

Chemistry Study Materials for Class 11 (NCERT Based Numericals of Chapter- 01)

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Some Basic Concept of Chemistry

Q. 27: The atomic masses of two elements (P and Q) are 20 and 40 respectively.
x g of P contains y atoms, how many atoms are present in 2x g of Q?

Solution:

$$\text{No. of mole of P} = \frac{x}{20}$$

$$\text{No. of atoms of P} = \left(\frac{x}{20}\right) \times N \quad [N \text{ is Avogadro constant}]$$

$$\text{Therefore, } y = \frac{x}{20} \times N \quad \text{or } x = \frac{20y}{N}$$

Now,

$$\text{No. of mole of Q} = \frac{2x}{40}$$

$$\begin{aligned} \text{No. of atoms of Q} &= \left(\frac{2x}{40}\right) \times N \\ &= \frac{2N}{40} \times \frac{20y}{N} \\ &= y \end{aligned}$$

Q. 28: Oxygen is present in a 1-litre flask at a pressure of 7.6×10^{-10} mm of Hg at 0°C .
Calculate the number of oxygen molecules in the flask.

Solution:

$$\text{Pressure} = 7.6 \times 10^{-10} \text{ mm Hg as } 1 \text{ atm} = 760 \text{ mm Hg}$$

$$p = \frac{7.6 \times 10^{-10}}{760} = 10^{-12} \text{ atm}$$

$$\text{Volume} = 1 \text{ litre}$$

$$\text{Temperature} = 0^\circ\text{C} = 273 \text{ K}$$

$$\text{We know } pV = nRT \text{ or } n = \frac{pV}{RT}$$

$$\begin{aligned} n &= \frac{(10^{-12} \times 1)}{(0.0821 \times 273)} \\ &= 0.44 \times 10^{-13} \end{aligned}$$

$$\text{No. of molecules} = \text{no. of mole} \times \text{Avogadro constant}$$

$$\begin{aligned} &= 0.44 \times 10^{-13} \times 6.022 \times 10^{23} \\ &= 2.65 \times 10^{10} \end{aligned}$$

Q.29: What is the ratio of the volumes occupied by 1 mole of O_2 and 1 mole of O_3 in identical conditions?

Solution:

$$\begin{aligned}\text{Volume ratio} &= \text{Molar ratio (Avogadro's principle – the molar ratios are also} \\ &\text{volume ratios for gases)} \\ &= 1:1\end{aligned}$$

Q.30: The cost of the Table Salt ($NaCl$) and Table sugar ($C_{12}H_{22}O_{11}$) is Rs 10 and Rs 40 per kg. Find the cost of the salt and sugar per mole?

Solution:

$$\begin{aligned}\text{Molar Mass of } NaCl &= 23+35.5=58.5 \text{ g/mol} \\ \text{Cost of 1 Mole of } NaCl &= (10 / 1000) \times 58.5 = 0.585 \text{ Rs/mole} \\ \text{Molar Mass of } C_{12}H_{22}O_{11} &= 12 \times 12 + 22 \times 1 + 11 \times 16 \\ &= 342 \text{ g/mol} \\ \text{Cost of 1 Mole of } C_{12}H_{22}O_{11} &= (40 / 1000) \times 342 \\ &= 13.68 (40 / 1000) \times 342 \\ &= 13.68 \text{ Rs/mole}\end{aligned}$$

Q.31: Calculate the number of oxygen atoms in 0.2 mole of $Na_2CO_3 \cdot 10H_2O$.

Solution:

$$\begin{aligned}\text{Moles of oxygen atoms in 1 mole of } Na_2CO_3 \cdot 10H_2O &= 3+10 = 13 \\ \text{Moles of oxygen atoms in 0.2 mole of } Na_2CO_3 \cdot 10H_2O &= 0.2 \times 13 \\ &= 2.6 \\ &= 2.6 \times 10^{23} \\ \text{Therefore, Number of oxygen atoms} &= 2.6 \times 6.022 \times 10^{23} \\ &= 1.565 \times 10^{24}.\end{aligned}$$
