Chapter 5 Review

Make Your Own Summary

Summarize the key concepts of this chapter using a graphic organizer. The Chapter Summary on the previous page will help you identify the key concepts. Refer to Study Toolkit 4 on pages 566–567 to help you decide which graphic organizer to use.

Reviewing Key Terms

1. An electron in the outermost occupied energy level of an atom is a _____. (5.4)

2. A _____ is a column in the periodic table. (5.3)

3. An element that is not shiny, malleable, or ductile and is a poor conductor of heat is a _____. (5.3)

4. A system for organizing the elements by atomic number is the _____. (5.3)

5. The number of protons in an atom is the _____. (5.2)

6. The centre of an atom, which is composed of protons and neutrons, is the _____. (5.1)

7. The negatively charged particles in an atom are the _____. (5.1)

8. The _____ of an atom is the sum of the number of protons and the number of neutrons. (5.2)

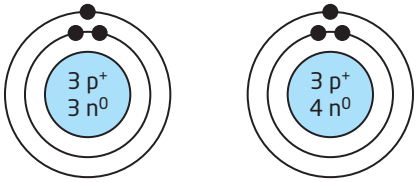
Knowledge and Understanding K/U

9. What component of the atom did Rutherford identify in his gold foil experiment? Describe the experimental evidence that supported this discovery.

10. Describe the relative masses of a proton, a neutron, and an electron. What charge, if any, does each have?

11. What can you determine from the atomic number of an atom?

12. a. Do the following diagrams represent isotopes of the same element? Explain.



These Bohr-Rutherford models differ by a key feature.

b. What are the mass numbers of these atoms? Explain your reasoning.

13. Determine the number of protons, neutrons, and electrons in each of the following atoms. Identify each element as a metal, a non-metal, or a metalloid.

a. $^{7}_{3}\mathrm{Li}$

b. $^{30}_{15}\mathrm{P}$

c. $^{28}_{13}\mathrm{Al}$

d. $^{13}_{6}\mathrm{C}$

e. $^{28}_{14}\mathrm{Si}$

f. $^{35}_{17}\mathrm{Cl}$

14. Describe the process that Mendeleev used to create his periodic table.

15. Describe the properties of non-metals. Where are non-metals located in the periodic table?

16. Describe the number of valence electrons in each atom as you move down Group 2 in the periodic table.

17. What arrangement of valence electrons makes an atom non-reactive?

18. How many valence electrons are in an atom of each of the following elements?

a. hydrogen

b. boron

c. chlorine

d. helium

e. phosphorus

f. beryllium

g. silicon

h. sulfur

19. What determines the size of an atom?

20. Based on its position in the periodic table, which atom in each pair of elements is larger?

a. sodium or lithium

b. chlorine or bromine

c. nitrogen or fluorine

Thinking and Investigation T/I

21. Which metal is more reactive: potassium or rubidium? Explain.

22. Elements within a group in the periodic table have similar properties. In which two groups in the periodic table would you expect to find elements with the widest range of properties? Explain your reasoning.

23. What would have happened if Rutherford had placed the screen to detect where the particles went after hitting the gold foil only where he had expected them to go? How might Rutherford's conclusions have changed?

24. Argon, potassium, and calcium have naturally occurring isotopes that have the same mass number, 40. Explain how this is possible.

25. How did Thomson's model of the atom differ from Rutherford's model?

Communication C

26. Draw each of the following models of the atom. Make sure that you show the key features and indicate any negatively or positively charged regions.

- **a.** the Rutherford model
- **b.** the Bohr model
- **c.** the Thomson model

27. Draw a Bohr-Rutherford model for each of the following atoms.

- **a.** $^{4}_{2}\mathrm{He}$
- **b.** carbon-13
- **c.** an aluminum atom with a mass number of 28
- **d.** an atom that has an atomic number of 19 and a mass number of 41

28. BIG IDEAS The use of elements and compounds has both positive and negative effects on society and the environment. As a contributing author to an on-line environmental magazine, you have been asked to write an article about the effects of metals on people's health. Write a short paragraph to discuss the positive and negative effects.

29. BIG IDEAS Elements and compounds have specific physical and chemical properties that determine their practical uses. Discuss how the properties of gold make it useful in the aerospace industry.

Application A

30. Elements cannot be broken down into smaller particles by physical or chemical methods. How does this help when isolating elements for industrial uses?

31. Deuterium is a naturally occurring isotope of hydrogen that contains one neutron.

- **a.** Draw a Bohr-Rutherford model of deuterium and write the standard atomic notation for this element.
- **b.** Deuterium is an element in a compound called heavy water. Research what heavy water is. Why do you think it is called heavy water?
- **c.** As part of your research, determine what heavy water is used for in the National Research Universal (NRU) reactor at the Chalk River Laboratories in Chalk River, Ontario.