Chapter 5. States of matter

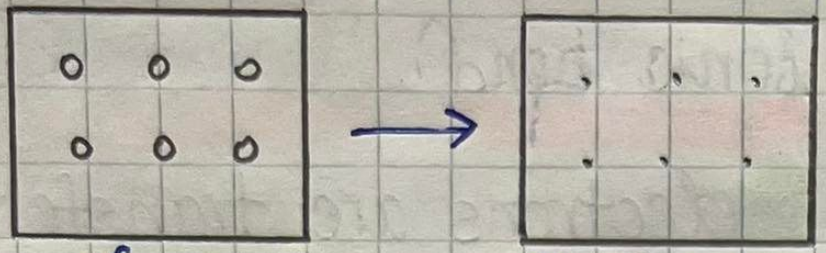
Ideal and real gas.

$$\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$$

real gas

$$PV = nRT$$

ideal gas equation



real gas ideal gas

Ideal gas

- no volume of molecule
- no interaction between molecules

$PV = nRT$ V: volume [m^3]

P: pressure [Pa] n: mole number [mol]

T: temperature [K] R: 8.31 $J\,mol^{-1}\,K^{-1}$

$K = C° + 273$

1. Calculate the volume occupied by 0.5mol of CO_2 at 150kPa and 19°C.

~ $P = 150kPa = 150000Pa$ $T = 19°C = 292K$

$PV = nRT$ $150000 \times V = 0.5 \times 8.31 \times 292$

$V = 8.09 \times 10^{-3}\ m^3$

2. A flask volume $2dm^3$ was found to contain 5.28g gas. The pressure in the flask was 200kPa temp 20°C. Calculate Mr?

~ $2dm^3 = 0.002m^3$ $\quad 20°C = 293K$ $\quad \text{mol number} = \frac{m}{Mr}$

$200kPa = 200000Pa$ $\quad PV = nRT$ $\quad Mr = 5.28 \div 0.164 = 32.1 \ g\,mol^{-1}$

$200000 \times 0.002 = n \times 8.31 \times 293$ $\quad n = 0.164mol$

3. A flask of volume $5 dm^3$ contains 4g O_2. Calculate the pressure exerted by the gas at temperature of 127°C.

$5 dm^3 = 5 \times 10^{-3} m^3$ $\quad$ 127°C = 400K $\quad$ $PV = nRT$

$n = \frac{m}{Mr} \Rightarrow 4g \div (16 \times 2) g\,mol^{-1} = 0.125 mol$

$P \times (5 \times 10^{-3}) = 0.125 \times 8.31 \times 400$ $\quad$ $P = 83100 Pa$

4. 150°C = 423K $\quad$ 1.2atm = 121.2kPa $\quad$ m = 10g

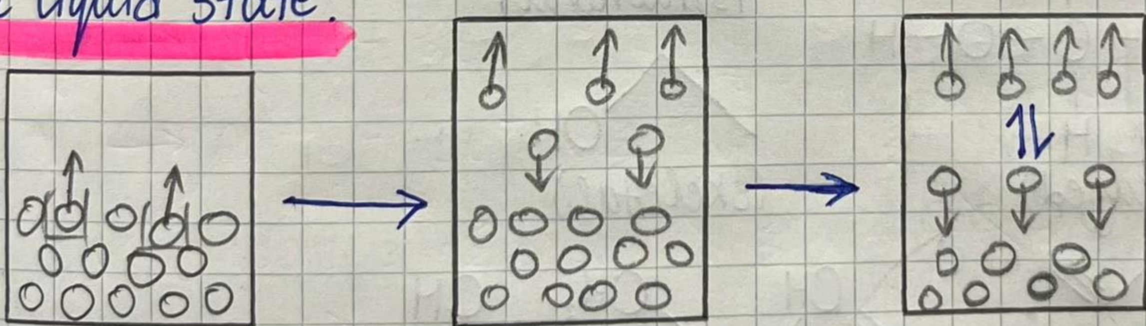
$1.133 dm^3 = 1.133 \times 10^{-3} m^3$ $\quad$ $PV = nRT$

$121200 Pa \times 1.133 \times 10^{-3} m^3 = n \times 8.31 J\,mol^{-1} K^{-1} \times 423K$

$n = 0.039 mol$ $\quad$ $Mr = \frac{m}{n}$ $\quad$ $Mr = 10 \div 0.039 = 256 g\,mol^{-1}$

$\frac{S}{Mr = 32} \Rightarrow \frac{256}{32} = 8 \Rightarrow S_8$

The liquid state.



water molecule in liquid ⇌ water molecule in vapour (equal rate of movement)

In this situation the pressure exerted by a vapour equilibrium with its liquid is called vapour pressure.

Solid state.

ижил зүйлээс бүтсэн (энгийн бүтэц), гэрэл нэвтэрс- дэгүй

crystal lattice: regularly repeating arrangement of ions, atoms or molecules
(талст орон тор)