1. Assume that you have a sample of gas at 350 K in a sealed container, as represented in (a). Which of the drawings (b) - (d) represents the gas after the temperature is lowered from 350 K to 150 K?

2. Show the approximate level of the movable piston in drawings (a) and (b) after the indicated changes have been made to the initial gas sample.

\[ PV = nRT \]
\[ V = \frac{(0.3 \text{ mol})R(300 \text{ K})}{(1 \text{ atm})} = 7.4 \text{ L} \]

(a) \[ V = \frac{(0.225 \text{ mol})R(400 \text{ K})}{(1 \text{ atm})} = 7.4 \text{ L} \]
The piston will be in the same place.

(b) \[ V = \frac{(0.225 \text{ mol})R(200 \text{ K})}{(1 \text{ atm})} = 3.7 \text{ L} \]
The piston will move down halfway.
3. Which sample contains the most molecules: 1.00 L of O\(_2\) at STP, 1.00 L of air at STP, or 1.00 L of H\(_2\) at STP.

   **1.00 L of gas at STP contains the same number of moles of gas not matter what the identity of the gas.**

4. A helium gas cylinder of the sort used to fill balloons has a volume of 43.8 L and a pressure of \(1.51 \times 10^4\) kPa at 25.0°C. How many moles of helium are in the tank?

   \[
P = (1.51 \times 10^4 \text{ kPa})(1 \text{ atm} / 101.3 \text{ KPa}) = 149.06 \text{ atm}
   \]

   \[
n = \frac{PV}{RT} = \frac{(149.06 \text{ atm})(43.8 \text{ L})}{R(298 \text{ K})} = 267 \text{ mol of He}
   \]

5. How many moles of air are in the lungs of an average adult with a lung capacity of 3.8 L? Assume that the person is at 1.00 atm pressure and has a normal body temperature of 37°C.

   \[
n = \frac{PV}{RT} = \frac{(1.00 \text{ atm})(3.8 \text{ L})}{R(310 \text{ K})} = 0.15 \text{ mol air}
   \]

6. In a typical automobile engine, the mixture of gasoline and air in a cylinder is compressed from 1.0 atm to 9.5 atm. If the uncompressed volume of the cylinder is 410 mL, what is the volume (in milliliters) when the mixture is fully compressed?

   \[
   P_1V_1 = P_2V_2
   \]

   \[
   V_2 = \frac{(1.0 \text{ atm})(410 \text{ mL})}{(9.5 \text{ atm})} = 43 \text{ mL}
   \]