**Exercise 3.1**

Determine the point groups of the following: (a) $CH_2ClF$; (b) $NH_3$; (c) $BCl_3$; (d) allene; (e) 1,3,5-trichlorobenzene; (f) trans-$Pt(NH_3)_2Cl_2$ (considered as square planar); (g) BFClBr.

**Solution 3.1**

**Exercise 3.2**

Determine the point groups of the following octahedral compounds: (a) $CoN_6$; (b) $CoN_5A$; (c) cis-$CoN_4A_2$; (d) trans-$CoN_4A_2$; (e) cis-cis-$CoN_3A_3$; (f) trans-cis-$CoN_3A_3$.

**Solution 3.2**

**Exercise 3.3**

Determine the point groups of the following: (a) chair form of cyclohexane (ignoring the H's); (b) boat form of cyclohexane (ignoring the H's); (c) staggered $C_2H_6$; (d) eclipsed $C_2H_6$; (e) between staggered and eclipsed $C_2H_6$.

**Solution 3.3**

**Exercise 3.4**

Determine the point groups of the following: (a) ivy leaf; (b) iris; (c) starfish; (d) a right circular cone; (e) twin-bladed propellor; (f) rectangular bar; (g) hexagonal bathroom tile; (h) swastika; (i) tennis ball (with seam); (j) Chinese abacus (counters all in their lowest positions); (k) ying-yang.

**Solution 3.4**

**Exercise 3.5**

Determine the point groups of the following: (a) a square-based pyramid; (b) a right circular cone; (c) a square lamina; (d) a square lamina with the top and bottom sides painted differently; (e) a right circular cylinder; (f) a right circular cylinder with the two ends painted differently; (g) a right circular cylinder with a stripe painted parallel to the axis.

**Solution 3.5**

**Exercise 3.6**

What is the point group for the tris(ethylenediamine)cobalt(III) ion?

**Solution 3.6**

**Exercise 3.7**

For which point groups can a molecule (a) have a dipole moment, (b) be optically active?

**Solution 3.7**