

Figure 2.2

Using Figure 2.2, match the following:

8) Deoxyribose sugar.

Answer: B

9) Thymine.

Answer: D

10) Guanine.

Answer: E

11) Phosphate.

Answer: C

12) Hydrogen bonds.

Answer: A

Match the following chemical bonds to the correct description:

13) A bond in which electrons are shared unequally. A) Polar covalent bond

Answer: A

14) A bond in which electrons are completely lost or gained by the atoms involved. A) Ionic bond

Answer: A

15) A bond in which electrons are shared equally. A) Nonpolar covalent bond

Answer: A

16) A type of bond important in tying different parts of the same molecule together into a three-dimensional structure. A) Hydrogen bond

Answer: A

Match the following particles to the correct description:

17) Electrically charged particle due to loss of an electron. A) Cation

Answer: A

18) Neutral subatomic particle. A) Neutron

Answer: A

19) Smallest particle of an element that retains its properties. A) Atom

Answer: A

20) Smallest particle of a compound that still retains its properties. A) Molecule

Answer: A

Match the following:

21) Water. A) Compound

Answer: A

22) Carbon. A) Element

Answer: A

23) Dry ice (frozen carbon dioxide). A) Compound

Answer: A

24) Blood. A) Mixture

Answer: A

Match the following:

25) Can be measured only by its effects on matter. A) Energy

Answer: A

26) Anything that occupies space and has mass. A) Matter

Answer: A

27) Although a man who weighs 175 pounds on Earth would be lighter on the moon and heavier on Jupiter, his _____ would not be different. A) Mass

Answer: A

28) Is a function of, and varies with, gravity. A) Weight

Answer: A

Match the following:

29) Legs moving the pedals of a bicycle. A) Mechanical energy

Answer: A

30) When the bonds of ATP are broken, energy is released to do cellular work. A) Chemical energy

Answer: A

31) Energy that travels in waves. Part of the electromagnetic spectrum. A) Radiant energy

Answer: A

32) Represented by the flow of charged particles along a conductor, or the flow of ions across a membrane. A) Electrical energy

Answer: A

Match the following:

33) Heterogeneous, will not settle. A) Colloids

Answer: A

34) Heterogeneous, will settle. A) Suspensions

Answer: A

35) Homogeneous, will not settle. A) Solutions

Answer: A

36) Will not scatter light. A) Solutions

Answer: A

- 37) The atomic weight is only an average of relative weights of an atom and its isotopes, and it may vary from the weight of a specific isotope.
Answer: True False
- 38) Emulsions and colloids are the same thing.
Answer: True False
- 39) Chemical properties are determined primarily by neutrons.
Answer: True False
- 40) A charged particle is generally called an ion.
Answer: True False
- 41) Isotopes differ from each other only in the number of electrons contained.
Answer: True False
- 42) About 60% to 80% of the volume of most living cells consists of organic compounds.
Answer: True False
- 43) Lipids are a poor source of stored energy.
Answer: True False
- 44) Current information theorizes that omega-3 fatty acids decrease the risk of heart disease.
Answer: True False
- 45) Glucose is an example of a monosaccharide.
Answer: True False
- 46) A molecule consisting of one carbon atom and two oxygen atoms is correctly written as CO₂.
Answer: True False
- 47) The lower the pH, the higher the hydrogen ion concentration.
Answer: True False
- 48) Covalent bonds are generally less stable than ionic bonds.
Answer: True False
- 49) Hydrogen bonds are comparatively strong bonds.
Answer: True False
- 50) The fact that *no* chemical bonding occurs between the components of a mixture is the chief difference between mixtures and compounds.
Answer: True False
- 51) Alpha particles, although relatively weak energy particles, are second only to smoking as a cause of lung cancer.
Answer: True False

- 63) The single most abundant protein in the body is _____.
A) DNA B) hemoglobin C) glucose D) collagen
Answer: D
- 64) Carbohydrates are stored in the liver and muscles in the form of _____.
A) glycogen B) triglycerides C) glucose D) cholesterol
Answer: A
- 65) Which of the following describes coenzymes?
A) enzymes that work together B) metal ions
C) two enzymes that perform the same function D) organic molecules derived from vitamins
Answer: D
- 66) Which of the following is *not* a role of molecular chaperonins?
A) act as a biological catalyst
B) aid the desired folding and association process of polypeptides
C) promote the breakdown of damaged or denatured proteins
D) prevent accidental, premature, or incorrect folding of polypeptide chains
E) help to translocate proteins and certain metal ions across cell membranes
Answer: A
- 67) A chemical reaction in which bonds are broken is usually associated with _____.
A) a synthesis B) the consumption of energy
C) forming a larger molecule D) the release of energy
Answer: D
- 68) Salts are always _____.
A) double covalent compounds B) single covalent compounds
C) ionic compounds D) hydrogen bonded
Answer: C
- 69) The numbers listed represent the number of electrons in the first, second, and third energy levels, respectively. On this basis, which of the following is an unstable or reactive atom?
A) 2 B) 2, 8, 8 C) 2, 8 D) 2, 8, 1
Answer: D
- 70) A solution that has a pH of 2 could best be described as being _____.
A) neutral B) slightly acidic C) basic D) acidic
Answer: D
- 71) Which of the following is the major positive ion outside cells?
A) hydrogen B) potassium C) nitrogen D) sodium
Answer: D
- 72) Which of the following would be regarded as an organic molecule?
A) NaCl B) CH₄ C) NaOH D) H₂O
Answer: B

73) What is a chain of 25 amino acids called?

- A) protein B) polypeptide C) nucleotide D) starch

Answer: B

74) Which of the following constitutes a long chain of simple sugars?

- A) polysaccharide B) nucleic acid C) protein D) monosaccharide

Answer: A

75) What level of protein synthesis is represented by the coiling of the protein chain backbone into an alpha helix?

- A) quaternary structure B) primary structure
C) tertiary structure D) secondary structure

Answer: D

76) Carbohydrates and proteins are built up from their basic building blocks by the _____.

- A) removal of a nitrogen atom between each two units
B) removal of a water molecule between each two units
C) addition of a water molecule between each two units
D) addition of a carbon atom between each two units

Answer: B

77) Which statement about enzymes is *false*?

- A) Enzymes are composed mostly of protein.
B) Enzymes raise the activation energy needed to start a reaction.
C) Enzymes are organic catalysts.
D) Enzymes may be damaged by high temperature.

Answer: B

78) Which of the following statements is false?

- A) Larger particles move faster than smaller ones and thus collide more frequently and more forcefully.
B) Catalysts increase the rate of chemical reactions.
C) Chemical reactions progress at a faster rate when the reacting particles are present in higher numbers.
D) Chemical reactions proceed more quickly at higher temperatures.

Answer: A

79) Which of the following is true regarding the concentration of solutions?

- A) To calculate molarity, one must know the atomic number of the solute.
B) Percent solutions are parts per 1000 parts.
C) To calculate molarity, one must know the atomic weight of the solvent.
D) Molarity is one mole of solute per 1000 ml of solution.

Answer: D

80) Select the statement about mixtures that is correct.

- A) Suspensions are homogeneous mixtures of two or more components.
B) A solution contains solvent in large amounts and solute in smaller quantities.
C) Suspensions can change reversibly from liquid to solid.
D) Solutions contain particles that settle out in time.

Answer: B

81) Choose the answer that best describes HCO_3^- .

- A) a weak acid
- B) common in the liver
- C) a bicarbonate ion
- D) a proton donor

Answer: C

82) Select which reactions will usually be irreversible regarding chemical equilibrium in living systems.

- A) glucose to CO_2 and H_2O
- B) $\text{ADP} + \text{Pi}$ to make ATP
- C) glucose molecules joined to make glycogen
- D) $\text{H}_2\text{O} + \text{CO}_2$ to make H_2CO_3

Answer: A

83) What happens in redox reactions?

- A) both decomposition and electron exchange occur
- B) the electron donor is reduced
- C) the reaction is always easily reversible
- D) the electron acceptor is oxidized

Answer: A

84) Choose the answer that best describes fibrous proteins.

- A) are usually called enzymes
- B) rarely exhibit secondary structure
- C) are very stable and insoluble in water
- D) are cellular catalysts

Answer: C

85) Which of the following does *not* describe the ATP molecule?

- A) chemical work
- B) mechanical work
- C) pigments
- D) transport

Answer: C

86) Select the most correct statement regarding nucleic acids.

- A) Three forms exist: DNA, RNA, and tDNA.
- B) RNA is a long, single-stranded molecule made up of the bases A, T, G, and C.
- C) DNA is a long, double-stranded molecule made up of A, T, G, and C bases.
- D) tDNA is considered a molecular slave of DNA.

Answer: C

87) Which of the following is an example of a suspension?

- A) blood
- B) rubbing alcohol
- C) cytoplasm
- D) salt water

Answer: A

88) Select the correct statement about isotopes.

- A) Isotopes of the same element have the same atomic number but differ in their atomic masses.
- B) Isotopes occur only in the heavier elements.
- C) All the isotopes of an element are radioactive.
- D) All the isotopes of an element have the same number of neutrons.

Answer: A

89) The four elements that make up about 96% of body matter are _____.

- A) carbon, oxygen, phosphorus, calcium
- B) sodium, potassium, hydrogen, oxygen
- C) carbon, oxygen, hydrogen, nitrogen
- D) nitrogen, hydrogen, calcium, sodium

Answer: C

90) An example of a coenzyme is _____.

A) iron

B) riboflavin (vitamin B₂)

C) zinc

D) copper

Answer: B

91) _____ is fat soluble, produced in the skin on exposure to UV radiation, and necessary for normal bone growth and function.

A) Vitamin K

B) Vitamin D

C) Vitamin A

D) Cortisol

Answer: B

92) In liquid XYZ, you notice that light is scattered as it passes through. There is *no* precipitant in the bottom of the beaker, though it has been sitting for several days. What type of liquid is this?

A) solution

B) mixture

C) colloid

D) suspension

Answer: C

93) Atom X has 17 protons. How many electrons are in its valence shell?

A) 3

B) 10

C) 7

D) 5

Answer: C

94) Which protein types are vitally important to cell function in all types of stressful circumstances?

A) catalytic proteins

B) molecular chaperones

C) regulatory proteins

D) structural proteins

Answer: B

95) If atom X has an atomic number of 74 it would have which of the following?

A) 74 protons

B) 37 protons and 37 neutrons

C) 37 protons and 37 electrons

D) 37 electrons

Answer: C

96) What does the formula C₆H₁₂O₆ mean?

A) There are 12 hydrogen, 6 carbon, and 6 oxygen atoms.

B) There are 6 calcium, 12 hydrogen, and 6 oxygen atoms.

C) The substance is a colloid.

D) The molecular weight is 24.

Answer: A

97) Two good examples of a colloid would be Jell-O[®] and _____.

A) toenails

B) urine

C) blood

D) cytosol

Answer: D

98) An atom with a valence of 3 may have a total of _____ electrons.

A) 13

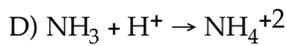
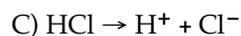
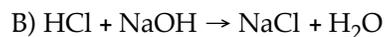
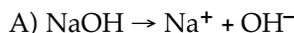
B) 17

C) 3

D) 8

Answer: A

99) Which of the following is a neutralization reaction?



Answer: B

100) The chemical symbol $\text{O}=\text{O}$ means _____.

A) zero equals zero

B) the atoms are double bonded

C) both atoms are bonded and have zero electrons in the outer orbit

D) this is an ionic bond with two shared electrons

Answer: B

101) What is a dipole?

A) a type of reaction

B) a type of bond

C) an organic molecule

D) a polar molecule

Answer: D

102) What does CH_4 mean?

A) There is one carbon and four hydrogen atoms.

B) This was involved in a redox reaction.

C) There are four carbon and four hydrogen atoms.

D) This is an inorganic molecule.

Answer: A

103) Amino acids joining together to make a peptide is a good example of a(n) _____ reaction.

A) reversible

B) exchange

C) decomposition

D) synthesis

Answer: D

104) Which of the following is *not* considered a factor in influencing a reaction?

A) time

B) particle size

C) temperature

D) concentration

Answer: A

105) Which of the following is *not* an electrolyte?

A) NaOH

B) Ca_2CO_3

C) HCl

D) H_2O

Answer: D

106) Which property of water is demonstrated when we sweat?

A) reactivity

B) high heat capacity

C) polar solvent properties

D) cushioning

E) high heat of vaporization

Answer: E

107) Sucrose is a _____.

A) disaccharide

B) monosaccharide

C) polysaccharide

D) triglyceride

Answer: A

108) What is the ratio of fatty acids to glycerol in neutral fats?

- A) 3:1 B) 4:1 C) 1:1 D) 2:1

Answer: A

109) In a DNA molecule, the phosphate serves _____.

- A) to bind the sugars to their bases B) to hold the molecular backbone together
C) as nucleotides D) as a code

Answer: B

110) Heat shock proteins (hsp) are a type of protein called _____.

- A) chaperonins B) cofactors C) coenzymes D) eicosanoids

Answer: A

111) Which bonds often bind different parts of a molecule into a specific three-dimensional shape?

- A) Oxygen B) Hydrogen C) Carbon D) Amino acid

Answer: B

112) The atomic number is equal to the number of _____.

Answer: protons (and electrons)

113) Molecules such as methane that are made of atoms that share electrons have _____ bonds.

Answer: covalent

114) An atom with three electrons would have a valence of _____.

Answer: one

115) $AB \rightarrow A + B$ is an example of a(n) _____ reaction.

Answer: decomposition

116) _____ have a bitter taste, feel slippery, and are proton acceptors.

Answer: Bases

117) A holoenzyme is composed of an apoenzyme and a(n) _____.

Answer: cofactor

118) In a DNA molecule, guanine would connect to _____.

Answer: cytosine

119) The _____ molecule directly provides energy for cellular work.

Answer: ATP

120) Hydrogen bonds are more like a type of weak _____ than true bonds.

Answer: attraction

121) Weak acids and bases make good _____.

Answer: buffers

- 122) Starch is the stored carbohydrate in plants, while _____ is the stored carbohydrate in animals.
Answer: glycogen
- 123) How many phosphates would AMP have attached to it?
Answer: one
- 124) Which metals have a toxic effect on the body?
Answer: heavy
- 125) What does the polar end of a phospholipid contain?
Answer: a phosphorus-containing group
- 126) What type of chemical bond can form between an element with 11 protons and an element with 17 protons?
Answer: ionic
- 127) What happens when globular proteins are denatured?
Answer: The active sites are destroyed.
- 128) Explain the difference between potential and kinetic energy.
Answer: Potential energy is inactive stored energy that has potential to do work. Kinetic energy is energy in action.
- 129) How can phospholipids form a film when mixed in water?
Answer: Phospholipids have both polar and nonpolar ends. The polar end interacts with water, leaving the nonpolar end oriented in the opposite direction.
- 130) What properties does water have that make it a very versatile fluid?
Answer: High heat capacity, high heat of vaporization, polarity and solvent properties, reactivity, and cushioning.
- 131) What advantages does ATP have in being the energy currency molecule?
Answer: Its energy is easy to capture and store; it releases just the right amount of energy for the cell's needs so it is protected from excessive energy release. A universal energy currency is efficient because a single system can be used by all the cells in the body.
- 132) Explain why chemical reactions in the body are often *irreversible*.
Answer: Chemical reactions that release energy cannot be reversed unless energy is put back into the system. Also, the body may use the chemicals solely for its energy, such as glucose, or some reactions produce molecules in excessive quantities (like CO₂ and NH₄) that the body needs to discard.
- 133) When a set of electrodes connected to a lightbulb is placed in a solution of dextrose and a current is applied, the lightbulb does not light up. When the same unit is placed in HCl, it does. Why?
Answer: HCl ionizes to form current-conducting electrolytes. Dextrose does not ionize, and therefore does not conduct current.

134) Describe the factors that affect chemical reaction rates.

Answer: Temperature increases kinetic energy and therefore the force of molecular collisions. Particle size: smaller particles move faster at the same temperature and therefore collide more frequently; also, smaller particles have more surface area given the same concentration of reactants. Concentration: the higher the concentration, the greater the chance of particles colliding. Catalysts increase the rate of the reaction at a given temperature. Enzymes are biological catalysts.

135) Protons and electrons exist in every atom nucleus except hydrogen. Is this statement true or false and why?

Answer: False—Hydrogen has one proton and one electron. It is the neutron that hydrogen does not have.

136) A chemical bond never occurs in a mixture. Discuss this.

Answer: Mixtures come in three forms— solutions, colloids, and suspensions. Components of these mixtures always retain their original makeup and can be separated into their individual components; therefore no chemical bonding has taken place.

137) All chemical reactions are *theoretically* reversible. Comment on this statement.

Answer: It is possible to reverse any reaction if the products are still present. Those that are only slightly exergonic are easily reversible. Some would require an enormous amount of energy to reverse. In the simple reaction $\text{Na} + \text{Cl} \rightarrow \text{NaCl}$ the amount of energy it takes to reverse table salt to chlorine gas and sodium metal is enormous. The reversing of the covalently bonded sugar molecule once it is reduced to ATP molecules is even harder or next to impossible.

138) What is the major difference between polar and nonpolar covalent bonds?

Answer: Polar bonds have an unequal sharing of electrons resulting in a slight negative charge at one end of the molecule and a slight positive charge at the other end. Nonpolar bonds have an equal sharing of electrons, resulting in a balanced charge among the atoms.

139) An amino acid may act as a proton acceptor or donor. Explain.

Answer: Amino acids have two components—a base group (proton acceptor) and an organic acid part (a proton donor).

140) Name at least four things you know about enzymes.

Answer: 1. They are proteins.
2. They have specific binding sites for specific substrates.
3. They lower the activation barrier for a specific reaction.
4. The names end in "ase."
5. They can be denatured.
6. They can be used again and again.

141) In the compound H_2CO_3 , what do the numbers 2 and 3 represent?

Answer: The 2 indicates that there are two hydrogen atoms in the compound and the 3 indicates that there are three oxygen atoms in the compound.

142) Are all chemical reactions reversible? If not, why aren't they all reversible?

Answer: All chemical reactions are theoretically reversible, but only if the products are not consumed.

- 143) Mrs. Mulligan goes to her dentist and, after having a couple of cavities filled, her dentist strongly suggests that she reduce her intake of sodas and increase her intake of calcium phosphates in the foods she eats. Why?
- Answer: Sodas are strong acids that can reduce bone and tooth salts. Calcium phosphate makes teeth hard and therefore more resistant to tooth decay.
- 144) Although his cholesterol levels were not high, Mr. Martinez read that cholesterol was bad for his health, so he eliminated all foods and food products containing this molecule. He later found that his cholesterol level dropped only 20%. Why did it not drop more?
- Answer: Cholesterol is produced by the liver, in addition to being ingested in foods.
- 145) How can DNA be used to "fingerprint" a suspect in a crime?
- Answer: The DNA of a person is unique to that individual. By obtaining the DNA from nucleated cells from the crime scene (e.g., tissue, sperm), enzymes may be used to break up the DNA into fragments. Because nearly everyone's DNA is different, it also breaks up into fragments differently. When the fragments are separated, they form patterns even more unique than fingerprint patterns. A match of suspect and crime scene DNA is strong evidence.
- 146) Why is it possible for us to drink a solution that contains a mixture of equal concentration of a strong acid and a strong base, either of which, separately, would be very caustic?
- Answer: When an acid and base of equal strength are mixed, they undergo a displacement reaction to form a water and a salt.
- 147) A 65-year-old patient came to the emergency room with complaints of severe heartburn unrelieved by taking a "large handful" of antacids. Would you expect the pH to be high or low? Explain why.
- Answer: You would expect a high pH. Taking antacids will neutralize the acidic stomach. Taking a "handful" of antacids can cause an alkaloid state. Certain drugs, such as corticosteroids and antacids that contain baking soda, will lead to metabolic alkalosis.
- 148) A 23-year-old male was riding his road bike in 100-degree heat, when he suddenly became nauseated and weak. He called 911 from his cell phone. When the ambulance came, the paramedics started intravenous therapy for severe dehydration. Explain the critical role of water to maintain homeostasis.
- Answer: Water is the most abundant and important inorganic compound in living material. It makes up 60% to 80% of the volume of most living cells. The properties of water are: high heat capacity, high heat of vaporization, polar solvent properties, reactivity, and cushioning. In this case the bicyclist lost a large amount of water through perspiration in an effort to cool his body. This caused a disruption in homeostasis.
- 149) Brenda is a 26-year-old female who is being discharged from the hospital after a vaginal delivery of an 8-pound healthy infant. Brenda is instructed by the nurse to eat a diet high in fiber and to drink 8 glasses of water per day to prevent constipation. Explain the role of fiber and water to promote defecation.
- Answer: Cellulose is a polysaccharide found in all plant products that adds bulk to the diet to promote feces through the colon. Water acts as a lubricating liquid within the colon, which eases feces through the bowel.

150) A 64-year-old man is admitted to the hospital for nonhealing pressure ulcers to his heels. He has been bedridden for 10 years because of a degenerative muscle disease. Explain why protein would be an important part of his diet to promote wound healing.

Answer: Protein composes 10% to 30% of cell mass and is the basic structural material of the body. Proteins regulate body processes. Skin, hair, and eyes are made of protein, as are the enzymes needed for digestion and absorption. Protein is essential for growth, maintenance, and repair of tissue.