# Review and Assessment

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## Target Reading Skill

**Compare and Contrast** Complete the compare–contrast table on Types of Chemical Bonds.

| Type of Chemical Bond | How Bonds Forms | Charge on Bonded Atoms | Example |
|---|---|---|---|
| Ionic bond | a. ? | Yes; positive and negative | b. ? |
| Polar bond | Unequal sharing of electrons | c. ? | d. ? |
| Nonpolar bond | e. ? | f. ? | $O_2$ molecule |
| Metallic bond | g. ? | yes; positive | h. ? |

## Reviewing Key Terms

**Choose the letter of the best answer.**

1. Valence electrons in an atom are those that are
   **a.** held most loosely.
   **b.** of the lowest energy level.
   **c.** always easily lost.
   **d.** never easily lost.
2. An electron dot diagram shows an atom's number of
   **a.** protons.
   **b.** electrons.
   **c.** valence electrons.
   **d.** chemical bonds.
3. When an atom loses or gains electrons, it becomes a(n)
   **a.** ion. **b.** formula.
   **c.** crystal. **d.** subscript.
4. A covalent bond in which electrons are shared unequally is a
   **a.** double bond.
   **b.** triple bond.
   **c.** polar bond.
   **d.** nonpolar bond.
5. The metal atoms in stainless steel are held together by
   **a.** ionic bonds.
   **b.** polar bonds.
   **c.** covalent bonds.
   **d.** metallic bonds.

**Complete the following sentences so that your answers clearly explain the key terms.**

6. When atoms react, they form a **chemical bond,** which is _____ .
7. **Polyatomic ions** such as ammonium ions ($NH_4^-$) and nitrate ions ($NO_3^-$) are ions that consist of _____ .
8. Magnesium chloride is an example of an **ionic compound,** which means a compound composed of _____ .
9. The formulas $N_2$, $H_2O$, and $CO_2$ all represent **molecules,** which are defined as _____ .
10. Pure metals tend to be weaker and more reactive than an **alloy,** which is a _____ .

## Writing in Science

**Comparing and Contrasting** Go to your local grocery store and observe how the products on the shelves are organized. Write a paragraph comparing how foods are organized in a grocery store and how elements are organized in the periodic table.

**Video Assessment**
**Discovery Channel School**
*Atoms and Bonding*



# Review and Assessment

## Target Reading Skill

**Compare and Contrast**

**a.** Attraction between oppositely charged ions
**b.** Sample answer: sodium chloride (NaCl)
**c.** Yes; slightly positive and slightly negative
**d.** Sample answer: hydrogen fluoride (HF)
**e.** Equal sharing of electrons
**f.** No
**g.** Attraction between positively charged ions and surrounding electrons
**h.** Sample answer: aluminum foil

## Reviewing Key Terms

**1.** a **2.** c **3.** a **4.** c **5.** d

**6.** the force of attraction that holds two atoms together as a result of the rearrangement of electrons between them.
**7.** more than one atom.
**8.** positive and negative ions.
**9.** neutral particles made of two or more atoms joined by covalent bonds.
**10.** a mixture made of two or more elements, at least one of which is a metal.

## Writing in Science

**E-LA: Writing 8.2.0**

**Writing Mode** Expository

**Scoring Rubric**

**4** Exceeds criteria; shows in-depth understanding of the periodic table
**3** Meets criteria
**2** Includes a comparison but lacks details and/or reveals some misconceptions about the periodic table
**1** Includes a general comparison only and/or reveals little knowledge of the periodic table

## Video Assessment

***Atoms and Bonding***

Show the Video Assessment to review chapter content and as a prompt for the writing assignment. Discussion questions: **What do the elements in a single group on the periodic table have in common?** *(They have the same number of electrons in their outer shell.)* **Where are the most reactive elements located on the periodic table?** *(In Groups 1 and 17)*

# Review and Assessment

## Checking Concepts

11. Which element is less reactive, an element whose atoms have seven valence electrons or an element whose atoms have eight valence electrons? Explain.

12. Why do ionic compounds generally have high melting points?

13. The formula of sulfuric acid is $H_2SO_4$. How many atoms of hydrogen, sulfur, and oxygen are in one molecule of sulfuric acid?

14. How is the formation of an ionic bond different from the formation of a covalent bond?

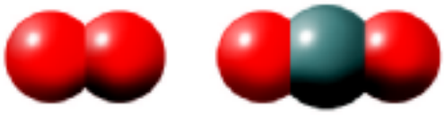
15. Why is the covalent bond between two atoms of the same element a nonpolar bond?

16. Explain how metallic bonding causes metals to conduct electric current.

## Thinking Critically

17. **Making Generalizations** What information does the organization of the periodic table tell you about how reactive an element may be?

18. **Classifying** Classify each molecule below as either a polar molecule or a nonpolar molecule. Explain your reasoning.



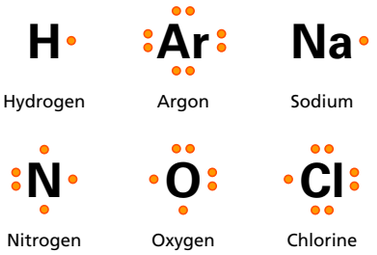
Oxygen Carbon dioxide

19. **Relating Cause and Effect** Many molecular compounds with small molecules are gases at room temperature. Water, however, is a liquid. Use what you know about polar and nonpolar molecules to explain this difference. (*Hint:* Molecules of a gas are much farther apart than molecules of a liquid.)

20. **Applying Concepts** Why does a metal horseshoe bend but not break when a blacksmith pounds it into shape?

## Applying Skills

**Use the electron dot diagrams below to answer Questions 21–25.**




21. **Predicting** When nitrogen and hydrogen combine, what will be the ratio of hydrogen atoms to nitrogen atoms in a molecule of the resulting compound? Explain.

22. **Inferring** Which of these elements can become stable by losing one electron? Explain.

23. **Drawing Conclusions** Which of these elements is least likely to react with other elements? Explain.

24. **Interpreting Diagrams** Which of these elements would react with two atoms of sodium to form an ionic compound? Explain.

25. **Classifying** What type of bond forms when two atoms of nitrogen join to form a nitrogen molecule? When two atoms of oxygen join to form an oxygen molecule?

## Lab zone Standards Investigation

**Performance Assessment** Present your models to the class, telling what the parts of each model represent. Explain why you chose particular items to model the atoms and chemical bonds. Which kind of bonds were easier to show? Why? What more would you like to know about bonding that could help improve your models?



## Checking Concepts

**11.** An element whose atoms have eight valence electrons is less reactive, because it does not require any additional electrons to become stable.

**12.** Because a lot of energy is required to break their strong ionic bonds

**13.** Two atoms of hydrogen, one atom of sulfur, and four atoms of oxygen

**14.** An ionic bond forms as a result of an attraction between oppositely charged ions. A covalent bond forms when two atoms share one or more pairs of electrons.

**15.** Because each atom exerts the same pull on the shared electrons.

**16.** The valence electrons in metals are only loosely held by the positively charged ions, allowing them to move freely among the ions and conduct electricity.

## Thinking Critically

**17.** Sample answer: Elements within the same group have the same number of valence electrons in their atoms, and the number of valence electrons determines how elements react. The reactivity of metals decreases from left to right across the table. The Group 17 elements are the most reactive nonmetals. The Group 18 elements are the least reactive elements of all.

**18.** Both molecules are nonpolar. The oxygen atoms in the oxygen molecule pull equally on the shared electrons. The oxygen atoms in carbon dioxide each pull more strongly than the carbon atom does, creating polar bonds. But the oxygen atoms pull in opposite directions, so the polar bonds cancel each other out.

**19.** Because water is polar, water molecules have positive and negative ends. This causes water molecules to be attracted to one another and form a liquid at room temperature. Nonpolar molecules, lacking this type of attraction, can move farther apart and form a gas at room temperature.

**20.** Because the horseshoe is metal, pounding it causes the positive metal ions to change position, but the metallic bonds between the ions and the freely moving valence electrons keep the metal ions from breaking apart.

## Applying Skills

**21.** There will be three hydrogen atoms to one nitrogen atom. That combination gives the nitrogen atom eight valence electrons and each hydrogen atom two valence electrons.

**22.** Sodium can become stable by losing one electron, leaving it with eight electrons in its next level.

**23.** Argon is least likely to react; it has a stable set of eight valence electrons.

**24.** Oxygen would react with two atoms of sodium to form an ionic compound. An oxide ion has a charge of 2– and needs two sodium ions, each with a 1+ charge, to balance it.

**25.** Covalent bonds form in both cases. A triple bond forms when two atoms of nitrogen join, and a double bond forms when two atoms of oxygen form.

# CALIFORNIA Standards Practice

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**Choose the letter of the best answer.**

**1.** What is the atomic number of calcium?

**A** 6 **B** 20
**C** 40.08 **D** 48 S 8.3.f

**Use the electron dot diagrams below to answer Questions 2–5.**

**Electron Dot Diagrams**


**2.** Which element is the most likely to lose two electrons and form an ion with a charge of 2+?

**A** potassium (K)
**B** oxygen (O)
**C** magnesium (Mg)
**D** aluminum (Al) S 8.3.b

**3.** Oxygen has 6 valence electrons, as indicated by the 6 dots around the letter symbol "O." Based on this information, how many covalent bonds could an oxygen atom form?

**A** six **B** three
**C** two **D** none S 8.3.b

**4.** If a reaction occurs between potassium (K) and oxygen (O), what will be the ratio of potassium ions to oxide ions in the resulting compound, potassium oxide?

**A** 1 : 1 **B** 1 : 2
**C** 2 : 1 **D** 2 : 2 S 8.3.b

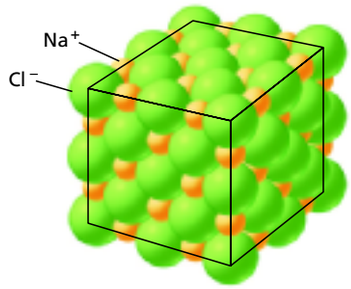
**5.** The element boron (B) is directly above aluminum (Al) on the periodic table. Which statement about boron is true?

**A** Boron is in the same period as aluminum and has two valence electrons.
**B** Boron is in the same group as aluminum and has two valence electrons.
**C** Boron is in the same period as aluminum and has three valence electrons.
**D** Boron is in the same group as aluminum and has three valence electrons. S 8.3.f

**6.** An ice cube (solid $H_2O$) and a scoop of table salt (NaCl) are left outside on a warm, sunny day. Which best explains why the ice cube melts and the salt does not?

**A** The attractive forces between molecules of $H_2O$ are much weaker than those between ions in NaCl.
**B** NaCl can dissolve in $H_2O$.
**C** The mass of the $H_2O$ was less than the mass of the NaCl.
**D** NaCl is white and $H_2O$ is colorless. S 8.3.c

**The diagram below shows the crystal structure of sodium chloride. Use the diagram to answer Question 7.**




**7.** In a crystal of sodium chloride, each sodium ion is attracted to the

**A** other sodium ions surrounding it.
**B** chloride ions surrounding it.
**C** neutral sodium atoms surrounding it.
**D** neutral chlorine atoms surrounding it. S 8.3.c

## Apply the BIG Idea

**8.** Use the periodic table to find the number of valence electrons for potassium (K), calcium (Ca), aluminum (Al), oxygen (O), and iodine (I). Then write the formulas for the following compounds: potassium iodide, calcium oxide, aluminum iodide, and potassium oxide. S 8.3.b, 8.3.f



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Teachers can monitor student progress and supply remediation when necessary.

## Standards Practice

**1.** B; S 8.3.f
**2.** C; S 8.3.b
**3.** C; S 8.3.b
**4.** C; S 8.3.b
**5.** D; S 8.3.f
**6.** A; S 8.3.c
**7.** B; S 8.3.c

## Apply the BIG Idea

**8.** Valence electrons—potassium, 1; calcium, 4; aluminum, 3; oxygen, 6; iodine, 7. KI, CaO, $AlI_3$, $K_2O$. S 8.3.b, 8.3.f

## Lab zone Standards Investigation S 8.3.c

**Performance Assessment** In their presentations, students should describe how their models represent atoms, bonds, and compounds. They also should explain why they chose the materials they did and describe any problems they had building their models. After the presentations, suggest that students compare their models with other students' models of the same compounds. They should note any differences and consider how the differences affect the quality and usefulness of the models. To help improve their models, students might say they would like to know more about relative sizes of atoms of different elements or more about the modern atomic model.

**Teaching Resources**

**Laboratory Manual TE**

- Standards Investigation Scoring Rubric

The Standards Investigation Scoring Rubric will help you evaluate students' work. If you share the rubric in advance, students will know what is expected of them.