

## Testing Your Knowledge

### Multiple Choice

- Which of the following is a trace element, required only in small amounts by most living things?
  - oxygen
  - iron
  - nitrogen
  - carbon
  - hydrogen
- An acid is a substance that
  - dissolves in water.
  - forms covalent bonds with other substances.
  - donates hydrogen ions to solutions.
  - is a versatile solvent.
  - removes hydrogen ions from solutions.
- How an atom behaves when it comes into contact with other atoms is determined by its
  - nucleus.
  - size.
  - protons.
  - neutrons.
  - electrons.
- Most of water's unique properties result from the fact that water molecules
  - are very small.
  - tend to repel each other.
  - are extremely large.
  - tend to stick together.
  - are in constant motion.
- Atoms of different phosphorus isotopes
  - have different atomic numbers.
  - have different numbers of neutrons.
  - react differently with other atoms.
  - have different numbers of electrons.
  - have different numbers of protons.
- An ion is formed when an atom
  - forms a covalent bond with another atom.
  - gains or loses an electron.
  - becomes part of a molecule.
  - gains or loses a proton.
  - gains or loses a neutron.
- The smallest particle of water is
  - an atom.
  - a crystal.
  - an element.
  - a compound.
  - a molecule.
- Why are biologists so interested in chemistry?
  - Chemicals are the fundamental parts of all living things.
  - Most chemicals are harmful to living things.
  - They know little about life except the chemicals it is made from.
  - If you understand the chemistry of life, you can make a lot of money.
  - Everything about life can be known by understanding its chemistry.
- Molecules are always moving. Some molecules move faster than others; \_\_\_\_\_ is a measure of their average velocity of movement.
  - polarity
  - heat
  - temperature
  - electronegativity
  - density
- Which of the following holds atoms together in a molecule?
  - ionic bonds between atoms
  - transfer of protons from one atom to another
  - sharing of electrons between atoms
  - loss of neutrons by atoms
  - sharing of protons between atoms
- Ice floats because
  - it is colder than liquid water.
  - its molecules are moving faster than in liquid water.
  - it is more dense than liquid water.
  - its hydrogen molecules bond to the water surface film.
  - its water molecules are farther apart than in liquid water.
- Adding acid tends to \_\_\_\_\_ of a solution.
  - increase the hydrogen ion concentration and raise the pH
  - increase the hydrogen ion concentration and lower the pH
  - decrease the hydrogen ion concentration and raise the pH
  - decrease the hydrogen ion concentration and lower the pH
  - c or d, depending on the original acidity

### Essay

- List the four elements needed by living things in large amounts, two others needed in moderate amounts, and two elements needed in trace amounts.

- Explain why the smallest particle of iron is an atom, but the smallest particle of water is a molecule.
- Explain the following statement: The temperature of the water in a teakettle is higher than the temperature of water in a swimming pool, but the swimming pool contains more heat.
- How does acid precipitation form? How does it injure animals? Plants?
- Explain why water molecules are polar, how this makes them tend to bond to each other, and how this causes water to have a large heat-storage capacity.
- Explain how evaporation of water from your skin cools you on a hot day.
  - finding out whether cadmium atoms form ionic or covalent bonds.
  - finding out whether cadmium is acidic in water.
  - determining the number of bonds formed by cadmium atoms.

- Changing the number of \_\_\_\_\_ would change it into an atom of a different element.
  - bonds formed by an atom
  - electrons circling the nucleus of an atom
  - protons in an atom
  - particles in the nucleus of an atom
  - neutrons in an atom
- A glass of grapefruit juice, at pH 3, contains \_\_\_\_\_  $H^+$  as a glass of tomato juice, at pH 4.
  - one-tenth as much
  - half as much
  - twice as much
  - three times as much
  - ten times as much

## Applying Your Knowledge

### Multiple Choice

- Which of the following best states a reductionist point of view?
  - You can understand something by taking it apart.
  - Small things are more complex than large ones.
  - A team can accomplish tasks individual members cannot.
  - A system has functions more complex than its parts.
  - If you look at something long enough, you will understand it.
- An atom that normally has \_\_\_\_\_ in its outer shell would tend *not* to form chemical bonds with other atoms.
  - 1 electron
  - 3 electrons
  - 4 electrons
  - 6 electrons
  - 8 electrons
- Researchers studying the effects of toxic wastes knew that animals were poisoned by the heavy metal cadmium, but they wanted to know where cadmium accumulated in the body. They could find out by
  - tracing the movement of cadmium isotopes in test animals.
  - measuring the size of cadmium atoms.
- Fluorine atoms tend to take electrons from any atoms that come near. As a result, fluorine atoms
  - tend to become positively charged.
  - are nonpolar.
  - do not react readily with other atoms.
  - tend to form ionic bonds.
  - are not very electronegative.
- Tim added 10 milliliters (mL) of hydrochloric acid and 10 mL of water (pH 7) to a beaker containing 100 mL of water. The pH of the resulting solution was 4. Next he is going to add 10 mL of hydrochloric acid and 10 mL of pH 7 buffer to a different beaker containing 100 mL of water. What do you think will happen?
  - The resulting pH will be less than 4.
  - The resulting pH will be between 4 and 7.
  - The resulting pH will be 7.
  - The resulting pH will be between 7 and 11.
  - The resulting pH will be greater than 11.
- A sodium atom has a mass number of 23. Its atomic number is 11. How many electrons does it have (if it is not an ion)?
  - 11
  - 12
  - 22
  - 23
  - 34