$PV = nRT$

① find the volume occupied by 2.20g of carbon dioxide, CO_2, at 298K and a pressure of 100kPa.

$V = \frac{nRT}{P}$ $\quad$ $\frac{2.20g}{44} = 0.05 \text{ moles}$

44 ← mr of CO_2

R is a constant

$$V = \frac{0.05 \times 8.31 \times 298}{100000} = 1.238 \times 10^{-3} \, m^3$$

100000 ← in Pascals

② What pressure is exerted by 1·60g of oxygen, O_2, in a volume of 2·00dm^3 at a temperature of 80°C?

$P = \frac{nRT}{V}$ $\quad \frac{1.60}{32} = 0.05$ $\quad 80°C = 353K$

mr of O_2

$2.00dm^3 = 2\times10^{-3}m^3$ $\quad P = \frac{0.05 \times 8.31 \times 353}{2\times10^{-3}}$

$P = 73335.75$ Pa.

③ 56.0cm^3 of an unknown gas X, measured at a temperature of 90°C and a pressure of 101kPa, was found to weigh 0.135g. find the relative formula mass of gas.

$PV = nRT$ $\quad n = \frac{PV}{RT}$ $\quad 90°C = 363K$

$101kpa = 101000pa$ $\quad \frac{56.0}{(1000 \times 1000)} = 5.6 \times 10^{-5} m^3$

$n = \frac{101000 \times 5.6 \times 10^{-5}}{8.31 \times 363}$ $\quad n = 1.875 \times 10^{-3}$ moles.

$moles = \frac{mass}{M_r}$ $\quad \frac{mass}{moles} = M_r$ $\quad \frac{0.135}{1.875 \times 10^{-3}} = 72$

④ find the volume occupied by 0·100g of hydrogen, H_2, at 293K and a pressure of 100kPa.

$$V = \frac{nRT}{P} \qquad \frac{0.100}{2} = 0.05 \text{moles}$$

100kPa = 100000 pa

$$V = \frac{0.05 \times 8.31 \times 293}{100000} \qquad V = 1.217 \times 10^{-3}$$

⑤ find the mass of $200cm^3$ of carbon monoxide, CO, at 17°C and a pressure of 98900 Pa.

$\frac{200}{(1000 \times 1000)} = 2 \times 10^{-4} m^3$ $\quad$ $17°C = 290K$

$PV = nRT$ $\quad$ $n = \frac{PV}{RT}$ $\quad$ $n = \frac{98900 \times 2 \times 10^{-4}}{8.31 \times 290}$

$n = 8.21$ moles $\quad$ Mr of CO = 28

moles × Mr = mass $\quad$ $8.21 \times 28 = 229.88g$

⑥ 1·25g of an unknown gas occupied 923cm³ at a pressure of 102kPa and a temperature of 290k. find the relative formula mass of the gas.

$\frac{923}{(1000 \times 1000)} = 9{\cdot}23 \times 10^{-4} m^3$ $\quad$ 102kpa = 102000pa

$PV = nRT$ $\quad$ $n = \frac{PV}{RT}$ $\quad$ $n = \frac{102000 \times 9{\cdot}23 \times 10^{-4}}{8{\cdot}31 \times 290}$

$n = 0{\cdot}039$ $\quad$ $\text{moles} = \frac{\text{mass}}{Mr}$ $\quad$ $\frac{\text{mass}}{\text{moles}} = Mr$

$\frac{1{\cdot}25}{0{\cdot}039} = 32{\cdot}05$