

***Biology: Life on Earth with Physiology, 10e (Audesirk)***  
**Chapter 2 Atoms, Molecules, and Life**

**2.1 Multiple Choice Questions**

1) A substance with specific properties that cannot be broken down or converted into another substance is called a(n)

- A) element.
- B) molecule.
- C) ion.
- D) compound.
- E) mixture.

Answer: A

Diff: 1

Section: 2.1

Skill: Knowledge/Comprehension

2) If you examined the human body, which of the following combinations of elements would be most common?

- A) C, O, P, S
- B) C, Na, O, N
- C) Cl, Ca, C, H
- D) C, S, Ca, N
- E) O, N, H, C

Answer: E

Diff: 2

Section: 2.1

Skill: Knowledge/Comprehension

3) The atomic number of an atom is defined as the

- A) number of electrons in the outermost energy level.
- B) total number of energy shells.
- C) number of neutrons in the atomic nucleus.
- D) number of protons in the atomic nucleus.
- E) total number of electrons and neutrons.

Answer: D

Diff: 2

Section: 2.1

Skill: Knowledge/Comprehension

4) Phosphorus has an atomic number of 15, so what is the distribution of its electrons?

- A) The first energy level has 8 and the second has 7.
- B) The first energy level has 2, the second has 8, and the third has 5.
- C) The first energy level has 2 and the second has 13.
- D) The first, second, and third energy levels have 5 electrons each.
- E) The electron arrangement cannot be determined from the atomic number alone.

Answer: B

Diff: 2

Section: 2.1

Skill: Application/Analysis

5) Which four elements make up approximately 96% of living matter?

- A) Carbon, hydrogen, nitrogen, oxygen
- B) Carbon, phosphorus, hydrogen, sulfur
- C) Carbon, sodium, chlorine, magnesium
- D) Carbon, oxygen, calcium, sulfur
- E) Oxygen, hydrogen, calcium, sodium

Answer: A

Diff: 2

Section: 2.1

Skill: Knowledge/Comprehension

6) Imagine that you have been hired as a chemist and your first task is to examine a newly discovered atom. The paperwork you are given states that its atomic number is 110. What does this mean?

- A) The atom contains 110 protons.
- B) The atom contains 55 electrons.
- C) The atom contains 55 protons and 55 neutrons.
- D) The atom is an isotope.

Answer: A

Diff: 1

Section: 2.1

Skill: Application/Analysis

7) Iron is an important element in human body cells. If iron has an atomic number of 26, what does this tell you about this element?

- A) An iron atom has 13 electrons and 13 protons.
- B) An iron atom has 13 protons and 13 neutrons.
- C) An iron atom has 26 protons.
- D) An iron atom is unable to become an isotope.

Answer: C

Diff: 2

Section: 2.1

Skill: Application/Analysis

8) Carbon-14 is often used for carbon dating, where scientists measure the rate of carbon-14 decay to determine the age of items. Carbon-14 contains six protons and eight neutrons. During the process of carbon-14 decay, one of its eight neutrons becomes a proton and an electron is emitted. Which of the following is the best explanation of what has occurred?

- A) The resulting atom still has an unstable nucleus.
- B) The resulting atom is now a different element because the number of protons has changed.
- C) The resulting atom is still carbon-14.
- D) An ionic bond has formed.

Answer: B

Diff: 3

Section: 2.1

Skill: Knowledge/Comprehension

9) Radioactive isotopes are biological tools that are often used to

- A) measure the size of fossils.
- B) detect brain tumors.
- C) build up a store of calcium in a cell.
- D) increase the pH of blood.

Answer: B

Diff: 2

Section: 2.1

Skill: Knowledge/Comprehension

10) For an atom to achieve maximum stability and become chemically inert, what must occur?

- A) Its outermost energy shell must be filled with electrons.
- B) The number of electrons must equal the number of protons.
- C) Electron pairs are shared.
- D) Ionization occurs.

Answer: A

Diff: 2

Section: 2.2

Skill: Application/Analysis

11) An atom's nucleus is composed of

- A) protons only.
- B) neutrons only.
- C) protons and electrons.
- D) protons and neutrons.
- E) neutrons and electrons.

Answer: D

Diff: 1

Section: 2.2

Skill: Knowledge/Comprehension

12) The formation of ions involves the

- A) sharing of electrons.
- B) gain or loss of electrons.
- C) gain or loss of protons.
- D) sharing of protons.
- E) gain or loss of neutrons.

Answer: B

Diff: 2

Section: 2.2

Skill: Knowledge/Comprehension

13) If a certain atom has a tendency to lose two electrons, this lends itself to the formation of a(n)

- A) polar molecule.
- B) ion.
- C) water molecule.
- D) isotope.

Answer: B

Diff: 2

Section: 2.2

Skill: Synthesis/Evaluation

14) The formation of sodium chloride (NaCl) is the result of

- A) covalent bonding.
- B) chemical unreactivity.
- C) attraction between opposite charges.
- D) the lack of chemical attraction.

Answer: C

Diff: 2

Section: 2.2

Skill: Knowledge/Comprehension

15) Atoms or molecules that have gained or lost electrons are called

- A) acids.
- B) bases.
- C) covalent.
- D) ions.
- E) buffers.

Answer: D

Diff: 2

Section: 2.2

Skill: Knowledge/Comprehension

16) Most biological molecules are joined by

- A) peptide bonds.
- B) ionic bonds.
- C) hydrogen bonds.
- D) disulfide bonds.
- E) covalent bonds.

Answer: E

Diff: 2

Section: 2.2

Skill: Knowledge/Comprehension

17) Sulfur is an essential element in the human body, and studying its characteristics is important in understanding human physiology. Sulfur atoms have six electrons in their outer shell. Based on this information, which of the following is true?

- A) Sulfur can form important molecules using covalent bonds.
- B) Sulfur is inert.
- C) Sulfur is an important isotope of hydrogen.
- D) Sulfur has eight electrons in its outer shell.

Answer: A

Diff: 2

Section: 2.2

Skill: Synthesis/Evaluation

18) Free radicals contain unpaired electrons in their outermost energy shell, so they react readily with other atoms or molecules to reach a more stable state. Which of the following could potentially be a free radical?

- A) Oxygen (atomic number 8)
- B) Helium (atomic number 2)
- C) Neon (atomic number 10)

Answer: A

Diff: 2

Section: 2.2

Skill: Application/Analysis

19) Free radicals are considered dangerous because they

- A) attack the atomic nucleus.
- B) emit dangerous radiation.
- C) steal electrons from other atoms, causing them to become free radicals.
- D) damage oxygen and cause it to become an antioxidant.

Answer: C

Diff: 2

Section: 2.2

Skill: Knowledge/Comprehension

20) Scientists recommend a diet rich in antioxidants to stay healthy. What occurs at the atomic level to explain this recommendation?

- A) Antioxidants stop the chain reaction of cellular damage caused by free radicals.
- B) Antioxidants cause an increase in pH, which is necessary for neutrality in cells.
- C) Antioxidants steal electrons, which gives cells extra energy.
- D) Antioxidants are inert and do not interact with free radicals.

Answer: A

Diff: 2

Section: 2.2

Skill: Application/Analysis

21) Which of the following best explains why a particular atom may not form compounds readily?

- A) The atom has no electrons.
- B) The atom has an uneven number of protons.
- C) The atom has seven electrons in its outer shell.
- D) The atom's outer energy shells are completely full.

Answer: D

Diff: 2

Section: 2.2

Skill: Application/Analysis

22) The element carbon has atomic number 6. Carbon most likely

- A) forms an ionic bond.
- B) forms four covalent bonds.
- C) forms two covalent bonds.
- D) donates two electrons to another atom.

Answer: B

Diff: 2

Section: 2.2

Skill: Application/Analysis

23) Sodium (Na), atomic number 11, has a tendency to lose an electron in the presence of chlorine. After losing the electron, Na has \_\_\_\_\_ protons in its nucleus.

- A) 10
- B) 11
- C) 12
- D) 21
- E) 22

Answer: B

Diff: 3

Section: 2.2

Skill: Application/Analysis

24) Carbon has atomic number 6. Carbon most likely

- A) shares electrons.
- B) gains electrons.
- C) loses electrons.
- D) shares protons.
- E) loses protons.

Answer: A

Diff: 1

Section: 2.2

Skill: Application/Analysis

25) What does H-O-H represent?

- A) an atom of water
- B) a mixture including water
- C) a molecule of water
- D) ionic bonding of water

Answer: C

Diff: 2

Section: 2.2

Skill: Application/Analysis

26) The atomic number of hydrogen is 1. Based on this fact, all of the following must be true of hydrogen gas (H<sub>2</sub>) EXCEPT that it

- A) is stable.
- B) is covalently bonded.
- C) shares one pair of electrons.
- D) is polar.

Answer: D

Diff: 2

Section: 2.2

Skill: Application/Analysis

27) Polar covalent bonds form when

- A) electrons are shared unequally between atoms.
- B) more than one pair of electrons is shared.
- C) ions are formed.
- D) an acid and a base are combined.
- E) atoms from two molecules are attracted to each other.

Answer: A

Diff: 1

Section: 2.2

Skill: Knowledge/Comprehension

28) Which of the following represents a molecule characterized by polar covalent bonding?

A) NaCl

B) H<sub>2</sub>

C) H<sub>2</sub>O

D) C-C

E) CH<sub>4</sub>

Answer: C

Diff: 3

Section: 2.2

Skill: Knowledge/Comprehension

29) What type of bond is easily disrupted in aqueous solutions?

A) Covalent

B) Polar covalent

C) Ionic

Answer: C

Diff: 2

Section: 2.2

Skill: Knowledge/Comprehension

30) If sulfur has an atomic number of 16, how many covalent bonds does it form?

A) Zero

B) Two

C) Four

D) Six

E) Eight

Answer: B

Diff: 2

Section: 2.2

Skill: Application/Analysis

31) The part of the atom that has the greatest biological interest and influence is the

A) proton.

B) electron.

C) neutron.

D) innermost electron shell.

Answer: B

Diff: 2

Section: 2.2

Skill: Knowledge/Comprehension



32) Which of the following pairs has the most similar chemical properties?

- A)  $^1\text{H}$  and  $^{22}\text{Na}$
- B)  $^{12}\text{C}$  and  $^{28}\text{Si}$
- C)  $^{16}\text{O}$  and  $^{32}\text{S}$
- D)  $^{12}\text{C}$  and  $^{14}\text{C}$
- E)  $^1\text{H}$  and  $^2\text{He}$

Answer: D

Diff: 3

Section: 2.2

Skill: Synthesis/Evaluation

33) A single covalent chemical bond represents the sharing of how many electrons?

- A) One
- B) Two
- C) Three
- D) Four
- E) Six

Answer: B

Diff: 2

Section: 2.2

Skill: Knowledge/Comprehension

34) Polar molecules

- A) have an overall negative electric charge.
- B) have an equal distribution of electric charge.
- C) have an overall positive electric charge.
- D) have an unequal distribution of electric charge.
- E) are always ions.

Answer: D

Diff: 1

Section: 2.2

Skill: Knowledge/Comprehension

35) The hydrogen bond between two water molecules forms because water is

- A) polar.
- B) nonpolar.
- C) a liquid.
- D) a small molecule.
- E) hydrophobic.

Answer: A

Diff: 1

Section: 2.2

Skill: Application/Analysis

36) What type of bond would most likely form between two polar molecules?

- A) ionic bond
- B) hydrogen bond
- C) peptide bond
- D) covalent bond
- E) No bond would form; the molecules would repel each other.

Answer: B

Diff: 1

Section: 2.2

Skill: Knowledge/Comprehension

37) Which statement is an accurate description of water molecules?

- A) They are ionically bonded.
- B) They are charged and nonpolar.
- C) They are slightly charged and polar.
- D) They are uncharged and nonpolar.

Answer: C

Diff: 2

Section: 2.2

Skill: Knowledge/Comprehension

38) Which of the following is an example of hydrogen bonding?

- A) The bond between O and H in a single molecule of water
- B) The bond between O of one water molecule and H of a second water molecule
- C) The bond between O of one water molecule and O of a second water molecule
- D) The bond between H of one water molecule and H of a second water molecule
- E) The bond between the H of a water molecule and H of a hydrogen molecule

Answer: B

Diff: 2

Section: 2.2

Skill: Knowledge/Comprehension

39) Which of the following results from a transfer of electron(s) between atoms?

- A) Nonpolar covalent bond
- B) Polar covalent bond
- C) Ionic bond
- D) Hydrogen bond
- E) Electron-proton interaction

Answer: C

Diff: 1

Section: 2.2

Skill: Knowledge/Comprehension

40) Which of the following results from an unequal sharing of electrons between atoms?

- A) Nonpolar covalent bond
- B) Polar covalent bond
- C) Ionic bond
- D) Hydrogen bond
- E) Electron-proton interaction

Answer: B

Diff: 1

Section: 2.2

Skill: Knowledge/Comprehension

41) Which of the following best explains the attraction of water molecules to each other?

- A) Nonpolar covalent bond
- B) Polar covalent bond
- C) Ionic bond
- D) Hydrogen bond
- E) Electron-proton interaction

Answer: D

Diff: 1

Section: 2.2

Skill: Application/Analysis

42) Which of the following is LEAST affected by the presence of water?

- A) Nonpolar covalent bond
- B) Polar covalent bond
- C) Ionic bond
- D) Hydrogen bond
- E) Electron-proton interaction

Answer: A

Diff: 2

Section: 2.2

Skill: Application/Analysis

43) What happens when hydrochloric acid (HCl) is added to pure water?

- A) The HCl molecules separate into  $\text{H}^+$  and  $\text{Cl}^-$  ions.
- B) The water has a decrease of  $\text{H}^+$  ions.
- C) The HCl molecules float on top of the water.
- D) The concentration of  $\text{OH}^-$  ions increases.
- E) The pH of the solution increases.

Answer: A

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

44) An atom of nitrogen attracts electrons more strongly than an atom of hydrogen. In an ammonia molecule ( $\text{NH}_3$ ), which of the following best describes the electrical charge of the individual atoms?

- A) The nitrogen is more slightly positive.
- B) The nitrogen becomes neutral.
- C) The hydrogens are more slightly positive.
- D) The hydrogens are strongly negative.
- E) Charges balance out and none of the atoms has any charge.

Answer: C

Diff: 2

Section: 2.3

Skill: Application/Analysis

45) If a substance measures 7 on the pH scale, that substance

- A) has equal concentrations of  $\text{H}^+$  and  $\text{OH}^-$  ions.
- B) may be lemon juice.
- C) has a higher concentration of  $\text{OH}^-$  than  $\text{H}^+$  ions.
- D) probably lacks  $\text{OH}^-$  ions.
- E) is basic.

Answer: A

Diff: 2

Section: 2.3

Skill: Application/Analysis

46) A neutral solution

- A) has no  $\text{H}^+$ .
- B) has no  $\text{OH}^-$ .
- C) has equal amounts of  $\text{H}^+$  and  $\text{OH}^-$ .
- D) is hydrophobic.
- E) has a pH of 0.

Answer: C

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

47) How do buffers work?

- A) They soak up extra acid and base.
- B) They accept or release  $\text{H}^+$ .
- C) They accept or release  $\text{OH}^-$ .
- D) They convert  $\text{H}^+$  and  $\text{OH}^-$  to water.
- E) They monitor the blood pH.

Answer: B

Diff: 3

Section: 2.3

Skill: Knowledge/Comprehension

48) The human body must maintain a constant pH. In the blood, bicarbonate serves as a(n) \_\_\_\_\_ to help maintain the necessary pH.

- A) acid
- B) buffer
- C) base
- D) solvent

Answer: B

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

49) Milk of magnesia is often used to treat stomach upset. It has a pH of 10. Based on this information, milk of magnesia

- A) is a base.
- B) is hydrophobic.
- C) is an acid.
- D) has the same pH as stomach acid.

Answer: A

Diff: 2

Section: 2.3

Skill: Application/Analysis

50) What is meant by the statement that water has a high specific heat?

- A) It can absorb a lot of energy without changing temperature.
- B) It grows hot very quickly.
- C) The boiling point of water is very low.
- D) Water can heat up to only a certain temperature.
- E) Water freezes easily.

Answer: A

Diff: 3

Section: 2.3

Skill: Knowledge/Comprehension

51) Which of the following properties of water enable(s) it to function as a moderator of temperature for living organisms?

- A) High specific heat
- B) Low specific heat
- C) High heat of vaporization
- D) High specific heat and high heat of vaporization
- E) High specific heat and low heat of vaporization

Answer: E

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

52) The fact that salt dissolves in water is best explained by the

- A) slightly charged nature of water molecules.
- B) polar nature of water molecules.
- C) hydrophobic nature of salt.
- D) ionic nature of water molecules.
- E) hydrophobic nature of the water.

Answer: B

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

53) Hydrophilic molecules

- A) form hydrogen bonds among themselves.
- B) are neutral and nonpolar.
- C) readily dissolve in water.
- D) do not readily dissolve in water.
- E) are repelled by water.

Answer: C

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

54) Water moves through a plant because of the property of

- A) high heat of fusion.
- B) high heat of vaporization.
- C) high specific heat.
- D) cohesion.

Answer: D

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

55) Water molecules are cohesive because they

- A) make up 60% to 90% of an organisms body weight.
- B) form hydrogen bonds.
- C) contain protons.
- D) stick to other polar molecules.
- E) are repelled by nonpolar molecules.

Answer: B

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

56) When the acidic level of human blood increases, how is the proper balance of hydrogen ions ( $\text{H}^+$ ) restored?

- A) Bicarbonate ( $\text{HCO}_3^-$ ) releases  $\text{H}^+$  ions that combine with excess  $\text{OH}^-$  ions to form  $\text{H}_2\text{O}$ .
- B)  $\text{H}^+$  ion-donor levels increase.
- C) Bicarbonate ( $\text{HCO}_3^-$ ) accepts  $\text{H}^+$  ions and forms carbonic acid.
- D) Carbonic acid eats up the extra  $\text{OH}^-$  ions.

Answer: C

Diff: 2

Section: 2.3

Skill: Application/Analysis

57) For ice to melt, it has to

- A) absorb heat from its surroundings.
- B) become less dense.
- C) increase its property of cohesion.
- D) increase its heat of vaporization.

Answer: A

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

58) What determines the cohesiveness of water molecules?

- A) Hydrogen bonds
- B) Ionic bonds
- C) Covalent bonds
- D) Hydrophobic interactions

Answer: A

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

59) If you place a paper towel in a dish of water, the water will

- A) separate into  $\text{H}^+$  and  $\text{OH}^-$  ions, which will react with the paper towel molecules.
- B) dissolve the towel because water is a good solvent.
- C) move away from the towel because water molecules have hydrophobic interactions.
- D) move up the towel as the water adheres to the paper towel while the cohesive water molecules stay bound to each other.
- E) move up the towel because water molecules move quickly as it vaporizes.

Answer: D

Diff: 2

Section: 2.3

Skill: Synthesis/Evaluation

- 60) Sweating is a useful cooling mechanism for humans because water
- A) takes up a great deal of heat in changing from its liquid state to its gaseous state.
  - B) takes up a great deal of heat in changing from its solid state to its liquid state.
  - C) can exist in two states at temperatures common on Earth.
  - D) is an outstanding solvent.
  - E) ionizes readily.

Answer: A

Diff: 2

Section: 2.3

Skill: Application/Analysis

- 61) In general, a substance that carries an electric charge can dissolve in water. Given this fact, which of the following would most likely NOT dissolve in water?

- A) Ionic compounds
- B) Polar covalent molecules
- C) Nonpolar molecules
- D) NaCl

Answer: C

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

- 62) If you place a feather on the surface of a bowl of water, the feather remains suspended on the surface due to the

- A) surface tension of the water.
- B) fact that water is a good solvent.
- C) polarity of the water.
- D) density of the water.

Answer: A

Diff: 1

Section: 2.3

Skill: Application/Analysis

- 63) The specific heat of water is 10 times greater than that of iron. You place a metal pot full of water on the stove to heat it up. You touch the metal handle of the pot when the water is still only lukewarm. Which of the following best describes what happens?

- A) You find that the handle is cooler than the water in the pot.
- B) You burn your finger and pull your hand away from the very hot handle.
- C) You find that both the water and the handle are the same temperature.
- D) You determine that metal pots full of water produce acids and bases.

Answer: B

Diff: 2

Section: 2.3

Skill: Application/Analysis



64) You drop a handful of salt into a glass of water. Which of the following best describes what is happening inside the glass at the molecular level?

- A) The positively charged hydrogen ends of the water molecules are attracted to sodium ions.
- B) The positively charged hydrogen ends of the water molecules are attracted to chloride ions.
- C) Sodium and chloride ions form a covalent bond.
- D) Water and sodium form a covalent bond.

Answer: B

Diff: 1

Section: 2.3

Skill: Application/Analysis

65) Your friend does a belly flop into the pool. The stinging pain he feels is most likely due to the

- A) surface tension of water (caused by the large number of hydrogen bonds that form between water molecules).
- B) fact that water is a good solvent.
- C) pH of the water.
- D) hydrophobic nature of your friend's skin.

Answer: A

Diff: 1

Section: 2.3

Skill: Knowledge/Comprehension

66) Which of the following is the most dense?

- A) Liquid water
- B) Water vapor
- C) Ice

Answer: A

Diff: 1

Section: 2.3

Skill: Knowledge/Comprehension

67) Unlike a rock, a reptile can sit in the hot sunshine without its body temperature soaring quickly. This is because the water in its body

- A) has a high specific heat.
- B) has a low specific heat.
- C) is a good solvent.
- D) is a poor solvent.

Answer: A

Diff: 1

Section: 2.3

Skill: Knowledge/Comprehension

## 2.2 True/False Questions

1) Isotopes are atoms of the same element that have different numbers of protons. True or False?

Answer: FALSE

Diff: 1

Section: 2.1

Skill: Knowledge/Comprehension

2) Every atom has an equal number of electrons and protons. True or False?

Answer: TRUE

Diff: 1

Section: 2.1

Skill: Knowledge/Comprehension

3) Acids have pH values below 7, whereas bases have pH values above 7. True or False?

Answer: TRUE

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

4) The attractive force that holds two or more water molecules together is called an ionic bond. True or False?

Answer: FALSE

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

5) When water freezes, stable hydrogen bonds form that create an open, six-sided (hexagonal) arrangement. True or False?

Answer: TRUE

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

6) Water surface tension is a result of the cohesive nature of water molecules. True or False?

Answer: TRUE

Diff: 1

Section: 2.3

Skill: Knowledge/Comprehension

7) In order to maintain a constant pH, buffers act to either accept or release  $H^+$ . True or False?

Answer: TRUE

Diff: 1

Section: 2.3

Skill: Knowledge/Comprehension

8) Most liquids become less dense upon solidification, but water is different in that it becomes more dense when it solidifies. True or False?

Answer: FALSE

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

### 2.3 Fill-in-the-Blank Questions

1) The chemical properties of an element are determined by the number of \_\_\_\_\_ in its outermost energy shell.

Answer: electrons

Diff: 2

Section: 2.1

Skill: Knowledge/Comprehension

2) Isotopes are atoms of the same element that have different numbers of which subatomic particle?

Answer: neutrons

Diff: 1

Section: 2.1

Skill: Knowledge/Comprehension

3) The second electron shell is considered to be full when it contains \_\_\_\_\_ electrons.

Answer: eight

Diff: 1

Section: 2.1

Skill: Knowledge/Comprehension

4) A basilisk lizard can run across the surface of a pond due to a property of water called \_\_\_\_\_.

Answer: surface tension

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

5) Ions and polar molecules that are electrically attracted to water molecules are \_\_\_\_\_.

Answer: hydrophilic

Diff: 2

Section: 2.3

Skill: Knowledge/Comprehension

## 2.4 Short Answer Questions

1) What is the difference between covalent and ionic bonds?

Answer: Covalent bonds are the sharing of electrons between atoms, whereas ionic bonds are the electric charge attraction between two ions.

Diff: 2

Section: 2.2

Skill: Synthesis/Evaluation

2) Why is a helium atom (atomic number 2) more stable than a hydrogen atom (atomic number 1)?

Answer: Two electrons completely fill the outermost electron shell of helium, but hydrogen must accept an electron before its outermost shell is filled.

Diff: 2

Section: 2.2

Skill: Synthesis/Evaluation

3) What type of bonding exists between the slight positive charge of a hydrogen atom and the slight negative charge of a nearby atom?

Answer: hydrogen bonding

Diff: 2

Section: 2.2

Skill: Knowledge/Comprehension

4) What property of water, in which water molecules stick to each other, is responsible for the ability of plants to get water from their roots up to their leaves?

Answer: cohesion

Diff: 1

Section: 2.3

Skill: Application/Analysis

5) How does a base differ from an acid?

Answer: A base is a solution with a concentration of  $\text{OH}^-$  that is higher than the concentration of  $\text{H}^+$  (pH greater than 7). An acid has a  $\text{H}^+$  concentration that exceeds its  $\text{OH}^-$  concentration (pH less than 7).

Diff: 2

Section: 2.3

Skill: Synthesis/Evaluation

6) Imagine you are trying to make a homemade salad dressing and place several drops of olive oil into a container of water. You stir the solution, but the oil doesn't readily mix. Instead, you observe a glistening clump of oil floating on the surface. Explain what is happening at the molecular level. (Your answer should include the term "hydrophobic.")

Answer: When oil molecules are together in water, their nonpolar surfaces are hydrophobic and nestle together. They are surrounded by water molecules that form hydrogen bonds with one another but not with the oil.

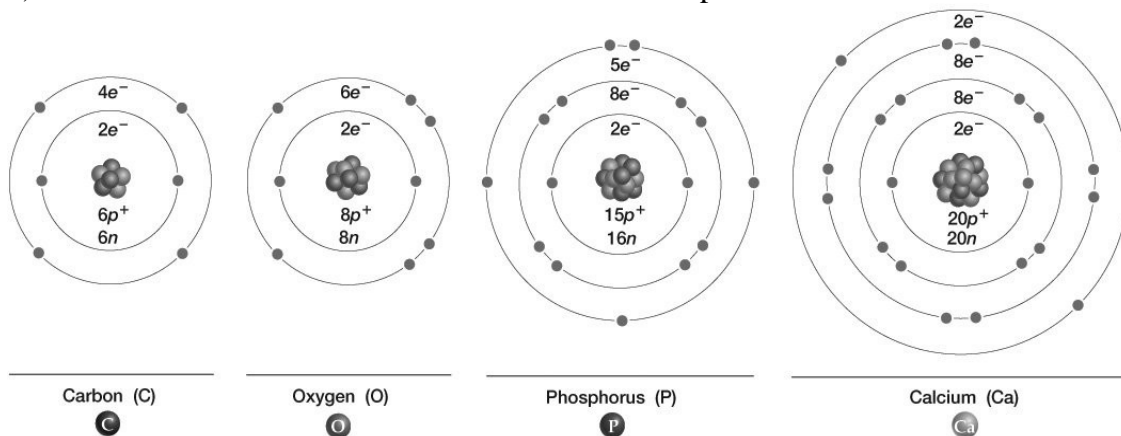
Diff: 3

Section: 2.3

Skill: Synthesis/Evaluation

## 2.5 Art Questions

1) Which of these atoms would become inert if it accepted three electrons?



- A) Carbon
- B) Hydrogen
- C) Phosphorus
- D) Calcium

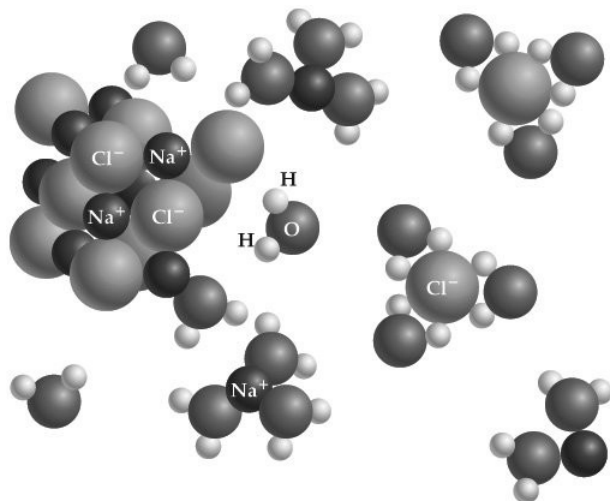
Answer: C

Diff: 2

Section: 2.2

Skill: Synthesis/Evaluation

2) Which of the following is attracted to the hydrogen "end" of a water molecule, as depicted in this figure?



A) NaCl

B) H

C) Cl<sup>-</sup>

D) Na<sup>+</sup>

Answer: C

Diff: 1

Section: 2.3

Skill: Application/Analysis

## 2.6 Scenario Questions

1) Different types of living matter often have different forms of the same elements in their bodies. For example, the nitrogen in an animal often has a slightly different atomic structure than the nitrogen in a plant. Recently, nutritionists have discovered how to deduce the diets of various animal species by examining the type of nitrogen (and other elements) inside their bodies.

What is the chemical basis behind this scenario?

- A) Antioxidants buffer the potential damage that free radicals do to cells.
- B) Radioactive elements can be used to trace the paths of molecules through the body.
- C) Hydrophobic interactions keep water molecules from forming bonds with fats and oils.
- D) Isotopes of the same element have the same atomic number but different atomic masses.
- E) Covalent bonds result when two atoms share electrons.

Answer: D

Diff: 3

Section: 2.1

Skill: Application/Analysis

2) All animals need oxygen gas ( $O_2$ ) for their primary cellular-level functioning. Inside the cell,  $O_2$  is split apart into oxygen atoms. Eventually, electrons that are flowing through the cell will be "received" by this oxygen. But first, the electrons combine with protons present in the cell to form a basic element that has a single proton and a single electron. Then, this element combines with the oxygen to form a certain chemical compound.

In this scenario, what chemical compound is produced?

- A) Water ( $H_2O$ )
- B) Carbon dioxide ( $CO_2$ )
- C) Ozone ( $O_3$ )
- D) Bicarbonate ( $HCO_3$ )

Answer: A

Diff: 3

Section: 2.1

Skill: Synthesis/Evaluation