CONCENTRATION TERMS

1. The molarity of HNO_3 in a sample which has density 1.4 g/mL and mass percentage of 63% is _____. (Molecular Weight of HNO_3 = 63)

2. 10.30 mg of O_2 is dissolved into a liter of sea water of density 1.03 g/mL. The concentration of O_2 in ppm is_____.

3. The volume strength of 8.9 M H_2O_2 solution calculated at 273 K and 1 atm is _____. (R=0.0821 L atm K^{-1} mol^{-1}) (rounded off to the nearest integer)

4. The mole fraction of glucose ($C_6H_{12}O_6$) in an aqueous binary solution is 0.1. The mass percentage of water in it, to the nearest integer, is _____.

5. 6.023×10^{22} molecules are present in 10 g of a substance 'x'. The molarity of a solution containing 5 g of substance 'x' in 2 L solution is _____ $\times 10^{-3}$.

6. The strengths of 5.6 volume hydrogen peroxide (of density 1 g/mL) in terms of mass percentage and molarity (M), respectively, are:
(Take molar mass of hydrogen peroxide as 34 g/mol)

(1) 1.7 and 0.25 (2) 1.7 and 0.5

(3) 0.85 and 0.5 (4) 0.85 and 0.25

7. A solution of two components containing n_1 moles of the 1st component and n_2 moles of the 2nd component is prepared. M_1 and M_2 are the molecular weights of component 1 and 2 respectively. If d is the density of the solution in g mL^{-1}, C_2 is the molarity and x_2 is the mole fraction of the 2nd component, then C_2 can be expressed as :

(1) $C_2 = \dfrac{1000x_2}{M_1 + x_2(M_2 - M_1)}$

(2) $C_2 = \dfrac{dx_2}{M_2 + x_2(M_2 - M_1)}$

(3) $C_2 = \dfrac{dx_1}{M_2 + x_2(M_2 - M_1)}$

(4) $C_2 = \dfrac{1000dx_2}{M_1 + x_2(M_2 - M_1)}$

SOLUTION

1. NTA Ans. (14.00)

Sol. 100 gm soln $\rightarrow$ 63 gm HNO_3

$\frac{100}{1.4}$mL $\rightarrow$ 1 mole HNO_3

$$\text{Molarity} = \frac{1}{\frac{100}{1.4}\times\frac{1}{1000}} = 14M$$

2. NTA Ans. (10)

Sol. $$\text{ppm} = \frac{10.3\times10^{-3}}{1030}\times10^6 = 10$$

3. Official Ans. by NTA (100)

Sol. Volume strength of H_2O_2 at 1 atm

273 kelvin = M × 11.2 = 8.9 × 11.2 = 99.68

Ans : 100

4. Official Ans. by NTA (47)

Sol. $X_{C_6H_{12}O_6}$ = 0.1

Let total mole is 1 mol then mole of glucose will be 0.1 and mole of water will be 0.9

$$\text{so mass \% of water} = \frac{0.9\times18}{0.1\times180+0.9\times18}\times100$$
$$= 47.36$$

Ans : 47

5. Official Ans. by NTA (25)

Sol. $$\text{moles} = \frac{\text{number of molecules}}{6\times10^{23}} = \frac{\text{given mass}}{\text{molar mass}}$$

$$\Rightarrow \text{molar mass} = \frac{10\times6.023\times10^{23}}{6.023\times10^{22}} = 100\,g/mol$$

$$\Rightarrow \text{molarity} = \frac{\text{moles of solute}}{\text{volume of sol}^n(\ell)} = \frac{(5/100)}{2} = 0.025$$

6. Official Ans. by NTA (2)

Sol. Volume strength = 11.2 × molarity

$$\Rightarrow \text{molarity} = \frac{5.6}{11.2} = 0.5$$

Assuming 1 litre solution;

mass of solution = 1000 ml × 1 g/ml = 1000 g

mass of solute = moles × molar mass

= 0.5 mol × 34 g/mol

= 17 gm.

$$\Rightarrow \text{mass\%} = \frac{17}{1000}\times100 = 1.7\%$$

7. Official Ans. by NTA (4)