The Ideal Gas Equation - Answers

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

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

Mr of CO_2

R is a constant

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

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?

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

Mr of O_2

$$2.00dm^3 = 2 \times 10^{-3}\ m^3 \qquad P = \frac{0.05 \times 8.31 \times 353}{2 \times 10^{-3}}$$

$$P = 73335.75\ Pa.$$

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

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

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

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

$\text{moles} = \frac{\text{mass}}{Mr}$ $\quad \frac{\text{mass}}{\text{moles}} = mr$ $\quad \frac{0.135}{1.875 \times 10^{-3}} = \underline{72}$

④ find the volume occupied by 0.100g of hydrogen, H_2, at 293K and a pressure of 100kPa.

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

$100kPa = 100000 pa$

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

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

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

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

$= 8.21 \times 10^{-3}$ moles of CO

$8.21 \times 10^{-3} \times 28 = 0.23$g of CO