

## Answers to Chapter 12 Study Questions

1. A chemical bond is the force holding atoms together. Atoms form chemical bonds to acquire a stable number of electrons, which is often the same number of electrons as the nearest noble gas. Covalent bonds involve the sharing of electrons between atoms, so that *both* atoms act as if they've acquired the shared electrons. In ionic bonds, electrons are NOT shared; a metal atom gives up one or more electrons to form a positive ion, a nonmetal gains one or more electrons to form a negative ion, and then the two ions are attracted to each other due to their opposite charges. Both covalent bonding and ionic bonding are strategies by which an atom attains a stable number of electrons.

2. The number of bonds a nonmetal forms usually = 8 – valence.

3. Covalent bonds are found in molecules (covalent compounds and some nonmetal elements) and in polyatomic ions.

4. a) As < P < N                      b) Li < C < O                      c) K < Mg < B

5. a) H—Cl                      b) F—C

6. a) Li<sup>+</sup>                      b) Na<sup>+</sup>                      c) F

7. a) 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>; N<sup>3-</sup>, F<sup>-</sup>, Na<sup>+</sup>, Mg<sup>2+</sup>, Al<sup>3+</sup>; Ne                      b) 1s<sup>2</sup>2s<sup>2</sup>2p<sup>6</sup>3s<sup>2</sup>3p<sup>6</sup>; S<sup>2-</sup>, Cl<sup>-</sup>, K<sup>+</sup>, Ca<sup>2+</sup>; Ar

8. Ca(s) + I<sub>2</sub>(s) → CaI<sub>2</sub>(s)

9. a) •Be•                      b) • $\overset{\cdot}{\underset{\cdot}{\text{C}}}$ •                      c)  $:\overset{\cdot}{\underset{\cdot}{\text{F}}}\cdot$

10. a)  $\text{H}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{S}}}-\text{H}$                       b)  $:\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{Br}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{Br}}}:$                       c)  $\text{H}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{N}}}-\text{H}$                       d)  $:\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{I}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{I}}}:$

e)  $\ominus:\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{O}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{O}}}\ominus$                       f) P<sub>2</sub>Cl<sub>2</sub>                      g) N<sub>2</sub>O<sub>4</sub>                       $:\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{Cl}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{P}}}=\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{P}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{Cl}}}:$                        $\ominus:\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{O}}}-\overset{\oplus}{\underset{\cdot\cdot}{\text{N}}}-\overset{\oplus}{\underset{\cdot\cdot}{\text{N}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{O}}}\ominus$

h)  $:\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{Cl}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}=\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{Cl}}}:$                       i)  $\text{H}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}=\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}=\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}-\text{H}$  or  $\text{H}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}\equiv\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}-\text{H}$

11. a) bent                      b) linear                      c) pyramidal                      d) tetrahedral

12. a) polar                      b) nonpolar                      c) polar                      d) polar

13.  $\text{H}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}-\text{H}$  or  $\text{H}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}-\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}=\overset{\cdot\cdot}{\underset{\cdot\cdot}{\text{C}}}-\text{H}$