

14	<b>Covalent Bonds</b> Chapter Test
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EXAM REVIEW

**A. Matching**

Match each description in Column B with the correct term in Column A.

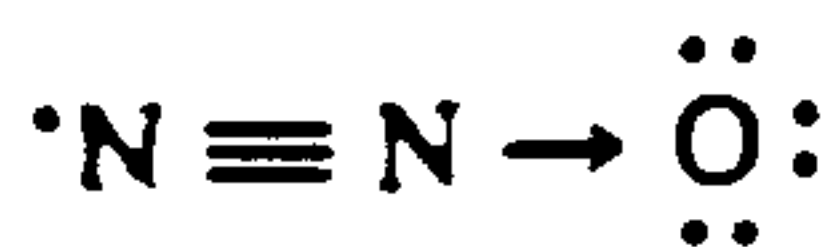
- | Column A   | Column B  |
|--|---|
| ___ 1. coordinate covalent bond 14-4                 | a. a covalent bond formed by the equal sharing of bonding electrons by two atoms  |
| ___ 2. double covalent bond 14-2                     | b. a covalent bond in which only one pair of electrons is shared by two bonded atoms  |
| ___ 3. hydrogen bond 14-13                           | c. a covalent bond between two atoms of different electronegativities in which the bonding electron pairs are not shared equally  |
| ___ 4. nonpolar covalent bond 14-10                  | d. a covalent bond involving two pairs of electrons; each atom donates one pair of electrons to the bond  |
| <del>omit</del> <del>5.</del> dispersion force 14-13 | e. a covalent bond in which three pairs of electrons are shared by two bonded atoms   |
| ___ 6. polar bond 14-10                              | f. caused by the motion of electrons  |
| ___ 7. structural formula 14-1                       | g. chemical formulas that show the arrangement of atoms in molecules and polyatomic ions  |
| ___ 8. single covalent bond 14-1                     | h. substances in which all of the atoms are covalently bonded to each other   |
| ___ 9. triple covalent bond 14-2                     | i. attractive forces in which hydrogen that is covalently bonded to a very electronegative atom is also weakly bonded to an unshared pair of electrons in the same or a nearby molecule |
| <del>omit</del> <del>10.</del> network solid 14-14   | j. a covalent bond between two atoms in which the shared electron pair comes from only one of the atoms   |

**B. Multiple Choice**

Choose the best answer and write its letter in the blank.

- \_\_\_ 11. Which of these elements does not exist as a diatomic molecule? 14-1  
 a. Ne                      b. F                      c. H                      d. I
- \_\_\_ 12. How many valence electrons does an atom of any halogen have? 14-1  
 a. 1                      b. 2                      c. 4                      d. 7
- \_\_\_ 13. Which one of the following compounds is *not* covalent? 14-10  
 a. BrCl                      b. LiCl                      c. HCl                      d. S<sub>2</sub>Cl<sub>2</sub>
- \_\_\_ 14. A diatomic molecule with a triple covalent bond is: 14-2  
 a. N<sub>2</sub>                      b. F<sub>2</sub>                      c. H<sub>2</sub>                      d. O<sub>2</sub>

15. A molecule of nitrous oxide,  $N_2O$ , contains all of the following except a: 14.1



- a. coordinate covalent bond
- b. triple bond
- c. double bond
- d. nonbonding pair of electrons

16. A covalent bond forms: 14.1

- a. when an element becomes a noble gas.
- b. when atoms share electrons.
- c. between metals and nonmetals.
- d. when electrons are transferred from one atom to another.

17. The electron dot structure for hydrogen sulfide is: 14.3

- a.  $H : S$
- b.  $H : \overset{\cdot\cdot}{\underset{\cdot\cdot}{S}} :$
- c.  $H^+ : : : S^-$
- d.  $H : : S : : H$

18. Which one of the following compounds is not ionic? 14.10

- a.  $NaI$
- b.  $CaS$
- c.  $CO$
- d.  $Na_2O$

19. If a bonding pair of electrons is unequally shared between two atoms, the bond is: 14.10

- a. ionic.
- b. nonpolar covalent.
- c. electrovalent.
- d. polar covalent.

20. The electron dot structure for the hydroxide polyatomic ion  $OH^-$  is: 14.4

- a.  $[H : H]^-$
- b.  $[\overset{\cdot\cdot}{O} : H]^-$
- c.  $[H : : \overset{\cdot\cdot}{O}]^-$
- d.  $[ \cdot \overset{\cdot\cdot}{O} : H]^-$

21. Which of these compounds would *not* have covalent bonds? 14.1

- a.  $NO_2$
- b.  $Cs_2O$
- c.  $N_2O$
- d.  $H_2O_2$

22. A molecule with a single covalent bond is: 14.2

- a.  $CO_2$
- b.  $Cl_2$
- c.  $CO$
- d.  $N_2$

23. When  $H^+$  forms a bond with  $H_2O$  to form the hydronium ion  $H_3O^+$ , this bond is called a coordinate covalent bond because: 14.4

- a. both bonding electrons come from the oxygen atom.
- b. it forms an especially strong bond.
- c. the electrons are equally shared.
- d. the oxygen no longer has eight valence electrons.

24. Chlorine is a gas, bromine is a liquid, and iodine a solid because of differences in the strength of their: 14.13

- a. hydrogen bonds.
- b. dispersion forces.
- c. dipole interactions.
- d. polar bonds.

25. Which of the following is the weakest "bond"? 14.13

- a. hydrogen bond
- b. dipole interaction
- c. polar covalent bond
- d. ionic bond

26. Which of the following molecules has *one* lone pair of electrons? 14.3

- a.  $CH_4$
- b.  $HCl$
- c.  $H_2O$
- d.  $NH_3$

**13****Ionic Bonds****Chapter Test****A. Matching**

Match each description in Column B with the correct term in Column A.

**Column A**

- \_\_\_ 1. halide ion 13-3  
 \_\_\_ 2. octet rule 13-2  
 \_\_\_ 3. ionic bond 13-4  
 \_\_\_ 4. electron dot structure 13-1  
 \_\_\_ 5. valence electron 13-1  
 ✕ omit 6. coordination number 13-5  
 ✕ omit 7. metallic bond 13-6

**Column B**

- a. the attraction of valence electrons for metal ions  
 b. an anion of chlorine or other halogen  
 c. the number of ions of opposite charge surrounding each ion in a crystal  
 d. a depiction of valence electrons around the symbol of an element  
 e. atoms react so as to acquire the stable electron structure of a noble gas  
 f. an electron in the highest occupied energy level of an atom  
 g. the force of attraction binding oppositely charged ions together

**B. Multiple Choice**

Write the letter of the best answer in the blank.

- \_\_\_ 8. How many valence electrons does an atom of any halogen have? 13-1  
 a. 7                      b. 4                      c. 6                      d. 8
- \_\_\_ 9. The electron dot structure for an atom of phosphorus is: 13-1  
 a.  $\cdot\dot{P}\cdot$                       b.  $\cdot\dot{P}:$                       c.  $\cdot\dot{P}\cdot$                       d.  $:\ddot{P}:$
- \_\_\_ 10. When an aluminum atom loses its valence electrons, the charge on the resulting ion is: 13-2  
 a.  $2^+$                       b.  $2^-$                       c.  $3^+$                       d.  $1^+$
- \_\_\_ 11. The electron configuration of a fluoride ion,  $F^-$ , is: 13-3  
 a.  $1s^2 2s^2 2p^5$ .                      c.  $1s^2 2s^2 2p^6$ .  
 b. the same as a neon atom.                      d. the same as a potassium ion.
- ✕ omit 12. Metals are good conductors of electricity because they: 13-6  
 a. are hard.  
 b. are ductile.  
 c. contain mobile valence electrons.  
 d. bend easily.

**D. Questions**

Answer the following questions in the space provided.

28. Write electron dot structures for the atoms and ions of each of the following elements. 13-1

Atoms	Ions
-------	------

- a. Mg
- b. F
- c. Al

29. Write the formulas obtained when each of these atoms loses or gains valence electrons and becomes an ion. Tell whether each is a cation or anion. 13-3

- |             |             |
|-------------|-------------|
| a. Cl _____ | c. Li _____ |
| b. Ca _____ | d. O _____  |

30. Write complete electron configurations for the ions in Problem 29. 13-3

- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_

31. Use electron dot formulas to predict the formula of the ionic compound composed of aluminum and fluorine. 13-4

32. Write the electron configuration diagram that shows the transfer of electrons that takes place to form the compound sodium fluoride. Include the electron configurations of the ions formed. Which noble gas configuration does each ion have? 13-4

**E. Essay**

33. Explain how scientists have used metallic bonding to account for many of the physical properties of metals, such as electrical conductivity and malleability. 13-6

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Multiple Choice** Write the letter of the correct answer on the line at the left.

- \_\_\_\_\_ 1. Atoms with loosely held valence electrons have  
a. high ionization energy and high electron affinity.  
b. high ionization energy and low electron affinity.  
c. low ionization energy and high electron affinity.  
d. low ionization energy and low electron affinity.
- \_\_\_\_\_ 2. The number of valence electrons in an atom that has an atomic number of 9 is  
a. 2.      b. 5.      c. 7.      d. 9.
- \_\_\_\_\_ 3. A metal that can be hammered into thin sheets without breaking is said to be  
a. brittle.      b. ductile.      c. malleable.      d. inert.
- \_\_\_\_\_ 4. A substance whose molecules are very large because its atoms continue to bond with one another is called a(an)  
a. polyatomic solid.      b. ionic solid.      c. crystalline solid.      d. network solid.
- \_\_\_\_\_ 5. Elements that tend to gain electrons easily are called  
a. metals.      b. nonmetals.      c. metalloids.      d. crystals.
- \_\_\_\_\_ 6. An element that is considered to be unreactive because it has a filled outer energy level is  
a. lithium.      b. silver.      c. hydrogen.      d. helium.
- \_\_\_\_\_ 7. The energy needed to remove electrons from an atom is called  
a. valence energy.      b. ionization energy.      c. network energy.      d. bonding energy.
- \_\_\_\_\_ 8. Elements that exist in nature as two atoms covalently bonded are called  
a. diatomic.      b. metals.      c. ions.      d. inert.
- \_\_\_\_\_ 9. Aluminum is a metallic element with 3 valence electrons. Its oxidation number is  
a. 3+.      b. 3-.      c. 5+.      d. 5-.
- \_\_\_\_\_ 10. Elements found on the left side of the periodic table are  
a. metalloids.      b. metals.      c. nonmetals.      d. ionic.

**Completion** Complete each statement on the line at the left.

- \_\_\_\_\_ 1. The negatively charged subatomic particle located outside the nucleus of an atom is called the \_\_\_\_\_.
- \_\_\_\_\_ 2. The maximum number of electrons that the second energy level of an atom can hold is \_\_\_\_\_.
- \_\_\_\_\_ 3. Bonding that occurs when there is a transfer of electrons is called \_\_\_\_\_.
- \_\_\_\_\_ 4. The number of electrons an atom gains, loses, or shares is called its \_\_\_\_\_.
- \_\_\_\_\_ 5. Substances produced when atoms of elements chemically combine with each other are called \_\_\_\_\_.

**True or False** Determine whether each statement is true or false. If it is true, write T. If it is false, change the underlined word or words to make the statement true.

- \_\_\_\_\_ 1. The electrons in the outermost energy level of an atom are called valence electrons.

- \_\_\_\_\_ 2. The tendency of an atom to attract electrons is called ionization energy.
- \_\_\_\_\_ 3. An example of a polyatomic ion is CO<sub>3</sub><sup>2-</sup>.
- \_\_\_\_\_ 4. Compounds formed between two nonmetals will have ionic bonds.
- \_\_\_\_\_ 5. A sea of mobile electrons is characteristic of a covalent bond.

**Using Science Skills: Making predictions**

1. Use the information in the table to predict the formulas for the compounds formed by each of the following pairs of atoms.

- a. Na and P \_\_\_\_\_      c. Sn and P \_\_\_\_\_
- b. Ca and F \_\_\_\_\_      d. K and O \_\_\_\_\_

Element	Oxidation Number
Sodium (Na)	1+
Calcium (Ca)	2+
Tin (Sn)	4+
Fluorine (F)	1-
Oxygen (O)	2-
Phosphorus (P)	3-

2. Use the information in the table to predict the type of bond formed by each of the following pairs of atoms.

- a. Be and I \_\_\_\_\_      c. I and I \_\_\_\_\_
- b. N and O \_\_\_\_\_      d. Li and Li \_\_\_\_\_

Element	Classification
Beryllium (Be)	metal
Iodine (I)	nonmetal
Lithium (Li)	metal
Nitrogen (N)	nonmetal
Oxygen (O)	nonmetal