Exam

Name_____

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

1) Which subatomic particle carries a negative charge? 1) _____
A) proton B) electron C) neutron D) nucleus
Answer: B

2) How many electrons are in the outermost shell of an atom with 15 electrons? 2) _____
A) 10 B) 2 C) 5 D) 8
Answer: C

3) The innermost shell of an atom holds: 3) _____
A) 8 electrons. B) 6 electrons. C) 2 electrons. D) 2 protons.
Answer: C

4) An electrically neutral atom with an atomic number of 8 and a mass number of 17 has: 4) _____
A) 9 electrons. B) 17 protons. C) 8 neutrons. D) 8 protons.
Answer: D

5) What predicts the element to which an atom belongs? 5) _____
A) total number of neutrons B) total number of electrons
C) total number of protons D) number of electrons in the first shell
Answer: C

6) The four most common elements, comprising 96% of the body's mass, are: 6) _____
A) carbon, sodium, phosphorus, sulfur. B) oxygen, nitrogen, hydrogen, carbon.
C) oxygen, potassium, iron, copper. D) chlorine, sodium, magnesium, potassium.
Answer: B

7) An atom of iron has an atomic number of 26. Which of the following is TRUE? 7) _____
A) Iron has 13 electrons. B) Iron has 13 protons and 13 electrons.
C) Iron has 13 protons and 13 neutrons. D) Iron has 26 protons.
Answer: D

8) The atomic number represents the number of: 8) _____
A) protons and neutrons in the nucleus of an atom.
B) neutrons in an atom.
C) electrons in an atom.
D) protons in an atom.
Answer: D

9) What contributes to the calculation of the mass number? 9) _____
A) sum of protons, neutrons, and electrons B) sum of protons and electrons
C) sum of protons and neutrons D) sum of electrons and neutrons
Answer: C

10) Determine the number of protons in an isotope of nitrogen with an atomic number of 7 and a mass number of 14. 10) _____

A) 7 B) 14 C) 10 D) 17

Answer: A

11) What varies from one isotope of an element to another isotope of the same element? 11) _____

A) atomic number
B) mass number
C) number of protons
D) both the atomic number and the number of protons

Answer: B

12) Interpret what is meant by carbon-13. 12) _____

A) Carbon-13 represents an isotope of carbon with 13 protons.
B) Carbon-13 represents an isotope of carbon with an atomic number of 13.
C) Carbon-13 represents an isotope of carbon with a mass number of 13.
D) Carbon-13 represents the mass number of every atom of carbon.

Answer: C

13) Solid blood cells would settle out of the liquid blood plasma if allowed to sit, illustrating that blood is a: 13) _____

A) solution. B) solute. C) suspension. D) colloid.

Answer: D

14) Atoms that satisfy the octet rule are said to be: 14) _____

A) isotopes. B) reactive. C) inert. D) ions.

Answer: C

15) Which of the following atoms is inert? 15) _____

A) atomic number of 8 B) atomic number of 14
C) atomic number of 10 D) atomic number of 6

Answer: C

16) An atom has 3 electrons in its valence shell. What is the atomic number of this atom? 16) _____

A) 7 B) 13 C) 3 D) 8

Answer: B

17) Two or more atoms of the same element that are chemically combined are known as: 17) _____

A) molecules. B) suspensions. C) compounds. D) ions.

Answer: A

18) Na^+ is best known as a(n): 18) _____

A) ion. B) compound.
C) molecule. D) macromolecule.

Answer: A

19) What is meant by N_2? 19) _____

A) Two nitrogen atoms form a compound. B) The atomic mass of nitrogen is two.
C) The atomic number of nitrogen is two. D) Two nitrogen atoms formed a molecule.

Answer: D

20) The formation of a cation and an anion is indicative of a(n): 20) _____
A) nonpolar bond. B) covalent bond. C) polar bond. D) ionic bond.

Answer: D

21) Ionic bonds result from: 21) _____
A) the unequal sharing of electrons between nonmetal atoms.
B) weak attractions between polar molecules.
C) the transfer of electrons from a metal atom to a nonmetal atom.
D) the equal sharing of electrons between nonmetal atoms.

Answer: C

22) Which of the following is the strongest bond? 22) _____
A) single covalent B) ionic
C) hydrogen D) double covalent

Answer: D

23) What does this structural formula, N≡N, indicate? 23) _____
A) An ionic bond holds the two atoms of nitrogen together.
B) Three atoms of nitrogen are double bonded.
C) Two atoms of nitrogen are held together by hydrogen bonds.
D) Two atoms of nitrogen share three pairs of electrons.

Answer: D

24) In a molecule of oxygen gas, the atoms of oxygen share electrons equally with one another. This statement best describes a(n): 24) _____
A) compound. B) polar covalent bond.
C) ionic bond. D) nonpolar covalent bond.

Answer: D

25) What is a dipole? 25) _____
A) a salt B) polar molecule
C) a type of reaction D) nonpolar molecule

Answer: B

26) Hydrogen bonds may occur between: 26) _____
A) nonpolar covalent molecules. B) polar molecules.
C) ions. D) metals.

Answer: B

27) What type of bond is responsible for the surface tension of water? 27) _____
A) polar covalent bond B) nonpolar covalent bond
C) hydrogen bond D) ionic bond

Answer: C

28) In the following chemical reaction, what is NaCl? 28) _____

$$NaOH + HCl \rightarrow NaCl + H_2O$$

A) product B) acid C) water D) reactant

Answer: A

29) The transfer of an electron from sodium to chlorine is an example of: 29) _____
A) chemical energy. B) electrical energy.
C) mechanical energy. D) sound energy.
Answer: A

30) What type of reaction releases energy? 30) _____
A) exergonic reaction B) equilibrium reaction
C) endergonic reaction D) catabolic reaction
Answer: A

31) The process of digesting food breaks large food particles into smaller particles. This example is best described as a(n): 31) _____
A) catabolic reaction. B) neutralization reaction.
C) exchange reaction. D) anabolic reaction.
Answer: A

32) What happens in oxidation-reduction (redox) reactions? 32) _____
A) Energy is used since these are endergonic reactions.
B) Electron exchange occurs.
C) Larger molecules are built from smaller subunits.
D) Atoms are exchanged.
Answer: B

33) Which of the following represents an exchange reaction? 33) _____
A) AB + CD → BA + DC B) AB → A + B
C) A + B → AB D) AB + CD → AD + BC
Answer: D

34) Which of the following increases the rate of a reaction? 34) _____
A) absence of a catalyst B) solid reactants
C) increased reactant concentration D) cold temperatures
Answer: C

35) Which biological catalyst lowers the activation energy of a reaction? 35) _____
A) enzyme B) salt C) carbohydrate D) lipid
Answer: A

36) Which statement best describes enzyme function? 36) _____
A) Enzymes can perform catabolic reactions only.
B) One enzyme can work on thousands of different substrates.
C) Enzymes chemically alter both the reactants and products.
D) Enzymes speed chemical reactions by lowering the activation energy.
Answer: D

37) What property of water helps keep body temperature stabilized? 37) _____
A) polarity B) heat capacity
C) surface tension D) universal solvent
Answer: B

38) What type of compound is NOT likely to dissolve in water? 38) _____
A) ionic compound
B) nonpolar covalent compound
C) both polar and nonpolar covalent compounds
D) polar covalent compound
Answer: B

39) Water is most likely to dissolve a solute that is: 39) _____
A) hydrophobic. B) hydrophilic. C) nonpolar. D) a lipid.
Answer: B

40) Which of the following is a hydrogen ion donor? 40) _____
A) acid B) base
C) alkali substance D) neutral substance
Answer: A

41) What chemical binds free hydrogen ions in solution? 41) _____
A) water B) base C) salt D) acid
Answer: B

42) Hydrochloric acid is a: 42) _____
A) hydroxide ion donor. B) proton acceptor.
C) hydrogen ion donor. D) hydrogen ion acceptor.
Answer: C

43) On the pH scale, which number has the highest concentration of hydrogen ions? 43) _____
A) pH 1 B) pH 7 C) pH 5 D) pH 10
Answer: A

44) What does the *H* in the pH scale represent? 44) _____
A) concentration of H^+ ions in solution B) negative charge
C) heat D) the negative logarithm
Answer: A

45) A solution containing equal number of hydrogen ions and hydroxide ions is: 45) _____
A) neutral. B) alkaline. C) basic. D) acidic.
Answer: A

46) Which pH represents a solution that has the highest concentration of hydroxide ions? 46) _____
A) pH 1 B) pH 10 C) pH 14 D) pH 7
Answer: C

47) Which of the following represents the strongest acidic solution? 47) _____
A) pH 4 B) pH 9 C) pH 6 D) pH 1
Answer: D

48) On average, blood pH is approximately: 48) _____
A) 7.1. B) 7.8. C) 7.6. D) 7.4.
Answer: D

49) What pH value represents a solution that releases 10 times more hydrogen ions than a pH of 7? 49) _____
A) pH 8 B) pH 5 C) pH 6 D) pH 4
Answer: C

50) Which pH represents a solution that releases 100 times less hydrogen ions than a pH of 9? 50) _____
A) pH 12 B) pH 7 C) pH 11 D) pH 8
Answer: C

51) Which two organ systems work to correct pH imbalances in the body? 51) _____
A) endocrine and nervous B) digestive and respiratory
C) urinary and endocrine D) respiratory and urinary
Answer: D

52) What is the function of a buffer system? 52) _____
A) Buffer systems absorb heat without changing temperature themselves.
B) Buffer systems prevent large swings in pH when an acid or base is added to a solution.
C) Buffer systems lower the activation energy of a chemical reaction.
D) Buffer systems act as a lubricant between two adjacent surfaces.
Answer: B

53) What is the effect of a buffer on a solution? 53) _____
A) Buffer systems resist changes in blood pH.
B) Buffer systems allow the blood to become too basic.
C) Buffer systems allow hydrogen ions to accumulate in blood until acidosis is reached.
D) Buffer systems cause the blood pH to increase, then to decrease dramatically.
Answer: A

54) Salts are held together by: 54) _____
A) nonpolar covalent bonds. B) polar covalent bonds.
C) single covalent bonds. D) ionic bonds.
Answer: D

55) Ionic compounds dissociate in water into: 55) _____
A) acids and bases. B) polar and nonpolar substances.
C) electrolytes. D) hydrophilic and hydrophobic substances.
Answer: C

56) Single subunits that serve as the building blocks for organic compounds are termed: 56) _____
A) reactants. B) polymers. C) monomers. D) enzymes.
Answer: C

57) Hydrolysis of a polymer will produce: 57) _____
A) monomers. B) enzymes. C) electrolytes. D) buffer.
Answer: A

58) When you soak dirty dishes in your kitchen sink, you allow the water to break apart the bonds of the food stuck to your plates. This type of reaction is known as: 58) _____
A) dehydration synthesis. B) neutralization.
C) anabolism. D) hydrolysis.
Answer: D

59) The monomer of the carbohydrates is the: 59) _____
A) fatty acid. B) nucleotide.
C) monosaccharide. D) amino acid.
Answer: C

60) Select the simplest sugar: 60) _____
A) glucose B) starch C) sucrose D) lactose
Answer: A

61) Glucose and fructose are joined through dehydration synthesis to produce: 61) _____
A) galactose. B) sucrose. C) lactose. D) maltose.
Answer: B

62) Glucose, galactose, and fructose have the molecular formula $C_6H_{12}O_6$ but have different arrangements of atoms. These sugars are: 62) _____
A) polysaccharides. B) isotopes.
C) disaccharides. D) isomers.
Answer: D

63) What is the building block of a lipid? 63) _____
A) glycogen B) fatty acid C) nucleic acid D) glucose
Answer: B

64) Which of the following fatty acid chains has the most double bonds? 64) _____
A) monounsaturated fatty acid B) polyunsaturated fatty acid
C) saturated fatty acid D) glycerol
Answer: B

65) A fatty acid that contains no double covalent bonds is: 65) _____
A) monounsaturated. B) hydrogenated.
C) polyunsaturated. D) saturated.
Answer: D

66) What forms the basis for the body's steroids? 66) _____
A) testosterone B) glucose C) cholesterol D) triglyceride
Answer: C

67) The main structural component of cell membranes is: 67) _____
A) cholesterol. B) phospholipids. C) triglycerides. D) steroids.
Answer: B

68) Amino acids are the monomers for: 68) _____
A) carbohydrates. B) nucleic acids. C) proteins. D) lipids.
Answer: C

69) What group makes each amino acid unique? 69) _____
A) carboxylic acid group B) ammonia group
C) amino group D) "R" group
Answer: D

70) What type of polar covalent bond links amino acids? 70) _____

A) peptide bond B) amphiphilic bond
C) ketone bond D) hydrophobic bond

Answer: A

71) The alpha-helix and beta-pleated sheet are characteristic of: 71) _____

A) primary protein structure. B) secondary protein structure.
C) tertiary protein structure. D) quaternary protein structure.

Answer: B

72) A long-lasting high fever is a concern for denaturation of: 72) _____

A) enzymes. B) saturated fats. C) phospholipids. D) glycogen.

Answer: A

73) Yuri is working with a chemical in lab. This chemical is composed of repetitive units that include a phosphate group, a nitrogenous base, and a sugar known as ribose. He is working with: 73) _____

A) a lipid. B) a protein. C) a nucleic acid. D) a carbohydrate.

Answer: C

74) What makes RNA a unique nucleic acid? 74) _____

A) RNA contains a nitrogenous base known as uracil.
B) RNA contains a sugar known as deoxyribose.
C) RNA is built from building blocks known as a nucleotide.
D) RNA is composed of two strands held together by hydrogen bonds.

Answer: A

75) The primary source of chemical energy in the body comes from a nucleotide known as: 75) _____

A) DNA B) ADP C) ATP D) AMP

Answer: C

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

76) Explain how to determine the atomic number and mass number for an atom.

Answer: An atom's atomic number is determined by its number of protons. The mass number is equal to the number of protons plus the number of neutrons in the atom.

77) Explain the difference between an inert atom and a reactive atom.

Answer: Atoms that have filled valence shells are known as inert or nonreactive atoms. Atoms that do not meet the octet rule are said to be reactive. That is, they are unstable and will react with other atoms until they obey the octet rule.

78) To make a gallon of lemonade, Emily mixed sugar with water until it dissolved. Did she create a solution, a suspension, or a colloid? Explain.

Answer: Emily made a solution. Solutions are described by saying that one substance, the sugar, dissolves in another substance, the water. The sugar is the solute since is it dissolved by the water. Water is the solvent since it dissolves the solute.

79) Determine the atomic number of a neutral atom with 3 shells and 6 electrons in its valence shell.

Answer: The innermost shell of the atom holds 2 electrons. The next shell holds a maximum of 8 electrons. The valence shell of this particular atom holds 6 electrons. This atom has 3 shells and 16 total electrons. Add the electrons (2 + 8 + 6 = 16). In a neutral atom, the numbers of protons equals the number of electrons. Thus, this atom has an atomic number of 16.

80) What is the octet rule?

Answer: The octet rule states that an atom is most stable when it has eight electrons in its valence shell.

81) Is N_2 a molecule or a compound? Explain.

Answer: Two or more atoms of the same element that are chemically bonded, such as these two nitrogen atoms, are known as a molecule.

82) Predict the type of chemical bond that may form between two nonmetals.

Answer: Covalent bonding occurs between two or more nonmetals sharing electrons.

83) How do nonpolar covalent bonds differ from polar covalent bonds?

Answer: In a nonpolar covalent molecule, the nonmetals sharing electrons have nearly equal electronegativities. The electrons are shared equally. In a polar covalent molecule, the more electronegative nonmetal does not share electrons equally with other nonmetal atoms participating in the bond.

84) Explain the difference between potential and kinetic energy.

Answer: Potential energy is energy that is stored, ready to be released and used to do work. Potential energy becomes kinetic energy when it is used to do work. Kinetic energy is energy of motion.

85) Predict the effect of a 101°F fever on reaction rate.

Answer: Increased temperature increases the kinetic energy of atoms involved in a chemical reaction. More forceful and effective collisions between atoms result in an increase in reaction rate.

86) Define activation energy (E_a).

Answer: Activation energy is the energy input required to overcome the repulsion of the atom's electrons and to allow an adequately strong collision to occur. All reactions must overcome activation energy to proceed.

87) Explain how water interacts with hydrophobic and hydrophilic substances. Which type of substance is more likely to be dissolved by water?

Answer: Water is only able to dissolve substances that are hydrophilic. Hydrophilic substances have fully or partially charged ends that make it possible for water molecules to grab. Hydrophobic substances do not dissolve in water since they lack the charged ends necessary for water to grab. Water is more likely to dissolve hydrophilic substances.

88) Describe the organization of the pH scale, including the locations of acids, bases, and neutral chemicals.

Answer: The pH scale ranges from 0 to 14. Acids are situated below 7 while bases or alkaline substances are found above 7. The more hydrogen ions present in solution, the lower the pH of the chemical. At a pH of 7, a chemical is said to be neutral as equal amounts of hydrogen and hydroxide ions are released.

89) Dwain is drinking a cup of coffee which has a pH of 5. Compare Dwain's coffee to his friend's coffee which has a pH of 6.

Answer: Each single digit change on the pH scale corresponds to a 10-fold change in hydrogen ion concentration. Dwain's coffee, with a pH of 5, is 10 times more acidic than his friend's coffee, with a pH of 6. The hydrogen ion concentration increases 10-fold from a pH of 6 to a pH of 5.

90) What are isomers? Explain using a set of carbohydrate examples.

Answer: Isomers are compounds with the same molecular formula but with different structures. Glucose, fructose, and galactose are isomers. They have the same molecular formula, $C_6H_{12}O_6$, but have different arrangements of atoms.

91) Describe how animals store excess glucose in the body.

Answer: Animals store their excess glucose as glycogen. Glycogen is primarily stored in the liver and skeletal muscles.

92) Explain three differences between saturated and unsaturated fatty acids.

Answer: Saturated fatty acids:

1. have no double bonds between carbon atoms in their hydrocarbon chains.
2. are found predominantly in animal fats.
3. are solid at room temperature.

Unsaturated fatty acids:

1. have one or more double bonds between carbon atoms in their hydrocarbon chains.
2. are commonly found in plant oils.
3. are generally liquid at room temperature.

93) Determine the type of reaction that occurs between fructose and glucose to form water and sucrose.

Answer: This chemical reaction is a dehydration synthesis reaction. Fructose and glucose are monosaccharides that are joined together through this chemical reaction. Water is formed as a product. Sucrose is a disaccharide formed from the union of these two monomers, glucose and fructose.

94) What is the role of ATP in the cell?

Answer: ATP stores chemical energy in its bonds and is the main source of chemical energy in the body.

TRUE/FALSE. Write 'T' if the statement is true and 'F' if the statement is false.

95) In a solution, the solute dissolves the solvent. 95) _____

Answer: True ✔ False

96) An atom with an atomic number of 13 has satisfied the octet rule and is inert. 96) _____

Answer: True ✔ False

97) Hydrogen bonds are strong attractions between nonpolar covalent molecules. 97) _____

Answer: True ✔ False

98) The strongest type of chemical bond is a covalent bond because electrons are shared between two or more nonmetals. 98) _____

Answer: ✔ True False

99) The two general types of energy are potential energy and kinetic energy. 99) _____

Answer: ✔ True False

100) The digestion of food is exergonic since chemical bonds are broken and energy is released. 100) _____

Answer: ✔ True False

101) Enzymes bind with substrates at their active sites and are permanently altered by the binding process. 101) _____

Answer: True False

102) Due to the low heat capacity of water, the human body is resistant to overheating and cooling down quickly. 102) _____

Answer: True False

103) A base is a hydrogen ion acceptor while an acid is a hydrogen ion donor. 103) _____

Answer: True False

104) Solutions with a pH less than 7 are considered basic or alkaline. 104) _____

Answer: True False

105) Growing new muscle proteins through the assembly of amino acids is a type of dehydration synthesis reaction. 105) _____

Answer: True False

106) Like the carbohydrates, lipids have twice the hydrogen atoms as carbon and oxygen atoms in their molecular structures. 106) _____

Answer: True False

107) Polypeptide chains that contribute to a protein's quaternary structure each have their own primary, secondary, and tertiary structures. 107) _____

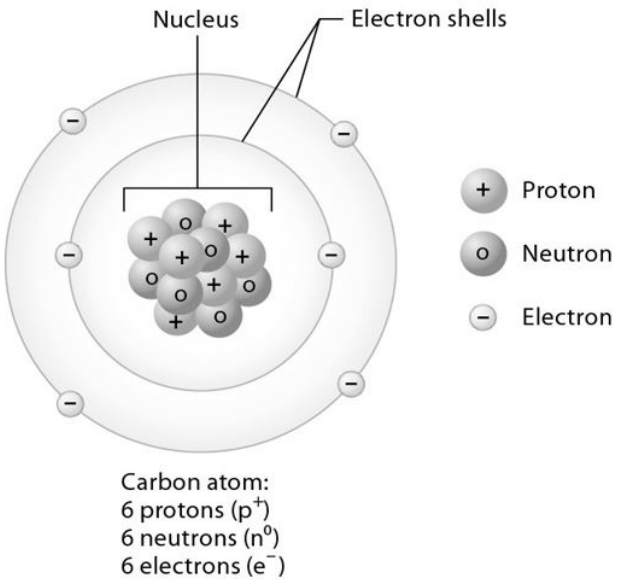
Answer: True False

108) Energy is released when ATP is broken down into ADP. 108) _____

Answer: True False

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

Match the following information about the carbon atom using the figure.



109) Determine the atomic number for this atom. 109) _____
Answer: 6

110) Determine the number of electrons in carbon's valence shell. 110) _____
Answer: 4

111) Determine the mass number for this atom. 111) _____
Answer: 12

112) Determine the number of protons in an isotope of carbon. 112) _____
Answer: 6

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

Match the following organic compounds with their descriptions.

A) carbohydrate

B) nucleic acid

C) lipid

D) protein

113) Monomers are composed of carbon, hydrogen, and oxygen in a 1C:2H:1O ratio
Answer: A

113) _____

114) Examples include phospholipids, triglycerides, and steroids
Answer: C

114) _____

115) Sucrose, glucose, galactose, and cellulose are examples
Answer: A

115) _____

116) Amino acids are the monomers
Answer: D

116) _____

117) Nucleotides are the monomers that form deoxyribonucleic acid and ribonucleic acid
Answer: B

117) _____

118) Three-dimensional shape is known as the tertiary structure
Answer: D

118) _____

119) Monomers vary by an "R" group
Answer: D

119) _____

120) Monomer is the fatty acid
Answer: C

120) _____

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

121) An atom of carbon has an atomic number of 6 and a mass number of 12. Predict how many hydrogen atoms must covalently bond with carbon to satisfy carbon's octet rule. Hydrogen has an atomic number of 1.

Answer: Carbon has an atomic number of 6. A neutral atom of carbon has 6 protons and 6 electrons. Four of those six electrons are situated in carbon's valence, or outermost, shell. Four more electrons would be needed to satisfy the octet rule. Hydrogen has an atomic number of 1. A neutral atom of hydrogen has 1 proton and 1 electron. The sole electron is situated in hydrogen's only shell. Each hydrogen atom can share one electron with the carbon atom. Four hydrogen atoms are needed to form four covalent bonds and share electrons with the carbon atom.

122) Blood pH exists within a narrow range of values. Describe the role of buffer systems in achieving blood pH homeostasis.

Answer: Buffers are chemical systems that resist changes in pH and prevent large swings in pH when an acid or a base is added to a solution. A buffer typically consists of a weak acid and its corresponding anion. When blood becomes too basic or alkaline, the weak acid releases hydrogen ions into the blood to lower the pH. When the blood becomes too acidic, the anion binds hydrogen ions in the blood. The removal of hydrogen ions from the blood offsets the decrease in pH.

123) The process of building protein from amino acids produces water. Describe the type of reaction used to build muscles.

Answer: Muscle contains protein built from amino acids. Dehydration synthesis is an anabolic reaction that links monomers, amino acids, through the removal of a water molecule to form a polymer, thus making new muscle proteins. Thus, muscle building generates water through the joining of amino acids.

124) Sophie is working in the lab with a chemical with the formula $C_{12}H_{24}O_{12}$. With what type of organic molecule does she work? Discuss how you came to your conclusion.

Answer: Sophie is working with a carbohydrate. Most carbohydrate monomers are composed of carbon, hydrogen, and oxygen atoms in the ratio 1C:2H:1O. This molecule satisfies the general pattern of atoms in a typical carbohydrate.

125) Sucrose and lactose are two common dietary disaccharides. Explain which one of these disaccharides a patient with fructosemia should avoid. Fructosemia is a disorder in which fructose cannot be metabolized.

Answer: Sucrose is formed through dehydration synthesis of a glucose and a fructose molecule. Lactose is formed through dehydration synthesis of a glucose and a galactose molecule. Patients who cannot breakdown fructose should avoid eating sucrose in their diets.

126) Catherine is confused by the information on food labels. Instruct her about the differences among the following three she sees on the label: polyunsaturated fat, saturated fat, and monounsaturated fat.

Answer: The polyunsaturated fat is the healthiest choice of the three that Catherine should choose to eat. The hydrocarbon chain of a polyunsaturated fatty acid has two or more double bonds between its carbon atoms. Although monounsaturated fats are often oils, the hydrocarbon chain has only one double bond between two carbons. The hydrocarbon chain of a saturated fat is full, or saturated with, hydrogen atoms.