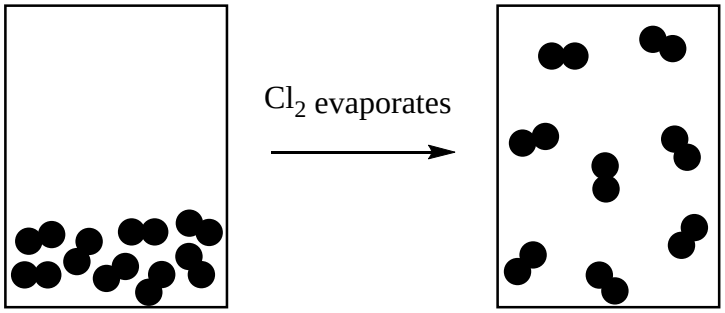
Answers to Exercise 9.3
Intermolecular Forces and Boiling Points

1.



(a) *see above; the chlorine is still Cl_2 molecules! no bonds were broken!*

(b) The Cl_2 molecules are much farther apart. As such, intermolecular forces are no longer holding the molecules near each other.

In reality, the molecules would be even further apart than suggested by the diagram.

2. In a liquid, intermolecular forces attract the molecules to each other. For some of the molecules to evaporate, they must have enough kinetic energy to overcome these intermolecular forces. If the intermolecular forces are stronger, more kinetic energy (and, therefore, a higher temperature) is required to overcome them. So, substances with stronger intermolecular forces require higher temperatures for enough substance to evaporate for the substance to boil. Thus, boiling point increases as intermolecular forces get stronger.

3.

(a) Octane

Both molecules are nonpolar. Since octane is a larger molecule, it has stronger induced dipole-induced dipole forces. Hence, octane has a higher boiling point.

(b) Argon

Both atoms are nonpolar. Since argon is a larger atom, it has stronger induced dipole-induced dipole forces. Hence, argon has a higher boiling point.

(c) SO_2

Sulfur dioxide is a polar molecule (bent geometry). On the other hand, carbon dioxide is a nonpolar molecule (linear geometry). The dipole-dipole forces between SO_2 molecules are stronger than the induced dipole-induced dipole forces between CO_2 molecules. Hence, sulfur dioxide has a higher boiling point.