11.44 $\dfrac{P_1V_1}{T_1} = \dfrac{P_2V_2}{T_2}$

$$V_2 = \frac{P_1V_1T_2}{P_2T_1} = \frac{(572\ \text{mmHg})(6.15\ \text{L})(273\ \text{K})}{(760\ \text{mmHg})(308\ \text{K})} = \mathbf{4.10\ L}$$

11.50 The density is given by:

$$\textbf{density} = \frac{\text{mass}}{\text{volume}} = \frac{4.65\ \text{g}}{2.10\ \text{L}} = \mathbf{2.21\ g/L}$$

Solving for the molar mass:

$$\textbf{molar mass} = \frac{dRT}{P} = \frac{(2.21\ \text{g/L})\left(0.0821\dfrac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}}\right)(300\ \text{K})}{(1.00\ \text{atm})} = \mathbf{54.4\ g/mol}$$

12.18 **(a)** NH_3 has a higher boiling point because it is polar and can form hydrogen bonds; CH_4 is nonpolar and can only form weak attractions through dispersion forces.

(b) KCl is an ionic compound. Ion–Ion forces are much stronger than any intermolecular forces. I_2 is a nonpolar molecular substance; only weak dispersion forces are possible.

12.22 Gases have large distances between molecules. Liquids have the molecules in close contact with each other and can't pack together much more tightly. (More detailed explanation: when molecules are in "van der Waals contact" with each other, the outermost orbitals are starting to overlap, and the repulsion between electrons keeps them from getting closer together. Think of trying to force two tennis balls together…there may be a slight amount of "squish", but with your body's own strength you can only push them together so closely.)

12.29 The greater kinetic energy and momentum of the molecules more easily overcomes the weak attractions between molecules, so the molecules slide past each other with less impediment.

12.31 Water expands when it freezes (i.e. ice is less dense than water). Freezing water can burst pipes.