STP

The Mole and Avogadro's Law

Purpose

To explore further the relationship between gas pressure and the number of gas particles in a sample.

Part 1: STP

Four samples of air have been collected at each of three different locations. Each air sample is in a different-size box. Assume that the temperature is 273 K at all three locations.

1. Fill in the missing amounts of moles of gas molecules for each box.

Volume (L)	Boxes filled at sea level P = 1 atm	Boxes filled on Mt. Denali P = 0.5 atm	Boxes filled outside airplane in flight P = 0.25 atm
11.2 L	0.500 mole	0.250 mole	
22.4 L	1.00 mole	0.500 mole	0.250 mole
33.6 L	1.50 moles		
44.8 L			

2. Describe at least three patterns that you notice in the data.

3. Analyze the data at sea level.

   a. What is the number density, n/V, in moles of gas molecules per liter of gas in the 22.4 L box at sea level?

   b. What is the number density of the gas in all four air samples at sea level?

4. What is the number density for each location?

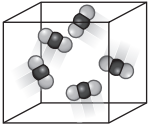**5.** Explain why the pressure is higher at sea level than on Mt. Denali.
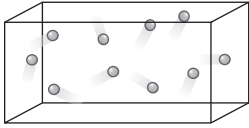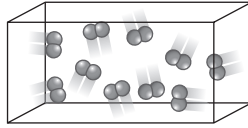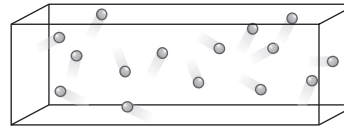
6. How many moles of gas would be in a 25.0 L box at sea level?

Part 2: Number and Mass

Consider samples of different gases. For each sample $T = 273$ K and $P = 1$ atm. (*Note:* The drawings simply represent the number of gas particles in correct proportion to one another.)

1	2	3	4	5
He	CO_2	He	N_2	He
0.50 mole	0.50 mole	1.0 mole	1.0 mole	1.5 moles
11.2 L	11.2 L	22.4 L	22.4 L	33.6 L
2.0 g	22.0 g	4.0 g	28.0 g	6.0 g

1. In the boxes showing helium gas, how many moles does each sphere represent?

2. Which box(es) has/have the most gas particles?

3. Which box(es) has/have the most total atoms?

4. There are twice as many total atoms in box 4 as in box 3, yet both boxes are at the same pressure. Explain why.

5. The masses of boxes 3 and 4 are different. Explain why.

6. Describe or sketch a box containing 8.0 g of He atoms at 1 atm pressure. Show the relative number of He atoms and the size of this box compared to the size of the boxes in the table.

7. Making Sense   If you know that two gas samples are at the same temperature, what do you need to know in order to determine which gas is at a greater pressure?

8. If You Finish Early   Consult the illustrations in Part 2. At a temperature of 273 K and a pressure of 1 atm, what volume does 1.0 mole of a gas occupy? Does it matter what the gas is? Explain.