CONCENTRATION TERMS

1. A 6.50 molal solution of KOH (aq.) has a density of 1.89 g cm^{-3}. The molarity of the solution is _____ mol dm^{-3}. (Round off to the Nearest Integer).
[Atomic masses: K :39.0 u; O :16.0 u; H :1.0 u]

2. When 35 mL of 0.15 M lead nitrate solution is mixed with 20 mL of 0.12 M chromic sulphate solution, _____ × 10^{-5} moles of lead sulphate precipitate out. (Round off to the Nearest Integer).

3. The mole fraction of a solute in a 100 molal aqueous solution _____ × 10^{-2}.
(Round off to the Nearest Integer).
[Given : Atomic masses : H : 1.0 u, O : 16.0 u]

4. An aqueous KCl solution of density 1.20 g mL^{-1} has a molality of 3.30 mol kg^{-1}. The molarity of the solution in mol L^{-1} is _____ (Nearest integer)

[Molar mass of KCl = 74.5]

5. 100 mL of Na_3PO_4 solution contains 3.45 g of sodium. The molarity of the solution is _____×10^{-2} mol L^{-1} . (Nearest integer)

[Atomic Masses-Na : 23.0 u, O : 16.0 u, P : 31.0 u]

6. The molarity of the solution prepared by dissolving 6.3 g of oxalic acid ($H_2C_2O_4.2H_2O$) in 250 mL of water in mol L^{-1} is x × 10^{-2}. The value of x is _____. (Nearest integer)

[Atomic mass : H : 1.0, C : 12.0, O : 16.0]

7. Sodium oxide reacts with water to produce sodium hydroxide. 20.0 g of sodium oxide is dissolved in 500 mL of water. Neglecting the change in volume, the concentration of the resulting NaOH solution is _____ ×10^{-1} M. (Nearest integer)

[Atomic mass : Na = 23.0, O = 16.0, H = 1.0]

8. If 80 g of copper sulphate $CuSO_4 \cdot 5H_2O$ is dissolved in deionised water to make 5 L of solution. The concentration of the copper sulphate solution is x × 10^{-3} mol L^{-1}. The value of x is _____.

[Atomic masses Cu : 63.54 u, S : 32 u, O : 16 u, H : 1 u]

SOLUTION

1. Official Ans. by NTA (9)

Sol. 6.5 molal KOH = 1000gm solvent has
6.5 moles KOH

so wt of solute = 6.5 × 56
= 364 gm

wt of solution = 1000 + 364 = 1364

Volume of solution = $\frac{1364}{1.89}$ mℓ

Molarity = $\frac{\text{mole of solute}}{V_{solution}\text{ in Litre}}$

$= \frac{6.5\times1.89\times1000}{1364}$

= 9.00

2. Official Ans. by NTA (525)

Sol. $3\,Pb(NO_3)_2 + Cr_2(SO_4)_3 \rightarrow 3PbSO_4 + 2Cr(NO_3)_3$

35 ml 20 ml

0.15 M 0.12 M

= 5.25 m.mol = 2.4 m.mol 5.25 m.mol

$= 5.25 \times 10^{-3}$ mol

therefore moles of $PbSO_4$ formed = 5.25×10^{-3}

$= 525 \times 10^{-5}$

3. Official Ans. by NTA (64)

Sol. 100 molal aqueous solution means there is 100 mole solute in 1 kg = 1000 gm water.

Now,

mole-fraction of solute = $\frac{n_{solute}}{n_{solute}+n_{solvent}}$

$= \frac{100}{100+\frac{1000}{18}} = \frac{1800}{2800} = 0.6428$

$= 64.28 \times 10^{-2}$

4. Official Ans. by NTA (3)

Sol. 1000 kg solvent has 3.3 moles of KCl

1000 kg solvent ⟶ 3.3 × 74.5 gm KCl

⟶ 245.85

Weight of solution = 1245.85 gm

Volume of solution = $\frac{1245.85}{1.2}$ ml

So molarity = $\frac{3.3\times1.2}{1245.85}\times1000 = 3.17$

5. Official Ans. by NTA (50)

Sol. Na_3PO_4 (100ml Sol.)

$Na_3PO_4 \longrightarrow 3Na$

$\frac{1}{3}\times\frac{3.45}{23}$ mol 3.45g

$\frac{3.45}{23}$ mol

therefore molarity of Na_3PO_4 Solution =

$$\frac{n_{Na_3PO_4}}{\text{volume of solution in L}}$$

$$= \frac{\frac{1}{3}\times\frac{3.45}{23}\text{ mol}}{0.1\,L}$$

$= 0.5 = 50 \times 10^{-2}$

6. Official Ans. by NTA (20)

Sol. $[H_2C_2O_4.2H_2O] = \frac{\text{weight}/M_W}{V(L)}$

$\Rightarrow x \times 10^{-2} = \frac{6.3/126}{250/1000}$

x = 20

7. Official Ans. by NTA (13)

Sol. $Na_2O + H_2O \rightarrow 2NaOH$

$\frac{20}{62}$ moles

Moles of NaOH formed = $\frac{20}{62}\times2$

$[NaOH] = \frac{\frac{40}{62}}{\frac{500}{1000}} = 1.29\,M = 13 \times 10^{-1}$ M

(Nearest integer)

8. Official Ans. by NTA (64)

Sol. Moles of $CuSO_4\cdot5H_2O = \frac{80}{249.54}$

Molarity = $\frac{\frac{80}{249.54}}{5} = 64.117 \times 10^{-3}$

Nearest integer, x = 64