permeable to all molecules except water.
Answer: C
Chapter Section: 2.3
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.1
Global LO: G7

18) Detergents are best able to dissolve oil from fabric or dishes during washing because
A) the positively charged end is associated with water molecules, while the negatively charged end interacts with the oil droplet.
B) the negatively charged end is associated with water molecules, while the positively charged end interacts with the oil droplet.
C) the nonpolar end is associated with water molecules, while the charged end interacts with the oil droplet.
D) the charged end is associated with water molecules, while the nonpolar end interacts with the oil droplet.
E) detergents are nonpolar, they increase the size of the oil droplet, allowing the water to be more effective at removing the oil.
Answer: D
Chapter Section: 2.3
Bloom's Taxonomy: Application
Learning Outcome: 2.1
Global LO: G7

19) While synthesizing a new blue pigment, a chemist notices that the new compound accumulates between an aqueous (water) environment and a hydrophobic environment. When added to a mixture of oil and water, the pigment creates a blue ring around the droplets of oil. Which of the following statements best describes this new pigment?
A) The pigment is a polar molecule and is forming hydrogen bonds with both the water and oil molecules.
B) The pigment is hydrophilic and will not form hydrophobic bonds with the oil.
C) The pigment is amphipathic, having polar and nonpolar regions.
D) The pigment is neither polar nor nonpolar; it is apolar.
E) The pigment is probably hydrophobic and is attempting to bond with the oil.
Answer: C
Chapter Section: 2.3
Bloom's Taxonomy: Analysis
Learning Outcome: 2.1
Global LO: G7

20) Which of the following statements concerning hydrocarbons is *false*?
A) Octane is a hydrocarbon.
B) Hydrocarbons are insoluble in water.
C) Hydrocarbons are the most abundant organic molecules in cells.
D) Only hydrogen atoms are used to complete the valence requirements of carbon in hydrocarbons.
E) Phospholipids have hydrocarbon tails.
Answer: C
Chapter Section: 2.3
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.1
Global LO: G7

21) Which of the following is important in protein folding after the formation of a polypeptide?
A) hydrogen bonding
B) ionic bonding
C) van der Waals interactions
D) hydrophobic interactions
E) hydrogen bonding, ionic bonding, van de Waals interactions, and hydrophobic interactions.
Answer: E
Chapter Section: 2.4
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.2
Global LO: G7

22) Which one of the following biological polymers is mismatched with its monomer?
A) DNA - nucleotide
B) enzyme - amino acid
C) chitin - monosaccharide
D) protein - amino acid
E) cellulose - amino acid
Answer: E
Chapter Section: 2.4
Bloom's Taxonomy: Analysis
Learning Outcome: 2.2
Global LO: G7

23) Which of the following is *not* an activated monomer?
A) adenosine triphosphate
B) glucose-6-phosphate
C) aminoacyl tRNA
D) amino acid
E) uracil triphosphate
Answer: D
Chapter Section: 2.4
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.2
Global LO: G7

24) Which of the following statements about the polymerization of macromolecules is *false?*
A) Often the energy needed for polymerization is supplied by ATP.
B) The polymer chain usually has two different ends.
C) Water is added to join the monomers of the macromolecules.
D) A monomer is usually activated by the coupling of the monomer to a carrier.
E) Macromolecules are synthesized by the stepwise addition of monomers.
Answer: C
Chapter Section: 2.4
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.2
Global LO: G7

25) Which of the following is a structural polysaccharide?
A) glycogen
B) fructose
C) cellulose
D) starch
E) All of the above are structural polysaccharides.
Answer: C
Chapter Section: 2.4
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.2
Global LO: G7

26) What inorganic precursors are needed to synthesize proteins?
A) carbon, water, and oxygen
B) carbon, water, oxygen, and phosphate
C) carbon, water, oxygen, nitrogen, and phosphate
D) carbon, water, oxygen, nitrogen, and sulfur
E) carbon, water, oxygen, sodium, and phosphate
Answer: D
Chapter Section: 2.4
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.2
Global LO: G7

27) Which of the following macromolecules is insoluble in water?

A) lipids
B) sugars
C) amino acids
D) disaccharides
E) nucleic acids
Answer: A
Chapter Section: 2.3
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.1
Global LO: G7

28) The hierarchical nature of cellular structure is accurately illustrated in which of the following lists of substances (from smallest to largest)?
A) nucleotides, chromosome, DNA, nucleus, cell
B) cellulose, glucose, cell wall, cell
C) nucleotides, nucleus, DNA, chromosome, cell
D) nucleotides, DNA, chromosome, nucleus, cell
E) protein, membrane, amino acids, chloroplast, cell
Answer: D
Chapter Section: 2.4
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.2
Global LO: G7

29) Which of the following sequences correctly lists the hierarchical nature of cellular structures, from smallest to largest?
A) organic molecules, supramolecular structures, macromolecules, organelles, cells
B) organelles, organic molecules, supramolecular structures, macromolecules, cells
C) organic molecules, macromolecules, organelles, supramolecular structures, cells
D) organic molecules, macromolecules, supramolecular structures, organelles, cells
E) macromolecules, organic molecules, supramolecular structures, organelles, cells
Answer: D
Chapter Section: 2.4
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.2
Global LO: G7

30) An enzyme synthesized in the laboratory is found to have little activity when compared to the enzyme extracted from cell culture. Both enzymes were examined and have identical amino acid composition. What is the best explanation for the lack of activity of the synthesized enzyme?
A) The van der Waals radius was altered during laboratory synthesis.
B) The synthetic enzyme was not made of amino acids.
C) The ATP required for self-assembly was present in the cell extract but not in the laboratory synthesis.
D) Denaturation of the synthesized enzyme was not complete.
E) The synthesized enzyme was not folded correctly because molecular chaperones were not present.
Answer: E
Chapter Section: 2.5
Bloom's Taxonomy: Synthesis
Learning Outcome: 2.2
Global LO: G7

31) A hypothetical automobile has 100 parts that are to be assembled by four workers. During the car's assembly, each worker constructs 25 parts individually, and then the 4 resulting components are assembled together. The manner in which the car was assembled is much like which cellular strategy?
A) hierarchical assembly
B) renaturation
C) electrostatic assembly
D) self-assembly
E) assisted self-assembly
Answer: A
Chapter Section: 2.4
Bloom's Taxonomy: Analysis
Learning Outcome: 2.2
Global LO: G7

32) Which of the following biomolecules are long polymers of repeating monomers?
A) polysaccharides
B) nucleic acids
C) proteins
D) lipids
E) polysaccharides, nucleic acids, and proteins
Answer: E
Chapter Section: 2.4
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.2
Global LO: G7

33) Which of the following molecules is involved with assisted assembly?
A) water molecules
B) helper proteins
C) molecular chaperones
D) tobacco mosaic viruses
E) none of the above
Answer: C
Chapter Section: 2.5
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.2
Global LO: G7

34) Ionic bonds are important in biological structures. Which of the following pairs of molecules would form an ionic bond?
A) two water molecules
B) two amino acids with oppositely charged functional groups
C) two different stereoisomers of the same sugar
D) two phospholipids
E) a water molecule and a lipid
Answer: B
Chapter Section: 2.4
Bloom's Taxonomy: Evaluation
Learning Outcome: 2.2
Global LO: G7

35) Self-assembly of some structures may depend on
A) the size of the monomers.
B) the presence of lipids in the cytosol.
C) information supplied by preexisting structures.
D) the time associated with forming noncovalent interactions.
E) all of the above.
Answer: C
Chapter Section: 2.5
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.2
Global LO: G7

36) All of the following are common functional groups found in biological molecules *except*
A) phosphate groups.
B) carbonyl groups.
C) amino groups.
D) sulfhydryl groups.
E) butyl groups.
Answer: E
Chapter Section: 2.1
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

37) Which of the following is an informational macromolecule?
A) DNA
B) ATP
C) starch
D) glycogen
E) polypeptide
Answer: A
Chapter Section: 2.4
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.2
Global LO: G7

38) Monomers are removed from polymers by _____ reactions.
A) condensation
B) hydrolysis
C) neutralization
D) substitution
E) redox
Answer: B
Chapter Section: 2.4
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.2
Global LO: G7

39) Self-assembly can be used for which of the following applications*?*
A) nanotechnology
B) quantum computing
C) biosensors
D) drug delivery systems
E) all of these
Answer: E
Chapter Section: 2.5
Bloom's Taxonomy: Application
Learning Outcome: 2.2
Global LO: G7

40) Which of the following statements about self-assembly is *false*?

A) The noncovalent interactions that drive supramolecular assembly processes are similar to those that dictate the folding of individual protein molecules.
B) Self-assembly only occurs in structures composed of protein.
C) Self-assembly requires specific chemical conditions.
D) Molecular chaperones are sometimes required for the proper folding and assembly of complex proteins.
E) All of the above.
Answer: B
Chapter Section: 2.5
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.2
Global LO: G7

2.2 Matching Questions

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

A) ATP
B) lipid bilayer
C) hydroxyl group
D) assists in protein assembly
E) nucleic acid
F) assists in lipid assembly
G) glycogen
H) methyl group
I) cellulose
J) spheres of hydration

1) molecular chaperone
Chapter Section: 2.4, 2.5
Bloom's Taxonomy: Synthesis
Learning Outcome: 2.2
Global LO: G7

2) important in hydrogen bonding
Chapter Section: 2.4, 2.5
Bloom's Taxonomy: Synthesis
Learning Outcome: 2.2
Global LO: G7

3) structural polysaccharide
Chapter Section: 2.4, 2.5
Bloom's Taxonomy: Synthesis
Learning Outcome: 2.2
Global LO: G7

4) informational macromolecule
Chapter Section: 2.4, 2.5
Bloom's Taxonomy: Synthesis
Learning Outcome: 2.2
Global LO: G7

5) membrane structure
Chapter Section: 2.4, 2.5
Bloom's Taxonomy: Synthesis
Learning Outcome: 2.2
Global LO: G7

6) storage polysaccharide
Chapter Section: 2.4, 2.5
Bloom's Taxonomy: Synthesis
Learning Outcome: 2.2
Global LO: G7

Answers: 1) D 2) C 3) I 4) E 5) B 6) G

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

A) lipase
B) ribosome
C) ethylene and carbon dioxide
D) hydrolysis
E) addition of monomer
F) TMV self-assembly
G) ionic bonds
H) subassembly
I) hydrophobic and van der Waals interactions
J) nitrogen gas
K) disassembly

7) important in protein folding
Chapter Section: 2.4
Bloom's Taxonomy: Analysis
Learning Outcome: 2.2
Global LO: G7

8) degradation of polymers
Chapter Section: 2.4
Bloom's Taxonomy: Analysis
Learning Outcome: 2.2
Global LO: G7

9) condensation reaction
Chapter Section: 2.4
Bloom's Taxonomy: Analysis
Learning Outcome: 2.2
Global LO: G7

10) examples of double bonds
Chapter Section: 2.4
Bloom's Taxonomy: Analysis
Learning Outcome: 2.2
Global LO: G7

11) electrostatic interactions
Chapter Section: 2.4
Bloom's Taxonomy: Analysis
Learning Outcome: 2.2
Global LO: G7

12) requirement of hierarchical assembly
Chapter Section: 2.4
Bloom's Taxonomy: Analysis
Learning Outcome: 2.2
Global LO: G7

Answers: 7) I 8) D 9) E 10) C 11) G 12) H

Match the interaction or bond on the left with the phrase that best describes it on the right.

A) electrostatic interactions
B) transient interactions at very close range
C) sharing of electrons
D) association of nonpolar groups
E) noncovalent attraction among water molecules

13) hydrogen bond
Chapter Section: 2.1, 2.2, 2.3
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

14) ionic bonds
Chapter Section: 2.1, 2.2, 2.3
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

15) van der Waals interactions
Chapter Section: 2.1, 2.2, 2.3
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

16) hydrophobic interaction
Chapter Section: 2.1, 2.2, 2.3
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

17) covalent bonding
Chapter Section: 2.1, 2.2, 2.3
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

Answers: 13) E 14) A 15) B 16) D 17) C

2.3 Short Answer Questions

1) TMV, or _____, is a rodlike particle with a genome of _____ and a _____ consisting of 2130 copies of a single polypeptide.
Answer: tobacco mosaic virus; RNA; protein coat (capsid)
Chapter Section: 2.5
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.2
Global LO: G7

2) Although energy is _____ for polymerization, most macromolecules fold into their final three-dimensional conformations _____.
Answer: required, spontaneously (or something similar)
Chapter Section: 2.4, 2.5
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.2
Global LO: G7

3) _____ and _____ groups are negatively charged functional groups of carbon, whereas the _____ group is a positively charged functional group.
Answer: Carboxyl; phosphoryl; amino
Chapter Section: 2.1
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

4) As a protein is being synthesized, the correct folding of the protein is aided by the movement of nonpolar amino acids toward the inner areas of the protein. How can this phenomenon be explained?
Answer: The exclusion of hydrophobic groups from the aqueous surface is called the hydrophobic effect.
Chapter Section: 2.5
Bloom's Taxonomy: Application
Learning Outcome: 2.2
Global LO: G7

5) The cell membrane is composed of a bilayer of _____. These molecules have regions that are polar and nonpolar and are therefore _____.
Answer: phospholipids; amphipathic
Chapter Section: 2.3
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

6) The _____ of water is caused by the unequal sharing of electrons between oxygen and hydrogen atoms.
Answer: polarity
Chapter Section: 2.1
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.1
Global LO: G7

7) A selectively _____ membrane is one that allows some molecules to pass through but not others.
Answer: permeable
Chapter Section: 2.3
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

8) _____ is a method used to determine the chemical structure and measure the relative abundance of individual molecules in a sample based on their mass to charge ratio.
Answer: Mass spectrometry
Chapter Section: 2.1
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

9) In order to facilitate polymerization, monomers must be _____.
Answer: activated
Chapter Section: 2.4
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.2
Global LO: G7

10) _____ aid in the assembly of some biomolecules.
Answer: Molecular chaperones
Chapter Section: 2.5
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.2
Global LO: G7

11) _____ carbon atoms allow for the formation of _____, which are mirror images of each other.
Answer: Asymmetric; stereoisomers
Chapter Section: 2.1
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

12) Macromolecules can be assembled into _____ that are components of organelles and other subcellular organelles.
Answer: supramolecular structures
Chapter Section: 2.5
Bloom's Taxonomy: Comprehension
Learning Outcome: 2.2
Global LO: G7

13) Polymers are synthesized by _____ reactions and broken down into their constituent monomers by _____ reactions.
Answer: condensation; hydrolysis
Chapter Section: 2.4
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.2
Global LO: G7

14) Because carbon is able to form four covalent bonds, it can form a huge variety of structures, including linear, _____, and _____ molecules.
Answer: branched; ring-containing
Chapter Section: 2.1
Bloom's Taxonomy: Knowledge
Learning Outcome: 2.1
Global LO: G7

2.4 Inquiry

Water has many unique properties. Can you identify the property of water that is responsible for each of the following observations?

A) Water has a high specific heat.
B) Water is polar.
C) Water has a temperature-stabilizing capacity.
D) Water is cohesive.
E) Water is a good solvent.
F) Water has a high heat of vaporization.

1) Many insects, such as the water strider, are able to move across the surface of water.
Chapter Section: 2.2
Bloom's Taxonomy: Analysis
Learning Outcome: 2.1
Global LO: G7

2) Most people get chilled immediately after taking a shower.
Chapter Section: 2.2
Bloom's Taxonomy: Analysis
Learning Outcome: 2.1
Global LO: G7

3) A dime can be made to "float" on the surface of a glass of water.
Chapter Section: 2.2
Bloom's Taxonomy: Analysis
Learning Outcome: 2.1
Global LO: G7

4) On cold days, the water temperature is often warmer than the surrounding air.
Chapter Section: 2.2
Bloom's Taxonomy: Analysis
Learning Outcome: 2.1
Global LO: G7

5) Many salts dissolve in water.
Chapter Section: 2.2
Bloom's Taxonomy: Analysis
Learning Outcome: 2.1
Global LO: G7

6) Many oils will not dissolve in water.
Chapter Section: 2.2
Bloom's Taxonomy: Analysis
Learning Outcome: 2.1
Global LO: G7

7) The coastal areas of the world have a climate that is more moderate than inland areas.

Chapter Section: 2.2
Bloom's Taxonomy: Analysis
Learning Outcome: 2.1
Global LO: G7

8) Some springs contain high amounts of arsenic.
Chapter Section: 2.2
Bloom's Taxonomy: Analysis
Learning Outcome: 2.1
Global LO: G7

9) The Great Salt Lake contains high quantities of mineral solutes.
Chapter Section: 2.2
Bloom's Taxonomy: Analysis
Learning Outcome: 2.1
Global LO: G7

Answers: 1) D 2) F 3) D 4) A 5) E 6) B 7) C 8) E 9) E

10) Single covalent carbon-carbon bonds have a bond energy of 83 kcal/mol while visible light from the sun has 40–70 kcal of energy per mole of photons. Why is this property of carbon-carbon bonds important for life on earth? Based on this observation, how could the degradation of the earth's atmosphere and an increase in high-energy ultraviolet radiation affect life on earth?
Answer: The fact that carbon-carbon bonds have a high bond energy indicates that the bonds are quite stable and do not easily break apart. The stability of carbon-carbon bonds provides relatively stable molecules in biological systems that do not degrade at temperatures typically found on earth. The fact that visible light waves from the sun contain less energy than what is required to break a carbon-carbon bond indicates that carbon-carbon bonds will not degrade when exposed to visible light. If the earth's atmosphere loses its ability to absorb or reflect ultraviolet (UV) radiation, which contains more energy than visible light, biological systems will be damaged, as UV radiation will damage critical biomolecules in living organisms on the surface of the earth.
Chapter Section: 2.1
Bloom's Taxonomy: Evaluation
Learning Outcome: 2.1
Global LO: G4, G7

11) For each of the three basic macromolecules (proteins, polysaccharides, and nucleic acids), identify the monomer, its activated/carrier form, and one or two basic functions.
Answer: Proteins: amino acids; amino acids bound to tRNAs; catalysis, structure. Polysaccharides: monosaccharides; monosaccharide phosphates; energy storage, structure.Nucleic acids: nucleotides; nucleotides; information storage.
Chapter Section: 2.4
Bloom's Taxonomy: Synthesis
Learning Outcome: 2.2
Global LO: G7

12) Describe how the amphipathic nature of phospholipids leads to the formation of the phospholipid bilayer organization observed in membrane structure. Based upon this information,

how would you design a drug delivery system to cross the cell membrane?
Answer: Basically, student answers should include the orientation of phospholipids such that the phosphate ends are surrounded by a hydrating sphere and the hydrophobic tails are sequestered within each other (giving the bilayer organization). The drugs could be placed inside phospholipid micelles that would be able to deliver the drugs by fusing with the cell membrane and releasing their contents into the cytoplasm.
Chapter Section: 2.3
Bloom's Taxonomy: Synthesis
Learning Outcome: 2.1
Global LO: G7

13) Predict whether or not each of the following substances can cross a biological membrane directly. Give a reason for each prediction.
a. Nucleotides
b. Na^+
c. Steroid hormones
d. Polar amino acids
e. Water
f. Oxygen
g. Cl^-
Answer:
a. Nucleotides can't cross biological membranes directly because they are large, negatively charged molecules (students should recognize at least the large size, and probably that the functional groups are polar or charged).
b. Na^+ can't cross biological membranes directly because it is charged.
c. Steroid hormones CAN cross biological membranes directly because they are nonpolar.
d. Polar amino acids can't cross biological membranes directly because they are large, polar molecules.
e. Water CAN cross biological membranes directly even though it is polar because of its small size.
f. Oxygen CAN cross biological membranes directly because it is nonpolar and small.
g. Cl^- can't cross biological membranes directly because it is charged.
Chapter Section: 2.3
Bloom's Taxonomy: Evaluation
Learning Outcome: 2.1
Global LO: G2, G7