Chem11 The Ideal Gas Law : W.S. - 70

The **Ideal Gas Law** states that : **PV = nRT**, or, the pressure multiplied by the volume of a gas equals the product of the number of moles, the universal gas constant R, and the Kelvin temperature. The pressure is usually measured in kilopascals (kPa), the volume in liters (L), the temperature in degrees Kelvin (K). The constant R = 8.31 (L•kPa) / (mol•K).

We can use this law to find the volume occupied by one mole of **any** gas at S.T.P.. Using the formula above, n = 1.0 mol, P = 101.3 kPa, R = 8.31, T = 273°K, so **V = 22.4 L** This law also leads to "**Avogadro's Principle**", which states that : equal volumes of gases contain equal numbers of molecules if P and T are constant.

Problems :

1) Find the volume of 0.384 moles of argon gas at S.T.P..

2) If 3.5 moles of O_2 gas occupy a 12 L container at 22°C, what is the pressure?

3) How many moles of N_2 gas, can be contained in a 7.1 L container at 41°C and 84 kPa?

4) A steel cylinder contains 34 grams of helium gas at S.T.P.. Find the volume.

5) The dirigible Hindenburg contained 8.9×10^6 moles of H_2 gas. Calculate the volume occupied by this amount of hydrogen gas at a temperature of 26°C and a pressure of 98 kPa.

6) A 5.2 L container is filled with nitrogen gas at a pressure of 95 kPa and a temperature of 18°C. Find the mass of gas in the container.

7) Find the Celsius temperature of 3.9 moles of any gas at 3100 kPa in a 2.3 L container.

8) Calculate the density of oxygen gas (in grams per L) at S.T.P..

9) Prove Avogadro's Principle.

Answers : 1) 8.60 L, 2) 720 kPa, 3) 0.23 mol, 4) 190 L, 5) 2.3×10^8 L, 6) 5.7 g, 7) - 53°C, 8) 1.43 g/L, 9) PV = nRT, since P, T and R are constant, V is proportional to n for **any** gas.