DPP - Daily Practice Problems

Chapter-wise Sheets

Date : ☐ **Start Time :** ☐ **End Time :** ☐

CHEMISTRY (CC16)

SYLLABUS : Solutions

Max. Marks : 180 **Marking Scheme :** + 4 for correct & (–1) for incorrect **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 45 MCQ's. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. How many grams of concentrated nitric acid solution should be used to prepare 250 mL of 2.0M HNO_3 ? The concentrated acid is 70% HNO_3

(a) 90.0 g conc. HNO_3 (b) 70.0 g conc. HNO_3

(c) 54.0 g conc. HNO_3 (d) 45.0 g conc. HNO_3

2. For a solution of two liquids A and B it was proved that $P_S = x_A(p^\circ_A - p^\circ_B) + p^\circ_B$. The resulting solution will be

(a) Non -ideal (b) ideal

(c) semi-ideal (d) None of these

3. If the elevation in boiling point of a solution of 10 gm of solute (mol. wt. = 100) in 100 gm of water is ΔT_b, the ebullioscopic constant of water is

(a) 10 (b) $10\,\Delta T_b$

(c) ΔT_b (d) $\dfrac{\Delta T_b}{10}$

4. Which of the following aqueous solution will have highest depression in freezing point?

(a) 0.1 M Urea (b) 0.1 M Sucrose

(c) 0.1 M $AlCl_3$ (d) 0.1 M $K_4[Fe(CN)_6]$

5. Two liquids X and Y form an ideal solution. At 300 K, vapour pressure of the solution containing 1 mol of X and 3 mol of Y is 550 *mm*Hg. At the same temperature, if 1 mol of Y is further added to this solution, vapour pressure of the solution increases by 10 *mm*Hg. Vapour pressure (in *mm*Hg) of X and Y in their pure states will be, respectively:

(a) 300and400 (b) 400and600

(c) 500and600 (d) 200and300

6. 6.02×10^{20} molecules of urea are present in 100 ml of its solution. The concentration of urea solution is

(a) 0.02M (b) 0.01 M

(c) 0.001 M (d) 0.1 M

(Avogadro constant, $N_A = 6.02 \times 10^{23}$ mol^{-1})

RESPONSE GRID

1. ⓐⓑⓒⓓ 2. ⓐⓑⓒⓓ 3. ⓐⓑⓒⓓ 4. ⓐⓑⓒⓓ 5. ⓐⓑⓒⓓ
6. ⓐⓑⓒⓓ

Space for Rough Work

7. To neutralise completely 20 mL of 0.1 M aqueous solution of phosphorous acid (H_3PO_3), the value of 0.1 M aqueous KOH solution required is
(a) 40mL (b) 20mL
(c) 10mL (d) 60mL

8. Two 1-litre flask A and B are connected to each other by a valve which is closed. Flask A has benzene in equilibrium with its vapours at 30°C. The flask B, is evacuated, and the valve is opened. Which of the following is true. If temperature is kept constant.'
(a) Some of the benzene molecules would move to flask B from flask A.
(b) Vapour pressure will be half the initial value.
(c) The vapour pressure remains unchanged
(d) Some more of the liquid benzene in flask A would evaporate.

9. Two Aqueous solutions S_1 and S_2 are separated by a semipermeable membrane. Solution S_1 has got a greater vapour pressure than solution S_2. Water will be flowing
(a) from S_1 to S_2
(b) from S_2 to S_1
(c) in both the directions
(d) in either direction depending upon the nature of the solute

10. Henry's law constant of oxygen is 1.4×10^{-3} mol. lit^{-1}. atm^{-1} at 298 K. How much of oxygen is dissolved in 100 ml at 298 K when the partial pressure of oxygen is 0.5 atm?
(a) 1.4g (b) 3.2g
(c) 22.4mg (d) 2.24mg

11. Which of the following liquid pairs shows a positive deviation from Raoult's law?
(a) Water - nitric acid
(b) Benzene - methanol
(c) Water - hydrochloric acid
(d) Acetone - chloroform

12. Dissolving 120 g of urea (mol. wt. 60) in 1000 g of water gave a solution of density 1.15 g/mL. The molarity of the solution is
(a) 1.78 M (b) 2.00 M
(c) 2.05 M (d) 2.22M

13. The vapour pressure of a solution of the liquids A ($p^\circ = 80$ mm Hg and $x_A = 0.4$) and B ($p^\circ = 120$ mm Hg and $x_B = 0.6$) is found to be 100 mm Hg. It shows that the solution exhibits
(a) positive deviation from ideal behaviour
(b) negative deviation from ideal behaviour
(c) ideal behaviour
(d) positive deviation for lower conc. and negative for higher conc.

14. The vapour pressure of two liquids X and Y are 80 and 60 torr respectively. The total vapour pressure of the ideal solution obtained by mixing 3 moles of X and 2 moles of Y would be
(a) 68 Torr (b) 140 Torr
(c) 48 Torr (d) 72 Torr

15. Iodine and sulphur dissolve in
(a) water (b) benzene
(c) carbon disulphide (d) ethanol

16. A 5% solution of cane sugar (molar mass 342) is isotonic with 1% of a solution of an unknown solute. The molar mass of unknown solute in g/mol is :
(a) 171.2 (b) 68.4 (c) 34.2 (d) 136.2

17. Coolent used in car radiator is aqueous solution of ethylene glycol. In order to prevent the solution from freezing at – 0.3 °C. How much ethylene glycol must be added to 5 kg of water ? (K_f = 1.86 K kg mol^{-1})
(a) 50 kg (b) 55 g
(c) 45 g (d) 40 g

18. A solution of urea (mol. mass 56 g mol^{-1}) boils at 100.18°C at the atmospheric pressure. If K_f and K_b for water are 1.86 and 0.512 K kg mol^{-1} respectively, the above solution will freeze at
(a) 0.654°C (b) –0.654°C
(c) 6.54°C (d) –6.54°C

RESPONSE GRID

7. ⓐⓑⓒⓓ 8. ⓐⓑⓒⓓ 9. ⓐⓑⓒⓓ 10. ⓐⓑⓒⓓ 11. ⓐⓑⓒⓓ
12. ⓐⓑⓒⓓ 13. ⓐⓑⓒⓓ 14. ⓐⓑⓒⓓ 15. ⓐⓑⓒⓓ 16. ⓐⓑⓒⓓ
17. ⓐⓑⓒⓓ 18. ⓐⓑⓒⓓ

Space for Rough Work

19. A solution is prepared by mixing 8.5 g of CH_2Cl_2 and 11.95 g of $CHCl_3$. If vapour pressure of CH_2Cl_2 and $CHCl_3$ at 298 K are 415 and 200 mmHg respectively, the mole fraction of $CHCl_3$ in vapour form is :
(Molar mass of Cl = 35.5 g mol^{-1})
(a) 0.162 (b) 0.675 (c) 0.325 (d) 0.486

20. If α is the degree of dissociation of Na_2SO_4, the Vant Hoff's factor (i) used for calculating the molecular mass is
(a) $1+\alpha$ (b) $1-\alpha$ (c) $1+2\alpha$ (d) $1-2\alpha$

21. The molecular mass of a solute cannot be calculated by which of the following?

(a) $M_B = \dfrac{W_B \times RT}{\pi V}$

(b) $M_B = \dfrac{p^\circ W_B M_A}{(p^\circ - p)W_A}$

(c) $M_B = \dfrac{\Delta T_b W_B \times 1000}{K_b W_A}$

(d) $M_B = \dfrac{K_b W_B \times 1000}{\Delta T_b \times W_A}$

22. We have three aqueous solutions of NaCl labelled as 'A', 'B' and 'C' with concentrations 0.1M, 0.01M and 0.001M, respectively. The value of van't Hoff factor for these solutions will be in the order ________.
(a) $i_A < i_B < i_C$ (b) $i_A > i_B > i_C$
(c) $i_A = i_B = i_C$ (d) $i_A < i_B > i_C$

23. The value of Henry's constant K_H is ________.
(a) greater for gases with higher solubility.
(b) greater for gases with lower solubility.
(c) constant for all gases.
(d) not related to the solubility of gases.

24. Which one of the following gases has the lowest value of Henry's law constant?
(a) N_2 (b) He (c) H_2 (d) CO_2

25. A binary liquid solution is prepared by mixing n-heptane and ethanol. Which one of the following statements is correct regarding the behaviour of the solution?
(a) The solution is non-ideal, showing – ve deviation from Raoult's Law.
(b) The solution is non-ideal, showing + ve deviation from Raoult's Law.
(c) n-heptane shows + ve deviation while ethanol shows – ve deviation from Raoult's Law.
(d) The solution formed is an ideal solution.

26. Which one of the following salts will have the same value of van't Hoff factor (i) as that of $K_4[Fe(CN)_6]$.
(a) $Al_2(SO_4)_3$ (b) NaCl
(c) $Al(NO_3)_3$ (d) Na_2SO_4.

27. Relation between partial pressure and mole fraction is stated by
(a) Graham's law (b) Raoult's law
(c) Le-Chatelier (d) Avogadro law

28. Which is an application of Henry's law?
(a) Spray paint (b) Bottled water
(c) Filling up a tire (d) Soft drinks (soda)

29. For which of the following parameters the structural isomers C_2H_5OH and CH_3OCH_3 would be expected to have the same values?
(Assume ideal behaviour)
(a) Boiling points
(b) Vapour pressure at the same temperature
(c) Heat of vapourization
(d) Gaseous densities at the same temperature and pressure

30. 5 g of Na_2SO_4 was dissolved in x g of H_2O. The change in freezing point was found to be 3.82°C. If Na_2SO_4 is 81.5% ionised, the value of x
(K_f for water = 1.86°C kg mol^{-1}) is approximately :
(molar mass of S = 32 g mol^{-1} and that of Na = 23 g mol^{-1})
(a) 15 g (b) 25 g (c) 45 g (d) 65 g

31. The vapour pressure of acetone at 20°C is 185 torr. When 1.2 g of a non-volatile substance was dissolved in 100 g of acetone at 20°C, its vapour pressure was 183 torr. The molar mass (g mol^{-1}) of the substance is :
(a) 128 (b) 488 (c) 32 (d) 64

RESPONSE GRID

19.ⓐⓑⓒⓓ 20.ⓐⓑⓒⓓ 21.ⓐⓑⓒⓓ 22.ⓐⓑⓒⓓ 23.ⓐⓑⓒⓓ
24.ⓐⓑⓒⓓ 25.ⓐⓑⓒⓓ 26.ⓐⓑⓒⓓ 27.ⓐⓑⓒⓓ 28.ⓐⓑⓒⓓ
29.ⓐⓑⓒⓓ 30.ⓐⓑⓒⓓ 31.ⓐⓑⓒⓓ

Space for Rough Work

32. In mixture A and B components show -ve deviation as

(a) $\Delta V_{mix} > 0$

(b) $\Delta H_{mix} < 0$

(c) $A - B$ interaction is weaker than $A - A$ and $B - B$ interaction

(d) $A - B$ interaction is stronger than $A - A$ and $B - B$ interaction.

33. Which among the following will show maximum osmotic pressure?

(a) 1 M NaCl (b) 1 M $MgCl_2$

(c) 1 M $(NH_4)_3PO_4$ (d) 1 M Na_2SO_4

34. At 80° C, the vapour pressure of pure liquid 'A' is 520 mm Hg and that of pure liquid 'B' is 1000 mm Hg. If a mixture of solution of 'A' and 'B' boils at 80° C and 1 atm pressure, the amount of 'A' in the mixture is (1 atm = 760 mmHg)

(a) 52 mol percent (b) 34 mol percent

(c) 48 mol percent (d) 50 mol percent

35. The observed osmotic pressure for a 0.10 M solution of $Fe(NH_4)_2(SO_4)_2$ at 25°C is 10.8 atm. The expected and experimental (observed) values of van't Hoff factor (i) will be respectively:

($R = 0.082$ L atm k^{-1} mol^{-1})

(a) 5 and 4.42 (b) 4 and 4.00

(c) 5 and 3.42 (d) 3 and 5.42

36. The freezing point of equimolal aqueous solution will be highest for

(a) $C_6H_5NH_3^+Cl^-$ (b) $Ca(NO_3)_2$

(c) $La(NO_3)_3$ (d) $C_6H_{12}O_6$

37. If the solution boils at a temperature T_1 and the solvent at a temperature T_2 the elevation of boiling point is given by

(a) $T_1 + T_2$ (b) $T_1 - T_2$

(c) $T_2 - T_1$ (d) $T_1 + T_2$

38. The freezing point of a 1.00 m aqueous solution of HF is found to be -1.91°C. The freezing point constant of water, K_f is 1.86 K kg mol^{-1}. The percentage dissociation of HF at this concentration is

(a) 30% (b) 10% (c) 5.2% (d) 2.7%

39. A solution containing 0.85 g of $ZnCl_2$ in 125.0 g of water freezes at -0.23°C. The apparent degree of dissociation of the salt is (K_f for water = 1.86 K kg mol^{-1}, atomic mass: Zn = 65.3 and Cl = 35.5)

(a) 1.36% (b) 73.5% (c) 7.35% (d) 2.47%

40. During depression of freezing point in a solution the following are in equilibrium

(a) liquid solvent, solid solvent

(b) liquid solvent, solid solute

(c) liquid solute, solid solute

(d) liquid solute, solid solvent

41. The molecular weight of benzoic acid in benzene as determined by depression in freezing point method corresponds to

(a) ionization of benzoic acid

(b) dimerization of benzoic acid

(c) trimerization of benzoic acid

(d) solvation of benzoic acid

42. How many grams of methyl alcohol should be added to 10 litre tank of water to prevent its freezing at 268 K ? (K_f for water is 1.86 K kgmol^{-1})

(a) 880.07 g (b) 899.04 g

(c) 886.02 g (d) 868.06 g

43. The solubility of N_2 in water at 300 K and 500 torr partial pressure is 0.01 g L^{-1}. The solubility (in g L^{-1}) at 750 torr partial pressure is :

(a) 0.0075 (b) 0.005 (c) 0.02 (d) 0.015

44. When mercuric iodide is added to the aqueous solution of potassium iodide then

(a) freezing point is raised.

(b) freezing point is lowered.

(c) freezing point does not change.

(d) boiling point does not change.

45. Azeotropic mixture of HCl and H_2O has

(a) 48%HCl (b) 22.2%HCl

(c) 36%HCl (d) 20.2%HCl

RESPONSE GRID	32. ⓐⓑⓒⓓ	33. ⓐⓑⓒⓓ	34. ⓐⓑⓒⓓ	35. ⓐⓑⓒⓓ	36. ⓐⓑⓒⓓ
	37. ⓐⓑⓒⓓ	38. ⓐⓑⓒⓓ	39. ⓐⓑⓒⓓ	40. ⓐⓑⓒⓓ	41. ⓐⓑⓒⓓ
	42. ⓐⓑⓒⓓ	43. ⓐⓑⓒⓓ	44. ⓐⓑⓒⓓ	45. ⓐⓑⓒⓓ	

DAILY PRACTICE PROBLEMS

CHEMISTRY SOLUTIONS

DPP/CC16

1. **(d)** Molarity $(M) = \dfrac{wt \times 1000}{mol.\ wt. \times vol\ (ml)}$

$2 = \dfrac{wt.}{63} \times \dfrac{1000}{250}$

$wt. = \dfrac{63}{2}$ gm

wt. of 70% acid $= \dfrac{100}{70} \times 31.5 = 45$ gm

2. **(b)** $p_s = X_A(p_A^\circ - p_B^\circ) + p_B^\circ;$

$p_s = p_A^\circ \times x_A - p_B^\circ \times x_A + p_B^\circ;$

$p_s = p_A^\circ \times x_A - p_B^\circ(1 - x_B) + p_B^\circ$

$\therefore p_s = p_A^\circ \times x_A + p_B^\circ \times x_B.$

This is condition for ideal solution.

3. **(c)** $\Delta T_b = \dfrac{K_b \times w \times 1000}{M \times W};$

$\therefore K_b = \dfrac{\Delta T_b \times 100 \times 100}{10 \times 1000} = \Delta T_b$

4. **(d)** For $K_4[Fe(CN)_6]$, $i = 5$ hence lowest freezing point.

5. **(b)** $P_{total} = P_A^\circ X_A + P_B^\circ X_B$

$550 = P_A^\circ \times \dfrac{1}{4} + P_B^\circ \times \dfrac{3}{4}$

$P_A^\circ + 3P_B^\circ = 550 \times 4$ ...(i)

In second case

$P_{total} = P_A^\circ \times \dfrac{1}{5} + P_B^\circ \times \dfrac{4}{5}$

$P_A^\circ + 4P_B^\circ = 560 \times 5$ ...(ii)

Subtract (i) from (ii)

$\therefore P_B^\circ = 560 \times 5 - 550 \times 4 = 600$

$\because P_A^\circ = 400$

6. **(b)** $M = \dfrac{6.02 \times 10^{20} \times 1000}{6.02 \times 10^{23} \times 100} = 0.01M$

7. **(a)** $N_1V_1 = N_2V_2$ (H_3PO_3 is dibasic $\therefore M = 2N$)

$20 \times 0.2 = 0.1 \times V$

$\therefore V = 40ml$

8. **(c)** There is no change in vapour pressure.

9. **(a)** In case of osmosis the flow of the solvent, is from lower concentration to higher concentration.

10. **(d)** According to Henry's law,

$m = k \times p$

given $K_H = 1.4 \times 10^{-3}$

$p_{O_2} = 0.5$ or

$p_{O_2} = K_H \times x_{O_2}$

$\therefore x_{O_2} = \dfrac{0.5}{1.4 \times 10^{-3}}$

No. of moles; $n = \dfrac{m}{M}$

$0.7 \times 10^{-4} = \dfrac{m}{32}$

$m = 22.4 \times 10^{-4} g = 2.24$ mg

11. **(b)** A mixture of benzene and methanol show positive deviation from Raoult's law

12. **(c)** Number of moles of urea $= \dfrac{120}{60} = 2$

Total mass of solution $= 1000 + 120 = 1120$ g

Total volume of solution (in L) $= \dfrac{Mass}{Density}$

$= \dfrac{1120}{1.15 \times 10^3} = \dfrac{112}{115} L$

Molarity of the solution $= \dfrac{\text{Number of moles}}{\text{Volume of solution in litre}}$

$= \dfrac{2 \times 115}{112} = 2.05\ mol\ L^{-1}$

13. **(b)** $P_{total} = p_A^\circ \times x_A + p_B^\circ \times x_B$

$= 80.0 \times 0.4 + 120.0 \times 0.6 = 104 mm Hg$

The observed P_{total} is 100 mm Hg which is less than 104 mm Hg. Hence the solution shows negative deviation.

14. **(d)** According to given information

$p_X = 80$ Torr

$p_Y = 60$ Torr

$n_X = 3$ moles

$n_Y = 2$ moles

mole fraction of X$(x_X) = \dfrac{n_X}{n_X + n_Y} = \dfrac{3}{3+2} = \dfrac{3}{5}$

mole fraction of Y$(x_Y) = \dfrac{n_Y}{n_X + n_Y} = \dfrac{2}{3+2} = \dfrac{2}{5}$

Total Pressure, $P = p_X x_X + p_Y x_Y$

$= \dfrac{3}{5} \times 80 + \dfrac{2}{5} \times 60 = 48 + 24 = 72$ Torr.

15. **(c)**

16. **(b)** For isotonic solutions

$\pi_1 = \pi_2$

$C_1 = C_2$

$$\frac{5/342}{0.1} = \frac{1/M}{0.1}$$

$$\frac{5}{342} = \frac{1}{M}$$

$$\Rightarrow \; M = \frac{342}{5} = 68.4 \text{ gm/mol}$$

17. **(b)** $\Delta T_f = 0.3°C$

$$\Delta T_f = 0.3° C = \frac{K_f \times W_B \times 1000}{M_B \times W_A}$$

$$= \frac{1.86 \times W_B \times 1000}{62 \times 5000}$$

$\therefore \; W_B = 50$ g

The amount used should be more than 50 g.

18. **(b)** As $\Delta T_f = K_f\, m$

$\Delta T_b = K_b \cdot m$

Hence, we have $m = \frac{\Delta T_f}{K_f} = \frac{\Delta T_b}{K_b}$

or $\Delta T_f = \Delta T_b \frac{K_f}{K_b}$

$\Rightarrow [\Delta T_b = 100.18 - 100 = 0.18°C]$

$$= 0.18 \times \frac{1.86}{0.512} = 0.654°C$$

As the Freezing Point of pure water is 0°C,

$\Delta T_f = 0 - T_f$

$0.654 = 0 - T_f$

$\therefore T_f = -0.654$

Thus the freezing point of solution will be $-0.654°C$.

19. **(c)** Molar mass of $CHCl_3$ = 119.5 g/mol.

Molar mass of CH_2Cl_2 = 85 g/mol.

Moles of $CHCl_3 = \frac{11.95}{119.5} = 0.1$ mol.

Moles of $CH_2Cl_2 = \frac{8.5}{85} = 0.1$ mol.

Mole fraction of $CHCl_3 = \frac{0.1}{0.2} = 0.5$ mol.

Mole fraction of $CH_2Cl_2 = \frac{0.1}{0.2} = 0.5$ mol.

(Given -

Vapour pressure of $CHCl_3$ = 200 mm Hg = 0.263 atm.

Vapour pressure of CH_2Cl_2 = 415 mm Hg = 0.546atm.)

(1 atm=760mm Hg)

$\therefore P_{(\text{above solution})}$

= Mole fraction of $CHCl_3$ × (Vapour pressure of $CHCl_3$) + Mole fraction of CH_2Cl_2 × (Vapour pressure of CH_2Cl_2)

$= 0.5 \times 0.263 + 0.5 \times 0.546 = 0.4045$

Mole fraction of $CHCl_3$ in vapour form

$$= \frac{0.1315}{0.4045} = 0.325.$$

20. **(c)**

	$Na_2SO_4 \longrightarrow$	$2Na^+ +$	SO_4^{2-}
Mol. before dissociation	1	0	0
Mol. after dissociation	$1-\alpha$	2α	1α

$i = 1 - \alpha + 2\alpha + \alpha = 1 + 2\alpha$

21. **(c)** $M_B = \frac{\Delta T_b \times W_B \times 1000}{K_b \times W_A}$ is wrong. The correct form is $M_B = \frac{K_b \times W_B \times 1000}{\Delta T_b \times W_A}$

22. **(c)**

23. **(b)**

24. **(d)** According to Henry's law the mass of a gas dissolved per unit volume of solvent is proportional to the pressure of the gas at constant temperature m = K p i.e. as the solubility increases, value of Henry's law constant decreases. Since CO_2 is most soluble in water among the given set of gases. Therefore CO_2 has the lowest value of Henry's law constant.

25. **(b)** For this solution intermolecular interactions between *n*-heptane and ethanol are weaker than *n*-heptane-*n*-heptane & ethanol-ethanol interactions hence the solution of *n*-heptane and ethanol is non-ideal and shows positive deviation from Raoult's law.

26. **(a)** $K_4[Fe(CN)_6]$ and $Al_2(SO_4)_3$ both dissociates to give 5 ions or $i = 5$

$K_4[Fe(CN)_6] \rightleftharpoons 4K^+ + [Fe(CN)_6]^{4-}$

and $Al_2(SO_4)_3 \rightleftharpoons 2Al^{3+} + 3SO_4^{2-}$

27. **(b)** According to Raoult's law "The partial pressure of a volatile component of a solution is directly proportional to its mole fraction in solution at any temperature".

$p = P_x^{\circ}$

where, p = Partial pressure of component

P° = Vapour pressure of component in pure form

x = mole fraction of component in solution.

28. **(d)** To increase the solubility of CO_2 in soft drinks and soda water, the bottle is sealed under high pressure.

29. **(d)** Gaseous densities of ethanol and dimethyl ether would be same at same temperature and pressure. The heat of vaporisation, V.P. and b.pt. will differ due to H - bonding in ethanol.

30. **(c)** Molarity(experimental)

$$= \frac{\Delta T_f}{K_f} = \frac{3.82}{1.86} = 2.054 \text{ mol/1000 g solvent}$$

$$\text{Molarity (theartical)} = \frac{\text{mole of solute}}{\text{wt. of solventing(g)}} \times 1000$$

$$= \frac{5 \text{ g}/142 \text{ g / mole}}{x} \times 1000$$

	$Na_2SO_4 \longrightarrow$	$2Na^+ +$	SO_4^{2-}
Moles before dissociation	1	0	0
Moles after dissociation	$1-x$	$2x$	x

$$\text{Von't Hoff Factor } (i) = \frac{\text{Moles after dissociation}}{\text{Moles before dissociation}}$$

$$= \frac{(1-x)+2x+x}{1}$$

Na_2SO_4 is ionised 81.5% means $x = 0.815$

$$= \frac{(1-0.815)+2\times0.815+0.815}{1}$$

$= 2.63.$

$$i = \frac{\text{Observed molarity}}{\text{Calculated molarity}}$$

$$\Rightarrow 2.63 = \frac{2.054}{\frac{0.0352}{x}\times1000} = 45.07 \text{ g.}$$

31. **(d)** Using relation,

$$\frac{p^\circ - p_s}{p_s} = \frac{w_2M_1}{w_1M_2}$$

where w_1, M_1 = mass in g and mol. mass of solvent
w_2, M_2 = mass in g and mol. mass of solute
Let $M_2 = x$
$p^\circ = 185$ torr
$p_s = 183$ torr

$$\frac{185-183}{183} = \frac{1.2\times58}{100x} \text{ (Mol. mass of acetone} = 58)$$

$x = 64$
∴ Molar mass of substance = 64

32. **(b)** $[\Delta H_{mix} < 0]$

33. **(c)** Vant Hoff factor $i = 4$ in case of $(NH_4)_3PO_4$,

$$(NH_4)_3PO_4 \rightleftharpoons 3\overset{+}{N}H_4 + PO_4^{3-}$$

34. **(d)** At 1 atmospheric pressure the boiling point of mixture is 80°C.
At boiling point the vapour pressure of mixture, $P_T = 1$ atmosphere = 760 mm Hg.
Using the relation,

$$P_T = P_A^o X_A + P_B^o X_B, \text{ we get}$$

$$P_T = 520X_A + 1000(1 - X_A)$$

$$\{\because P_A^o = 520 \text{mm Hg},$$

$$P_B^o = 1000 \text{ mmHg}, X_A + X_B = 1\}$$

or $760 = 520X_A + 1000 - 1000X_A$ or $480X_A = 240$

or $X_A = \frac{240}{480} = \frac{1}{2}$ or 50 mol. percent

i.e., The correct answer is (d)

35. **(a)** Given $\pi_{ob} = 10.8$ atm
$\pi_{nor} = CST = 0.10 \times 0.0821 \times 298 = 2.446$
now experimental value of (i)

$$= \frac{\text{Observed osmotic pressure}}{\text{Normal osmotic pressure}} = \frac{10.8}{2.446} = 4.42$$

36. **(d)** Glucose is non electrolyte hence depression in freezing point will be minimum, hence freezing point will be highest.

37. **(b)** Solution always boil at higher temperature

$T_1 - T_2 = \Delta T_b$

38. **(d)** $\Delta T_f = K_f \times m \times i$

$$i = \frac{\Delta T_f}{K_f \times m} = \frac{1.91}{1.86\times1} = 1.02$$

For $HI \rightleftharpoons H^+ + I^-$
$(1-\alpha) \quad \alpha \quad \alpha$
$1 - \alpha + \alpha + \alpha = i = 1.027$
$1 + \alpha = 1.02$
$\alpha = 0.02$ or 2.7%

39. **(b)** $\text{Mol.wt.} = \dfrac{k_f \times w \times 1000}{\Delta T_f \times W}$

$$= \frac{1.86\times0.85\times1000}{0.23\times125} \approx 55 \text{ gm}$$

Where
$w = 0.85$g
$W = 125$ g
$\Delta T_f = 0°C - (-23°C) = 23°C$

$$\text{Now, } i = \frac{M_{normal}}{M_{observed}} = \frac{136.3}{55} = 2.47$$

$$\underset{1-\alpha}{ZnCl_2} \rightleftharpoons \underset{\alpha}{Zn^{++}} + \underset{2\alpha}{2Cl^-}$$

Van't Hoff factor (i)

$$= \frac{1-\alpha_\eta+\alpha_\eta+2\alpha_\eta}{1} = 2.47$$

∴ $\alpha\eta = 0.735 = 73.5\%$

40. **(a)** Liquid solvent and solid solvent are in equilibrium.

41. **(b)** Benzoic acid forms a dimer in benzene.

42. **(d)** $\Delta T_f = K_f m$
where m = molality

$$273 - 268 = 1.86 \times \frac{w}{M\times v}$$

$$5 = 1.86 \times \frac{w}{32\times10}$$

$$w = \frac{5\times32\times10}{1.86}$$

$= 860.2 \approx 868.06$ g

43. **(d)** According to Henry law

$$\frac{P_1}{P_2} \bullet \frac{S_1}{S_2}$$

$$\frac{500}{750} \bullet \frac{0.01}{S_2}$$

$$\bullet\ S_2 \bullet \frac{750 \bullet\ 0.01}{500} \bullet\ 0.015 \text{ g/L}$$

44. **(a)**

45. **(d)** Azeotrope of $HCl + H_2O$ contains 20.2% HCl.