PHYSICAL CHEMISTRY

DPP

DAILY PRACTICE PROBLEMS

DPP No. 8

Total Marks : 32

Max. Time : 32 min.

Topic : Mole Concept

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1,3,4	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.5,6	(4 marks, 4 min.)	[8, 8]
Short Subjective Questions ('–1' negative marking) Q.2	(3 marks, 3 min.)	[3, 3]
Comprehension ('–1' negative marking) Q.7 to 10	(3 marks, 3 min.)	[12, 12]

1. What volume of a 0.8 M solution contains 100 millimoles of the solute :
(A) 100 mL (B) 125 mL (C) 500 mL (D) 62.5 mL

2. Calculate the volume in litre of 1M solution of HCl, which contains 36.5 g HCl.

3. The molarity of the KOH solution which is 2.8% (mass/volume) solution is :
(A) M/10 (B) M/2 (C) M/5 (D) 1 M

4. 75 ml of H_2SO_4 (specific gravity = 1.18) containing 49% H_2SO_4 by mass is diluted to 590 ml. Calculate molarity of the diluted solution :
(A) 0.7 M (B) 7.5 M (C) 0.75 M (D) 0.25 M

5*. If 100 ml of 1M H_2SO_4 solution is mixed with 100 ml of 9.8%(w/w) H_2SO_4 solution (d = 1 g/ml), then :
(A) concentration of solution remains same (B) volume of solution become 200 ml
(C) mass of H_2SO_4 in the solution is 98 g (D) mass of H_2SO_4 in the solution is 19.6 g

6*. For 100 ml of 0.3 M $CaCl_2$ solution + 400 ml of 0.1 M HCl solution, correct datas is/are :
(A) Total concentration of cation(s) = 0.14 M (B) Total concentration of cation(s) = 0.07 M
(C) $[Cl^-]$ = 0.1 M (D) $[Cl^-]$ = 0.2 M

Comprehension # (Q.7 to Q.10)

The concentrations of solutions can be expressed in number of ways; viz : mass fraction of solute (or mass percent), Molar concentration (Molarity) and Molal concentration (molality). These terms are known as concentration terms and also they are related with each other i.e.knowing one concentration term for the solution, we can find other concentration terms also. The definition of different concentration terms are given below :
Molarity : It is number of moles of solute present in one litre of the solution.
Molality : It is the number of moles of solute present in one kg of the solvent.

$$\text{Mole Fraction} = \frac{\text{moles of solute}}{\text{moles of solute} + \text{moles of solvent}}$$

If molality of the solution is given as 'a', then mole fraction of the solute can be calculated by :

$$\text{Mole Fraction} = \frac{a}{a + \frac{1000}{M_{solvent}}} = \frac{a \times M_{solvent}}{(a \times M_{solvent} + 1000)}$$

where a = molality and $M_{solvent}$ = Molar mass of solvent.

We can change : Mole fraction $\leftrightarrow$ Molality $\leftrightarrow$ Molarity.

7. 120 g of solution containing 40% by mass of NaCl is mixed with 200 g of a solution containing 15% by mass NaCl. Determine the mass percent of sodium chloride in the final solution :
(A) 24.4% (B) 78% (C) 48.8% (D) 19.68%

8. What is the molality of the above final solution :
(A) 4.4 m (B) 5.5 m (C) 24.4 m (D) none of these

9. What is the mole fraction of the solute in the above final solution :
(A) 0.18 (B) 0.75 (C) 0.09 (D) 0.25

10. What is the molarity of above final solution if density of solution is 1.6 g/ml :
(A) 5.5 M (B) 6.6 M (C) 2.59 M (D) None of these

Answer Key

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1.	(B)	**2.**	1	**3.**	(B)	**4.**	(C)	**5*.**	(A,B,D)
6*.	(A,D)	**7.**	(A)	**8.**	(B)	**9.**	(C)	**10.**	(B)

Hints & Solutions

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1. $M = \frac{n_{solute}}{V_{solution}}$

$\frac{0.8}{1000} = \frac{100 \times 10^{-3}}{\text{vol. of solution}}$

vol. of solution = 125 ml

(Here n_{solute} = mole of solute, $V_{solution}$ = vol. of solution).

2. $\text{Volume} = \frac{\text{No. of moles}}{\text{Molarity}} = \frac{36.5/36.5}{1} = 1$

3. $M = \frac{\frac{2.8}{56}}{100} \times 1000 = \frac{1}{2} M$

4. $M_1V_1 = M_2V_2$

$\frac{49}{98} \times 1.18 \times 10 \times 75 = M_2 \times 590$

5*. (A) Molarity of second solution is = $\frac{10 \times d \times x}{M} = 1$ M

(B) Volume = 100 + 100 = 200 ml

(D) Mass of H_2SO_4 = $\frac{200 \times 1}{1000} \times 98 = 19.6$ gm.

6*. Molarity of cation = $\frac{M_1V_1 + M_2V_2}{V_1 + V_2} = \frac{0.2 \times 100 + 0.1 \times 400}{500} = \frac{0.6}{5} = 0.12\ M$

Molarity of Cl^- = $\frac{3(0.2)100 + 0.1 \times 400}{500} = \frac{0.6 + 0.4}{5} = 0.2\ M$

7. mass of NaCl in Ist solution = 120 × 0.4 = 48 g
mass of NaCl in IInd solution = 200 × 0.15 = 30 g
Total mass of NaCl = 30 + 48 = 78 g
Total mass of solution = 120 + 200 = 320 g

mass % of NaCl = $\frac{78}{320} \times 100 = 24.375\ \%$

8. mass of solvent = 320 – 78 = 242 g.

molality = $\frac{\frac{78}{58.5}}{242} \times 1000 = 5.5\ m$

9. Mole fraction of solute = $\frac{\frac{78}{58.5}}{\frac{78}{58.5} + \frac{242}{18}} = 0.09$

10. Molarity = $\frac{\frac{78}{58.5}}{\frac{320}{1.6}} \times 1000 = 6.66\ M$