Chemistry CP

Name:

Dalton's Law of Partial Pressures

Section:

Dalton's Law of Partial Pressures states that the sum of the individual pressures of all the gases that make up a mixture is equal to the total pressure exerted by the mixture.

$$P_{tot} = P_1 + P_2 + P_3 \ldots$$

Clues that a problem involves Dalton's Law of Partial Pressures:

- The gas is collected by water displacement
- The gas is collected over water
- The question asks about the dry gas
- The question gives you the vapor pressure of water

Level 1 Problems

For problems 1-3, use the data in Table 1.
Show all your work!

1. A gas is collected by water displacement at 55°C at a total pressure of 119.29 kPa. What is the partial pressure exerted by the gas?

2. A gas is collected over water at a temperature of 30°C. The total pressure is 92.87 kPa. Determine the partial pressure exerted by the gas.

Table 1. Vapor pressure of water at various temperatures

Temperature (°C)	H_2O Pressure (kPa)
0	0.61
5	0.87
10	1.25
15	1.71
20	2.34
25	3.17
30	4.25
35	5.63
40	7.38
45	9.59
50	12.34
55	15.75

3. The air pressure over a pond at 10°C is 106.87 kPa. What is the partial pressure of the dry air?

4. A 250. mL sample of oxygen is collected over water at 25°C and 755.0 torr pressure. What is the pressure of the dry oxygen alone? The vapor pressure of water at 25°C is 23.8 torr.

Level 2 Problems Dalton's Law, then the combined gas law

5. A 48.5 mL sample of hydrogen is collected over water at 23^{o}C and 778.0 torr pressure. What is the volume of the dry gas at STP? (The vapor pressure of water at 23^{o}C is 21.1 torr)

6. A 68.3 mL sample of a gas is collected over water at 20. C and 742.4 torr pressure. What is the volume of the dry gas at STP? (The vapor pressure of water at 20. ^{o}C is 17.5 torr)

Enrichment Problems

The mole fraction is defined as the moles of substance A divided by total moles. It is always expressed in decimal form.

$$mole\ fraction = \frac{moles\ A}{total\ moles}$$

Therefore, the partial pressure exerted by an individual gas is equal to the mole fraction of the gas times the total pressure.

$$P_A = \frac{moles\ A}{total\ moles} \times P_{tot}$$

1. A mixture of 3.00 moles of Ar, 4.50 moles of H_2O, 1.75 moles of N_2, and 6.00 moles of CO_2 exerts a total pressure of 900. torr. What is the partial pressure exerted by each gas?

2. The partial pressure of Cl_2 is 400. torr in a mixture of gases where the total pressure is 2.00 atm. What is the mole fraction of Cl_2?