***Biology of Humans, 4e* (Goodenough/McGuire)**
**Chapter 2 Chemistry Comes to Life**

Multiple-Choice Questions

1) A neutral atom must contain _____.
A) an equal number of protons and neutrons
B) an equal number of protons, neutrons, and electrons
C) an equal number of protons and electrons
D) an equal number of neutrons and electrons
Answer: C
Bloom's Taxonomy: Level 1 Knowledge

2) An element with more or fewer neutrons than the same element as it appears on the periodic table is known as which of the following terms?
A) ion
B) buffer
C) isotope
D) isomer
Answer: C
Bloom's Taxonomy: Level 1 Knowledge

3) A neutral atom has an atomic number of 14. How many electrons would be in its outer electron shell?
A) 14
B) 4
C) 8
D) There is not enough information provided to determine.
Answer: B
Bloom's Taxonomy: Level 2 Comprehension

4) You have information about an atom that contains 7 protons, 8 neutrons, and 8 electrons. Which of the following statements would be true?
A) It will have an atomic weight of 23.
B) It will be an ion.
C) It will have 8 electrons in its outermost shell.
D) It will have an atomic number of 15.
Answer: B
Bloom's Taxonomy: Level 2 Comprehension

5) Oxygen, with an atomic number of 8, is a neutral atom and would have _____ electrons in the first electron shell and _____ electrons in the second electron shell.
A) 1; 7
B) 5; 3
C) 4; 4
D) 2; 6
E) 3; 5
Answer: D
Bloom's Taxonomy: Level 2 Comprehension

6) The compound magnesium chloride ($MgCl_2$) turns into $Mg^{++}$ and $Cl^-$ when placed in water. You can guess that the Mg and Cl atoms are held together normally by a(n) _____ bond.
A) covalent
B) electronegative
C) hydrogen
D) ionic
Answer: D
Bloom's Taxonomy: Level 3 Application

7) The Cl ion has a single negative charge and the atomic number of 17. How many electrons are on its innermost shell?
A) 18
B) 17
C) 9
D) 2
Answer: D
Bloom's Taxonomy: Level 2 Comprehension

8) Which of the following monomers is not paired correctly?
A) glucose-carbohydrates
B) amino acids-proteins
C) nucleotides-nucleic acids
D) All of these are paired properly.
Answer: D
Bloom's Taxonomy: Level 1 Knowledge

9) In what ways are hydrogen bonds and ionic bonds similar?
A) Both are based on attraction between atoms that carry differences in electrical charge.
B) Both are based on attraction between two atoms that carry negative charges.
C) Both are based on repulsion between atoms that carry differences in electrical charge.
D) Both involve an even sharing of electrons between atoms.
E) Both are based on attraction between two atoms that carry positive charges.
Answer: A
Bloom's Taxonomy: Level 2 Comprehension

10) What is the difference between covalent and ionic bonds?
A) Covalent bonds are the sharing of electrons, whereas ionic bonds are the sharing of protons.
B) Covalent bonds involve the attraction between slightly charged molecules, whereas ionic bonds involve the attraction between two fully charged ions.
C) Covalent bonds involve the sharing of neutrons, whereas ionic bonds involve the attraction of slightly charged atoms.
D) Covalent bonds are the sharing of electrons, whereas ionic bonds involve the transfer of electrons from one atom to another.
Answer: D
Bloom's Taxonomy: Level 2 Comprehension

11) The interaction between two polar molecules would involve _____.
A) ionic bonds
B) peptide bonds
C) covalent bonds
D) hydrogen bonds
Answer: D
Bloom's Taxonomy: Level 2 Comprehension

12) A substance consisting of weak acids or bases designed to maintain a specific pH of a solution within a cell or a biological system would be which of the following?
A) buffer
B) catalyst
C) pH
D) acids
Answer: A
Bloom's Taxonomy: Level 1 Knowledge

13) The pH scale measures _____.
A) $OH^-$ concentration
B) buffer concentration
C) $H^+$ concentration
D) All of the above are true.
Answer: C
Bloom's Taxonomy: Level 1 Knowledge

14) Any substance that when dissolved in water will give off $H^+$ ions is referred to as a(n):
A) pH.
B) buffer.
C) catalyst.
D) acid.
Answer: D
Bloom's Taxonomy: Level 1 Knowledge

15) A substance in which other substances are dissolved is known as what?
A) solute
B) acid
C) solvent
D) buffer
Answer: C
Bloom's Taxonomy: Level 1 Knowledge

16) Your roommate is experiencing heartburn and asks you to purchase her an antacid. Chemically speaking, you know that the antacid will help eliminate her pain because _____.
A) it is a buffer and will prevent the pH in her digestive tract from changing
B) it has a low $H^+$ concentration to increase the pH in her digestive tract
C) it is probably high in $H^+$
D) it has a low pH to balance the acidity in her digestive tract
Answer: B
Bloom's Taxonomy: Level 3 Application

17) If I tested your intestinal fluid and found that it was basic, which of the pH values listed would best describe this solution?
A) 6.8
B) 3.2
C) 1.2
D) 8.0
Answer: D
Bloom's Taxonomy: Level 2 Comprehension

18) A molecule consisting of a long chain of glucose monomers linked by covalent bonds that serves as an energy source for plants and animals would be which of the following?
A) polysaccharide
B) oligosaccharide
C) monosaccharide
D) sucrose
Answer: A
Bloom's Taxonomy: Level 1 Knowledge

19) Which of the following carbohydrates is made by plants and is not digested by humans?
A) lactose
B) starch
C) cellulose
D) glycogen
Answer: C
Bloom's Taxonomy: Level 1 Knowledge

20) Saturated fatty acids are so named because they are saturated with _____.
A) hydrogen.
B) nitrogen.
C) carbon.
D) oxygen.
Answer: A
Bloom's Taxonomy: Level 1 Knowledge

21) Triglycerides _____.
A) are fatty acids bonded to glycerol through hydrolysis
B) have solid unsaturated form at room temperature, such as butter
C) can provide twice the energy per gram than proteins
D) All of the above are true.
Answer: C
Bloom's Taxonomy: Level 1 Knowledge

22) Regulatory lipids that control metabolic processes or cellular functions are called _____.
A) triglycerides
B) carotenoids
C) phospholipids
D) steroids
Answer: D
Bloom's Taxonomy: Level 1 Knowledge

23) The hydrogen, ionic, and covalent bonds that stabilize the shape of a protein contribute to which level of structure of a protein?
A) primary
B) quaternary
C) secondary
D) tertiary
Answer: D
Bloom's Taxonomy: Level 1 Knowledge

24) Alteration of the _____ structure of a protein can transform the protein into an infectious agent known as a prion.
A) primary
B) secondary
C) tertiary
D) quaternary
Answer: B
Bloom's Taxonomy: Level 1 Knowledge

25) Which of the following is not found in ATP?
A) a nitrogen-containing base
B) a sugar
C) a phosphate group
D) All of these are found in ATP.
Answer: D
Bloom's Taxonomy: Level 1 Knowledge

26) An organic compound that provides instructions for the synthesis or production of polypeptide chains is referred to as which of the following?
A) nucleotide
B) lipids
C) ATP
D) DNA
Answer: D
Bloom's Taxonomy: Level 1 Knowledge

27) You received your genetic material from your parents in the form of DNA. Your DNA provides your cells with instruction for making _____.
A) lipids
B) proteins
C) polysaccharides
D) cholesterol
Answer: B
Bloom's Taxonomy: Level 2 Comprehension

28) A researcher suspects that the food in an ecosystem has been contaminated with radioactive phosphates over
a period of months. Which of the following substances could be examined for radioactive phosphate to test the hypothesis?
A) the amino acids within proteins produced by organisms living in the area
B) the starch produced by plants in the area
C) the DNA of the organisms in the area
D) All of the above are true.
Answer: C
Bloom's Taxonomy: Level 3 Application

29) By analyzing the chemical formulas, you can determine that this molecule, $CH_3CH(NH_2)COOH$, is a(n) _____, whereas the molecule $C_5H_{10}O_5$ is a(n) _____.
A) cholesterol; amino acid
B) amino acid; sugar
C) nucleotide; glycerol
D) fatty acid; sugar
Answer: B
Bloom's Taxonomy: Level 3 Application

30) Based on your knowledge of the chemical composition of humans, your body would contain the largest amount of _____.
A) oxygen
B) potassium
C) sodium
D) phosphorous
Answer: A
Bloom's Taxonomy: Level 2 Comprehension

Fill-in-the-Blank Questions

1) A polysaccharide that is made by plants and can be digested by humans is _____.
Answer: starch
Bloom's Taxonomy: Level 1 Knowledge

2) A molecule with hydrophobic properties and polar molecular attributes would be called a(n) _____.
Answer: lipid
Bloom's Taxonomy: Level 1 Knowledge

3) A protein that speeds up chemical reactions without being consumed in the process is called a(n) _____.
Answer: enzyme
Bloom's Taxonomy: Level 1 Knowledge

4) A(n) _____ consists of many monomer subunits bonded together in order to produce a large molecule.
Answer: polymer
Bloom's Taxonomy: Level 1 Knowledge

5) A(n) _____ is a nonprotein substance that aids in forming the enzyme-substrate complex in metabolic reactions.
Answer: cofactor
Bloom's Taxonomy: Level 1 Knowledge

6) _____ is the process of using water to break down polymers to their monomer subunits.
Answer: Hydrolysis
Bloom's Taxonomy: Level 1 Knowledge

7) _____ refers to a structure of a protein in which two or more polypeptide chains bind together to form a functional protein.
Answer: Quaternary
Bloom's Taxonomy: Level 1 Knowledge

8) Lipids that regulate metabolic processes in biological systems are called _____.
Answer: steroids
Bloom's Taxonomy: Level 1 Knowledge

9) Partially hydrogenated fats are also referred to as _____ fats.
Answer: trans
Bloom's Taxonomy: Level 1 Knowledge

10) A substance that, when disassociated in water, will give off hydrogen ions is referred to as a(n) _____.
Answer: acid
Bloom's Taxonomy: Level 2 Comprehension

11) Atoms that have the same number of protons but differ in the number of neutrons are called _____.
Answer: isotopes
Bloom's Taxonomy: Level 1 Knowledge

12) The _____ can be used to measure whether a substance is an acid or a base.
Answer: pH scale
Bloom's Taxonomy: Level 1 Knowledge

13) A(n) _____ is a polymer that forms muscle, bone, hair, and other structural components of the body.
Answer: protein
Bloom's Taxonomy: Level 2 Comprehension

14) The energy storing polysaccharide that can be found mainly in liver and muscle cells is called _____.
Answer: glycogen
Bloom's Taxonomy: Level 2 Comprehension

15) A(n) _____ is a substance that accepts hydrogen ions or when disassociated in water will give off hydroxide ions.
Answer: base
Bloom's Taxonomy: Level 2 Comprehension

Matching Questions

*Match each definition in the first column to the correct term in the second column.*

A) Monosaccharides
B) Triglycerides
C) Compound
D) Denaturation
E) Element
F) Polarity
G) Active site
H) Tertiary structure
I) Hydrogen bonds
J) Amino acids

1) Weak bonds that function to stabilize water and nucleic acids such as DNA.
Bloom's Taxonomy: Level 1 Knowledge

2) A substance made up of two or more elements whose properties are usually different from those of the substance.
Bloom's Taxonomy: Level 1 Knowledge

3) The site where a substrate binds to an enzyme.
Bloom's Taxonomy: Level 1 Knowledge

4) A process that causes a three-dimensional protein to change shape, resulting in the loss of biological function.
Bloom's Taxonomy: Level 1 Knowledge

5) The tendency of a molecule to have positive and negative regions.
Bloom's Taxonomy: Level 1 Knowledge

6) The overall three-dimensional shape of a protein.
Bloom's Taxonomy: Level 1 Knowledge

7) A pure form of matter that cannot be broken down to simpler forms.
Bloom's Taxonomy: Level 1 Knowledge

8) The basic monomer of a protein that can be joined by peptide bonds using dehydration synthesis reactions.
Bloom's Taxonomy: Level 1 Knowledge

9) Lipid molecules composed of one glycerol and three fatty acids that can be saturated, unsaturated, or polyunsaturated.
Bloom's Taxonomy: Level 1 Knowledge

10) The smallest molecular units of carbohydrates, also known as simple sugars.
Bloom's Taxonomy: Level 1 Knowledge

Answers: 1) I 2) C 3) G 4) D 5) F 6) H 7) E 8) J 9) B 10) A

Short Answer and Essay Questions

1) Explain some of the modern uses for radioisotopes in society.
Answer: Radioisotopes can be used in a variety of medical applications for diagnosis (imaging, such as by radioactive iodine) or therapy (such as when radioactive seeds are used to treat prostate cancer). Although not discussed in the chapter, other uses include iodine and phosphorus isotopes being used to sequence DNA and RNA for medical, forensic, and criminal applications. Many isotopes have been used for a variety of dating in geological fields (e.g., carbon 14 has been used to date fossils).
Bloom's Taxonomy: Level 3 Application

2) Explain the major differences between covalent and ionic bonding.
Answer: In covalent bonding, electrons are shared between atoms. In ionic bonding, two oppositely charged ions are attracted to each other.
Bloom's Taxonomy: Level 2 Comprehension

3) Explain the relationship between nucleic acids and proteins. How would a change to the DNA ultimately affect proteins?
Answer: DNA is a nucleic acid that codes for specific amino acids that make up the proteins in the cell and in living organisms. The exact amino acid sequence is vital in producing a functional protein. Because the code is in the DNA and the DNA is in the nucleus, the DNA must be transcribed into RNA molecules that are translated into the specific amino acid sequence. A mutation occurs if the DNA has alterations in the code or if there is a mistake in the transcriptions or translation process. A change to the DNA would ultimately change the sequence of amino acids in a protein.
Bloom's Taxonomy: Level 3 Application

4) Radioactive iodine ($^{131}I$) is commonly used in medical situations for the diagnosis and treatment of thyroid conditions. The most common isotope of iodine that is not radioactive is $^{127}I$. Chemically, what is different between $^{127}I$ and $^{131}I$? What is the same between them?
Answer: The difference between the two isotopes of iodine is their weights (or mass). This is due to a difference in the number of neutrons present in each isotope. These isotopes have in common their atomic number (number of protons), which is what makes them both iodine.
Bloom's Taxonomy: Level 3 Application

5) Athletes are often told to eat starch before a strenuous athletic event. What monomer can be released from starch after hydrolysis, and what is it used for? Because cellulose (fiber) is made of the same type of monomer as starch, why aren't athletes told to eat fiber before an event?
Answer: When starch is broken down, glucose is released. This glucose can be used during cellular respiration to produce energy (ATP) for the cells. Cellulose, like starch, is also composed of glucose monomers; however, we lack the enzymes necessary to perform hydrolysis on cellulose. Therefore, the glucose cannot be used by the cells in order to produce ATP.
Bloom's Taxonomy: Level 4 Analysis

6) Within your body, there are two major categories of hormones. One category is the steroid (or lipid-soluble) hormones, and the other category is referred to as nonsteroid (or water-soluble) hormones, which are composed of proteins or amino acids. Estrogen and testosterone are examples of steroid hormones, whereas insulin is an example of a nonsteroid hormone. A researcher heats estrogen, testosterone, and insulin to a very high temperature. After heating the hormones, the researcher tests to determine whether they still work properly. She finds that estrogen and testosterone still function, but insulin does not. Based on the chemical nature of these molecules, explain why insulin no longer functions.
Answer: Given that the insulin is a peptide hormone, it is protein based. Proteins require a specific shape to function properly. Heat is one factor that can denature a protein, damaging its shape so that it can no longer function properly.
Bloom's Taxonomy: Level 4 Analysis

7) Your friend tells you that all dietary fat is bad for your health. Is this correct?
Answer: Although excess fat can be harmful, especially to the circulatory system, fat does serve important functions in the body including long-term energy storage, insulation, and protection from blows.
Bloom's Taxonomy: Level 3 Application

8) When new food products are being analyzed for nutritional content, the food will be subjected to hydrolysis in the lab. The end products are analyzed to determine things such as fat and sugar content. Suppose a lab is analyzing a new product that claims to be fat free. After the hydrolysis of the product is complete, they find glucose, glycerol, hydrocarbons, and amino acids. Is this product free of fat? Justify your answer.
Answer: This product is not fat free. It contains hydrocarbons, which are fatty acids. It also contains glycerol. Because fats are composed of a glycerol molecule and three fatty acids, this product contains all components found in fat.
Bloom's Taxonomy: Level 4 Analysis