PREVIOUS YEARS' QUESTIONS EXERCISE-II

1. A 0.004 M solution of Na_2SO_4 is isotonic with a 0.010 M solution of glucose at same temperature. The apparent degree of dissociation of Na_2SO_4 is **[JEE 2004]**
(1) 25% (2) 50% (3) 75% (4) 85%

2. The elevation in boiling point, when 13.44 g of freshly prepared $CuCl_2$ are added to one kilogram of water, is [Some useful data, K_b (H_2O) = 0.52 kg K mol^{-1}, mol. wt. of $CuCl_2$ = 134.4 gm] **[JEE 2005]**
(1) 0.05 (2) 0.1 (3) 0.16 (4) 0.21

3. 72.5 g of phenol is dissolved in 1 kg of a solvent (k_f = 14) which leads to dimerization of phenol and freezing point is lowered by 7 kelvin. What percent of total phenol is present in dimeric form? **[JEE 2006]**
(1) 20 (2) 30 (3) 35 (4) 40

4. When 20 g of naphtholic acid ($C_{11}H_8O_2$) is dissolved in 50 g of benzene (K_f = 1.72 K kg mol^{-1}), a freezing point depression of 2 K is observed. The van't Hoff factor (*i*) is **[JEE 2007]**
(1) 0.5 (2) 1 (3) 2 (4) 3

5. The degree of dissociation (1) of a weak electrolyte, A_xB_y is related to van't Hoff factor (i) by the expression :- **[AIEEE-2011]**
(1) $\alpha = \frac{x+y-1}{i-1}$ (2) $\alpha = \frac{x+y+1}{i-1}$
(3) $\alpha = \frac{i-1}{(x+y-1)}$ (4) $\alpha = \frac{i-1}{x+y+1}$

6. K_f for water is 1.86 K kg mol^{-1}. If your automobile radiator holds 1.0 kg of water, how many grams of ethylene glycol ($C_2H_6O_2$) must you add to get the freezing point of the solution lowered to –2.8°C ? **[AIEEE-2012]**
(1) 27 g (2) 72 g (3) 93 g (4) 39 g

7. 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 : **[JEE (MAIN)-2012 ONLINE]**
(k_f for water = 1.86 K kg mol^{-1}, atomic mass ; Zn = 65.3 and Cl = 35.5)
(1) 1.36% (2) 2.47% (3) 73.5% (4) 7.35%

8. Liquids A and B form an ideal solution. At 30°C, the total vapour pressure of a solution containing 1 mol of A and 2 moles of B is 250 mm Hg. The total vapour pressure becomes 300 mm Hg when 1 more mol of A is added to the first solution. The vapour pressures of pure A and B at the same temperature are **[JEE (MAIN)-2012 ONLINE]**
(1) 450, 150 mm Hg (2) 250, 300 mm Hg
(3) 125, 150 mm Hg (4) 150, 450 mm Hg

9. 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 **[JEE (MAIN)-2012 ONLINE]**
(1) 2.7% (2) 30% (3) 10% (4) 5.2%

10. How many grams of methyl alcohol should be added to 10 litre tank of water to prevent its freezing at 268 K ? **[JEE (MAIN)-2013 ONLINE]**
(K_f for water is 1.86 K kg mol^{-1})
(1) 899.04 g (2) 886.02 g
(3) 868.06 g (4) 880.07 g

11. Vapour pressure of pure benzene is 119 torr and that of toluene is 37.0 torr at the same temperature. Mole fraction of toluene in vapour phase which is in equilibrium with a solution of benzene and toluene having a mole fraction of toluene 0.50, will be : **[JEE (MAIN)-2013 ONLINE]**
(1) 0.137 (2) 0.205 (3) 0.237 (4) 0.435

12. A molecule M associates in a given solvent according to the equation $M \rightleftharpoons (M)_n$. For a certain concentration of M, the van't Hoff factor was found to be 0.9 and the fraction of associated molecules was 0.2. The value of n is : **[JEE (MAIN)-2013 ONLINE]**
(1) 2 (2) 4 (3) 5 (4) 3

13. 12g of a nonvolatile solute dissolved in 108g of water produces the relative lowering of vapour pressure of 0.1. The molecular mass of the solute is : **[JEE (MAIN)-2013 ONLINE]**
(1) 60 (2) 80 (3) 40 (4) 20

14. The molarity of a solution obtained by mixing 750 mL of 0.5(M)HCl with 250 mL of 2(M)HCl will be :- **[JEE (MAIN)-2013]**
(1) 0.875 M (2) 1.00 M (3) 1.75 M (4) 0.975 M

15. 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^- mol^{-1})
[JEE (MAIN)-2014 ONLINE]
(1) 3 and 5.42 (2) 5 and 3.42
(3) 4 and 4.00 (4) 5 and 4.42

16. For an ideal Solution of two components A and B, which of the following is true ?
[JEE(MAIN)-2014 ONLINE]
(1) $\Delta H_{mixing} < 0$ (zero)
(2) A – A, B – B and A – B interactions are identical
(3) A – B interaction is stronger than A – A and B – B interactions
(4) $\Delta H_{mixing} > 0$ (zero)

17. Consider separate solution of 0.500 M C_2H_5OH(aq), 0.100 M $Mg_3(PO_4)_2$(aq), 0.250 M KBr(aq) and 0.125 M Na_3PO_4(aq) at 25°C. Which statement is true about these solutions, assuming all salts to be strong electrolytes ? **[JEE (MAIN)-2014]**
(1) 0.125 M Na_3PO_4 (aq) has the highest osmotic pressure.
(2) 0.500 M C_2H_5OH (aq) has the highest osmotic pressure.
(3) They all have the same osmotic pressure.
(4) 0.100 M $Mg_3(PO_4)_2$ (aq) has the highest osmotic pressure.

18. Consider separate solution of 0.500 M C_2H_5OH(aq), 0.100 M $Mg_3(PO_4)_2$(aq), 0.250 M KBr(aq) and 0.125 M Na_3PO_4(aq) at 25°C. Which statement is true about these solutions, assuming all salts to be strong electrolytes ? **[JEE-MAIN-2014]**

(1) 0.125 M Na_3PO_4(aq) has the highest osmotic pressure.
(2) 0.500 M C_2H_5OH(aq) has the highest osmotic pressure.
(3) They all have the same osmotic pressure.
(4) 0.100 M $Mg_3(PO_4)_2$(aq) has the highest osmotic pressure.

19. Determination of the molar mass of acetic acid in benzene using freezing point depression is affected by : **[JEE (MAIN)-2015 ONLINE]**

(1) association (2) dissociation
(3) complex formation (4) partial ionization

20. A solution at 20°C is composed of 1.5 mol of benzene and 3.5 mol of toluene. If the vapour pressure of pure benzene and pure toluene at this temperature are 74.7 torr and 22.3 torr, respectively, then the total vapour pressure of the solution and the benzene mole fraction in equilibrium with it will be, respectively : **[JEE (MAIN)-2015 ONLINE]**

(1) 38.0 torr and 0.589
(2) 30.5 torr and 0.389
(3) 35.8 torr and 0.280
(4) 35.0 torr and 0.480

21. The vapour pres sure of acetone at 20°C is 185 torr. When 1.2 g of 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 : **[JEE (MAIN)-2015]**

(1) 128 (2) 488 (3) 32 (4) 64

22. An aqueous solution of a salt MX_2 at certain temperature has a van't Hoff factor of 2. The degree of dissociation for this solution of the salt is : **[JEE (MAIN--2016-ONLINE]**

(1) 0.50 (2) 0.80 (3) 0.67 (4) 0.33

23. 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 : **[JEE (MAIN--2016-ONLINE]**

(1) 0.02 (2) 0.005
(3) 0.015 (4) 0.0075

24. 18 g glucose ($C_6H_{12}O_6$) is added to 178.2 g water. The vapour pressure of water (in torr) for this aqueous solution is : **[JEE (MAIN)-2016]**

(1) 759.0 (2) 7.6 (3) 76.0 (4) 752.4

25. The freezing point of benzene decreases by 0.45°C when 0.2 g of acetic acid is added to 20 g of benzene. If acetic acid associates to form a dimer in benzene, percentage association of acetic acid in benzene will be :-
(K_f for benzene = 5.12 K kg mol^{-1}) **[JEE (MAIN)-2017]**

(1) 64.6% (2) 80.4% (3)74.6% (4) 94.6%

26. 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}) **[JEE (MAIN--2017-ONLINE]**

(1) 45 g (2) 65 g (3) 15 g (4) 25 g

27. 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}) **[JEE (MAIN--2017-ONLINE]**

(1) 0.486 (2) 0.325 (3) 0.162 (4) 0.675

28. For 1 molal aqueous solution of the following compounds, which one will show the highest freezing point ? **[JEE (MAIN)-2018]**

(1) $[Co(H_2O)_5Cl]Cl_2.H_2O$
(2) $[Co(H_2O)_4Cl_2]Cl.2H_2O$
(3) $[Co(H_2O)_3Cl_3].3H_2O$
(4) $[Co(H_2O)_6]Cl_3$

29. Two 5 molal solutions are prepared by dissolving a non-electrolyte non-volatile solute separately in the solvents X and Y. The molecular weights of the solvents are M_X and M_Y, respectively where $M_X = \frac{3}{4} M_Y$. The relative lowering of vapour pressure of the solution in X is "m" times that of the solution in Y. Given that the number of moles of solute is very small in comparison to that of solvent, the value of "m" is - **[JEE (MAIN-2018-ONLINE]**

(1) $\frac{3}{4}$ (2) $\frac{4}{3}$ (3) $\frac{1}{2}$ (4) $\frac{1}{4}$

30. The mass of a non-volatile, non-electrolyte solute (molar mass = 50 g mol^{-1}) needed to be dissolved in 114 g octane to reduce its vapour pressure to 75%, is :- **[JEE (MAIN-2018-ONLINE]**

(1) 50 g (2) 37.5 g (3) 75 g (4) 150 g

PREVIOUS YEARS QUESTIONS	ANSWER KEY									Exercise-II
Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**3**	**3**	**3**	**1**	**3**	**3**	**3**	**1**	**1**	**3**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**3**	**1**	**4**	**1**	**4**	**2**	**3**	**3**	**1**	**1**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**4**	**1**	**3**	**4**	**4**	**1**	**2**	**3**	**1**	**4**