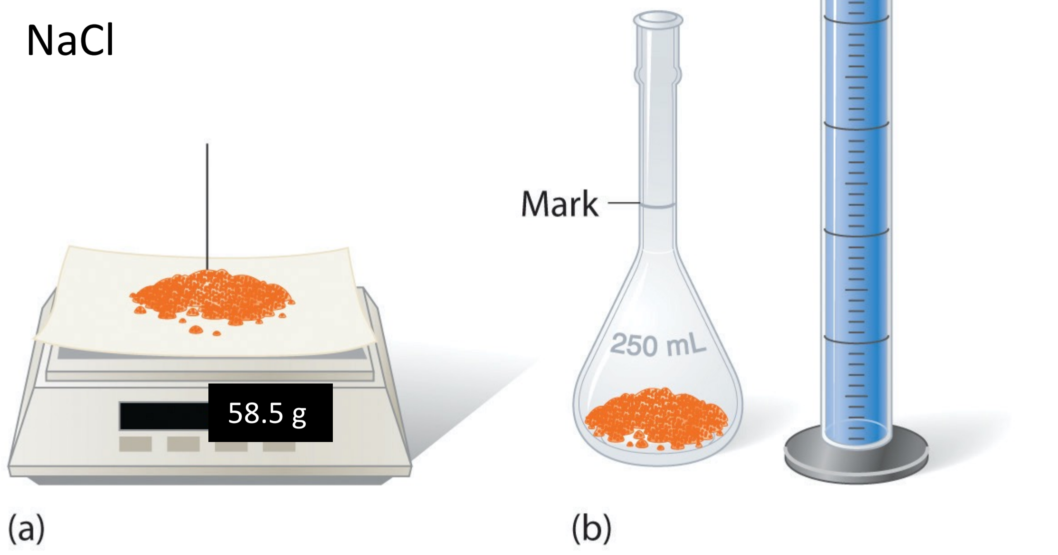


58.5 g of NaCl in 1 L,
We have 1 molar solution of sodium chloride. If we have 0.25 L of the solution, the sodium chloride concentration is 4 mol/L

$$HCl_{(gas)} + NH_{3\,(gas)} \rightarrow NH_4Cl_{(solid)}$$

$$2H_{2\,(gas)} + O_{2\,(gas)} \rightarrow 2H_2O_{(gas)}$$

$$H_{2\,(gas)} + Cl_{2\,(gas)} \rightarrow 2HCl_{(gas)}$$

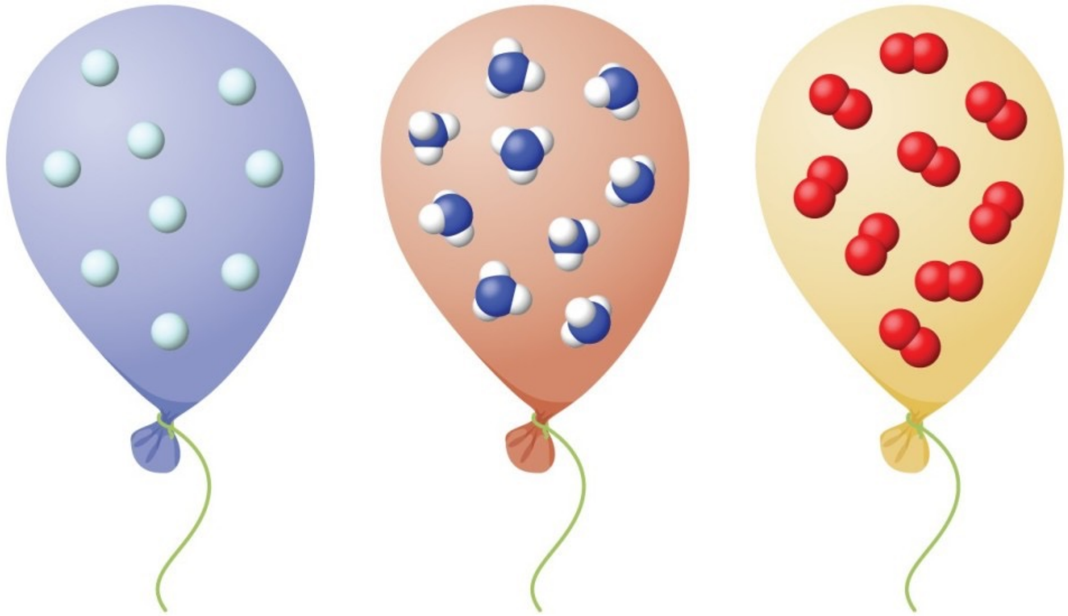
Equal gas volumes (at equal temperature and pressure) contain the same number of particles

- 1 mole of any gas takes a volume of **22.4 liters** at “normal conditions “. This is a molar gas volume under normal conditions.

- Normal conditions are temperature of 0ºC (273 K) and pressure of 1 atm (101 325 Pa)

Avogadro's Law

Equal volumes of ideal gases measured at the same temperature and pressure contain the same number of molecules.



How can we use this law?

$m = k\ d$

$k = m/d$

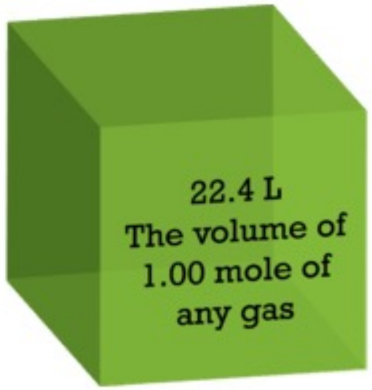
Molecular weight (m) of any gas will be proportional (k – proportionality coefficient) to its density (d).

We can change molecular weight to molar weight (g/mol)

$k = M/d$

$K = 32/1.427 = 22.4$ L/mol

	Density, g/l	M, molar mass, g/mol	Coefficient, k
H_2	0.0894	2	~22.4
O_2	1.427	32	~22.4



22.4 L - the volume that one mole of any gas occupy under normal conditions.

Clapeyron-Mendeleev equation

Under standard conditions RT = 22.4 (0.0821x273), pressure = 1atm. In 22.4 L we will have n = 1.
n = pV/RT
n = 1x22.4/22.4 = 1
22.4 L contains 1 mole of any gas.

$$pV = nRT$$

n - gas mole number
p - gas pressure (atm)
V - gas volume (liters)
T - temperature (K)
R - gas constant (0.0821 l x atm/mole x K)

Example

A closed flask of 2.6 L contains oxygen under the pressure of 2.3 atm and temperature of 26°C.
How many moles of O_2 are there in the flask?

$$pV = nRT$$

$$n = PV/RT$$

$$n = (2.3\ atm \times 2.6\ L)/(0.0821\ (L \times atm/mole \times K) \times 299\ K)$$

$$273\ K + 26^oC = 299\ K$$

Ideal Gas Equation is

$$PV = nRT$$

n = no. of moles

$$P \times V = \frac{\text{mass}}{\text{molar mass}} \times R \times T$$

$n = \frac{\text{weight / mass}}{\text{molar mass}}$.

Let molar mass = M

mass = m.

$$\Rightarrow \quad P \times V = \frac{m}{M} \times R \times T$$

$$\Rightarrow \quad M = \frac{m \times R \times T}{P \times V}$$

we know that density $= \frac{\text{mass}}{\text{Volume}} = \frac{m}{V}$ $\therefore$ $d = \frac{m}{V}$

Substitute the value $\frac{m}{V}$ with d

$$\therefore \quad \boxed{M = \frac{d \times R \times T}{P}}$$