

## Polymer Chemist

1. Students are asked to write a job description for a polymer chemist in the form of a company advertisement. Answers should include a list of responsibilities of a polymer chemist for the position and perhaps the amount of experience required. They may also include a brief description of the company and the type of work it does or products it makes.
2. Students answers will vary, but in general the university courses needed to become a polymer chemist include introductory chemistry, physics, calculus, computer programming, biochemistry and organic chemistry, and many different polymer chemistry courses.

Pages 190–191

**4 CHAPTER REVIEW**

**ADDITIONAL QUESTIONS**

1. Name two properties possessed by all forms of matter.

2. Identify two kinds of pure substances and their kinds of mixtures.

3. Explain the difference between a homogeneous mixture and a heterogeneous mixture, giving an example of each.

4. Identify the three subatomic particles, their electric charge, and location in an atom.

5. What are the two main types of compounds, and what are the names of the chemical bonds formed in each?

6. Name each of the following ions:

(a)  $\text{Na}^+$  (b)  $\text{Cl}^-$  (c)  $\text{Fe}^{3+}$  (d)  $\text{P}^{3-}$  (e)  $\text{O}^{2-}$

7. Suppose that a friend tells you that a balanced chemical equation involves only coefficients and chemical symbols. Would your friend be correct? If not, what else is needed?

8. Name all seven elements that form diatomic molecules. Provide the correct symbols for each molecule.

**Connect Your Understanding**

9. A group of students wanted to test the law of conservation of mass. They carefully weighed a test tube and one chemical compound provided by their teacher. They then carefully poured their substance into a test tube. After several minutes, the chemical reaction was complete (indicated by the test tube and its contents being sealed). The students then weighed the test tube and its contents and found that the mass had decreased by 0.17 g. The students concluded the chemical reaction caused a loss of mass.

(a) correct results  
(b) experimental errors

10. Suppose that Canadian scientists discovered a new neutral element, called *canadene* (symbol  $\text{Ca}$ ). Canadene has two valence electrons. Write the chemical formula for the following compounds of canadene:

(a) canadene oxide  
(b) canadene chloride  
(c) canadene phosphate

11. Write the formula in name for each molecule:

—methane  
(a) diphosphorus trioxide  
(b) carbon monoxide  
(c) sulphur hexafluoride  
(d)  $\text{PBr}_3$   
(e)  $\text{CCl}_4$   
(f)  $\text{NH}_3$

**Reflect and Evaluate**

12. In this chapter, you will be using the following subatomic particles in order to predict and explain chemical reactions. Think up all the interesting or unusual uses you can think of for each particle, and write them up in the space provided.

**Open Book Link**

13. In this chapter, you will be using the following subatomic particles in order to predict and explain chemical reactions. Think up all the interesting or unusual uses you can think of for each particle, and write them up in the space provided.

## 4

## Chapter Review



## ANSWERS TO QUESTIONS

### Key Concept Review

1. Student answers may include density, mass, volume, freezing point, and so on.
2. Two examples of pure substances are gold, silver, and water (or any other elements and/or compounds). Three examples of mixtures are cereal, salad dressing, a coin collection, salt dissolved in water, or any other mixtures.
3. A homogeneous mixture is a mixture that is the same throughout (evenly mixed). A solution of salt and water is an example. A heterogeneous mixture is a mixture that is not the same throughout (each sample contains different components). An example is a box of raisin bran cereal.
4. Three subatomic particles are protons (positive, in the nucleus), neutrons (no charge, in the nucleus) and electrons (negative, exist in shells surrounding the nucleus).
5. The two main types of compounds are ionic compounds (that have ionic bonds) and molecular compounds (that have covalent bonds).
6. (a) sodium  
(b) calcium  
(c) iron(III)  
(d) fluoride  
(e) oxide
7. The friend is incorrect. A balanced chemical equation also includes chemical formulas (for compounds), symbols such as an arrow and at least one plus sign. Symbols such as (s) and (l) are not necessary for an equation to be balanced. Although many balanced equations do appear showing states, they have nothing to do with the equation being balanced or not.
8. The seven elements that form diatomic molecules and their respective symbols are  $\text{H}_2$ ,  $\text{N}_2$ ,  $\text{O}_2$ ,  $\text{F}_2$ ,  $\text{Cl}_2$ ,  $\text{Br}_2$ , and  $\text{I}_2$ .

## Connect Your Understanding

9. (a) The students' conclusion about the loss of mass was incorrect because the test tube allowed the gas to escape.  
(b) The students could revise their procedure by using a sealed test tube that does not allow any of the gas to escape.
10. There are two compounds that can be formed from the elements hydrogen and oxygen:  $\text{H}_2\text{O}$  (water) and  $\text{H}_2\text{O}_2$  (hydrogen peroxide).
11. (a) An element is a pure substance that is made up of only one kind of atom. A compound is a pure substance that is composed of two or more different kinds of atoms (elements) joined together.  
(b) An atom is the smallest particle of an element. Atoms are neutral in charge. An ion is a charged atom or charged group of atoms.
12. H represents a single atom of hydrogen.  $\text{H}_2$  represents a single diatomic molecule of hydrogen gas, which has two atoms of hydrogen.
13. In one molecule of sucrose, there are 45 atoms in total ( $12 \times \text{C}$ ;  $22 \times \text{H}$ ;  $11 \times \text{O}$ ).
14. (a)  $\text{O}^{2-}$   
(b)  $\text{Br}^-$   
(c)  $\text{S}^{2-}$   
(d)  $\text{Ca}^{2+}$   
(e)  $\text{Cu}^+$
15. (a)  $\text{NH}_4^+$   
(b)  $\text{CO}_3^{2-}$   
(c)  $\text{HCO}_3^-$   
(d)  $\text{PO}_4^{3-}$
16. (a) sodium nitride  
(b) calcium fluoride  
(c) aluminum hydroxide  
(d) iron(II) chloride  
(e) palladium(IV) oxide  
(f) potassium permanganate  
(g) ammonium phosphate  
(h) chromium(II) nitrate
17. (a) KI  
(b)  $\text{Sr}_3\text{N}_2$   
(c)  $\text{MnCl}_4$   
(d) SnS  
(e)  $\text{Mg}(\text{OH})_2$   
(f)  $\text{Zn}_3(\text{PO}_4)_2$   
(g)  $\text{Ag}_2\text{O}$   
(h)  $(\text{NH}_4)_3\text{PO}_4$

18. (a) ontarium oxide:  $\text{OnO}$   
(b) ontarium chloride:  $\text{OnCl}_2$   
(c) ontarium phosphate:  $(\text{On})_3(\text{PO}_4)_2$
19. (a)  $\text{N}_2\text{O}_3$   
(b)  $\text{CO}$   
(c)  $\text{SF}_6$   
(d) phosphorus pentabromide  
(e) carbon tetrachloride  
(f) nitrogen tribromide
20. (a)  $2\text{Li(s)} + \text{F}_2\text{(g)} \rightarrow 2\text{LiF(s)}$   
(b)  $2\text{Be(s)} + \text{O}_2\text{(g)} \rightarrow 2\text{BeO(s)}$   
(c)  $\text{HCl(aq)} + \text{NaOH(s)} \rightarrow \text{NaCl(aq)} + \text{H}_2\text{O(l)}$   
(d)  $\text{Ca(CH}_3\text{COO)}_2\text{(aq)} + 2\text{AgNO}_3\text{(aq)} \rightarrow \text{Ca(NO}_3)_2\text{(aq)} + 2\text{AgCH}_3\text{COO(s)}$   
(e)  $2\text{NBr}_3\text{(l)} \rightarrow \text{N}_2\text{(g)} + 3\text{Br}_2\text{(g)}$   
(f)  $2\text{HF(aq)} + \text{Ba(OH)}_2\text{(aq)} \rightarrow \text{BaF}_2\text{(aq)} + 2\text{H}_2\text{O(l)}$

## Reflection

21. Students will describe three or more new ideas about elements that they have learned in this chapter. Examples are: there are metal elements; there are non-metal elements; elements come in families; elements are monoatomic. Students' questions will vary but may include: Have all the elements been discovered? Which elements are poisonous? Which are the most common?

### After Reading

This is a useful after-reading strategy in which students use a two-column chart to summarize how they were able to determine important ideas in this chapter. In the first column, students list words (bold terms), text features, and purpose. In the second column, students record examples from the text. You may wish to ask students to submit their charts for assessment. Encourage students to retain their charts and use them as study aids for a chapter test, unit exam, or end-of-year exam.

### Unit Task Link

Mg (magnesium, element),  $\text{MgSO}_4$  (magnesium sulphate, ionic compound),  $\text{CuCl}_2$  (copper(II) chloride, ionic compound),  $\text{Na}_2\text{CO}_3$  (sodium carbonate, ionic compound),  $\text{HCl(aq)}$  (hydrochloric acid or hydrogen chloride, ionic compound), Fe (iron, element).