

Chapter 2 Chemical Level of Organization

Multiple-Choice Questions

- 1) Atoms are electrically neutral
- A) because the number of protons and neutrons are equal.
 - B) because the number of protons and electrons are equal.
 - C) because the number of neutrons and electrons are equal.
 - D) only when the atomic numbers are even.
 - E) when electron shells are full.

Answer: B

Learning Outcome: 2.1

Bloom's Taxonomy: Knowledge

- 2) An element is defined as a pure substance consisting only of
- A) atoms of the same atomic number.
 - B) atoms of the same atomic mass.
 - C) unbonded atoms.
 - D) atoms that are created in research laboratories.
 - E) atoms that occur naturally on earth.

Answer: A

Learning Outcome: 2.1

Bloom's Taxonomy: Knowledge

- 3) One reason that electrons remain in their electron shells is that they
- A) are repelled by one another's negative charges.
 - B) naturally resist change.
 - C) are immobile.
 - D) are attracted to the positive protons in the nucleus.
 - E) associate with neutrons.

Answer: D

Learning Outcome: 2.1

Bloom's Taxonomy: Knowledge

- 4) Elements found within the body at amounts lower than 0.0002 percent are called
- A) minerals.
 - B) vitamins.
 - C) metabolites.
 - D) trace elements.
 - E) metals.

Answer: D

Learning Outcome: 2.1

Bloom's Taxonomy: Knowledge

- 5) The atomic number of an element describes the
- A) number of protons in the nucleus.
 - B) number of neutrons in the nucleus.
 - C) weight of a single atom in amu.
 - D) number of electrons needed to fill the shells.
 - E) number of atoms needed to create a 1 gram quantity.

Answer: A

Learning Outcome: 2.1

Bloom's Taxonomy: Knowledge

- 6) The element that is important both to living things in its gaseous form and as a component of water is
- A) hydrogen.
 - B) oxygen.
 - C) carbon.
 - D) hydroxide.
 - E) helium.

Answer: B

Learning Outcome: 2.1

Bloom's Taxonomy: Knowledge

- 7) The number of protons present in an element is revealed by
- A) the atomic mass.
 - B) the molecular formula.
 - C) the atomic number.
 - D) the electron shells available.
 - E) determining the difference between the atomic number and the atomic mass.

Answer: C

Learning Outcome: 2.1

Bloom's Taxonomy: Knowledge

- 8) The most abundant element, by weight, found in the human body is
- A) hydrogen.
 - B) helium.
 - C) carbon.
 - D) oxygen.
 - E) nitrogen.

Answer: D

Learning Outcome: 2.1

Bloom's Taxonomy: Knowledge

- 9) Isotopes have the same number of _____ but different numbers of _____.
- A) protons; neutrons
 - B) protons; electrons
 - C) neutrons; protons
 - D) neutrons; electrons
 - E) electrons; protons

Answer: A

Learning Outcome: 2.1

Bloom's Taxonomy: Knowledge

- 10) The atomic mass of an atom describes the
- A) number of protons in the nucleus.
 - B) number of neutrons in the nucleus.
 - C) number of electrons in the nucleus.
 - D) total weight of both protons and neutrons in the nucleus.
 - E) number of atoms needed to bond.

Answer: D

Learning Outcome: 2.1

Bloom's Taxonomy: Knowledge

- 11) The atomic number of an element is 7. How many electrons does it have?
- A) one
 - B) two
 - C) seven
 - D) fourteen
 - E) Not enough information is given.

Answer: C

Learning Outcome: 2.1

Bloom's Taxonomy: Application

- 12) The atomic number of an atom is 2. The mass number is 4. Which of the following statements is accurate?
- A) There are 6 protons, 6 neutrons, and 6 electrons.
 - B) There are 12 protons, 12 neutrons, and 12 electrons.
 - C) There are 2 protons, 4 neutrons, and 2 electrons.
 - D) There are 2 protons, 2 neutrons, and 2 electrons.
 - E) There are 2 protons, 2 neutrons, and 4 electrons.

Answer: D

Learning Outcome: 2.1

Bloom's Taxonomy: Application

- 13) The atomic number of an atom is 6 and its atomic mass is 12. Which of the following statements is accurate?
- A) There are 6 protons, 6 neutrons, and 6 electrons.
 - B) There are 12 protons, 12 neutrons, and 12 electrons.
 - C) There are 6 protons, 12 neutrons, and 6 electrons.
 - D) There are 2 protons, 2 neutrons, and 2 electrons.
 - E) There are 2 protons, 2 neutrons, and 4 electrons.

Answer: A

Learning Outcome: 2.1

Bloom's Taxonomy: Application

- 14) The mass number of an element is 7. How many neutron(s) does it have?
- A) one
 - B) two
 - C) seven
 - D) fourteen
 - E) Not enough information is given

Answer: E

Learning Outcome: 2.1

Bloom's Taxonomy: Application

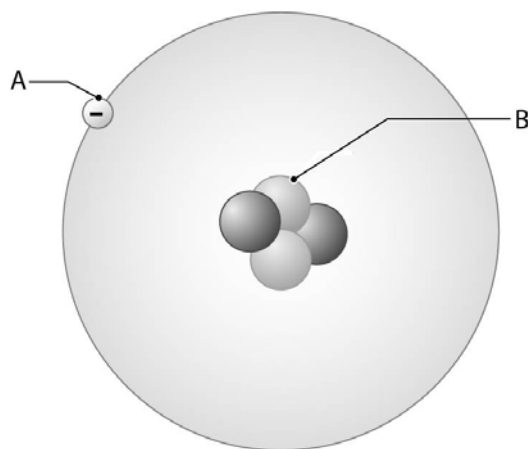


Figure 2.1

Use Figure 2.1 to answer the following questions:

- 15) The particle labeled "A" is a(n)
- A) proton.
 - B) neutron.
 - C) electron.
 - D) molecule.
 - E) cell.

Answer: C

Learning Outcome: 2.1

Bloom's Taxonomy: Knowledge

- 16) The area labeled "B" holds
- A) electrons only.
 - B) protons only.
 - C) neutrons only.
 - D) protons and neutrons.
 - E) protons and electrons.

Answer: D

Learning Outcome: 2.1

Bloom's Taxonomy: Knowledge

- 17) The first energy level of atoms holds _____ electron(s).
- A) one
 - B) two
 - C) three
 - D) four
 - E) eight

Answer: B

Learning Outcome: 2.2

Bloom's Taxonomy: Knowledge

- 18) The second energy level of atoms holds _____ electron(s).
- A) one
 - B) two
 - C) three
 - D) four
 - E) eight

Answer: E

Learning Outcome: 2.2

Bloom's Taxonomy: Knowledge

- 19) Adding electrons to an atom
- A) turns it into an anion.
 - B) changes its atomic number.
 - C) changes its atomic mass.
 - D) turns it into a cation.
 - E) turns it into either an anion or a cation.

Answer: A

Learning Outcome: 2.2

Bloom's Taxonomy: Knowledge

- 20) Atoms with filled outer shells
- A) form both anions and cations.
 - B) form anions.
 - C) form cations.
 - D) do not bond.
 - E) form only covalent bonds.

Answer: D

Learning Outcome: 2.2

Bloom's Taxonomy: Comprehension

- 21) Lithium has an atomic number of 3. How many electrons are in the second energy level?
- A) one
 - B) two
 - C) three
 - D) four
 - E) zero

Answer: A

Learning Outcome: 2.2

Bloom's Taxonomy: Application

- 22) Nitrogen has an atomic number of 7. How many electrons are normally in the third energy level?
- A) one
 - B) two
 - C) three
 - D) four
 - E) zero

Answer: E

Learning Outcome: 2.2

Bloom's Taxonomy: Application

- 23) Which of the following statements about helium (atomic number 2) and neon (atomic number 10) is FALSE?
- A) Both are inert.
 - B) Both have full outer energy shells.
 - C) Both are highly reactive.
 - D) Both are will not form chemical bonds with other atoms.
 - E) Both are inert gases.

Answer: C

Learning Outcome: 2.2

Bloom's Taxonomy: Analysis

- 24) A chemical entity that contains at least two different elements bonded together is a(n)
- A) molecule.
 - B) atom.
 - C) element.
 - D) ion.
 - E) compound.

Answer: E

Learning Outcome: 2.3

Bloom's Taxonomy: Knowledge

- 25) NaCl is a(n)
- A) anion.
 - B) cation.
 - C) compound.
 - D) molecule.
 - E) atom.

Answer: C

Learning Outcome: 2.3

Bloom's Taxonomy: Knowledge

- 26) In solutions of polar molecules, partial positive charges of one polar molecule will be attracted to partial negative charge on a neighboring polar molecule. This results in _____ bonds.
- A) hydrogen
 - B) ionic
 - C) partial
 - D) covalent
 - E) carbon

Answer: A

Learning Outcome: 2.3

Bloom's Taxonomy: Knowledge

- 27) Water is a(n)
- A) ionic compound.
 - B) diatomic molecule.
 - C) nonpolar covalent molecule.
 - D) inert gas.
 - E) polar covalent molecule.

Answer: E

Learning Outcome: 2.3

Bloom's Taxonomy: Knowledge

- 28) Which of the following statements about pure water is FALSE?
- A) Pure water contains ionic bonds.
 - B) Pure water demonstrates polarity.
 - C) Pure water has hydrogen bonds.
 - D) Pure water carries partial charges.
 - E) Pure water is a polar covalent compound.

Answer: A

Learning Outcome: 2.3

Bloom's Taxonomy: Knowledge

- 29) Chloride (Cl^-) is a(n)
- A) ion.
 - B) compound.
 - C) molecule.
 - D) atom.
 - E) bond.

Answer: A

Learning Outcome: 2.3

Bloom's Taxonomy: Comprehension

- 30) Assume that K^+ , H^+ , Na^+ , Br^- , and Cl^- are all available for bonding. Which combination is NOT a possible ionic interaction?
- A) KCl
 - B) KNa
 - C) HCl
 - D) NaCl
 - E) KBr

Answer: B

Learning Outcome: 2.3

Bloom's Taxonomy: Comprehension

31) Assume that K^+ , H^+ , Na^+ , Br^- , and Cl^- are all available for bonding. Which combination is a possible ionic interaction?

- A) HH
- B) HCl
- C) KNa
- D) HNa
- E) HK

Answer: B

Learning Outcome: 2.3

Bloom's Taxonomy: Comprehension

32) Which of the following statements is TRUE?

- A) Compounds always are ionic.
- B) Compounds always are covalent.
- C) Compounds always contain at least two different elements.
- D) Molecules always contain at least two different elements.
- E) Compound and molecule are synonyms.

Answer: C

Learning Outcome: 2.3

Bloom's Taxonomy: Application

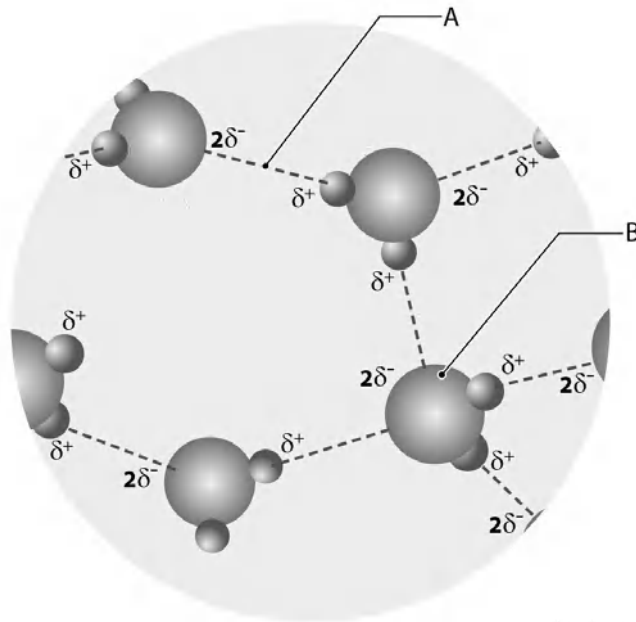


Figure 2.2

Use Figure 2.2 to answer the following questions:

33) The bonds labeled "A" are a representation of _____ bonds.

- A) covalent
- B) metal
- C) hydrogen
- D) nonpolar
- E) ionic

Answer: C

Learning Outcome: 2.3

Bloom's Taxonomy: Comprehension

34) The substance labeled "B" is

- A) a salt.
- B) a solute.
- C) a carbohydrate.
- D) water.
- E) a protein.

Answer: D

Learning Outcome: 2.3

Bloom's Taxonomy: Comprehension

- 35) The substance labeled "B" is held together by _____ bonds.
- A) covalent
 - B) metal
 - C) hydrogen
 - D) nonpolar
 - E) ionic

Answer: A

Learning Outcome: 2.3

Bloom's Taxonomy: Comprehension

- 36) Which of the following is NOT a requirement of all chemical reactions?
- A) heat
 - B) energy transfer
 - C) rearrangement of atoms
 - D) bonding
 - E) reactants

Answer: A

Learning Outcome: 2.4

Bloom's Taxonomy: Knowledge

- 37) Enzymes are substances that can promote chemical reactions because they can
- A) increase activation energy.
 - B) lower activation energy.
 - C) destabilize reactants.
 - D) break chemical bonds.
 - E) promote new chemical bond formation.

Answer: B

Learning Outcome: 2.4

Bloom's Taxonomy: Knowledge

- 38) Chemical reactions that release energy are
- A) endergonic.
 - B) exergonic.
 - C) catalyzed.
 - D) enzymatic.
 - E) equilibrated.

Answer: B

Learning Outcome: 2.4

Bloom's Taxonomy: Knowledge

- 39) The starting substances in a chemical reaction are called
- A) reactants.
 - B) products.
 - C) enzymes.
 - D) exergonic.
 - E) catalysts.

Answer: A

Learning Outcome: 2.4

Bloom's Taxonomy: Knowledge

40) Which correctly represents the chemical notation of an atom that has lost two electrons?

- A) Cl^-
- B) Na^+
- C) Ca^{2+}
- D) S^{2-}
- E) $\text{O}^{\delta-}$

Answer: C

Learning Outcome: 2.4

Bloom's Taxonomy: Comprehension

41) Which is a likely strategy in a living system to overcome activation energy barriers for chemical reactions?

- A) Heat the reactants.
- B) Provide a catalyst.
- C) Increase cellular pressure.
- D) Decrease the temperature.
- E) Add energy from carbohydrates.

Answer: B

Learning Outcome: 2.4

Bloom's Taxonomy: Comprehension

42) Which of the following represents the chemical notation of three carbon dioxide molecules?

- A) 3CO_2
- B) C_3O_6
- C) 3CO
- D) $3\text{C}_2\text{O}$
- E) C_3O_3

Answer: A

Learning Outcome: 2.4

Bloom's Taxonomy: Comprehension

43) Which of the following does NOT represent a correctly balanced chemical reaction?

- A) $\text{C} + 2\text{O} = \text{CO}_2$
- B) $2\text{H} + 2\text{O} = 2\text{H}_2\text{O}$
- C) $2\text{H} + \text{O} = \text{H}_2\text{O}$
- D) $2\text{H}_2 + 2\text{O} = 2\text{H}_2\text{O}$
- E) $2\text{C} + 2\text{O}_2 = 2\text{CO}_2$

Answer: B

Learning Outcome: 2.4

Bloom's Taxonomy: Analysis

- 44) Chemical reactions in your digestive tract break down large food fragments into smaller, absorbable fragments. What type of chemical reaction is this?
- A) decomposition
 - B) synthesis
 - C) exchange
 - D) dehydration
 - E) peptide

Answer: A

Learning Outcome: 2.5

Bloom's Taxonomy: Knowledge

- 45) Decomposition reactions
- A) result in products smaller than reactants.
 - B) assemble larger molecules.
 - C) are energetically uphill reactions.
 - D) are synthetic.
 - E) never require water.

Answer: A

Learning Outcome: 2.5

Bloom's Taxonomy: Knowledge

- 46) What is the commonality shared by hydrolysis and dehydration reactions?
- A) Both are anabolic.
 - B) Both are catabolic.
 - C) Both are exchange reactions.
 - D) Both are decomposition reactions.
 - E) Both involve water.

Answer: E

Learning Outcome: 2.5

Bloom's Taxonomy: Comprehension

- 47) Which of the following is NOT true of hydrolysis?
- A) Hydrolysis is a type of decomposition.
 - B) Hydrolysis contributes to catabolism.
 - C) Water molecules are split during hydrolysis.
 - D) Biological hydrolysis reactions require a catalyst.
 - E) Hydrolysis produces larger products from smaller reactants.

Answer: E

Learning Outcome: 2.5

Bloom's Taxonomy: Comprehension

- 48) Synthesis of new, large biological molecules in the body
- A) is endergonic.
 - B) is exergonic.
 - C) creates energy.
 - D) requires hydrolysis.
 - E) results in no net energy balance.

Answer: A

Learning Outcome: 2.5

Bloom's Taxonomy: Comprehension

- 49) The energy that is required to carry out biological synthesis is provided by
- A) endergonic reactions carried out on food molecules.
 - B) exergonic reactions carried out on food molecules.
 - C) anabolic chemical reactions.
 - D) exchange reactions.
 - E) dehydration synthesis.

Answer: B

Learning Outcome: 2.5

Bloom's Taxonomy: Comprehension

- 50) Water composes _____ percent of the human body, by weight.
- A) 50
 - B) 75
 - C) 25
 - D) 66
 - E) 1

Answer: D

Learning Outcome: 2.6

Bloom's Taxonomy: Knowledge

- 51) Which of the following types of substances are NOT likely to associate with water?
- A) proteins
 - B) sugars
 - C) fats and oils
 - D) electrolytes
 - E) salts

Answer: C

Learning Outcome: 2.6

Bloom's Taxonomy: Knowledge

- 52) The term electrolyte refers to the group of chemicals that
- A) are compounds.
 - B) are soluble.
 - C) are not soluble in water, but are soluble in oil.
 - D) are molecules.
 - E) dissolve and dissociate in water.

Answer: E

Learning Outcome: 2.6

Bloom's Taxonomy: Knowledge

- 53) The high heat capacity of water
- A) is responsible for thermal inertia.
 - B) is important in dehydration reactions.
 - C) aids lubrication of joints.
 - D) makes water an excellent solvent.
 - E) causes water temperature to change rapidly.

Answer: A

Learning Outcome: 2.6

Bloom's Taxonomy: Comprehension

- 54) Ion excretion is primarily controlled by the _____ system.
- A) urinary
 - B) cardiovascular
 - C) skeletal
 - D) digestive
 - E) integumentary

Answer: A

Learning Outcome: 2.6

Bloom's Taxonomy: Comprehension

- 55) Which of the following would NOT be considered hydrophilic?
- A) electrolytes
 - B) polar covalent molecules
 - C) ionic molecules
 - D) nonpolar molecules
 - E) water

Answer: D

Learning Outcome: 2.6

Bloom's Taxonomy: Comprehension

- 56) Whole blood is considered a(n)
- A) colloid.
 - B) suspension.
 - C) electrolyte.
 - D) organ system.
 - E) amalgam.

Answer: B

Learning Outcome: 2.6

Bloom's Taxonomy: Comprehension

- 57) The distinction between a colloid and a suspension is that
- A) a suspension's particles settle out of solution but a colloid's particles do not.
 - B) colloids contain larger particles.
 - C) suspensions are not solutions but colloids are.
 - D) suspensions are more Jello-like.
 - E) colloids are always temporary.

Answer: A

Learning Outcome: 2.6

Bloom's Taxonomy: Comprehension

- 58) Which of the following is NOT an important property of water for the function of the human body?
- A) lubrication
 - B) reactivity
 - C) high heat capacity
 - D) solubility
 - E) hydrophobicity

Answer: E

Learning Outcome: 2.6

Bloom's Taxonomy: Comprehension

- 59) The behavior expected of a polar covalent molecule in water is to
- A) be nonsoluble.
 - B) ionize.
 - C) conduct electricity.
 - D) create the formation of hydration spheres.
 - E) dissociate.

Answer: D

Learning Outcome: 2.6

Bloom's Taxonomy: Application

- 60) Which of the following statements is TRUE?
- A) All electrolytes are insoluble.
 - B) All soluble compounds are electrolytes.
 - C) All electrolytes are molecules.
 - D) All compounds are electrolytes.
 - E) All electrolytes are compounds.

Answer: E

Learning Outcome: 2.6

Bloom's Taxonomy: Analysis

- 61) Salts are substances that can be described as
- A) electrolytes containing hydrogen ions.
 - B) electrolytes containing hydroxide ions.
 - C) electrolytes containing both hydrogen ions and hydroxide ions.
 - D) electrolytes containing neither hydrogen ions nor hydroxide ions.
 - E) not electrolytes.

Answer: D

Learning Outcome: 2.7

Bloom's Taxonomy: Knowledge

- 62) Sodium hydroxide (NaOH) is considered a base because it
- A) dissociates and releases Na^+ , which resembles H^+ .
 - B) dissolves and releases OH^- , which absorbs H^+ .
 - C) is part of normal buffering systems.
 - D) is not normally found within biological systems.
 - E) dissociates and releases H^+ .

Answer: B

Learning Outcome: 2.7

Bloom's Taxonomy: Knowledge

- 63) Which of the following is NOT a direct potential negative effect of abnormal pH?
- A) broken chemical bonds
 - B) cellular and tissue damage
 - C) changes in protein shape
 - D) disruption of water balance
 - E) alteration of cellular function

Answer: D

Learning Outcome: 2.7

Bloom's Taxonomy: Knowledge

- 64) A substance that dissociates completely and releases hydrogen ions is called a
- A) strong acid.
 - B) strong base.
 - C) weak acid.
 - D) weak base.
 - E) salt.

Answer: A

Learning Outcome: 2.7

Bloom's Taxonomy: Comprehension

- 65) Which statement about alkalosis is FALSE?
- A) It represents abnormally high blood pH.
 - B) It is caused by abnormally high hydrogen ion levels.
 - C) It can be life threatening.
 - D) It can cause sustained muscle contractions.
 - E) It can damage protein structure.

Answer: B

Learning Outcome: 2.7

Bloom's Taxonomy: Comprehension

- 66) A solution with a pH of 3.7 would best be described as
- A) acidic.
 - B) alkaline.
 - C) buffered.
 - D) physiological.
 - E) neutral.

Answer: A

Learning Outcome: 2.7

Bloom's Taxonomy: Knowledge

- 67) A solution of pH 8 has _____ alkalinity than a solution of pH 4.
- A) greater
 - B) lesser
 - C) no more

Answer: A

Learning Outcome: 2.7

Bloom's Taxonomy: Knowledge

- 68) A cook adds vinegar (acetic acid) to a marinade. As a result,
- A) hydrogen ion concentration increases and pH increases.
 - B) hydrogen ion concentration increases and pH decreases.
 - C) hydrogen ion concentration decreases and pH increases.
 - D) hydrogen ion concentration decreases and pH decreases.
 - E) hydrogen ion concentration and pH are unaffected.

Answer: B

Learning Outcome: 2.7

Bloom's Taxonomy: Application

- 69) An aspiring actress hyperventilates on opening night at the high school musical. As her carbon dioxide levels fall due to non-productive respiration, so does her blood hydrogen ion concentration. How is this condition described?
- A) pH is increasing; this is acidosis.
 - B) pH is decreasing; this is acidosis.
 - C) pH is increasing; this is alkalosis.
 - D) pH is decreasing; this is alkalosis.
 - E) Not enough information is given.

Answer: C

Learning Outcome: 2.7

Bloom's Taxonomy: Analysis

- 70) Organic compounds
- A) always contain both C and H.
 - B) always contain only C.
 - C) cannot contain C.
 - D) always include acids and bases.
 - E) can be either ionic or covalent.

Answer: A

Learning Outcome: 2.8

Bloom's Taxonomy: Knowledge

- 71) Which of the following statements about inorganic compounds is FALSE?
- A) They can be either covalent or ionic.
 - B) They can be important metabolites.
 - C) They can never contain carbon.
 - D) They may be electrolytes.
 - E) They can contain partial charges.

Answer: C

Learning Outcome: 2.8

Bloom's Taxonomy: Knowledge

- 72) The basic unit of carbohydrates is the
- A) monosaccharide.
 - B) disaccharide.
 - C) starch.
 - D) amino acid.
 - E) fatty acid.

Answer: A

Learning Outcome: 2.8

Bloom's Taxonomy: Knowledge

- 73) Roughly half, by weight, of the typical U.S. diet consists of
- A) carbohydrates.
 - B) fats and oils.
 - C) protein.
 - D) simple sugars.
 - E) nutrients.

Answer: A

Learning Outcome: 2.8

Bloom's Taxonomy: Knowledge

74) Which of the following is a monosaccharide?

- A) fructose
- B) sucrose
- C) lactose
- D) maltose
- E) glycogen

Answer: A

Learning Outcome: 2.8

Bloom's Taxonomy: Knowledge

75) Which of the following is NOT a disaccharide?

- A) glucose
- B) sucrose
- C) lactose
- D) maltose

Answer: A

Learning Outcome: 2.8

Bloom's Taxonomy: Knowledge

76) Carbohydrates account for approximately _____ percent of total body weight.

- A) 66
- B) 100
- C) 50
- D) 10
- E) 1

Answer: E

Learning Outcome: 2.8

Bloom's Taxonomy: Knowledge

77) Where does disaccharide dehydration synthesis of lactose typically occur?

- A) digestive tract
- B) lungs
- C) only in plants
- D) mammary glands of a nursing mother
- E) kidneys

Answer: D

Learning Outcome: 2.8

Bloom's Taxonomy: Application

78) Hydrolysis reactions are responsible for

- A) breakdown of maltose in the digestive tract.
- B) formation of glycogen in the liver.
- C) formation of sucrose in sugar beets.
- D) conversion of fructose into glucose.
- E) formation of water.

Answer: A

Learning Outcome: 2.8

Bloom's Taxonomy: Application

79) Fatty acids consist of

- A) a carbonyl and a long hydrocarbon tail.
- B) many alcohols and a long hydrocarbon tail.
- C) a carbon and multiple alcohols.
- D) a phosphate on a long hydrocarbon entail.
- E) four fused carbon rings.

Answer: A

Learning Outcome: 2.9

Bloom's Taxonomy: Knowledge

80) Lipids typically contain a carbon-to-hydrogen ratio of

- A) 1 : 1.
- B) 1 : 2.
- C) 2 : 1.
- D) 2 : 3.
- E) 1 : 3.

Answer: B

Learning Outcome: 2.9

Bloom's Taxonomy: Knowledge

81) Lipids contain

- A) fewer oxygens than carbohydrates.
- B) more oxygens than carbohydrates.
- C) roughly the same number of oxygens as carbohydrates.
- D) no oxygens at all, but more hydrogens than carbohydrates.

Answer: A

Learning Outcome: 2.9

Bloom's Taxonomy: Knowledge

82) The lipid typically used for energy storage is a

- A) steroid.
- B) fatty acid.
- C) triglyceride.
- D) cholesterol.
- E) phospholipid.

Answer: C

Learning Outcome: 2.9

Bloom's Taxonomy: Knowledge

83) Fatty acids with all single C-C bonds are

- A) saturated.
- B) unsaturated.
- C) polyunsaturated.
- D) hydrophilic.
- E) soluble.

Answer: A

Learning Outcome: 2.9

Bloom's Taxonomy: Knowledge

- 84) Fatty acids with at least one double C-C bond are
- A) saturated.
 - B) unsaturated.
 - C) polyunsaturated.
 - D) hydrophilic.
 - E) soluble.

Answer: B

Learning Outcome: 2.9

Bloom's Taxonomy: Knowledge

- 85) Fatty acids with multiple double C-C bonds are
- A) saturated.
 - B) unsaturated.
 - C) polyunsaturated.
 - D) hydrophilic.
 - E) soluble.

Answer: C

Learning Outcome: 2.9

Bloom's Taxonomy: Knowledge

- 86) A shared chemical property of lipids is that most are
- A) electrolytes.
 - B) insoluble.
 - C) steroids.
 - D) hydrophilic.
 - E) inorganic.

Answer: B

Learning Outcome: 2.9

Bloom's Taxonomy: Knowledge

- 87) The reaction used to create triglycerides is
- A) hydrolysis.
 - B) dehydration.
 - C) glyceride.
 - D) exchange reaction.
 - E) catabolism.

Answer: B

Learning Outcome: 2.9

Bloom's Taxonomy: Knowledge

- 88) A structural component of cell membranes is a(n)
- A) fatty acid.
 - B) fat.
 - C) oil.
 - D) steroid.
 - E) triglyceride.

Answer: D

Learning Outcome: 2.9

Bloom's Taxonomy: Knowledge

- 89) When metabolized for energy, lipids provide
- A) twice as much energy as a similarly sized carbohydrate.
 - B) half as much energy as a similarly sized carbohydrate.
 - C) roughly the same amount of energy as a similarly sized carbohydrate.
 - D) no energy, but provide building blocks.
 - E) no energy, but reduce cholesterol.

Answer: A

Learning Outcome: 2.9

Bloom's Taxonomy: Knowledge

- 90) A triglyceride consists of
- A) steroid molecules.
 - B) phosphate, glycerol, and a fatty acid.
 - C) three fatty acids and a glycerol.
 - D) three glycerols and a fatty acid.
 - E) three fatty acids in a fused ring.

Answer: C

Learning Outcome: 2.9

Bloom's Taxonomy: Knowledge

- 91) The structure that acts as an effective barrier between two aqueous solutions is a
- A) cholesterol.
 - B) membrane.
 - C) steroid.
 - D) micelle.
 - E) triglyceride.

Answer: B

Learning Outcome: 2.10

Bloom's Taxonomy: Knowledge

- 92) A major component of the cell membrane is
- A) triglycerides.
 - B) monoglycerides.
 - C) cortisol.
 - D) phospholipids.
 - E) fats.

Answer: D

Learning Outcome: 2.10

Bloom's Taxonomy: Knowledge

- 93) Phospholipids are composed of
- A) steroid molecules.
 - B) a phosphate group, glycerol, and two fatty acids.
 - C) three fatty acids and a glycerol.
 - D) three glycerols and a fatty acid.
 - E) three fatty acids in a fused ring.

Answer: B

Learning Outcome: 2.10

Bloom's Taxonomy: Knowledge

- 94) When large numbers of phospholipids aggregate into a droplet this structure is called a(n)
- A) micelle.
 - B) membrane.
 - C) fat.
 - D) oil.
 - E) phosphate bridge.

Answer: A

Learning Outcome: 2.10

Bloom's Taxonomy: Knowledge

- 95) Which of the following is NOT a steroid?
- A) cholesterol
 - B) lauric acid
 - C) cortisol
 - D) estrogen
 - E) testosterone

Answer: B

Learning Outcome: 2.10

Bloom's Taxonomy: Knowledge

- 96) Steroids all share
- A) the same attached functional groups.
 - B) the function as a biological sex hormone.
 - C) hydrophilicity.
 - D) a distinctive four-carbon ring framework.
 - E) fatty acid derivatives.

Answer: D

Learning Outcome: 2.10

Bloom's Taxonomy: Knowledge

- 97) Which of the following is NOT a structural lipid?
- A) cholesterol
 - B) phospholipids
 - C) estrogen
 - D) triglycerides

Answer: C

Learning Outcome: 2.10

Bloom's Taxonomy: Comprehension

- 98) Phospholipids and glycolipids can be distinguished because glycolipids contain a
- A) steroid.
 - B) carbohydrate.
 - C) fatty acid.
 - D) phosphate.
 - E) glycerol.

Answer: B

Learning Outcome: 2.10

Bloom's Taxonomy: Comprehension

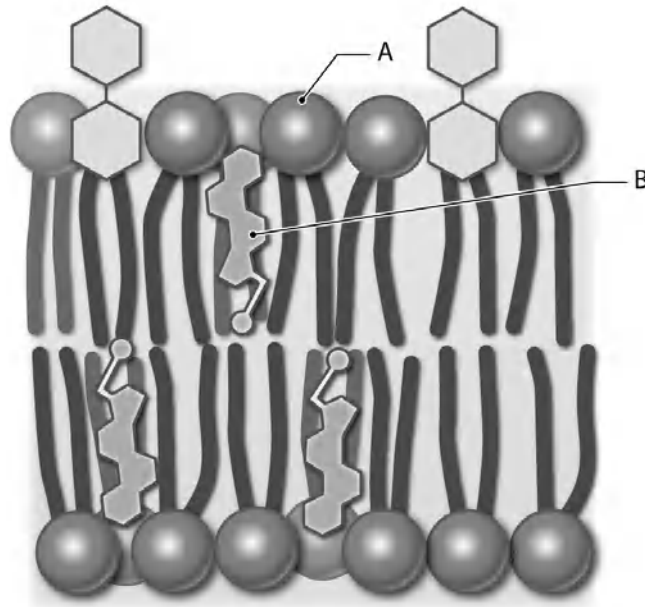


Figure 2.3

Use Figure 2.3 to answer the following questions:

99) The substance labeled "A" is named

- A) cholesterol.
- B) phospholipid.
- C) triglyceride.
- D) lycolipid.
- E) channel protein.

Answer: B

Learning Outcome: 2.10

Bloom's Taxonomy: Knowledge

100) The substance labeled "B" is named

- A) cholesterol.
- B) phospholipid.
- C) triglyceride.
- D) lycolipid.
- E) channel protein.

Answer: A

Learning Outcome: 2.10

Bloom's Taxonomy: Knowledge

- 101) The most abundant organic compounds in the human body are
- A) proteins.
 - B) carbohydrates.
 - C) lipids.
 - D) steroids.
 - E) nucleic acids.

Answer: A

Learning Outcome: 2.11

Bloom's Taxonomy: Knowledge

- 102) The subunit of proteins is called a(n)
- A) monosaccharide.
 - B) disaccharide.
 - C) amino acid.
 - D) fatty acid.
 - E) nucleic acid.

Answer: C

Learning Outcome: 2.11

Bloom's Taxonomy: Knowledge

- 103) Which of the following is NOT a constituent of all amino acids?
- A) amino group
 - B) central carbon
 - C) carboxyl group
 - D) side chain
 - E) alcohol group

Answer: E

Learning Outcome: 2.11

Bloom's Taxonomy: Knowledge

- 104) How many different amino acids are found in proteins?
- A) two
 - B) three
 - C) ten
 - D) twenty
 - E) twenty-two

Answer: D

Learning Outcome: 2.11

Bloom's Taxonomy: Knowledge

- 105) The bond that links two amino acids together in a protein chain is called a(n) _____ bond.
- A) dipeptide
 - B) ionic
 - C) hydrogen
 - D) peptide
 - E) protein

Answer: D

Learning Outcome: 2.11

Bloom's Taxonomy: Knowledge

106) The reaction used to create protein linkages is

- A) hydrolysis.
- B) dehydration.
- C) glyceride.
- D) exchange.
- E) catabolism.

Answer: B

Learning Outcome: 2.11

Bloom's Taxonomy: Knowledge

107) Primary protein structure refers to

- A) the sequence of amino acids in a protein.
- B) regular three-dimensional structures like spirals or sheets.
- C) interactions between polypeptide chains and water.
- D) two or more interacting polypeptides.
- E) any interaction involving hydrogen bonds.

Answer: A

Learning Outcome: 2.11

Bloom's Taxonomy: Knowledge

108) Quaternary protein structure refers to

- A) the sequence of amino acids in a protein.
- B) regular three-dimensional structures like spirals or sheets.
- C) interactions between polypeptide chains and water.
- D) two or more interacting polypeptides.
- E) any interaction involving hydrogen bonds.

Answer: D

Learning Outcome: 2.11

Bloom's Taxonomy: Knowledge

109) High body temperatures deleteriously affect proteins by

- A) disrupting tertiary and quaternary structures.
- B) disrupting primary protein structure.
- C) removing side chains.
- D) destroying amino acids.
- E) causing side chains to exchange places.

Answer: A

Learning Outcome: 2.11

Bloom's Taxonomy: Knowledge

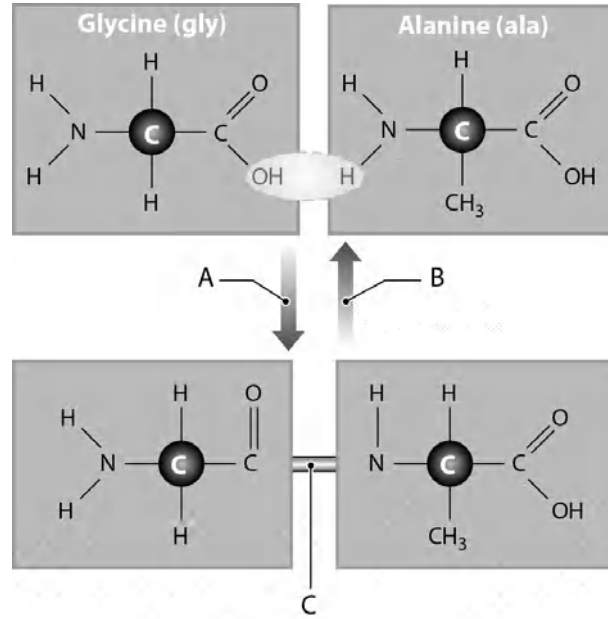


Figure 2.4

Use Figure 2.4 to answer the following questions:

110) The substances in this figure are undergoing a reversible pair of chemical reactions. What type of large macromolecule is being depicted?

- A) starch
- B) glycogen
- C) cholesterol
- D) dipeptide
- E) nucleic acid

Answer: D

Learning Outcome: 2.11

Bloom's Taxonomy: Knowledge

111) The type of reaction being carried out by the arrow labeled "A" is

- A) dehydration.
- B) hydrolysis.
- C) exchange.
- D) ionic.
- E) catabolic.

Answer: A

Learning Outcome: 2.11

Bloom's Taxonomy: Application

- 112) The type of reaction being carried out by the arrow labeled "B" is
- A) dehydration.
 - B) hydrolysis.
 - C) exchange.
 - D) ionic.
 - E) catabolic.

Answer: B

Learning Outcome: 2.11

Bloom's Taxonomy: Application

- 113) The bond labeled "C" is a _____ bond.
- A) hydrogen
 - B) substrate–enzyme
 - C) dehydration
 - D) peptide
 - E) protein

Answer: D

Learning Outcome: 2.11

Bloom's Taxonomy: Comprehension

- 114) The reactants in biological chemical reactions are called
- A) catalysts.
 - B) products.
 - C) enzymes.
 - D) substrates.
 - E) inhibitors.

Answer: D

Learning Outcome: 2.12

Bloom's Taxonomy: Knowledge

- 115) The location of substrate binding in an enzyme is called the
- A) active site.
 - B) inhibitor.
 - C) catalyst.
 - D) substrates.
 - E) reactant.

Answer: A

Learning Outcome: 2.12

Bloom's Taxonomy: Knowledge

- 116) A researcher is studying enzyme activity. Unfortunately, during a power outage, the enzyme overheats. Which statement is NOT likely to be true of the enzyme?
- A) Its active site is disrupted.
 - B) It has alterations to tertiary structure.
 - C) It has alterations to primary structure.
 - D) It will no longer catalyze the reaction.
 - E) Its secondary structure has been disrupted.

Answer: C

Learning Outcome: 2.12

Bloom's Taxonomy: Application

117) Choose the answer that places the following steps involved in enzymatic catalysis of biological reactions into the logical sequence of events.

1. Enzyme free to repeat process
 2. Enzyme-substrate complex forms
 3. Chemical reaction
 4. Product detachment
 5. Substrate binding at the active site
 6. Temporary reversible change in enzyme shape
- A) 5; 2; 6; 3; 4; 1
 B) 5; 2; 3; 6; 4; 1
 C) 5; 2; 1; 3; 6; 4
 D) 1; 3; 5; 2; 6; 4
 E) 1; 4; 5; 2; 6; 3

Answer: A

Learning Outcome: 2.12

Bloom's Taxonomy: Analysis

118) The most common energy donor(s) in enzymatic reactions is/are

- A) ATP.
- B) glucose.
- C) sucrose.
- D) catalysts.
- E) vitamins.

Answer: A

Learning Outcome: 2.13

Bloom's Taxonomy: Knowledge

119) The structure that consists of one phosphate bonded to an adenosine is called

- A) ATP.
- B) ADP.
- C) AMP.
- D) creatine.
- E) the nitrogenous base.

Answer: C

Learning Outcome: 2.13

Bloom's Taxonomy: Knowledge

120) ATP and related molecules are high-energy because they carry

- A) high-energy phosphate groups.
- B) high-energy bonds.
- C) ionic bonds.
- D) ribose sugars.
- E) high-energy nitrogenous bases.

Answer: B

Learning Outcome: 2.13

Bloom's Taxonomy: Comprehension

- 121) The individual subunits of a nucleic acid are
- A) monosaccharides.
 - B) disaccharides.
 - C) fatty acids.
 - D) amino acids.
 - E) nucleotides.

Answer: E

Learning Outcome: 2.14

Bloom's Taxonomy: Knowledge

- 122) The primary role of nucleic acids is
- A) biosynthesis.
 - B) information storage and transfer.
 - C) energy storage.
 - D) metabolism.
 - E) structural.

Answer: B

Learning Outcome: 2.14

Bloom's Taxonomy: Knowledge

- 123) Which of the following is NOT a component of a nucleotide?
- A) ribose
 - B) phosphate
 - C) nitrogenous base
 - D) alcohol group

Answer: D

Learning Outcome: 2.14

Bloom's Taxonomy: Knowledge

- 124) The reaction used to create nucleic acid linkages is
- A) hydrolysis.
 - B) dehydration.
 - C) glyceride.
 - D) exchange.
 - E) catabolism.

Answer: B

Learning Outcome: 2.14

Bloom's Taxonomy: Knowledge

- 125) Guanine has the ability to form complementary base pairing with
- A) guanine.
 - B) thymine.
 - C) uracil.
 - D) cytosine.
 - E) adenine.

Answer: D

Learning Outcome: 2.14

Bloom's Taxonomy: Knowledge

126) What type of bond forms between complementary nitrogenous bases?

- A) polar covalent
- B) nonpolar covalent
- C) ionic
- D) hydrogen
- E) peptide

Answer: D

Learning Outcome: 2.14

Bloom's Taxonomy: Knowledge

127) Which of the following is an appropriate complementary pair of nucleotides?

- A) A-T
- B) A-G
- C) T-G
- D) T-C
- E) A-C

Answer: A

Learning Outcome: 2.14

Bloom's Taxonomy: Knowledge

128) The backbone of a nucleic acid molecule consists of

- A) sugars covalently bonded to one another.
- B) alternating sugars and phosphates covalently bonded together.
- C) alternating sugars and nitrogenous bases covalently bonded together.
- D) hydrogen bonded nitrogenous bases.
- E) hydrogen bonded sugars and phosphates.

Answer: B

Learning Outcome: 2.14

Bloom's Taxonomy: Comprehension

129) Which of the following is NOT a difference between DNA and RNA?

- A) Only DNA has a sugar component.
- B) RNA is single stranded.
- C) DNA is usually much longer.
- D) RNA contains U instead of T.
- E) RNA has direct contact with protein synthesis.

Answer: A

Learning Outcome: 2.14

Bloom's Taxonomy: Comprehension

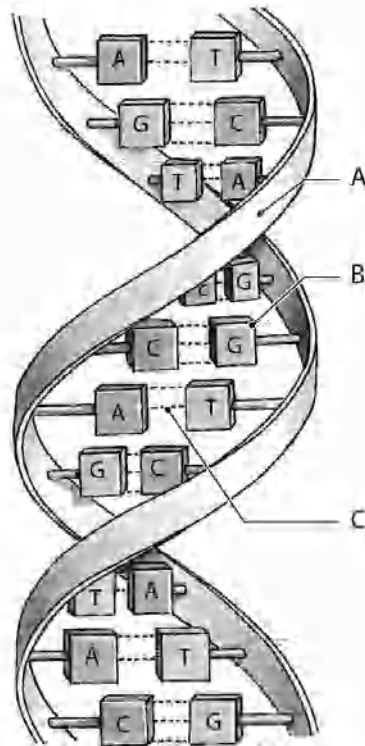


Figure 2.5

Use Figure 2.5 to answer the following questions:

- 130) The ribbon-like structure labeled "A" represents
- A) phosphate groups.
 - B) nitrogenous bases.
 - C) amino acid side chains.
 - D) a sugar-phosphate backbone.
 - E) complementary base pairing.

Answer: D

Learning Outcome: 2.14

Bloom's Taxonomy: Comprehension

- 131) The box labeled "B" represents a(n)
- A) guanine nitrogenous base.
 - B) adenine nitrogenous base.
 - C) guanine amino acid side chain.
 - D) sugar-phosphate backbone.
 - E) ribose sugar.

Answer: A

Learning Outcome: 2.14

Bloom's Taxonomy: Knowledge

- 132) The dotted lines labeled "C" represent
- A) covalent bonds.
 - B) sugar-phosphate backbone.
 - C) complementary hydrogen bonds.
 - D) ionic bonds.
 - E) peptide bonds.

Answer: C

Learning Outcome: 2.14

Bloom's Taxonomy: Comprehension

Essay Questions

- 1) Atoms contain discrete numbers of protons, neutrons, and electrons. Explain why they do not have discrete atomic mass values.

Answer: All elements contain various isotopes, which are different forms of the same atom having the same atomic number, but differing numbers of neutrons in their atomic core. Each isotope has a characteristic mass. Researchers who are aware of how abundant each isotope is are able to determine the average mass value. The mass number reported for each element is that average value.

Learning Outcome: 2.1

Bloom's Taxonomy: Knowledge

- 2) Explain why it is necessary to study chemistry in an anatomy class.

Answer: Living organisms are assemblies of chemicals that are arranged into naturally occurring hierarchical orders. Since the human body is composed of chemicals, such as water, electrolytes, and macromolecules, for a complete understanding of the higher level of organization, such as organ systems, you must understand the intricacies of the lower levels, such as atoms.

Learning Outcome: 2.1

Bloom's Taxonomy: Comprehension

- 3) Explain why the visual representation of atoms with electrons in shells is not truly accurate.

Answer: Electrons in energy levels are actually known to travel in very complex patterns around the nucleus. It is, however, useful in anatomy and physiology to simplify the representation of electrons in order to make simple predications about bonding patterns.

Learning Outcome: 2.2

Bloom's Taxonomy: Knowledge

- 4) Explain, in terms of chemical energy, how and why consuming more food than is required for daily activity usually results in weight gain.

Answer: Living organisms such as humans eat food as fuel sources. That fuel is then used to provide the energy needed for activation of the set of metabolic chemical reactions that occur in the body. Nature has devised the strategy of allowing the organism to store the excess fuel for the future when more fuel is "purchased" through ingestion than is needed at that time. In our evolutionary history this was a valuable survival characteristic, allowing humans and other animals to live on stored energy when food sources were not readily available (drought, winter, etc.). In advanced cultures, with food often readily available at all times, metabolic imbalance and weight gain often occur.

Learning Outcome: 2.4

Bloom's Taxonomy: Application

- 5) Name at least three body systems that are involved in the maintenance of electrolyte balance, explaining what the system's specific contribution is.

Answer: The skeletal system is involved in storage of electrolytes, particularly calcium and phosphate, within bone tissue. Limited amounts of electrolytes may be excreted through sweat pores in the integumentary system. We ingest and absorb our electrolytes with our digestive system. Both the nervous and endocrine systems are communication systems that have receptors able to monitor electrolytes, and the ability to send chemical or electrical messages that promote homeostatic response to electrolyte imbalances. Finally, the urinary system contains the kidneys, the major organs responsible for monitoring and maintaining electrolyte levels.

Learning Outcome: 2.6

Bloom's Taxonomy: Comprehension

- 6) Fructose and glucose both share the same molecular formula, $C_6H_{12}O_6$. Explain how the body is capable of treating them differently.

Answer: Organic compounds contain inherent three-dimensional structure. This means that molecules that appear similar on paper might actually have very different appearances in solution when the orientations of their chemical bonds are apparent. Enzymes do not see atoms; they actually are capable of distinguishing patterns and shapes of charges.

Learning Outcome: 2.8

Bloom's Taxonomy: Comprehension

- 7) Carbohydrates are typically 50 percent by weight of healthy diet, yet represent less than 2 percent of body composition by weight. Explain, with respect to the function of carbohydrates, why this is true.

Answer: The major function of carbohydrates is to provide energy to drive anabolic chemical reactions, such as synthesis, in cells. The majority of carbohydrate that is absorbed by the digestive system is sent to catabolic pathways that break the chemical bonds of the monosaccharides and transfer that bond energy to ATP, the most common high-energy compound in the body. ATP is then used to drive anabolic chemical reactions. A limited amount of carbohydrate is used for structural purposes in animals.

Learning Outcome: 2.13

Bloom's Taxonomy: Analysis

8) Compare and contrast DNA and RNA.

Answer: Both DNA and RNA consist of polymers of nucleotides, and each building block nucleotide consists of a ribose sugar, a nitrogenous base, and a phosphate group. DNA consists of very long (usually in excess of 45 million base pairs) double-stranded segments. RNA is almost always single-stranded, and typically will have strands varying from 100 to 50,000 bases in length. In RNA molecules the nitrogenous base thymine (T) is replaced with uracil (U). DNA stands for deoxyribonucleic acid, and RNA stands for ribonucleic acid, the names representing that the ribose sugar of DNA is lacking one oxygen. DNA is normally constrained to the nucleus of the cell and functions as a blueprint storage of that organism's genetic material. RNA is produced in the nucleus but then travels into the cytoplasm to direct protein synthesis. In other words, RNA is a copy of the genetic material.

Learning Outcome: 2.14

Bloom's Taxonomy: Analysis