**Chapter 5** **5.1** ionic: metal and nonmetal; covalent: two or more nonmetals **5.3** ionic: extended array of alternating positive and negative ions; covalent: molecules **5.5** (a) :Br:Br: (b) H:I: (c) :I:Br: (d) :Br:F: **5.7** (a) 8 (b) 4 (c) 0 (d) 6 **5.9** (a) $NF_3$ (b) $Cl_2O$ (c) $H_2S$ (d) $CH_4$ **5.11** (a) one triple bond (b) three single bonds (c) one double and two single bonds (d) one double and four single bonds

**5.13** (a) :N≡N: (b) H—C(H)—C(H)—H (c) H—C(=O:)—H (d) H—O—O—H **5.15** (a) normal (b) normal (c) not normal (d) normal **5.17** (a) N (b) C (c) N (d) C **5.19** Oxygen forms three bonds instead of the normal two. **5.21** (a) nitrogen–oxygen (b) none present (c) oxygen–chlorine (d) two (oxygen–bromine) **5.23** (a) 20 (b) 8 (c) 8 (d) 24

**5.25** (a) H:P(H):H (b) :Cl:P(:Cl:):Cl: (c) :Br:Si(:Br:):Br: (d) :F:O:F:

**5.27** (a) :F:S:F: (b) :I:C(:I:):I: (c) :Br:N(:Br:):Br: (d) H:Se:H

**5.29** (a) H:C(H):C:::C:H(H) (b) :F:N:::N:F: (c) H:C(H):C:::N: (d) H:C(H):C:::C:H(H) **5.31** (a) [:O:H]⁻ (b) [H:Be:H]²⁻ (H) (c) [:Cl:Al(:Cl:):Cl:]⁻ (:Cl:) (d) [:O:N(:O:):O:]⁻ (:O:) **5.33** (a) $Na^+$ [:C:::N:]⁻ (b) 3 [K]⁺ [:O:P(:O:):O:]³⁻ (:O:) **5.35** (a) linear (b) angular (c) tetrahedral (d) linear **5.37** (a) angular (b) angular (c) angular (d) linear **5.39** (a) trigonal pyramidal (b) trigonal planar (c) tetrahedral (d) tetrahedral **5.41** (a) trigonal pyramidal (b) tetrahedral (c) angular (d) angular **5.43** (a) trigonal planar about each carbon atom (b) tetrahedral about carbon atom and angular about oxygen atom **5.45** (a) Na, Mg, Al, P (b) I, Br, Cl, F (c) Al, P, S, O (d) Ca, Mg, C, O **5.47** (a) N, O, Cl, F, Br (b) Na, K, Rb, (c) F, O, Cl, N (d) 0.5 units

**5.49** (a) $\overset{\delta^+}{B}—\overset{\delta^-}{N}$ (b) $\overset{\delta^+}{Cl}—\overset{\delta^-}{F}$ (c) $\overset{\delta^-}{N}—\overset{\delta^+}{C}$ (d) $\overset{\delta^-}{F}—\overset{\delta^+}{O}$ **5.51** (a) H—Br, H—Cl, H—O (b) O—F, P—O, Al—O (c) Br—Br, H—Cl, B—N (d) P—N, S—O, Br—F **5.53** (a) polar covalent (b) ionic (c) nonpolar covalent (d) ionic **5.55** (a) nonpolar (b) polar (c) polar (d) polar **5.57** (a) nonpolar (b) polar (c) polar (d) polar **5.59** (a) polar (b) polar (c) nonpolar (d) polar **5.61** (a) sulfur tetrafluoride (b) tetraphosphorus hexoxide (c) chlorine dioxide (d) hydrogen sulfide **5.63** (a) diagram I (b) diagram II (c) diagram IV (d) diagram III **5.65** (a) ICl (b) $N_2O$ (c) $NCl_3$ (d) HBr **5.67** (a) $H_2O_2$ (b) $CH_4$ (c) $NH_3$ (d) $PH_3$ **5.69** (a) 26 (b) 24 (c) 14 (d) 8 **5.70** (a) same, both single (b) different, double and single (c) same, both triple (d) same, both single **5.71** (a) not enough electron dots (b) not enough electron dots (c) improper placement of a correct number of electron dots (d) too many electron dots **5.72** (a) tetrahedral; tetrahedral (b) tetrahedral; tetrahedral (c) trigonal planar; angular (d) trigonal planar; trigonal planar **5.73** (a) can't classify (b) nonpolar (c) can't classify (d) polar **5.74** (a) BrI (b) $SO_2$ (c) $NF_3$ (d) $H_3CF$ **5.75** BA, CA, DB, DA

**5.76** (a) H—C(H)(H)—H, H—C(H)(H)—F:, H—C(H)(:F:)—F:, H—C(:F:)(:F:)—F:, :F—C(:F:)(:F:)—F:

(b) all are tetrahedral (c) nonpolar, polar, polar, polar, nonpolar **5.77** Chemical formulas for molecular compounds are written with the least electronegative atom first; N is the least electronegative atom **5.78** $NaNO_3$ is an ionic compound; the ions present are sodium ion and nitrate ion. **5.79** (a) sodium chloride (b) bromine monochloride (c) potassium sulfide (d) dichlorine monoxide **5.80** d **5.81** c **5.82** b **5.83** b **5.84** d **5.85** b **5.86** c **5.87** c **5.88** c **5.89** d