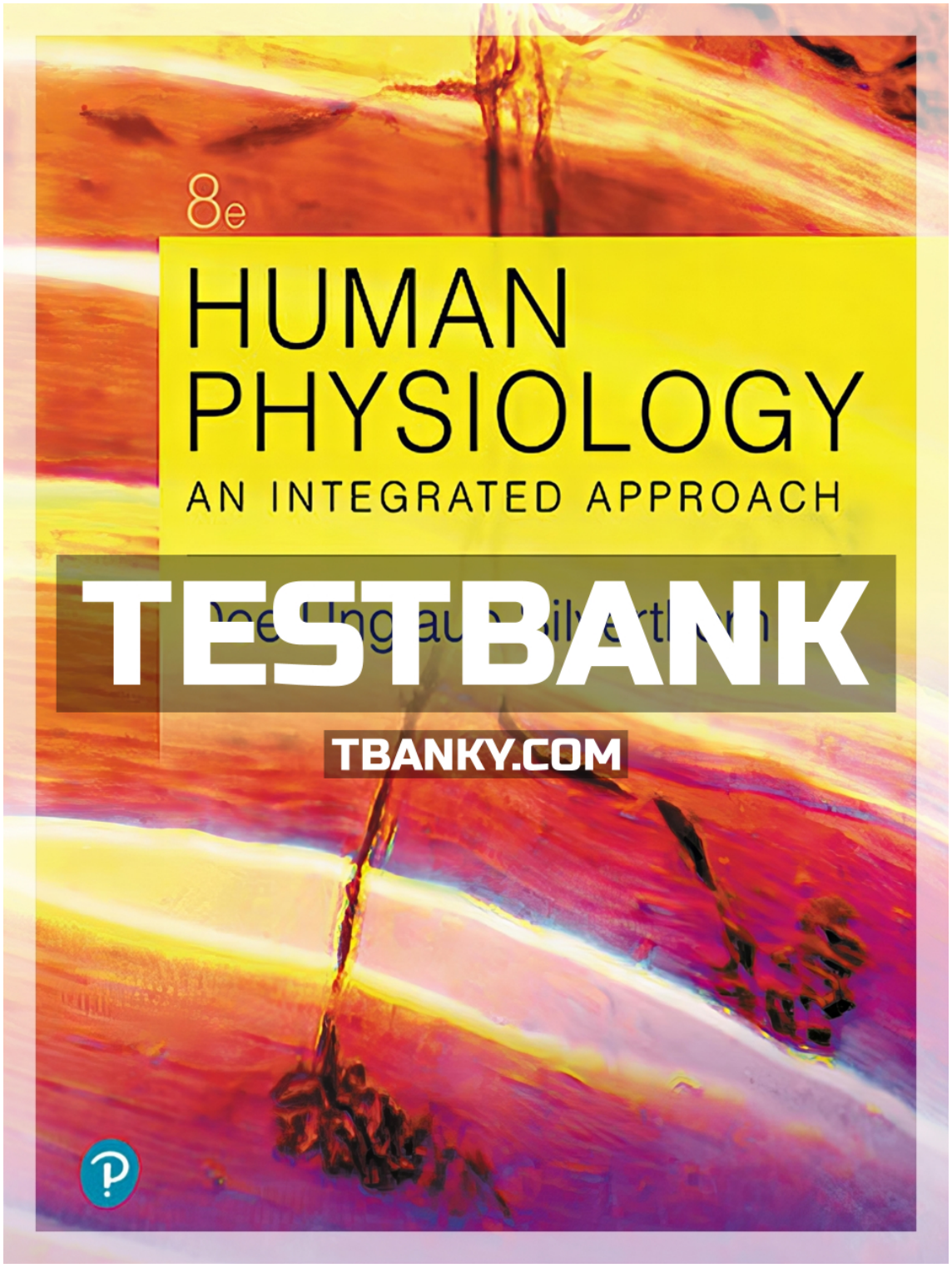
# TEST BANK FOR HUMAN PHYSIOLOGY AN INTEGRATED APPROACH 8TH EDITION SILVERTHORN ISBN 9780134605197



Exam

Name_____

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

1) Stanley Miller set out to demonstrate an explanation for the origins of organic molecules using a combination of simple organic molecules, heat and periodic bursts of electricity through the mixture, ultimately producing which kind of molecules? 1) _____
A) glycoproteins
B) amino acids
C) nucleic acids
D) lipids
E) carbohydrates

2) Glycosylated molecules are formed with 2) _____
A) lysosomes.
B) cholesterol.
C) nucleic acids.
D) carbohydrates.
E) DNA.

3) Cells regulate their level of activity by regulating the amount of proteins in the cell at any given time, so an up–regulation of enzymes would be expected to 3) _____
A) increase the cell's response produced by the reaction catalyzed by the enzyme.
B) have no effect on the rate of reactions catalyzed by the enzyme.
C) decrease the level of productivity of chemical reactions that rely on the enzyme.
D) decrease the rate of reactions catalyzed by the enzyme.
E) decrease the level of productivity of chemical reactions that rely on the enzyme and decrease the rate of reactions catalyzed by the enzyme.

4) When an enzyme reaches its saturation point, the amount of 4) _____
A) substrate for the enzyme to act upon is very low and the amount of product produced by the enzyme decreases.
B) product produced continues to increase.
C) substrate for the enzyme to act upon is high.
D) substrate for the enzyme to act upon is low.
E) product produced by the enzyme decreases.

5) Which element make up more than 90% of the body's mass? 5) _____
A) C, Na, K B) O, Ca, H C) O, H, Na D) Ca, C, O E) O, C, H

6) Phospholipids are key components of cell membranes and made up of which molecules? 6) _____
A) nucleotides
B) amino acids
C) fatty acids
D) glycerol and fatty acids
E) glycerol

7) Chromium is 7) _____
A) a dietary supplement with no natural role in the body.
B) an essential element involved in glucose metabolism.
C) a protein.
D) not an element in the periodic table.

8) Which is a way to recognize a carbohydrate by looking at its name? 8) _____
A) It begins with proteo–.
B) It begins with lipo–.
C) It ends in –ase.
D) It begins with nucleo–.
E) It ends in –ose.

9) Which is NOT an essential element for a living organism? 9) _____
A) nitrogen B) mercury C) oxygen D) carbon E) hydrogen

10) The largest carbohydrate molecules are called polysaccharides because they are made up of _____ molecules bonded together with one another. 10) _____
A) amino acid
B) nucleotide
C) pyrimidine
D) purine
E) simple sugar

11) Essential amino acids that are used to build proteins 11) _____
A) exist in twenty six different forms.
B) can only be made by cells within our bodies.
C) must be derived from the foods we eat and digest.
D) are linked together by ionic chemical bonds in proteins.
E) can be used medically for both diagnosis and treatment of diseases.

12) Which is an example of a cation? 12) _____
A) $HCO_3^-$ B) $Ca^{2+}$ C) $Cl^-$ D) $SO_4^{2-}$ E) $HPO_4^{2-}$

13) A positively–charged ion is called a(n) 13) _____
A) proton. B) cation. C) electron. D) neutron. E) anion.

14) The most important polar molecule is _____ because it is a universal solvent in biological solutions. 14) _____
A) magnesium sulfate
B) water
C) nucleic acid
D) sodium chloride
E) bicarbonate

15) A substance is highly soluble if it is 15) _____
A) very likely to dissolve in water and is called aqueous.
B) very likely to dissolve in water.
C) not very likely to dissolve in water.
D) not very likely to dissolve in water and is called aqueous.
E) called aqueous.

16) A free radical is a 16) _____
A) molecule with an extra proton.
B) molecule with an extra neutron.
C) molecule with an extra electron.
D) charged particle.
E) molecule with an unpaired electron.

17) The chemical bonding behavior of an atom is directly determined by the 17) _____
A) number and arrangement of electrons.
B) number of protons.
C) number of neutrons.
D) mass of the atom.
E) size of the atom.

18) Atoms in a covalent molecule share electrons 18) _____
A) in single pairs.
B) in double pairs.
C) singly, never in pairs.
D) in triple pairs.
E) can share electrons in single pairs, double pairs, or triple pairs.

19) The weak interactions between atoms that keep atoms near each other are called 19) _____
A) van der Waals forces and ionic bonds.
B) ionic bonds.
C) hydrogen bonds.
D) van der Waals forces.
E) hydrogen bonds and van der Waals forces.

20) Which statement about carbohydrates is FALSE? 20) _____
A) Simple sugars include galactose, glucose, and ribose.
B) Glycogen is a storage polysaccharide made by animal cells.
C) Polysaccharides include cellulose and glycogen.
D) Polysaccharides are important both for energy storage and to provide structure to cells.
E) Glycogen is important both for energy storage and to provide structure for cells.

21) In lipids, *unsaturated* refers to 21) _____
A) the ring structure of steroids.
B) fats, such as butter and lard, which come from animal sources.
C) the presence of double bonds between adjacent carbon atoms in a fatty acid.
D) glycerol, which acts as an anchor for joined fatty acids.
E) the absence of double bonds between adjacent carbon atoms in a fatty acid.

22) Each amino acid differs from others in the 22) _____
A) chemical structure of the R group.
B) number of carboxyl groups.
C) size of the amino group.
D) number of central carbon atoms.
E) number of peptide bonds in the molecule.

23) The alpha–helix and B–sheets are examples of the _____ structure of a protein. 23) _____
A) primary
B) secondary
C) tertiary
D) quaternary
E) pentanary

24) Interactions between different globular or fibrous polypeptide chains result in which type of structure? 24) _____
A) primary
B) secondary
C) tertiary
D) quaternary
E) pentagonal

25) The concentration of a solution expresses the amount of 25) _____
A) solute per volume of solvent.
B) solvent per volume of solution.
C) solute per volume of solution.
D) solvent per volume of solute.
E) None of the answers are correct.

26) Nucleic acids are polymers of units called 26) _____
A) amino acids.
B) bases.
C) ribose.
D) fatty acids.
E) nucleotides.

27) A nucleotide is made up of a 27) _____
A) five–carbon sugar and an amino acid.
B) five–carbon sugar and phosphate group.
C) five–carbon sugar and a nitrogenous base.
D) phosphate group and a nitrogenous base.
E) five–carbon sugar, a nitrogenous base, and a phosphate group.

28) A nucleotide containing the base cytosine would base pairs with a nucleotide containing the base 28) _____
A) cytosine. B) uracil. C) thymine. D) guanine. E) adenine.

29) An energy–transferring compound in cells is a nucleotide known as 29) _____
A) glucose.
B) deoxyribonucleic acid.
C) fructose.
D) adenosine triphosphate.
E) protein.

30) Which bases are purines? 30) _____
1. adenine
2. cytosine
3. guanine
4. thymine
5. uracil
A) 1 and 2 B) 1, 3, and 5 C) 2 and 3 D) 1 and 3 E) 2, 4, and 5

31) Biomolecule polymers are a typical formation of _____ molecules. 31) _____
A) inorganic
B) organic
C) either organic or inorganic

32) Cholesterol is a 32) _____
A) component of animal cell membranes.
B) precursor to steroid hormones.
C) dangerous fat that is absent from a healthy body.
D) A and B
E) A, B, and C

33) An important buffer in the human body is 33) _____
A) NaCl. B) $H^+$. C) HCl. D) $H_2O$. E) $HCO_3^-$.

34) Which of the following is most alkaline? 34) _____
A) tomato juice, pH = 4
B) urine, pH = 6
C) lemon juice, pH = 2
D) stomach secretions, pH = 1
E) white wine, pH = 3

35) If a solution has a pH that is less than 7, it is 35) _____
A) a salt. B) a buffer. C) alkaline. D) acidic. E) neutral.

36) Protein specificity is the 36) _____
A) degree to which a protein–ligand complex initiates a response.
B) activation of a specific protein that is needed to perform a particular function.
C) degree to which a protein is attracted to a ligand.
D) ability of a protein to bind a certain ligand or a group of related ligands.
E) B and C

37) Which is a common feature of soluble proteins? 37) _____
A) chemical modulation
B) receptor binding
C) structural support
D) noncovalent interaction
E) All of the answers are correct.

38) An ion has gained or lost 38) _____
A) proton(s).
B) neutron(s).
C) electron(s).
D) carbon atom(s).
E) double bond(s).

39) An isotope has gained or lose 39) _____
A) proton(s).
B) neutron(s).
C) electron(s).
D) carbon atom(s).
E) double bond(s).

40) The number of _____ determines the element. 40) _____
A) protons
B) neutrons
C) electrons
D) carbon atoms
E) double bonds

41) This subatomic particle has a positive charge. 41) _____
A) electron
B) sodium chloride
C) proton
D) neutron
E) molecular oxygen

42) This subatomic particle has a negative charge. 42) _____
A) hydrogen
B) electron
C) magnesium
D) proton
E) neutron

43) This subatomic particle has a neutral charge. 43) _____
A) electron
B) proton
C) neutron
D) magnesium
E) hydrogen

44) A change in pH value of one unit indicates a 44) _____
A) 1–fold change in [H+].
B) change of $10^{-2}$ in pH.
C) 10 fold change in [H+].
D) change of $10^{-1}$ in pH.
E) Cannot be determined.

45) A blood pH of less than 7.00 and greater than 7.70 is incompatible with life. 45) _____
A) True B) False

46) Which statement describes the relationship between pH and hydrogen ions? 46) _____
A) pH and hydrogen ions are inversely related.
B) pH and hydrogen ions are independent and unrelated.
C) pH and hydrogen ions are equivalent.
D) pH is always 100 times more than the number of hydrogen ions.
E) pH and hydrogen ions are directly related.

47) HCl (hydrochloric acid) is an acid because 47) _____
A) in solution it donates its H+.
B) in solution it increases the pH.
C) it is able to form hydroxide ions.
D) in solution it decreases the concentration of free H+.
E) it is similar to ammonia.

48) Molecular structure and function of large complex biomolecules result from which interactions? 48) _____
A) ionic bonds
B) hydrogen bonds
C) van der Waals forces
D) covalent bond angles
E) All of the choices can contribute.

49) Which formula describes the relationship between pH and hydrogen ions? 49) _____
A) pH = log [H+]
B) pH= [H+] + [OH−]
C) [H+] = –log pH
D) pH = –log [H+]
E) [H+] = log pH

50) All organic molecules contain 50) _____
A) adenosine. B) lipids. C) carbon. D) oxygen. E) calcium.

51) Molecules that contain carbon are known as 51) _____
A) atoms.
B) nonessential elements.
C) minerals.
D) protons.
E) organic molecules.

52) Which elements make up 90% of the body's mass? 52) _____
A) carbon dioxide, oxygen, and sodium
B) oxygen, carbon, and nucleic acids
C) sodium, potassium, and calcium
D) hydrogen, nitrogen, and oxygen
E) oxygen, carbon, and hydrogen

53) Which results when an atom has such a strong attraction for electrons that it pulls one or more electrons completely away from another atom? 53) _____
A) ionic bond
B) Van der Waals attraction
C) covalent bond
D) weak bond
E) hydrogen bond

54) These are weak attractive forces that are responsible for the surface tension of water. 54) _____
A) Van der Waals attractions
B) covalent bonds
C) ionic bonds
D) hydrogen bonds
E) potassium bonds

55) These result when the carbon atoms in phospholipids share a pair of electrons. 55) _____
A) potassium bonds
B) ionic bonds
C) covalent bonds
D) Van der Waals attractions
E) hydrogen bonds

56) Van der Waals forces are weak attractive forces between the nucleus of one atom and the electrons of another atom close by. 56) _____
A) True B) False

57) Glycogen is an example of a 57) _____
A) nucleotide.
B) carbohydrate.
C) lipid and protein.
D) protein.
E) lipid.

58) Nucleotides perform which function(s)? 58) _____
A) They are the building blocks of proteins like cell receptors.
B) They transfer energy and are part of genetic material.
C) They store glucose as fat.
D) They are the starting material for steroid hormones.
E) They form structural elements in the cell membrane.

59) Which biological molecules exhibit saturation, specificity and competition? 59) _____
A) lipids
B) proteins
C) lipids and proteins
D) nucleotides
E) carbohydrates

60) Triglycerides and steroids are examples of 60) _____
A) carbohydrates.
B) proteins.
C) nucleotides.
D) lipids.
E) lipids and proteins.

61) Potassium channels are usually made up of several subunits. This is an example of which level of protein structure? 61) _____
A) primary
B) secondary
C) tertiary
D) quaternary
E) alpha helix

62) The sequence of amino acids in the chain is an example of which level of protein structure? 62) _____
A) primary
B) secondary
C) tertiary
D) quaternary
E) alpha helix

63) Hemoglobin molecules are made from four globular protein subunits. The three-dimensional shape of these globular subunits is an example of which level of protein structure? 63) _____
A) primary
B) secondary
C) tertiary
D) quaternary
E) alpha helix

64) β-strands are an example of a flat arrow arrangement of amino acids. 64) _____
A) True B) False

65) Which level of protein structure occurs from spontaneous folding that results from covalent bonds and noncovalent interactions? 65) _____
A) triangular
B) tertiary
C) primary
D) quaternary
E) secondary

66) The protein keratin which is found in hair and nails is categorized as which protein shape? 66) _____
A) globular
B) acidic
C) triangular
D) fibrous
E) hexavalent

67) Which types of bonds between amino acids plays an important role in the shape of globular proteins? 67) _____
A) collagen bonds
B) disulfide bonds
C) metallic bonds
D) sodium bonds
E) secondary bonds

68) Which would be disrupted by changes in free hydrogen ions in solution, thus disrupting the molecule's shape and function? 68) _____
A) double bonds
B) sodium bonds
C) hydrogen bonds
D) covalent bonds
E) disulfide bonds

69) During intense exercise our muscles produce lactate and hydrogen ions. Which molecules would be affected by the accumulation of hydrogen ions? 69) _____
A) DNA in the nucleus
B) phospholipids in the membrane
C) glucose molecules in the adipose tissue
D) the proteins actin and myosin
E) cholesterol in the plasma membrane

70) Which best describes an irreversible antagonist? 70) _____
A) binds to proteins away from the active site
B) reversible agonist
C) involved in activation via phosphorylation
D) allosteric enhancer
E) cannot be displaced by competition

71) Protein kinase A is a molecule inside our cells that can activate enzymes within the cell. Protein kinase A does this by adding phosphates to the enzymes. This is which type of modulation? 71) _____
A) competitive inhibitor
B) allosteric modulator
C) reversible antagonist
D) covalent modulator
E) irreversible agonist

72) A reaction is stopped by substance X but can recover when more of the customary ligand is supplied. Substance X is an example of a 72) _____
A) competitive inhibitor.
B) phosphatase.
C) covalent modulator.
D) irreversible antagonist.
E) allosteric modulator.

73) Which is an allosteric modulator? 73) _____
A) A substance that binds irreversibly.
B) A substance involved in activation via phosphorylation.
C) A substance that can be displaced by competition at the active site.
D) A substance that has no effect on the affinity of the ligand.
E) A substance that binds to proteins away from the active site.

74) The smallest organizational level is a(n) 74) _____
A) tissue. B) element. C) molecule. D) nucleus. E) atom.

75) When two or more atoms are chemically linked, they form a(n) 75) _____
A) nucleus. B) molecule. C) atom. D) tissue. E) element.

76) Oxygen, carbon, and hydrogen, along with eight other elements are considered 76) _____
A) compounds.
B) molecules.
C) major essential elements.
D) minor essential elements.
E) atoms.

77) The center of an atom is called the 77) _____
A) molecule. B) electron. C) element. D) nucleus. E) proton.

78) Electrons travel around the center of the atom at high speed forming a(n) 78) _____
A) nucleus. B) shell. C) atom. D) element. E) molecule.

79) An element's ability to bind other elements is determined by 79) _____
A) the arrangement of electrons in the outer shell of an atom.
B) the amount of folding in its subunits.
C) its state of glycosylation.
D) its amino acid composition.
E) the number of enzymes required.

80) Ions with a positive charge are called 80) _____
A) electrons. B) cations. C) tissues. D) anions. E) neurons.

81) Ions with a negative charge are called 81) _____
A) anions. B) electrons. C) neurons. D) tissues. E) cations.

82) A _____ is a made up of solutes dissolved in a solvent. 82) _____
A) nucleus
B) molecule
C) cocktail
D) compound
E) solution

83) Substances that easily dissolve in water are 83) _____
A) lipids.
B) isotonic.
C) nonpolar.
D) hydrophobic.
E) hydrophilic.

84) Substances that do not dissolve well in water are 84) _____
A) hydrophilic.
B) isotonic.
C) polar.
D) hydrophobic.
E) salts.

85) A(n) _____ is any molecule or ion that binds to a receptor protein. 85) _____
A) ligand
B) vitamin
C) enzyme
D) cofactor
E) phospholipid

86) Two methods of protein activation include _____ and _____. 86) _____
A) homeostatic, osmotic
B) proteolytic, cofactor binding
C) mechanistic, covalent bonding
D) exergonic, endogonic
E) enzymatic, glycolytic

87) DNA contains the five-carbon sugar 87) _____
A) lactose.
B) deoxyribose.
C) uracil.
D) glucose.
E) ribose.

88) RNA contains the five-carbon sugar 88) _____
A) glucose.
B) uracil.
C) deoxyribose.
D) ribose.
E) lactose.

89) The purines found in DNA are _____ and _____. 89) _____
A) cytosine, thymine
B) cytosine, uracil
C) deoxyribose, guanine
D) guanine, cytosine
E) adenine, guanine

90) The pyrimidines found in DNA are _____ and _____. 90) _____
A) guanine, cytosine
B) deoxyribose, guanine
C) adenine, guanine
D) cytosine, uracil
E) cytosine, thymine

91) In a chemical reaction, _____ between atoms are broken as atoms are rearranged in new combinations to form different chemical substances. 91) _____
A) chemical bonds
B) electron shells
C) homeostatic interactions
D) protons
E) nuclei

92) The reaction rate of many chemical reactions that occur in the body are controlled by molecules called 92) _____
A) nucleic acids.
B) enzymes.
C) purines.
D) neurotransmitters.
E) intermediates.

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

93) How many milliequivalents are represented by a mole of bicarbonate ions ($HCO_3^-$)?

94) List and define the seven categories of soluble proteins.

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

95) Which elements combine to form nonpolar covalent bonds? 95) _____
A) carbon and hydrogen
B) carbon and chlorine
C) hydrogen and oxygen
D) sodium and chlorine
E) nitrogen and hydrogen

96) The symbol $Ca^{2+}$ means calcium has 96) _____
A) lost two protons.
B) gained two protons.
C) lost two electrons.
D) gained two electrons.

97) In a 5% NaCl solution, 97) _____
A) there are 5 grams of sodium chloride for every 100 mL of water.
B) the solute is water.
C) there are 5 grams of sodium chloride for every 100 mL of total solution.
D) A and B
E) A and C

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

98) A molecule of sucrose has a molecular weight of 342 Daltons. How many grams of sucrose would be required to make one liter of a 2.5 Molar solution of sucrose? 98) _____

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

99) A covalent double bond is formed when atoms 99) _____
A) swap two pairs of electrons.
B) transfer a pair of electrons from one atom to the other.
C) transfer two pairs of electrons from one atom to the other.
D) share one pair of electrons (a total of two).
E) share two pairs of electrons (a total of four).

100) The term *polar* is used to describe molecules because 100) _____
A) there are at least two distinct ends of the molecule regarding electron position and the resulting charge.
B) polar covalent molecules were first discovered in polar bears.
C) such molecules are always linear in shape.
D) there are at least two distinct ends of the molecule regarding hydrogen placement.
E) polar covalent molecules are found in colder climates.

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

101) The more likely a fat is to be solid at room temperature, the more it potentially can contribute to cardiovascular disease. With this in mind, which fats will be the most dangerous?

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

102) Lipids are hydrophobic, and do not usually dissolve in water. Because blood is water–based, the lipid cholesterol is combined with _____ so it can be transported by blood. 102) _____
A) cations
B) hydrophilic molecules
C) anions
D) nothing; cholesterol is not transported in blood
E) hydrophobic molecules

103) Only free $H^+$ contributes to the hydrogen ion concentration. 103) _____
A) True B) False

104) In the equation $CO_2 + H_2O \leftrightarrow H_2CO_3 \leftrightarrow H^+ + HCO_3^-$, which of these is an acid? 104) _____
A) $CO_2$ B) $HCO_3^-$ C) $H_2CO_3$ D) $H_2O$ E) $H^+$

105) Chemical reactions that occur in the human body proceed at a faster rate due to special catalytic molecules called 105) _____
A) enzymes.
B) cytozymes.
C) proteins.
D) antagonists.
E) antibodies.

106) The fuel molecule cells use to run all their activities is 106) _____
A) vitamins. B) glucose. C) sucrose. D) starch. E) protein.

107) A fatty acid that contains three double bonds in its carbon chain is said to be 107) _____
A) carboxylated.
B) saturated.
C) monounsaturated.
D) hydrogenated.
E) polyunsaturated.

108) Most of the lipid found in the human body is in the form of 108) _____
A) monoglycerides.
B) phospholipids.
C) steroids.
D) prostaglandins.
E) triglycerides.

109) Each of the following is a function of proteins EXCEPT 109) _____
A) signaling.
B) catalyst.
C) transport.
D) storage of genetic information.
E) binding to ligands.

110) If a polypeptide contains 10 peptide bonds, how many amino acids does it contain? 110) _____
A) 11 B) 10 C) 0 D) 5 E) 12

111) Glycoprotein molecules 111) _____
A) allow atoms to pack closely together and occupy minimum space.
B) increase the solubility of lipids.
C) act as buffers in body fluids.
D) aid in the formation of chemical bonds between carbon atoms.
E) create a coat on the cell surface that assists in cell aggregation and adhesion.

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

112) Compare and contrast the role of up–regulation and down–regulation of proteins.

113) What is the induced–fit model? List the types of bonds involved and classify them as strong or weak.

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

114) The _____ of a solution is the negative logarithm of the hydrogen ion concentration, expressed in moles per liter of solution. 114) _____

115) When a nitrogenous base is bonded to a pentose sugar and a phosphate, a _____ is formed. 115) _____

116) Solutions are formed with water and _____ solutes which dissolve in them. 116) _____

117) The _____ molecules which form the bilayer region of the cell membrane have hydrophilic regions on the outer surface and hydrophobic regions on the inner surface. 117) _____

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

118) Compare and contrast the chemical bonds between adjacent monomers in DNA, and between two strands of DNA.

119) Compare and contrast the general chemical structures of monosaccharides and amino acids.

120) What are functional groups? List the common functional groups in biological molecules.

121) True or False? Lipids are hydrophobic because they easily dissolve in water. If true what allows them to dissolve in water or if false, what is it about their molecular structure that makes them less likely to dissolve in water?

122) Explain the polar character of an ammonia molecule ($NH_3$). What is the cause of the partial charges? What is the overall charge for $NH_3$?

123) Water striders are insects that literally walk on water. These insects are frequently found living on ponds. If hydrogen bonds did not exist, how would this affect the life of water striders?

124) If the dissociation constant of a protein is less than one ($K_d < 1$), what can you conclude about the affinity of the protein for the ligand?

125) Noncovalent molecular interactions occur between many different biomolecules and often involve proteins. Give an example of such an interaction and what the function might be.

126) Tenzin is assigned a project regarding ions, isotopes, and free radicals. Her teacher tells her that she has to describe what is similar between them, and how they are different. Tenzin is having some trouble, and calls you in for help. Assuming she has learned and understood some basic chemistry, help her organize her thoughts by making a table or flow chart.

127) Ahmed is trying to memorize chemical structures of every compound his professor has indicated are important to the human body. Explain to him that an easier way is to memorize a few rules of chemical bonding and then figure out the structure of the important compounds, especially the simpler compounds.

128) Define polar covalent, nonpolar covalent, ionic, and hydrogen bonding. Which of these bonds involves more than one molecule? Which of these bonds is/are important in determining the properties of water? Explain.

129) Ionic bonds are considered to be strong chemical bonds. Yet, ions dissociate in water. Explain how both can be true.

130) Your swimming buddy, Mario, jumped into a pool parallel to the water surface. When he stood up, he yelled "ouch," and you noticed that the skin on his chest and belly looked red and irritated. How would you describe the properties of water to explain to Mario why this happened? Why doesn't it hurt when pool water is penetrated perpendicular to the surface, as with a hands–first or feet–first dive?

131) You are helping your dad prepare food in the kitchen. Dad has a tablespoon of water in one hand and a tablespoon of vegetable oil in the other, when he trips over the rug and spills both spoons on the countertop. Dad notices that the oil forms a thin film on the countertop, whereas spilled water forms smaller, taller beads. How should you explain the different behavior of these liquids to your dad?

132) Mahamoud is confused on the similarities and differences between proteins and nucleic acids. Assuming he has learned and understood the basic chemistry, what is the likely source of his confusion? To help him sort this out, make a table or flow chart to explain the structure of these molecules and their relationship to each other.

133) Proteins are described as having different levels of structure. List and distinguish between the level(s) that produce a linear shape vs. a globular shape, and explain why one of those levels can result in either a linear or globular shape.

134) While every level of a protein's structure is important to the function of that protein, which level of structure is most important to the function of enzymes, and why?

135) You are a student intern in the research and development department of a pharmaceutical company. You have discovered a compound that destroys the common cold virus in cultured human cells. Chemical characterization reveals that carbon, hydrogen, and oxygen are present, in a 20:40:4 ratio of C:H:O. Experiments in rats show that neither oral nor injectable treatment with the compound was effective in destroying the virus. Discuss some possible reasons for this lack of effectiveness.

136) Describe what happens to NaCl when placed in water.

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

137) How many grams of glucose, molecular mass = 180 Daltons, is necessary to make 1 liter of a 1.0 molar solution? 137) _____
A) 180
B) 1.0
C) 90
D) 360
E) $6.02 \times 10^{23}$

138) A 5 M solution of 100 mL of glucose contains how many grams of glucose, molecular mass = 180 Daltons? 138) _____
A) 90
B) $6.02 \times 10^{23}$
C) 180
D) 1.0
E) 360

139) If 100 mL of water contains 5 grams of NaCl, molecular mass = 58.5 Daltons, what is the molarity of the solution in moles/L? 139) _____

A) 0.085 B) 0.25 C) 0.85 D) 2.92 E) 0.05

140) How many grams of NaCl, molecular mass = 58.5 Daltons, are the molar equivalent to 90 g of glucose (molecular mass = 180 daltons)? 140) _____

A) 0.5 B) 14.6 C) 117 D) 0.25 E) 29.25

141) How many grams of NaCl, molecular mass = 58.5 Daltons, are necessary to make 1 liter of 5% saline? 141) _____

A) 58.5
B) $6.02 \times 10^{23}$
C) 50
D) 1
E) 2.9

142) A typical blood concentration of glucose is 100 mg/dL. The molecular weight of glucose is approximately 180 Daltons. What is the molarity of this solution in millimoles? 142) _____

A) 100 B) 0.56 C) 5.6 D) 10 E) 18

143) If in an acid–base reaction $H_2SO_4^{2-}$ donates two $H^+$, one mole of $H_2SO_4^{2-}$ would equal how many equivalents? 143) _____

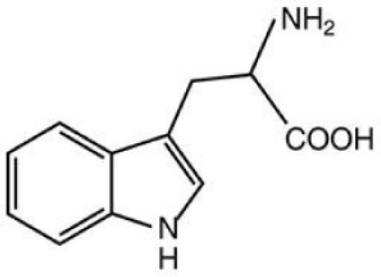
A) 2 B) 1 C) 0.75 D) 0.5 E) 4

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

144) What is the difference between atomic mass and molecular mass.

145) A. Distinguish between the mass of a molecule and the mass of a mole, using NaCl in your example.
B. Calculate the mass of a mole of NaCl in g, using the mass of one Da (amu).
C. Calculate the mass of a dozen NaCl molecules, a dozen donuts, and a mole of donuts, assuming a 30 gram dor

146) Write the chemical formula for the molecule drawn below. Which class of organic molecule does it belong to? Is i likely polar or nonpolar?




147) What is the pH of a 0.005 M HCl solution? Assume complete dissociation.

Answer Key
Testname: UNTITLED21

1) B
2) D
3) A
4) C
5) E
6) D
7) B
8) E
9) B
10) E
11) C
12) B
13) B
14) B
15) B
16) E
17) A
18) E
19) E
20) E
21) C
22) A
23) B
24) D
25) C
26) E
27) E
28) D
29) D
30) D
31) B
32) D
33) E
34) B
35) D
36) D
37) D
38) C
39) B
40) A
41) C
42) B
43) C
44) C
45) A
46) A
47) A
48) E
49) D
50) C

51) E
52) E
53) A
54) D
55) C
56) A
57) B
58) B
59) B
60) D
61) D
62) A
63) C
64) A
65) B
66) D
67) B
68) C
69) D
70) E
71) D
72) A
73) E
74) E
75) B
76) C
77) D
78) B
79) A
80) B
81) A
82) E
83) E
84) D
85) A
86) B
87) B
88) D
89) E
90) E
91) A
92) B
93) 1000 milliequivalents. This is calculated by taking the equivalent value of the molecule, which equals the molarity of the molecule (1 in this case) times the number of charges the molecule carries (in this case, the minus symbol indicates a charge of negative one, i.e., –1), so 1 × 1 = 1 equivalent. 1 equivalent = 1000 milliequivalents.
94) The seven categories: enzymes, membrane transporters, signal molecules, receptors, binding proteins, regulatory proteins, and immunoglobulins. See the "Protein Interactions" section of the chapter.
95) A
96) C
97) C

98) 805 grams (per liter). This is calculated by multiplying the amount of sucrose in one liter of a 1 molar solution (342 grams) times the molar concentration (2.5). 342 × 2.5 = 805 grams
99) E
100) A
101) The more saturated or the higher the number of hydrogens a fat contains, the more likely it will be solid at room temperature. Therefore, saturated animal fats are the most associated with cardiovascular disease.
102) B
103) A
104) C
105) A
106) B
107) E
108) E
109) D
110) A
111) E
112) These terms refer to the net change in the amount of a functional protein present in a cell in response to a signal. Up–regulation is an increase in the amount of the protein, whereas down–regulation is a decrease.
113) The interaction between a protein binding site and a ligand that are in close proximity results in a conformational change of the protein to fit more closely to the ligand. The bonds involved are hydrogen (weak), ionic (strong), and van der Waals (weak).
114) pH
115) nucleotide
116) hydrophilic
117) phospholipid
118) The bonds holding monomers together are covalent bonds, between sugar and phosphate molecules. The bonds holding neighboring strands together at the complementary bases are hydrogen bonds.
119) Monosaccharides consist of carbon, hydrogen, and oxygen, in the ratio C:H:O of 1:2:1. Amino acids consist of a central carbon (CH), a carboxylic acid (COOH), an amine ($NH_2$), and an organic side chain of variable structure (mainly a hydrocarbon chain, designated as R).
120) Several combinations of atoms that occur repeatedly in biological molecules. See Table 2.1 in the main text.
121) False. Lipids are considered hydrophobic because they have an even distribution of electrons and no positive or negative poles. Thus, nonpolar molecules have no regions of partial charge, and therefore tend to repel water molecules.
122) When chemically bonded with each other, the nitrogen atom is partially negative whereas the hydrogen atoms are partially positive. The nitrogen atom in a molecule of ammonia has a stronger attraction for the electrons participating in the covalent bonds than the hydrogen atoms. The net charge on the molecule is still zero, however.
123) Hydrogen bonds are responsible for the surface tension of water, the attractive force between water molecules that can make it difficult to separate them. The surface tension is strong enough to support the weight of water striders, thus allowing them to walk on water. If water molecules could not form hydrogen bonds, the water striders would not be able to walk on water because there would be no surface tension to support their weight. Therefore, these insects would have to adapt to terrestrial conditions near ponds or lakes rather than living on them.
124) Since $K_d < 1$, you know that [P][L] < [PL]. Therefore, at equilibrium, there is a higher concentration of protein–ligand complex suggesting that the protein has a relatively high binding affinity for the ligand.
125) Examples of such interactions would be the interactions between carbohydrates, proteins, and lipids. These interactions form molecules like glycolipids and glycoproteins. These molecules are usually used as signaling molecules on the surfaces of cells.

126) All of these terms are similar in that they describe a structure that has either gained or lost *something* but different in their overall function. An *ion* is an *atom* that has gained or lost one or more *electrons* and thus bears an electrical *charge*. Ions form when salts dissolve in water and are required for normal cell function. An ion's charge affects both its behavior in solution and its chemical reactivity. An *isotope* is an *atom* that has gained or lost one or more *neutrons*; as neutrons lack a charge, isotopes remain *neutral*. Some isotopes emit *radiation*, a type of energy, rendering them both useful and dangerous; compared to ions, they are rare in nature. A *free radical* is an *atom* or *molecule* that has at least one *unpaired* electron (an electron is more stable if paired with another electron). Free radicals can be either electrically *charged* (e.g., superoxide) or *neutral* (e.g., hydroxy), depending upon the total number of protons and electrons present. Because free radicals are unstable, they are highly reactive and disruptive to cell function; compared to ions, they are rare in the body. Neither isotopes nor free radicals are known to be required for normal cell function.

127) Elements combine to form molecules in predictable ways because of how the outer shell electrons combine between atoms. In most cases, the outer shell will be most stable with a total of eight electrons. This information is easily discernible from the periodic table. Therefore an atom with seven outer shell electrons, such as K, combines very readily with an atom with one outer shell electron, such as Cl; an atom with six outer shell electrons, such as Ca will combine with an atom with two outer shell electrons or with two atoms with one outer shell electron each, and so on. Examples: KCl, $CaCl_2$, $CH_4$.

128) Polar covalent bonds occur within a single molecule that shares electrons unequally; i.e., the constantly orbiting electrons spend more time at some locations and less at others. Nonpolar covalent bonds occur within a single molecule that shares electrons equally; i.e., the probability of an electron occupying a particular location is the same at all locations. Ionic bonds occur within a single molecule in which one atom completely loses an electron to another, causing each to develop an opposite charge; it is this electrical attraction that holds the molecule together. Hydrogen bonding occurs between separate molecules that contain polar covalent bonds; where electrons spend more time the molecule is partially negative, and where electrons spend less time the molecule is partially positive. The ends of different molecules are thus electrically attracted to each other. Water is a polar covalent molecule, with the oxygen end being partially negative and attracted to the partially positive hydrogen portions of other water molecules. Hydrogen–bonding between water molecules is responsible for surface tension and the crystalline structure of ice.

129) Molecules such as sodium chloride are bonded by ionic bonds. So much energy would be required to separate a molecule of NaCl into $Na^+$ and $Cl^-$ that it is practically impossible. That is, if the sodium chloride is DRY. Because water molecules have partial charges resulting from their polar covalent bonds, sodium chloride dissociates in water. This means that the ions separate and function relatively independently. An attraction between sodium and chloride still exists, however, and the dissociation can be described as an increase in bond length rather than a loss of the bond. Evaporate the water, though, and the sodium chloride crystals reform.

130) Because Mario was parallel to the water surface, the force of his mass was spread out over a relatively large area of the water, making the force per unit water lower than in a typical dive. The surface tension of water, while not strong enough to keep Mario from penetrating the water surface, was strong enough to momentarily resist him. The force of the water pushing back on Mario, however briefly, was enough to cause pain. In a typical dive position, the force of Mario's entire mass is spread only over a tiny area of the water, and thus the force per unit water surface is greater. This higher force is sufficient to immediately break the hydrogen bonds and overcome the surface tension.

131) Water forms beads when it strikes a nonabsorptive surface because of surface tension resulting from the hydrogen bonds between neighboring water molecules. Vegetable oil molecules are nonpolar covalent, therefore, there is no hydrogen bonding between the lipid molecules and no bead formation.

132) His confusion probably stems from the fact that both proteins and nucleic acids are classified as macromolecules, and both are assembled by covalently bonding certain monomers in a particular order. Also, nucleic acids contain the information necessary for manufacturing proteins, the term *acid* is used in describing the structure of both nucleic acids and proteins, and both nucleic acids and proteins must contain nitrogen. The monomer of protein is the amino acid, which has a central carbon, a variable chain denoted as R, and a nitrogen–containing amino group. There are 20 naturally occurring amino acids. The monomer of the nucleic acid is the nucleotide, which has a sugar attached to a nitrogen–containing base, and a phosphate. There are five different bases and two different sugars. The sequence of bases in a DNA or RNA molecule determines the sequence of amino acids in the protein.

133) Linear shapes: primary, secondary, quaternary. Primary structure is simply the sequence of covalently bonded amino acids in a peptide chain. Secondary structure is further bonding between nearby amino acids in a peptide chain, with the molecule still retaining a strand–like shape. Quaternary structure can involve separate linear polypeptide chains held together in a strand. Globular shapes: tertiary and quaternary. Tertiary structure involves bonding between distant amino acids, which causes the molecule to be wadded. Quaternary structure occurs when more than one globular peptide chain bonds together.

134) Enzymes and other globular proteins depend upon the three–dimensional shape resulting from the globular folding. Under conditions in which this shape is altered by denaturing agents such as heat, the protein ceases to function, though the primary and secondary structure may be unchanged.

135) The relatively low amount of oxygen and high carbon and hydrogen indicate that this compound is probably a lipid. Oral administration may result in digestion of the compound so that none is absorbed into the blood. Lipids are not highly soluble in water, and because blood is a watery medium, the injected lipid may not transport well in the blood. Also, human cells as well as the viruses may behave differently in culture compared to in a real patient.

136) Water molecules break the ionic bonds holding $Na^+$ and $Cl^-$ together. Each sodium ion becomes surrounded by polar water molecules, with the electronegative ends of water molecules interacting with the ion. Each chloride ion also becomes surrounded by polar water molecules, but in this case it is the electropositive ends of the water molecules that bind to the ion. A consequence is that sodium and chloride ions can function relatively independently of each other when in solution.

137) A

138) A

139) C

140) E

141) C

142) C

143) A

144) The atomic mass is the actual mass of an atom, expressed in atomic mass units (amu) or Daltons (Da), where 1 amu = $1.6 \times 10^{-27}$ kg. However, molecular mass is the sum of the atomic mass of each element × the number of atoms of each atom that make up the molecule.

145) A. The mass of a molecule is determined by the mass of its component atoms. From the periodic table, the mass of Na is 23 amu and of Cl is nearly 36 amu, so the mass of one molecule of NaCl is 59 Da. A mole is like a dozen, i.e., it is a particular number of items, specifically $6.02 \times 10^{23}$.
B. A mole of NaCl = $59 \text{ Da} \times 6.02 \times 10^{23} = 3.55 \times 10^{25}$ Da.
1 Da = $1.66 \times 10^{-27}$ kg, so $3.55 \times 10^{25} \text{ Da} \times 1.66 \times 10^{-27}$ kg/Da × 1000 g/kg = 59 g.
C. A dozen NaCl molecules: $12 \times 59 \text{ Da} \times 1.66 \times 10^{-27}$ kg/Da × 1000 g/kg = $1.2 \times 10^{-21}$ g.
A dozen donuts: $12 \times 30$ g = 360 g. A mole of donuts: $6.02 \times 10^{23} \times 30$ g = $1.8 \times 10^{25}$ g.

146) $C_{11}H_{12}N_2O_2$. The presence of the carboxylic acid (COOH) and amine ($NH_2$) indicates this is an amino acid. Because of the R group structure, it is relatively nonpolar (this amino acid is tryptophan).

147) pH = 2.3. If pH = – log [$H^+$] and HCl is a strong acid, we can assume complete dissociation will occur in solution.