Exercise-1

Marked Questions may have for Revision Questions.

E

## **OBJECTIVE QUESTIONS**

## Section (A) : Concentration terms

A-1.	8 g NaOH is dissolved (1) 0.8 M	in one litre of solution, its (2) 0.4 M	s molarity is : (3) 0.2 M	(4) 0.1 M
A-2.	A 500 g tooth paste sate terms of ppm level ?	ample has 0.02 g fluorid	e concentration. What is	the concentration of fluorine in
	(1) 250	(2) 40	(3) 400	(4) 1000
A-3.	H <sub>2</sub> O <sub>2</sub> solution used for solution. The molecular (1) 0.15 M	hair bleaching is sold as r mass of H <sub>2</sub> O <sub>2</sub> is 34. The (2) 1.5 M	a solution of approximat e molarity of this solution (3) 3.0 M	ely 5.0 g H <sub>2</sub> O <sub>2</sub> per 100 ml of the is approximately : (4) 3.4 M
A-4.	A mixture has 18 g was behaviour of the mixtur	ater and 414 g ethanol. e) :	The mole fraction of wa	ater in mixture is (assume ideal
	(1) 0.1	(2) 0.4	(3) 0.7	(4) 0.9
A-5.	25 mL of 3.0 M HNO <sub>3</sub> a the final mixture would	are mixed with 75 mL of be-	4.0M HNO <sub>3</sub> . If the volum	nes are additive, the molarity of
	(1) 3.25 M	(2) 4.0 M	(3) 3.75 M	(4) 3.50 M
A-6.	The mole fraction of ox 8	ygen in a mixture of 7g c	of nitrogen and 8g of oxy	gen is -
	(1) $15$	(2) 0.5	(3) 0.25	(4) 1.0
A-7.	15 gram of methyl alcol in solution ?	nol is dissolved in 35 gran	n of water. What is the ma	ass percentage of methyl alcohol
	(1) 30%	(2) 50%	(3) 70%	(4) 75%
A-8.	An X molal solution of a	a compound in benzene l	has mole fraction of solu	te equal to 0.2. The value of X is
	(1) 14	(2) 3.2	(3) 1.4	(4) 2
A-9.	Mole fraction of ethano weight of mixture is :	l in ethanol water mixtur	e is 0.25. Hence precent	age concentration of ethanol by
	(1) 25%	(2) 75%	(3) 46%	(4) 54%
A-10.	Density of a 2.05 M sol	ution of acetic acid in wa	ter is 1.02 g/mL. The mo	lality of the solution is
	(1) 3.28 mol Kg <sup>-1</sup>	(2) 2.28 mol Kg <sup>-1</sup>	(3) 0.44 mol Kg <sup>-1</sup>	(4) 1.14 mol Kg <sup>-1</sup>
A-11.	What is the molarity of the solution is 0.79 g m	HCI in a solution prepare	ed by dissolving 5.5g HC	in 200g ethanol if the density of
	(1) 21 M	(2) 0.93 M	(3) 6×10 <sup>-4</sup>	(4) 0.58 M
A-12.	A 5.2 molal aqueous s solution?	olution of CH₃OH is sup	plied. What is the mole	fraction of methyl alcohol in the
	(1) 0.050	(2) 0.100	(3) 0.190	(4) 0.086
A-13.	The molality of 15% (w (1) 1.2	t./vol.) solution of H <sub>2</sub> SO <sub>4</sub> (2) 1.4	of density 1.1 g/cm <sup>3</sup> is a (3) 1.8	pproximately- (4) 1.6

**SOLUTIONS & COLLIGATIVE PROPERITES** 

- A-14. The density of a solution containing 13% by mass of sulphuric acid is 1.09 g/mL. Calculate the molarity of the solution(1) 1.445 M
  (2) 14.45 M
  (3) 144 5 M
  (4) 0.1445 M
  - (1) 1.445 M (2) 14.45 M (3) 144.5 M (4) 0.1445 M

### Section (B) : Vapour Pressure

- **B-1.** A liquid is kept in a closed vessel. If a glass plate (negligible mass) with a small hole is kept on top of the liquid surface, then the vapour pressure of the liquid in the vessel is :
  - (1) More than what would be if the glass plate were removed
  - (2) Same as what would be if the glass plate were removed
  - (3) Less than what would be if the glass plate were removed
  - (4) Cannot be predicted
- B-2. The vapour pressure of water depends upon :
  - (1) Surface area of container(2) Volume of container(3) Temperature(4) All
- **B-3.** Among the following substances, the lowest vapour pressure is exerted by :
- (1) Water (2) Mercury (3) Acetone (4) Ethanol

B-4. At higher altitudes, water boils at temperature < 100°C because

- (1) temperature of higher altitudes is low
- (3) the proportion of heavy water increases
- (2) atmospheric pressure is low
- (4) atmospheric pressure becomes more.
- B-5.\_ The equilibrium vapour pressure of a liquid increases with increasing temperature mainly because(1) As the temperature is increased, a greater fraction of the molecules can escape the liquid's surface and enter the vapour phase.
  - (2) All gases expand when heated
  - (3) At higher temperature, the rate of condensation of molecules to liquid phase is less
  - (4) As temperature rises, molecules hit the wall of container with less force
- B-6. The vapour pressure of water at 20°C is 17.54 mmHg. What will be the vapour pressure of the water in the apparatus shown after the piston is lowered, decreasing the volume of the gas above the liquid to one half of its initial volume (assume temperature constant).



(1) 8.77 mmHg (2) 17.54 mmHg

(3) 35.08 mmHg (4) between 8.77 and 17.54 mmHg

### Section (C) : Solutions of Solid and Gases in Liquids

C-1. Which of the following curves represents the Henry'slaw?



C-2. According to Henry's law, the solubility of a gas in a given volume of liquid increases with increase in

	(1) Temperature	(2) Pressure	(3) Both (1) and (2)	) (4) None of these
C-3.	Some of the following g I : $CO_2$ ; II : $NH_3$ Water insoluble gases of I : $CO_2$ ; II : $NH_3$ (1) I, IV , V	Jases are soluble in wate 3; III : HCI ; can be : 3; III : HCI ; (2) I, V	r due to formation of IV : CH <sub>4</sub> ; V : IV : CH <sub>4</sub> ; V : (3) I, II, III	f their ions : : H <sub>2</sub> : H <sub>2</sub> (4) IV, V
C-4.	The solubility of gases i (1) increases with incre (2) decreases with incre (3) Increases with incre (4) decreases with incre	in liquids : ase in pressure and tem ease in pressure and tem ase in pressure and dec ease in pressure and incl	perature nperature rease in temperature rease in temperature	9
C-5.	The solubility of $N_2(g)$ 5.3 × 10 <sup>-4</sup> M. Its solubil (1) 4.1 × 10 <sup>-4</sup> M	in water exposed to the ity at 760 mm and at the (2) $6.8 \times 10^{-4} \text{ M}$	e atmosphere, wher same temperature is (3) 1500 M	the partial pressure is 593 mm is s : (4) 2400 M
Section	n (D) : Completelv misc	ble liquids : Raoult's l	aw	
D-1.	If Raoult's law is obeye (1) Mole fraction of the (3) Mole fraction of the	d, the vapour pressure o solvent solvent and solute	f the solvent in a sol (2) Mole fraction of (4) The volume of t	ution is directly proportional to the solute the solution
D-2.	The vapour pressure of toluene in vapour phase (1) 0.50	pure benzene and tolue e in contact with equimol (2) 0.6	ne are 160 and 60 to ar solution of benze (3) 0.27	orr respectively. The mole fraction of ne and toluene is : (4) 0.73
D-3.	What is the mole ratio of solution has a vapour p	of benzene (P <sub>B</sub> º= 150 torn pressure of 120 torr?	r) and toluene (Pr <sup>0</sup> =	50 torr) in vapour phase if the given
	(1) 7:1	(2) 7 : 3	(3) 8:1	(4) 7:8
D-4.	At 323 K, the vapour pr	essure in millimeters of r	nercury of a methan	ol-ethanol solution is represented by
	the equation $p = 120 X/$ (1) 250 mm	A + 140, where XA is the 1 (2) 140 mm	mole fraction of metl (3) 260 mm	nanol. Then the value of $\frac{\lim_{x_A \to 1} \frac{p_A}{X_A}}{(4) 20 \text{ mm}}$ is
D-5.	1 mole of heptane (V.F vapour pressure of resu	<ul> <li>P. = 92 mm of Hg) was n</li> <li>ulting ideal solution is :</li> </ul>	nixed with 4 moles of	of octane (V.P. = 31 mm of Hg) The
	(1) 46.2 mm of Hg	(2) 40.0 mm of Hg	(3) 43.2 mm of Hg	(4) 38.4 mm of Hg
D-6.	An aqueous solution co 160 mm at 37°C. Find t 150 mm).	ontaining 28% by mass on the vapour pressure of the theorem of the term of term of the term of	of a liquid A(mol. ma e pure liquid A. (The	ass = 140) has a vapour pressure of vapour pressure of water at 37ºC is
	(1) 360 mm	(2) 150 mm	(3) 160 mm	(4) None of these
D-7.	At 88°C benzene has a is the mole fraction of be - toluene form an ideal	vapour pressure of 900 enzene in the mixture wit solution :	torr and toluene has h toluene that will bo	s a vapour prssure of 360 torr. What il at 88°C at 1 atm pressure benzene
	(1) 0.416	(2) 0.588	(3) 0.688	(4) 0.740
D-8.	The vapour pressure of of the solution obtained	f two pure liquids "A" and by mixing 2 mol of "A" a	"B" are 100 and 80 nd 3 mol of "B" woul	torr respectively. The total pressure
D-9		(∠) 30 IUH	(S) 00 WIT	
5 0.	Mole fraction of 'A' vapo = 200 mm)	ours above solution in mi	xture of 'A' and 'B' (λ	$K_A = 0.4$ ) will be : ( $P_A^0 = 100 \text{ mm}, P_B^0$

<b>D-10</b> .W	<b>D-10.</b> Which statement about the composition of vapour over an ideal 1 : 1 molar mixture of benzene and toluene is correct 2 Assume the temperature is constant at 25°C.				
	Vapour pressure date (25°C) :         Benzene       75 mm Hg         Toluene       22 mm Hg         (1) The vapour will contain higher percentage of benzene         (2) The vapour will contain higher percentage of toluene         (3) The vapour will contain equal amount of benzene and toluene         (4) Not enough information is given to make a prediction				
D-11.	The vapour pressure of with liquid B is 72 torr. ( (1) 0.06	pure liquid 'A' at 310ºC Calculate the mole fractic (2) 0.9	is 120 torr. The vapour p on of 'A' in solution if the (3) 0.3	pressure of this liquid in solution mixture obeys Raoult's law. (4) 0.6	
<b>D-12.</b> Tv	wo liquids A and B form solution is 400 torr, the are the vapour pressure (1) $P_{A_0} = 213.33$ torr	an ideal solution at tem mol fraction of A in the of pure A? (2) $P_{A_2} = 216.32$ torr	nperature T. When the to vapour phase is 0.4 and (3) $P_{A_2} = 219.35$ torr	tal vapour pressure above the in the liquid phase 0.75. What (4) $P_{A_0} = 209.33$ torr	
D-13.	The vapour pressure of solution is formed at the fraction of methanol in t	of ethanol and methanol e same temperature by m the vapour is -	are 42.0 mm and 88.5 ixing 46.0 g of ethanol wi	mm Hg respectively. An ideal th 16.0 g of methanol. The mole	
Sectio E-1.	<ul> <li>(i) 61101</li> <li>(ii) 61101</li> <li>(iii) C2H₅OH and water</li> <li>(iii) C2H₅OH and CH₃COC</li> </ul>	ideal solution vill form an ideal solution	(c) 0.010 ? (2) HNO <sub>3</sub> and water (4) $C_6H_6$ and $C_6H_5CH_3$		
E-2.	Which of the following s (1) CHCl <sub>3</sub> and acetone	shows negative deviation (2) CHCl <sub>3</sub> and C <sub>2</sub> H <sub>5</sub> OH	from Raoult's law ? (3) C <sub>6</sub> H <sub>5</sub> CH <sub>3</sub> and C <sub>6</sub> H <sub>6</sub>	(4) $C_6H_6$ and $CCI_4$	
E-3.	Azeotropic mixture are (1) Mixture of two solids (3) Those which can be	: s fractionally distilled	(2) Those which boil at (4) Constant boiling mix	different temperature tures	
E-4.	For a solution of two liq (1) Ideal	uids A and B. it was prov (2) Non ideal	red that $P = X_A(P_A^0 - P_B^0)$ (3) Semiideal	) + P <sub>B</sub> <sup>0</sup> . The solution is : (4) None of these	
E-5.	Which of the following f (1) $C_2H_5OH - C_6H_{12}$ (3) water + alcohol	orm ideal solution?	(2) CH₃OH + C₂H₅OH (4) Ethanol + Cyclohexa	ane	
E-6.	<ul> <li>Which of the following solution containing components A and B follows Raoult's law :</li> <li>(1) A–B attraction force is greater than A–A and B–B</li> <li>(2) A–B attraction force is less than A–A and B–B</li> <li>(3) A–B attraction force remains same as A–A and B–B</li> <li>(4) Volume of solution is different from sum of volume of solute and solvent</li> </ul>				
E-7.	An azeotropic mixture of (1) It is saturated (3) It shows negative de	of two liquids boil at a low eviation from Raoult's law	ver temperature than eith (2) It does not deviate fi v (4) It show positive dev	er of them when rom Raoult's law iation from Raoult's law	

**E-8.** The azeotropic mixture of water (B.P 100°C) and HCI (B.P. 85°C) boils at 108.5°C. When this mixture is distilled, it is possible to obtain -

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(1) Pure H	ICI
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(3) Pure water as well as HCI

(2) Pure water

- (4) Neither HCl nor H<sub>2</sub>O in their pure states
- E-9. Solutions which distil without change in composition or temperature are called -

(1) Saturated solution (2) Azeotropic mixture (3) super saturated (4) ideal solution

- **E-10.** Among the following, that does not form an ideal solution is -(1)  $C_6H_6$  and  $C_6H_5CH_3$  (2)  $C_2H_5CI$  and  $C_6H_5OH(3)$   $C_6H_5CI$  and  $C_6H_5Br$  (4)  $C_2H_5Br$  and  $C_2H_5I$
- **E-11.** Total vapour pressure of mixture of 1 mol A ( $P_A^0$ =150 torr) and 2 mol B ( $P_B^0$ =240 torr) is 200 torr. In this case:
  - (1) there is positive deviation from Raoult's law
  - $\ensuremath{\left(2\right)}$  there is negative deviation from Raoult's law
  - (3) there is no deviation from Raoult's law
  - (4) molecular masses of A and B are also required for calculating the deviation

## Section (F) : Colligative properties & Van't Hoff factor

F-1. The value of observed and calculated molecular weight of silver nitrate are 92.64 and 170 respectively. The degree of dissociation of silver nitrate is :
(1) 60 % (2) 83.5% (3) 46.7% (4) 60.23%

**F-2.** For the given electrolyte  $A_x B_y$ , the degree of dissociation ' $\alpha$ ' can be given as

(1) 
$$\alpha = \frac{i-1}{x+y-1}$$
 (2)  $i = (1-\alpha) + x\alpha + y\alpha$  (3)  $\alpha = \frac{1-i}{1-x-y}$  (4) All of these

- F-3. Van't Hoff factor is :
  - (1) Less than one in case of dissociation
    (2) More than one in case of association
    (3) Always less than one
    (4) Less than one in case of association
- **F-4.** One mole of a solute A is dissolved in a given volume of solvent. The association of the solute take place as follows:  $nA \leftarrow A_n$

If  $\alpha$  is the degree of association of A, the van't Hoff factor i is expressed as:

(2)  $i = 1 + \frac{\alpha}{n}$ (1)  $i = 1 - \alpha$ (4) i = 1F-5. The Vant Hoff factor (i) for a dilute solution of K<sub>3</sub>[Fe(CN)<sub>6</sub>] is : (2) 4 (3)5(4) 0.25(1) 10 F-6. The experimental molecular weight of an electrolyte will always be less than its calculated value because the value of vant Hoff factor, 'i' is : (1) Less than 1 (2) Greater than 1 (3) One (4) Zero F-7. The substance A when dissolved in solvent B shows the molecular mass corresponding to A<sub>3</sub>. The vant Hoff's factor will be -(2) 2 (3) 3(4) 1/3 (1) 1Which of the following salt has the same value of Vont Hoff's factor as that of  $K_3[Fe(CN)_6]$ F-8. (1)  $AI_2(SO_4)_3$ (2) NaCl (3) AI(NO<sub>3</sub>)<sub>3</sub> (4) Na<sub>2</sub>SO<sub>4</sub> F-9. The van't Hoff factor i for an infinitely dilute solution of NaHSO4 is : (1) 1/2(2) 1/3(3) 3(4) 2

F-10. The experimental molecular weight of CH<sub>3</sub>COOH dissolved in benzene will always be more than its calculated value because the value of vant Hoff factor, 'i' is 
(1) Less than 1
(2) Greater than 1
(3) One
(4) Zero

F-11	Phenol associates in method, the vant Hoff's (1) 0.46	benzene solvent to forr factor has been found to (2) 0.54	n double molecules. By o be 0.54. To what degre (3) 0.98	the freezing point depression e, phenol is associated ? (4) 0.92
F-12.	The Vant Hoff factor (i) (1) Zero	for a dilute aqueous solu (2) 1.0	ution of Glucose is - (3) 1.5	(4) 2.0
F-13.	The ratio of the valu nearlytime	e of any colligative pr	operty for KCI solution	to that for sugar solution is $(4) 2.5$
F-14.	If $\alpha$ is the degree of dis mass is	ssociation of Na <sub>2</sub> SO <sub>4</sub> , th	e vant Hoff's factor (i) us	ed for calculating the molecular
	(1) 1 + α	(2) 1 – α	(3) 1 + 2α	(4) 1 – 2α
F-15.	1 mol each of following A. NaCl Osmotic pressure will $k$	solutes are taken in 9 n B. $K_2SO_4$ be in order	nol water C. Na <sub>3</sub> PO <sub>4</sub>	D. glucose
Sacti	$(1) \land C \subset C \subset C$			
G-1.	The relative lowering of statement was given by	of vapour pressure is eq y :	qual to the mole fraction	of the non volatile solute, this
	(1) Raoult	(2) Henry	(3) Joule	(4) Dalton
G-2.	The vapour pressure o (1) pressure applied or (3) nature of the solver	f a dilute solution of a no n solution (2) mo nt (4) deg	n volatile solute is not in le fraction of the solute gree of dissociation of the	luenced by
G-3.	Which one of the follow	ving is the incorrect form	of Raoult's law	
	(1) $\frac{P_s}{P^\circ} = \frac{N}{n+N}$	(2) $\frac{\frac{P^{\circ}}{P^{\circ}-P_{s}}}{P^{\circ}-P_{s}} = 1 + \frac{N}{n}$	$(3) \frac{\frac{P^{\circ} - P_{s}}{P_{s}}}{=} \frac{n}{n + N}$	$(4) \frac{P_s}{P^\circ - P_s} = \frac{N}{n}$
G-4.	If $P_0$ and P are the vapor N <sub>1</sub> and N <sub>2</sub> are the mole (1) P = P <sub>0</sub> N <sub>2</sub>	our pressures of a solven e fractions of the solvent a (2) P = P <sub>0</sub> N <sub>1</sub>	t and its solution with nor and solute respectively, t (3) P <sub>0</sub> = PN <sub>1</sub>	h-volatile solute respectively and hen correct relation is : (4) $P = P_0(N_1/N_2)$
G-5.	The vapour pressure o fraction of solute is -	f a dilute aqueous solution	on of Glucose is 750 mm	of mercury at 373 K. The mole
	(1) $\frac{1}{10}$	(2) $\frac{1}{7.6}$	(3) $\frac{1}{35}$	(4) $\frac{1}{76}$
G-6.	The vapour pressure of solution of sucrose with	f water at room temperatu	ure is 23.8 mm of Hg. The al to -	e vapour pressure of an aqueous
<b>.</b> -	(1) 23.9 mm Hg	(2) 24.2 mm Hg	(3) 21.42 mm Hg	(4) 31.44 mm Hg
G-7.	a non volatile substance (1) 0.20	e (Y). The mole fraction (2) 0.25	of (Y) in the solution is - (3) 0.5	(4) 0.75
G-8	Relative lowering in va 100% ionised)	pour pressure of a solut	tion containing 1 mole K	$_2$ SO4 in 54 g H $_2$ O is : (K $_2$ SO4 is
	(1) $\frac{1}{55}$	(2) $\frac{3}{55}$	(3) $\frac{3}{4}$	(4) $\frac{1}{2}$

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G-9	What weight of solute (molecular weight = 60) is required to dissolve in 180 g of water to reduce the				
	4 				
	vapour pressure to <sup>5</sup> th	n of pure water ?	(0) 450		
	(1) 48 g	(2) 96 g	(3) 150 g	(4) 175 g	
G-10.	Relative decrease in va 180g of H <sub>2</sub> O is :	pour pressure of an aque	eous NaCl is 0.167. Num	ber of moles of NaCl present in	
	(1) 2 mol	(2) 1 mol	(3) 3 mol	(4) 4 mol	
G-11.	If relative decrease in v % ionised.	apour pressure is 0.4 for	r a solution containing 1	mol NaCl in 3 mol H <sub>2</sub> O, NaCl is	
	(1) 60%	(2) 50%	(3) 100%	(4) 40%	
G-12.	The vapour pressure of per mol of benzene is re 50°C?	pure benzene, C <sub>6</sub> H <sub>6</sub> at t equired to prepare a solu	50°C is 268 Torr. How ma ition of benzene having a	any moles of non-volatile solute a vapour pressure of 167 Torr at	
	(1) 0.377	(2) 0.605	(3) 0.623	(4) 0.395	
<b>G-13.</b> .⊺	he vapour pressure of p of A, its vapour pressure mass of B is :	ure A is 10 torr and at the e is reduced to 9.0 torr. If	e same temperature whe the molecular mass of A	n 1 g of B is dissolved in 20 gm is 200 amu, then the molecular	
	(1) 100 amu	(2) 90 amu	(3) 75 amu	(4) 120 amu	
G-14.	One mole of non volati relative to that of water	le solute is dissolved in is.	20 moles of water. The	vapour pressure of the solution	
	20	1	21	20	
	(1) 21	(2) 20	(3) 20	(4) 1	
G-15.	The vapour pressure of the solvent. The mole fr solvent if the decrease	f a solvent decreases by raction of the solute in the in vapour pressure is to l	10 mm of Hg when a n e solution is 0.2. What sh be 20 mm of Hg	on volatile solute was added to nould be the mole fraction of the	
	(1) 0.2	(2) 0.4	(3) 0.6	(4) 0.8	
G-16.	The vapour pressure of approximate molality of	water at room temperatu solution is :	ure is lowered by 5% by a	dissolving a solute in it, then the	
	(1) 2	(2) 1	(3) 4	(4) 3	
G-17.	Moles of K <sub>2</sub> SO <sub>4</sub> to be dis at which vapour pressu	ssolved in 12 mol water to re of pure water is 50 mr	o lower its vapour pressu n is :	e by 10 mmHg at a temperature	
	(1) 3 mol	(2) 2 mol	(3) 1 mol	(4) 0.5 mol	
G-18.	The boiling point of C <sub>6</sub> H which will show highest	6, CH <sub>3</sub> OH, C <sub>6</sub> H <sub>5</sub> NH <sub>2</sub> and vapour pressure at roon	C <sub>6</sub> H₅NO₂ are 80°C, 65°C n temperature :	c, 184°C and 212°C respectively	
	(1) C <sub>6</sub> H <sub>6</sub>	(2) CH <sub>3</sub> OH	(3) $C_6H_5NH_2$	$(4) C_6H_5NO_2$	
Section	on (H) : Elevation in	n boiling point			
H-1.	At higher altitudes, wate	er boils at temperature <	100°C because		
	<ul><li>(1) temperature of high</li><li>(3) the proportion of heat</li></ul>	er altitudes is low avy water increases	<ul><li>(2) atmospheric pressure is low</li><li>(4) atmospheric pressure becomes more.</li></ul>		
H-2.	The molal elevation cor	nstant is the ratio of the e	levation in B.P. to -		
	(1) Molarity		(2) Molality		
	(3) Mole fraction of solu	ite	(4) Mole fraction of solv	ent	

**H-3.** An aqueous solution containing 1 g of urea boils at 100.25°C. The aqueous solution containing 3 g of glucose in the same volume will boil at -

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•	(1) 100.75°C	(2) 100.5°C	(3) 100°C	(4) 100.25°C	
H-4.	Elevation in boiling   Molecular weight of x (1) 120	ooint was 0.52°C when is : (K = 0.52 Kelvin kg (2) 60	n 6 g of a compound x v 1 mol <sup>-1</sup> ) (3) 100	vas dissolved in 100 g of water. (4) 342	
H-5.	What will be the tem molal elevation const (1) 1000.173°C	perature at which a sol ant for water is 0.52K-k (2) 100.0173°C	ution containing 6 g of glu g.mol. (3) 100.173°C	cose per 1000 g water will boil, if (4) None	
H-6.	Aluminium phosphate	e is 100% ionised in 0.0	1 molal aqueous solution.	Hence, $\Delta T_{b} / K_{b}$ is :	
	(1) 0.01	(2) 0.015	(3) 0.0175	(4) 0.02	
H-7.	The molal elevation solution (assuming control) (1) 100.52°C	constant of water = 0.5 omplete dissociation of (2) 101.04°C	52 K molality <sup>-1</sup> . The boiling KCl), should be : (3) 99.48°C	g point of 1.0 molal aqueous KCI (4) 98.96°C	
H-8.	Which one has the hi (1) 0.1 N Na₂SO₄	ghest boiling point : (2) 0.1 N MgSO₄	(3) 0.1 M Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>	(4) 0.1 M BaSO4	
H-9.	Which has the highes (1) 0.1 M Na <sub>2</sub> SO <sub>4</sub> (3) 0.1 M MgCl <sub>2</sub>	st boiling point ?	(2) 0.1 M C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> (gl (4) 0.1 M AI (NO <sub>3</sub> ) <sub>3</sub>	ucose)	
H-10.	1.0 molal aqueous so for $H_2O = 0.52$ K kg/	blution of an electrolyte	$X_3Y_2$ is 25% ionized. The	boiling point of the solution is ( $K_b$	
	(1) 375.5 K	(2) 374.04 K	(3) 377.12 K	(4) 373.25 K	
H-11.	solution is nearly - (1) 100.05°C	(2) 100.1°C	.51K-kg/mol. The boiling (3) 100.2°C	point of 0.1 molal aqueous NaCl (4) 101.0°C	
H-12.	Calculate the molal e	elevation constant if wa	ter evaporates at 100ºC w	ith the absorption of 536 calories	
	(1) 0.519K-kg/mol	(2) 0.0519K-kg/mol	(3) 1.519K-kg/mol	(4) 2.519K-kg/mol	
H-13.	A solution containing K kg mol <sup>-1</sup> . The form	28 g of phosphorus in 3 ula of phosphorus is (at	315 g CS <sub>2</sub> (b.p. 46.3ºC) bo mass of P = 31).	ils at 47.98°C. If $K_b$ for $CS_2$ is 2.38	
	(1) P <sub>6</sub>	(2) P <sub>4</sub>	(3) P <sub>3</sub>	(4) P <sub>2</sub> .	
Secti I-1.	on (I): Depression What is the effect of t (1) Both boiling point (2) Both boiling point (3) Boiling point increa (4) Boiling point decre	n in freezing point the addition of sugar on and freezing point incre and freezing point decr ases and freezing point eases and freezing point	the boiling and freezing p eases reases t decreases nt increases	oint of water	
I-2.	What should be the (water $K_f = 1.86 \text{ deg}$ (1) – 0.69°C	freezing point of aqueo – kg mol <sup>-1</sup> ) (2) – 0.34°C	ous solution containing 17 (3) 0.0°C	g of C <sub>2</sub> H <sub>5</sub> OH in 1000 g of water (4) 0.34°C	

I-3. 1.00 g of a non-electrolyte solute (molar mass 250 g mol<sup>-1</sup>) was dissolved in 51.2 g of benzene. If the freezing point depression constant, K<sub>f</sub> of benzene is 5.12 K kg mol<sup>-1</sup>, the freezing point of benzene will be lowered by :

CHE	MISTRY FOR JEE		SOLUTIONS & COLLIGATIVE PROPERITES		
•	(1) 0.4 K	(2) 0.3 K	(3) 0.5 K	(4) 0.2 K	
I-4.	If K <sub>f</sub> value of H₂O is 1. (1) 18.6	86. The value of ∆T (2) 0.186	f for 0.1 m solution of nor (3) 1.86	n-volatile solute is (4) 0.0186	
I-5.	Which of the following (1) Urea	aqueous molal solu (2) Barium chlorid	ution have highest freezir de (3) Potassium bro	ng point omide (4) Aluminium sulphate	
			$\Delta T_{\rm f}$	_1	
I-6.	Glucose is added to glucose added is :	1 litre water to such	n an extent that K <sub>f</sub> be	comes equal to $1000$ , the weight of	
	(1) 180 g	(2) 18 g	(3) 1.8 g	(4) 0.18 g	
I-7.	The freezing point of 1 $(K_f = 1.86 \text{ K molality}^{-1})$	I molal NaCl solutio	n assuming NaCl to be 1	00% dissociated in water is :	
	(1) –1.86°C	(2) –3.72°C	(3) +1.86°C	(4) +3.72°C	
I-8.	What is the freezing p 90% ionised (K <sub>f</sub> for wa	oint of a solution co ater = 1.86 K molalit	pntaining 8.1 g. of HBr in y <sup>-1</sup> )	100 g. water assuming the acid to be	
	(1) 0.85 °C	(2) – 3.53°C	(3) 0°C	(4) – 0.35°	
I-9.	A 0.2 molal aqueous s (Given : K <sub>f</sub> = 1.86 °C/r	solution of a weak a n for water)	cid (HX) is 20% ionised.	The freezing point of solution is	
	(1) – 0.31 °C	(2) – 0.45 °C	(3) – 0.53 °C	(4) – 0.90 °C	
	<ul> <li>(1) 0.05 M KNO<sub>3</sub> &gt; 0.0</li> <li>(2) 0.04 M BaCl<sub>2</sub> &gt; 0.1</li> <li>(3) 0.075 M CuSO<sub>4</sub> &gt;</li> <li>(4) 0.075 M CuSO<sub>4</sub> &gt;</li> </ul>	04 M CaCl <sub>2</sub> > 0.140 140 M sucrose > 0.0 0.140 M sucrose > 0 0.05 M NaNO <sub>3</sub> > 0.1	M sugar > 0.075 M CuS0 175 M CuSO <sub>4</sub> > 0.05 M K 0.04 M BaCl <sub>2</sub> > 0.05 M K 140 M sucrose > 0.04 M	D4 NO3 NO3 BaCl2	
I-11.	Which will show maxir (1) NaCl	num depression in f (2) Urea	freezing point when conc (3) Glucose	entration is 0.1 M (4) K <sub>2</sub> SO <sub>4</sub>	
I-12.	The freezing point of a Calculate the degree of $K_f$ for benzene = 5.12 (1) 49.5 %	a solution containing of association of ace K mol⊣ kg. (2) 94.5%	g 0.2 g of acetic acid in a etic acid in benzene. Assu (3) 85.5%	20.0 g benzene is lowered by 0.45°C. ume acetic acid dimerizes in benzene. (4) 58.5%	
Secti	on (.I) · Osmosis a	nd osmotic pre	ssure	、 <i>,</i>	
J-1.	If mole fraction of the	solvent in solution d	ecreases then		
	<ul><li>(1) Vapour pressure o</li><li>(3) Osmotic pressure</li></ul>	f solution increases increases	(2) B.P. decrease (4) All are correct	es t	
J-2.	Colligative properties (1) Nature of the solut (3) Concentration of s	of the solution depe ion olute particles	nd upon (2) Nature of the (4) All of these	solvent	
J-3.	Which inorganic preci (1) Calcium sulphate	pitate acts as semip (2) Barium oxalat	ermeable membrane ? e (3) Nickel phosph	nate (4) Copper ferrocyanide	
J-4.	Osmotic pressure of a (1) haber's method (3) Berkeley and Hartl	queous solution is o ey mothod	determine by : (2) solvay metho (4) Ostwalds met	d hod	
J-5.	FeCl <sub>3</sub> on reaction v semipermeable memb	vith K₄[Fe(CN) <sub>6</sub> ] in prane PQ as shown.	aq. solution gives blue Due to osmosis there is	e colour. These are separated by a	



	<ul> <li>(1) blue colour formation in side X</li> <li>(2) blue colour formation in side Y</li> <li>(3) blue colour formation in both of the sides X and Y</li> <li>(4) no blue colour formation</li> </ul>				
J-6.	Osmotic pressure of a s per litre is : (1) 10.25	sugar solution at $24^{\circ}$ C is 2	2.5 atmosphere. The con	centration of the solution in mole $(4) 0.1025$	
1.7	(1) 10.25 Ocmotic procesure of a	(2) 1.025	(3) 1025	(4) 0.1025	
J-7.	be				
	(1) 0.33	(2) 0.066	(3) 0.3 × 10 <sup>-2</sup>	(4) 3	
J-8.	A solution containing 4 of $6 \times 10^{-4}$ atm at 300K.	g of polyvinyl chloride in The molecular mass of p	1 litre of dioxane was fou polymer is :	Ind to have an osmotic pressure	
	(1) 3 ×10 <sup>3</sup>	(2) 1.6×10 <sup>5</sup>	(3) 5×10 <sup>4</sup>	(4) 6.4×10 <sup>2</sup>	
J-9.	Equal volumes of 0.1 M (1) Lower osmotic pres (3) Same osmotic pres	l urea and 0.1 M glucose sure sure	e solution are mixed. The (2) Higher osmotic pres (4) None of these	mixture will have ssure	
J-10.	A solution containing 4 pressure equal to 500 c (1) 14.97	4 g of a non volatile org cm of mercury at 27°C. T (2) 149.7	anic solute per 100 ml he molecular weight of s (3) 1697	was found to have an osmotic olute is : (4) 1.497	
J-11.	Osmotic pressure of 30 atm. The osmotic press (1) 2.5 atm	% solution of glucose is sure of the mixture contain (2) 3.7 atm	1.20 atm and that of 3.4 ining equal volumes of th (3) 1.85 atm	2% solution of cane sugar is 2.5 ne two solutions will be (4) 1.3 atm.	
J-12.	A solution of a substan solution. The molecular (1) 31.5	ce containing 1.05 g per mass of the substance i (2) 6.3	100 mL. was found to b is : (3) 630	e isotonic with 3%(w/v) glucose (4) 63	
J-13.	The compound whose (1) CaCl <sub>2</sub>	0.1 M solution has maxin (2) KCI	num osmotic pressure at (3) Glucose	: 25°C will be (4) Urea	
J-14.	A solution containing 5 per litre. The molecular	00 g of a protein per litre mass of protein is :	e is isotonic with a soluti	on containing 3.42 g of sucrose	
	(1) 5	(2) 146	(3) 34200	(4) 50000	
J-15.	<ul> <li>Which has maximum osmotic pressure at temperature T :</li> <li>(1) 100 mL of 1 M urea solution</li> <li>(2) 300 mL of 1 M glucose solution</li> <li>(3) mixture of 100 mL of 1 M urea solution and 300 mL of 1 M glucose solution</li> <li>(4) all are isotonic</li> </ul>				
J-16.	pH of a 0.1 M monobas	sic acid is found to be 2.	Hence its osmotic press	sure at a given temperature T K	
	is- (1) 0.1 RT	(2) 0.11 RT	(3) 1.1 RT	(4) 0.01 RT	
	<b>Exercise</b> -	2			

Marked Questions may have for Revision Questions.

# **OBJECTIVE QUESTIONS**

**1.** If 18 g of glucose is present in 1000 g of solvent the solution is said to be :

CHEMISTRY FOR JEE			SOLUTIONS & COLLIGATIVE PROPERITES		
•	(1) 1 molar	(2) 0.1 molar	(3) 0.5 molar	(4) 0.1 molal	
2.	The molarity of 98 (1) 6 M	% H <sub>2</sub> SO <sub>4</sub> (d = 1.8 g/ m (2) 18 M	l) by wt. is : (3) 10 M	(4) 4 M	
3.	Mole fraction of C (1) 0.46	₃H₅(OH)₃ in a solution c (2) 0.36	of 36 g of water and 46 g of (3) 0.20	glycerine is : (4) 0.40	
4.	Pressure cooker r (1) the heat is more (2) a large flame is (3) boiling point of (4) whole matter is	educes cooking time be re evenly distributed ins s used water is elevated s converted into steam	ecause side the cooker		
5.	The vapour press (1) Surface area c (3) Temperature	ure of water depends u If container	pon : (2) Volume of conta (4) All	ainer	
6.	In which case van (1) KCl, 50% ionis (3) FeCl₃, 30% ior	't Hoff factor is maximu ed nised	ım ? (2) K₂SO₄, 40% ior (4) SnCl₄, 20% ioni	ised sed	
7.	A sample of air is pressure. If it is iso is	saturated with benzend othermally compressed	e (vapor pressure = 100 mi to one third of its initial volu	n Hg at 298 K) at 298K, 750mm Hg ime, the final pressure of the system	
	(1) 2250 torr	(2) 2150 torr	(3) 2050 torr	(4) 1950 torr	
8.	0.01 mol each of f A. NaCl Assuming 100% id (1) A < B < C < D	ollowing solutes are tal B. KHSO4 onisation of the electrol (2) D < C < B < 7	ken in 5 mol water, C. [CO(NH₃)6]Cl₃ yte, relative decrease in va A (3) D < A < B < C	D. glucose pour pressure will be in order : (4) equal	
9.	Mixture of volatile	components A and B h	nas total vapour pressure (i	n Torr) p = 254 – 119 $x_A$ where $x_A$ is	
	mole fraction of A (1) 254, 119	in mixture. Hence $p_{A}^{0}$ a (2) 119, 254	and <sup>p<sub>B</sub><sup>0</sup></sup> are (in Torr) (3) 135, 254	(4) 119, 373	
10.	Given at 350 K p <sub>A</sub> 350 K is (1) X <sub>A</sub> = 0.08	° = 300 torr and $p_B^\circ$ = 8 (2) $X_A = 0.06$	300 torr, the composition of (3) $X_A = 0.04$	the mixture having a boiling point of (4) $X_A = 0.02$	
11.	Which of the follow	wing is not correct for a	n ideal solution ?		
	(1) $P_A = P_A^0 X_A$	(2) $\Delta H_{mix} = 0$	(3) $\Delta V_{mix} = 0$	(4) $\Delta S_{mix} = 0$	
12.	Which of the follov (1) ΔH <sub>mix</sub>	ving is less than zero fo (2) ΔV <sub>mix</sub>	or ideal solutions ? (3) ΔG <sub>mix</sub>	(4) ΔS <sub>mix</sub>	
13.	Consider a binary the mixture could (1) CHCl <sub>3</sub> – CH <sub>3</sub> C	mixture of volatile liquid be $(p_A^\circ = 300 \text{ torr}, p_B^\circ = OCH_3$ (2) C <sub>6</sub> H <sub>5</sub> Cl – C <sub>6</sub> H	ds. If at X <sub>A</sub> = 0.4 the vapour = 800 torr) : H <sub>5</sub> Br (3) C <sub>6</sub> H <sub>6</sub> - C <sub>6</sub> H <sub>5</sub> CH	pressure of solution is 580 torr ther $H_3$ (4) nC <sub>6</sub> H <sub>14</sub> – nC <sub>7</sub> H <sub>16</sub>	
14.	Assertion : If or deviation from Ra Reason : Solution (1) Both assertion (2) Both assertion	n mixing the two liquid oult's law. n which show negative of and reason are correct and reason are correct	s, the solution becomes h deviation are accompanied t, and the reason is the corr t, but the reason is not the c	ot, it implies that it shows negative by decrease in volume. rect explanation for the assertion correct explanation for the assertion	

(3) The assertion is incorrect, but the reason is correct

- (4) Both are assertion and reason are incorrect
- **15.** If vapour pressures of pure liquids 'A' & 'B' are 300 and 800 torr respectively at 25°C. When these two liquids are mixed at this temperature to form a solution in which mole percentage of 'B' is 92, then the total vapour pressure is observed to be 0.95 atm. Which of the following is true for this solution ? (1)  $\Delta V_{mix} > 0$  (2)  $\Delta H_{mix} < 0$  (3)  $\Delta V_{mix} = 0$  (4)  $\Delta H_{mix} = 0$
- **16.** The vapour pressure of the solution of two liquids  $A(p^0 = 80 \text{ mm})$  and  $B(p^0 = 120 \text{ mm})$  is found to be 100 mm when  $x_A = 0.4$ . The result shows that
  - (1) solution exhibits ideal behaviour
  - (2) solution shows positive deviations
  - (3) solution shows negative deviations

(4) solution will show positive deviations for lower concentration and negative deviations for higher concentrations.

**17.** Y g of non-volatile organic substance of molecular mass M is dissolved in 250 g benzene. Molal elevation constant of benzene is K<sub>b</sub>. Elevation in its boiling point is given by :

$$(1) \frac{M}{K_bY} \qquad (2) \frac{4K_bY}{M} \qquad (3) \frac{K_bY}{4M} \qquad (4) \frac{K_bY}{M}$$

**18.** Aqueous solution of barium phosphate which is 100% ionised has  $\Delta T_f / K_f$  as 0.05. Hence, given solution is

(1) 0.01 molal (2) 0.02 molal (3) 0.04 molal (4) 0.05 molal

**19.** The fraction of phenol dimerised in benzene if 20 g of phenol in 1 kg benzene exhibits a freezing point K - kg

depression of 0.69 K. (K<sub>f</sub> benzene = 5.12 mol), (MW phenol = 94) (1) 0.74 (2) 0.37 (3) 0.46 (4) 0.64

**20.** Assertion : 0.1 M solution of glucose has higher increment in the freezing point than 0.1 M solution of urea.

Reason : Kf for both has different values.

- (1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
- (2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
- (3) The assertion is incorrect, but the reason is correct
- (4) Both are assertion and reason are incorrect
- A solution of x moles of sucrose in 100 grams of water freezes at -0.2°C. As ice separates the freezing point goes down to -0.25°C. How many grams of ice would have separated?
  (1) 18 grams
  (2) 20 grams
  (3) 25 grams
  (4) 23 grams
- 22. Osmotic pressure of blood is 7.40 atm at 27°C. Number of mol of glucose to be used per L for an intravenous injection that is to have the same osmotic pressure as blood is :
  (1) 0.3 (2) 0.2 (3) 0.1 (4) 0.4
- **23.** A solution of glucose ( $C_6H_{12}O_6$ ) is isotonic with 4 g of urea ( $NH_2$ -CO- $NH_2$ ) per liter of solution. The concentration of glucose is :
  - (1) 4 g/ $\ell$  (2) 8 g/ $\ell$  (3) 12 g/ $\ell$  (4) 14 g/ $\ell$

# 24. Assertion : When dried fruits and vegetables are placed in water, they not get swelled.Reason : It happens due to the phenomenon of osmosis.

- (1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
- (2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
- (3) The assertion is incorrect, but the reason is correct
- (4) Both are assertion and reason are incorrect

## **SOLUTIONS & COLLIGATIVE PROPERITES**

- 25. The osmotic pressure of equimolar solutions of BaCl<sub>2</sub>, NaCl and glucose will be in the order
  - (1) glucose > NaCl > BaCl<sub>2</sub>
  - (3) NaCl > BaCl<sub>2</sub> > glucose

- (2) BaCl<sub>2</sub> > NaCl > glucose
- (4) NaCl > glucose > BaCl<sub>2</sub>
- **26.** If 'A' contains 2% NaCl and is separated by a semipermeable membrane from 'B' which contains 10% NaCl, which event will occur ?
  - (1) NaCl will flow from 'A' to 'B'
  - (3) Water will flow from 'A' to 'B'

# Exercise-3

- (2) NaCl will flow from 'B' to 'A'
- (4) Water will flow from 'B' to 'A'

# PART - I : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

## **OFFLINE JEE-MAIN**

1.	$6.02 \times 10^{20}$ molecules o	of urea are present in 10	0 ml of its solution. The o	concentration of urea solution is
	(1) 0.001 M	(2) 0.01 M	(3) 0.02 M	(4) 0.1 M.
2.	Which one of the follow (1) 0.01 M Na <sub>2</sub> SO <sub>4</sub>	ring aqueous solutions w (2) 0.01 M KNO <sub>3</sub>	ill exhibit highest boiling (3) 0.015 M urea	point ? <b>[AIEEE-2004, 3/225]</b> (4) 0.015 M glucose
3.	If $\alpha$ is the degree of diamass is :	ssociation of Na <sub>2</sub> SO <sub>4</sub> , the	e vant Hoff's factor (i) us	ed for calculating the moecular [AIEEE-2005, 1½/225]
4.	(1) 1 + $\alpha$ Equimolar solutions in t	(2) $1 - \alpha$ the same solvent have :	(3) 1 + 2α	(4) 1 – 2α. [AIEEE-2005, 3/225]
	<ul><li>(1) same boiling point b</li><li>(3) same boiling and sa</li></ul>	out different freezing poin ame freezing points	t (2) same freezing point (4) different boiling and	but different boiling point freezing points
5.	Two solutions of a sub solution + 520 mL of 1.	stance (non electrolyte) 2 M second solution. Wh	are mixed in the followin at is the molarity of the fi	g manner. 480 ml of 1.5 M first nal mixture?
				[AIEEE-2005, 3/225]
	(1) 1.20 M	(2) 1.50 M	(3) 1.344 M	(4) 2.70 M
6.	Benzene and toluene for that of toluene is 22 tor of benzene and 46 g of	orm nearly ideal solutions r. The partial vapour pre toluene in torr is :	s. At 20°C, the vapour pressure of benzene at 20 °	C for a solution containing 78 g [AIEEE-2005. 3/225]
	(1) 50	(2) 25	(3) 37.5	(4) 53.5
7.	Density of a 2.05 M sol	ution of acetic acid in wa	ter is 1.02 g/mL. The mo	lality of the solution is [AIEEE-2006, 3/165]
	(1) 3.28 mol Kg 1	(2) 2.28 mol Kg 1	(3) 0.44 mol Kg 1	(4) 1.14 mol Kg 1
8.	A mixture of ethyl alco pressure of propyl alco mm) at the same tempe	hol and propyl alcohol h hol is 200 mm. If the mo erature will be	as a vapour pressure of le fraction of ethyl alcoho	290 mm at 300 K. The vapour ol is 0.6, its vapour pressure (in [AIEEE-2007, 3/120]
	(1) 700	(2) 360	(3) 350	(4) 300
9.	A 5.25% solution of a s same solvent. If the der the substance will be	ubstance is isotonic with nsities of both the solution	a 1.5% solution of urea ns are assumed to be eq	(molar mass = $60g \text{ mol}^{-1}$ ) in the ual to 1.0 g cm <sup>-3</sup> , molar mass of [AIEEE-2007, 3/120]
	(1) 105.0 g mol⁻¹	(2) 210.0 g mol <sup>-1</sup>	(3) 90.0 g mol <sup>-1</sup>	(4) 15.0 g mol⁻¹
10.	The vapour pressure of	f water at 20º C is 17.5 m	m Hg. If 18g of glucose (	$(C_6H_{12}O_6)$ is added to 178.2 g of

water at 20° C, the vapour pressure of the resulting solution will be [AIEEE-2008, 3/105]

	(1) 15.750 mm Hg	(2) 16.500 mm l	Hg (3)	17.325 mm H	Чg	(4) 17.675 mm Hg
11.	At 80° C, the vapour period If a mixture solution of (1atm = 760 mm Hg)	A' and 'B' boils a	quid 'A' is 52 at 80º C and	20 mm Hg and I 1 atm press	d that of sure, the	pure liquid 'B' is 1000 mm Hg. amount of 'A' in the mixture is [AIEEE-2008, 3/105]
10	(1) 34 mol percent	(2) 48 mol perce	ent (3)	50 mol perce	ent al Which	(4) 52 mol percent
12.	is correct regarding the	behaviour of the	solution ?	from Recult's		[AIEEE-2009, 4/144]
	<ul> <li>(2) The solution is non-</li> <li>(3) n-heptane shows +v</li> <li>(4) The solution formed</li> </ul>	ideal, showing -\ ideal, showing -\ /e deviation while	e deviation e ethanol sho	from Raoult's	s Law. s Law. ation fror	n Raoult's Law.
13.	Two liquids X and Y for	m an ideal solution	on. At 300K,	, vapour pres	sure of th	ne solution containing 1 mol of
	X and 3 mol of Y is 550 vapour pressure of the	) mmHg. At the s solution increase	ame tempe es by 10 mm	rature, if 1 mo hHg. Vapour p	ol of Y is pressure	further added to this solution, (in mmHg) of X and Y in their [AIFFF-2009 8/144]
	(1) 300 and 400	(2) 400 and 600	) (3)	500 and 600		(4) 200 and 300
14.	If sodium sulphate is co the change in freezing water, is ( $K_f = 1.86 \text{ K}$ kg	nsidered to be co point of water (∆ g mol <sup>_1</sup> )	mpletely dis T <sub>f</sub> ), when 0	sociated into .01 mole of s	cations a odium si	nd anions in aqueous solution, ulphate is dissolved in 1 kg of [ <b>AIEEE-2010, 4/144</b> ]
	(1) 0.0372 K	(2) 0.0558 K	(3)	0.0744 K		(4) 0.0186 K
15.	On mixing, heptane and components (heptane a obtained by mixing 25. and of octane = 114 g r (1) 72.0 kPa	d octane form an and octane) are 1 0 g of heptane ai nol <sup>-1</sup> ) (2) 36.1 kPa	ideal solutio 05 kPa and nd 35 g of o (3)	on. At 373 K, 45 kPa respe octane will be 96.2 kPa	the vapo ctively. V (molar n	our pressures of the two liquid apour pressure of the solution hass of heptane - 100 g mol <sup>-1</sup> [AIEEE-2010, 4/144] (4) 144.5 kPa
16.	$K_f$ for water is 1.86 K ethylene glycol (C <sub>2</sub> H <sub>6</sub> O)	kg mol <sup>-1</sup> . If your 2) must you add t	automobile o get the fre	radiator hold ezing point o	ls 1.0 kg f the solu	of water, how may grams of ition lowered to –2.8°C ? [AIEEE 2012, 4/120]
	(1) 72 g	(2) 93 g	(3) 39 g		(4) 27 g	
17.	Consider separate solution 0.125 M Na <sub>3</sub> PO <sub>4</sub> (aq) a strong electrolytes ?	ution of 0.500 M t 25°C. Which st	I C₂H₅OH(a atement is	q), 0.100 M <b>true</b> about th	Mg₃(PO nese solu	a) <sub>2</sub> (aq), 0.250 M KBr(aq) and ition, assuming all salts to be [JEE(Main) 2014, 4/120]
	(1) They all have the sate (2) 0.100 M Mg <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub> ( (3) 0.125 M Na <sub>3</sub> PO <sub>4</sub> (aq (4) 0.500 M C <sub>2</sub> H <sub>5</sub> OH(ac	aq) has the highe ) has the highest a) has the highest	est osmotic   osmotic pre t osmotic pre	pressure. essure. essure.		
18.	The vapour pressure of in 100 g of acetone at 2 is:	acetone at 20ºC 0ºC, its vapour pi	is 185 torr. V ressure was	Vhen 1.2 g of 183 torr. The	a non-vo molar m	latile substance was dissolved ass (g mol <sup>-1</sup> ) of the substance in)-2015, $4/1201$
	(1) 32	(2) 64	(3)	128	L(	(4) 488
19.	18 g glucosse ( $C_6H_{12}O_6$ solution is. (1) 76.0	) is added to 178 (2) 752.4	.2 g water. ٦ (3)	The vapor pre 759.0	essure of	water (in torr) for this aqueous [ <b>JEE(Main)-2016, 4/120]</b> (4) 7.6
20.	The freezing point of be	nzene decreases	; by 0.45⁰C v	vhen 0.2 a of a	acetic ac	id is added to 20 g of benzene.
	If acetic acid associate will be : (K <sub>f</sub> for benzene	s to form a dime = 5.12 K kg mol	r in benzene <sup>-1</sup> )	e, percentage	e associa	tion of acetic acid in benzene [JEE(Main)-2017, 4/120]

СН	EMISTRY FOR J	E	SOLUTIONS & COLLIGATIVE PROPERITES							
•	(1) 80.4%	(2) 74.6%	(3) 94.6%	(4) 64.6%						
		ONLIN	NE JEE-MAIN							
1.	Choose the correct	statement with respect t	o the vapour pressure [JEE(I	of a liquid among the follov Main) 2014 Online (19-04-	ving : 1 <b>4), 4/120]</b>					
	(1) Increases linear	ly with increasing temper	rature							
	(2) Increase non-lir	early with increasing ter	nperature							
	(3) Decreases linea	arly with increasing								
	(4) Decreases non-	linearly with increasing to	emperature							
2.	The observed osmo (observed) and the	otic pressure for a 0.10 M oritical values of Van't Ho r	l solution of Fe(NH₄)₂(S off factor (i) will be resp JEF(Main) 2014 Onlin	$O_4$ ) <sub>2</sub> at 25°C is 10.8 atm exectively : (R = 0.082 L atm e (19-04-14) 4/1201	perimental k⁻ mol⁻¹)					
	(1) 5 and 4.42	(2) 4 and 4.00	(3) 5 and 3.42	(4) 3 and 5.42						
3.	For an ideal solutio	n of two components A a	and B, which of the follo	wing is true ? (						
	1) $\Delta H_{\text{mixing}} < 0$ (zero	)	[JEE(Mai	n) 2014 Online (19-04-14)	), <b>4/120]</b>					
	(2) $\Delta H_{\text{mixing}} > 0$ (zer	0)								
	(3) A–B interaction	is stronger than A-A and	d B–B interactions							
	(4) A–A, B – B and	A-B interactions are ide	ntical							
4.	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(Mai	n) 2015 Online (10-04-15)	, <b>4/120]</b>					
	(1) 35.0 torr and 0.4	480 (2) 30.5 torr and 0.3	389 (3) 38.0 torr and (	).589 (4) 35.8 torr and 0.2	280					
5.	Determination of th	e molar mass of acetic a	cid in benzene using fre	ezing point depression is a	affected by					
	:		[JEE(M	<i>l</i> lain) 2015 Online (10-04-	15), 4/120]					
	(1) partial ionizatior	n (2) dissociation	(3) complex forma	ation (4) association						
6.	The solubility of N <sub>2</sub>	in water at 300 K and 50	0 torr partial pressure i	s 0.01 g L <sup>-1</sup> . The solubility (	(in g L⁻¹) at					
	750 torr partial pres	ssure is :	[JEE(N	<i>l</i> lain) 2016 Online (09-04-	16), 4/120]					
	(1) 0.02	(2) 0.015	(3) 0.0075	(4) 0.005						
7.	An aqueous solution	on of a salt MX <sub>2</sub> at certa	ain temperature has a	van't Hoff factor of 2. The	degree of					
	dissociation for this	solution of the salt is :	[JEE(N	<i>l</i> lain) 2016 Online (10-04-	16), 4/120]					
	(1) 0.67	(2) 0.33	(3) 0.80	(4) 0.50						
8.	5 g of Na <sub>2</sub> SO <sub>4</sub> are	was dissolved in x g of $\vdash$	I₂O. The change in free	zing point was found to be	∋ 3.82ºC. If					
	Na <sub>2</sub> SO <sub>4</sub> is 81.5% io	nised, the value of x								
	(K <sub>f</sub> for water = 1.86	°C kg mol <sup>-1</sup> ) is approximation	ately : [JEE(N	<i>l</i> lain) 2017 Online (08-04-	17), 4/120]					
	(molar mass of S =	32 g mol <sup><math>-1</math></sup> and that of N	a = 23 g mol <sup>-1</sup> )							
	(1) 45 g	(2) 65 g	(3) 25 g	(4) 15 g						
9.	A solution is prepar	ed by mixing 8.5 g of CH	<sub>2</sub> Cl <sub>2</sub> and 11.95 g of CH	$Cl_3$ . If vapour pressure of (	CH <sub>2</sub> Cl <sub>2</sub> and					
	CHCl₃ at 298 K are	415 and 200 mmHg res	pectively, the mole frac	tion of CHCl <sub>3</sub> in vapour for	m is :					
	(Molar mass of CI =	= 35.5 g mol <sup>-1</sup> )	[JEE(	Main) 2017 Online 09-04-	17), 4/120]					
	(1) 0.675	(2) 0.162	(3) 0.486	(4) 0.325						

# PART - II : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

**1.** In the depression of freezing point experiment, it is found that :

[JEE-1999, 3/80]

I. The vapour pressure of the solution is less than that of pure solvent.

II. The vapour pressure of the solution is more than that of pure solvent.

III. Only solute molecules solidify at the freezing point.

CH	EMISTRY FOR JE	E	SOLUTIONS & COLLIGATIVE PROPERITES						
•	IV. Only solvent mo	lecules solidify at the fr	eezing point.		•				
	(A) I, II	(B) II, III	(C) I, IV	(D) I, II, III.					
2.	The van't Hoff facto	r for 0.1 M Ba(NO <sub>3</sub> )₂ so	plution is 2.74. The degree	of dissociation is :					
	(A) 91.3%	(B) 87%	(C) 100%	(D) 74% <b>[JEE-1999</b> ,	3/80]				
3.	To 500 cm <sup>3</sup> of wate be the depression respectively	r, 3.0 × 10 <sup>-3</sup> kg of acet in freezing point? k <sub>f</sub> a	ic acid is added. If 23% of nd density of water are 1	acetic acid is dissociated .86 K kgmole <sup>-1</sup> and 0.99 [JEE 20	, what will 97 g cm <sup>-3</sup> 0 <b>0, 3/135]</b>				
	(A) 0.186 K	(B) 0.228 K	(C) 0.372 K	(D) 0.556 K					
4.	During depression of	of freezing point in a so	lution, the following are in	equilibrium : [JEE-20	03, 3/144]				
	(A) Liquid solvent-se	olid solvent	(B) Liquid solvent-s	olid solute					
	(B) Liquid solute-so	lid solute	(D) Liquid solute-so	olid solvent					
5.	A 0.004 M solution apparent percentag	of Na <sub>2</sub> SO <sub>4</sub> is isotonic e dissociation of Na <sub>2</sub> SO	with 0.010 M solution of $D_4$ is :	glucose at same tempera	ature. The 04, 3/144]				
	(A) 25%	(B) 50%	(C) 75%	(D) 85%					
6.	The elevation in bo information, will be	biling point of a solution (Molecular weight of Co	on of 13.44 g of CuCl <sub>2</sub> in $uCl_2 = 134.4$ and $K_b = 0.52$	n 1kg of water using the 2 K molal <sup>_1</sup> ) : <b>[JEE-20</b>	following 05, 3/144]				
	(A) 0.16	(B) 0.05	(C) 0.1	(D) 0.2					
7.	When 20 g of napht point depression of	hoic acid (C₁₁HଃO₂) is ( 2 K is observed. The v	dissolved in 50 g of benze an't Hoff factor (i) is :	ne (K <sub>f</sub> = 1.72 K kg mol <sup>-1</sup> ), <b>[JEE-2007, 3/162]</b>	a freezing				
	(A) 0.5	(B) 1	(C) 2	(D) 3					
8.	The Henry's law cor of N₂ in air is 0.8. Th pressure is :	nstant for the solubility ne number of moles of	of N <sub>2</sub> gas in water at 298 $H_2$ from air dissolved in 10	K is 1.0 × 10 <sup>5</sup> atm. The mo moles of water of 298 K a [JEE-2009, 3/160]	le fraction and 5 atm				
	(A) 4 × 10 <sup>-4</sup>	(B) 4.0 × 10 <sup>−5</sup>	(C) 5.0 × 10 <sup>-4</sup>	(D) 4.0 × 10 <sup>-6</sup>					
9.	The freezing point ( (K <sub>f</sub> = 1.86 K kg mol <sup>-</sup>	in °C) of a solution cor <sup>-1</sup> ) is :	ntaining 0.1 g of K₃[Fe(CN	l) <sub>6</sub> ] (Mol. Wt. 329) in 100 ( [ <b>JEE-20</b>	g of water 11, 3/180]				
	(A) − 2.3 × 10 <sup>-2</sup>	(B) − 5.7 × 10 <sup>-2</sup>	(C) – 5.7 × 10 <sup>−3</sup>	(D) – 1.2 × 10 <sup>-2</sup>					
10.	For a dilute solutio	n containing 2.5 g of	a non-volatile non- electr	olyte solute in 100 g of v	water, the				

For a dilute solution containing 2.5 g of a non-volatile non- electrolyte solute in 100 g of water, the elevation in boiling point at 1 atm pressure is 2°C. Assuming concentration of solute is much lower than the concentration of solvent, the vapour pressure (mm of Hg) of the solution is (take K<sub>b</sub> = 0.76 K kg mol<sup>-1</sup>)
 [JEE-2012, 3/136]

(A) 724 (B) 740 (C) 736 (D)718

#### **SOLUTIONS & COLLIGATIVE PROPERITES**

11. For a solution formed by mixing liquids L and M, the vapour pressure of L plotted against the mole fraction of M in solution is shown in the following figure. Here  $x_{L}$  and  $x_{M}$  represent mole fractions of L and M, respectively, in the solution. The correct statement(s) applicable to this system is (are) [JEE-2017, 000]

(A) The point **Z** represents vapour pressure of pure liquid **M** and Raoult's law is obeyed from  $x_{L}=0$  to  $x_{L}=1$ 



(B) Attractive intermolecular interactions between L-L in pure liquid L

and M-M in pure liquid M are stronger than those between L-M when mixed in solution

- (C) The point **Z** represents vapour pressure of pure liquid **M** and Raoult's law is obeyed when  $x_{L} \rightarrow 0$
- (D) The point **Z** represents vapour pressure of pure liquid **L** and Raoult's law is obeyed when  $x_{L} \rightarrow 1$
- Pure water freezes at 273 K and 1 bar. The addition of 34.5 g of ethanol to 500 g of water changes the freezing point of the solution. Use the freezing point depression constant of water as 2 K kg mol<sup>-1</sup>. The figures shown below represent plots of vapour pressure (V.P.) versus temperature (T). [molecular weight of ethanol is 46 g mol<sup>-1</sup>]

Among the following, the option representing change in the freezing point is



**Answers** 

E

						EXER	-19E -	• 1					
A-1.	(3)	A-2.	(2)	A-3.	(2)	A-4.	(1)	A-5.	(3)	A-6.	(2)	A-7.	(1)
A-8.	(2)	A-9.	(3)	A-10.	(2)	A-11.	(4)	A-12.	(4)	A-13.	(4)	A-14.	(1)
B-1.	(2)	B-2.	(3)	B-3.	(2)	B-4.	(2)	B-5.	(1)	B-6.	(2)	C-1.	(A)
C-2.	(2)	C-3.	(4)	C-4.	(3)	C-5.	(2)	D-1.	(1)	D-2.	(3)	D-3.	(1)
D-4.	(3)	D-5.	(3)	D-6.	(1)	D-7.	(4)	D-8.	(3)	D-9.	(3)	D-10.	(1)
D-11.	(4)	D-12.	(1)	D-13.	(3)	E-1.	(4)	E-2.	(1)	E-3.	(4)	E-4.	(1)
E-5.	(2)	E-6.	(3)	E-7.	(4)	E-8.	(4)	E-9.	(2)	E-10.	(2)	E-11.	(2)
F-1.	(2)	F-2.	(4)	F-3.	(4)	F-4.	(3)	F-5.	(2)	F-6.	(2)	F-7.	(4)
F-8.	(3)	F-9.	(3)	F-10.	(1)	F-11.	(4)	F-12.	(2)	F-13.	(3)	F-14.	(3)
F-15.	(3)	G-1.	(1)	G-2.	(1)	G-3.	(3)	G-4.	(2)	G-5.	(4)	G-6.	(3)
G-7.	(2)	G-8.	(4)	G-9.	(3)	G-10.	(2)	G-11.	(3)	G-12.	(2)	G-13.	(2)
G-14.	(1)	G-15.	(2)	G-16.	(4)	G-17.	(3)	G-18.	(2)	H-1.	(2)	H-2.	(2)
H-3.	(4)	H-4.	(2)	H-5.	(2)	H-6.	(4)	H-7.	(2)	H-8.	(3)	H-9.	(4)
H-10.	(2)	H-11.	(2)	H-12.	(1)	H-13.	(2)	I-1.	(3)	1-2.	(1)	1-3.	(1)
1-4.	(2)	I-5.	(1)	I-6.	(4)	I-7.	(2)	1-8.	(2)	1-9.	(2)	I-10.	(1)
I-11.	(4) (4)	I-12.	(Z)	J-1.	(3)	J-2.	(3)	J-3.	(4)	J-4.	(3)	J-5.	(4)
J-0.	(4) (1)	J-7.	(3)	J-8.	(Z) (4)	J-9.	(3)	J-10.	(2)	J-11.	(3)	J-12.	(4)
J-13.	(1)	J-14.	(4)	5-15.	(4)	J-10.	(2)						
						EXER	CISE	2					
1.	(4)	2.	(2)	3.	(3)	4.	(3)	5.	(3)	6.	(3)	7.	(3)
8.	(3)	9.	(3)	10.	(1)	11.	(4)	12.	(3)	13.	(1)	14.	(2)
15.	(2)	16.	(3)	17.	(2)	18.	(1)	19.	(1)	20.	(4)	21.	(2)
22.	(1)	23.	(3)	24.	(3)	25.	(2)	26.	(3)				
						EXER	CISE -	- 3					
						D۸۵	от і						
						F A1							
					0	FFLINE	JEE-N	IAIN					
1.	(2)	2.	(1)	3.	(3)	4.	(3)	5.	(3)	6.	(1)	7.	(2)
8.	(3)	9.	(2)	10.	(3)	11.	(3)	12.	(1)	13.	(2)	14.	(2)
15.	(1)	16.	(2)	17.	(1)	18.	(2)	19.	(2)	20.	(3)		
					0	NLINE .	JEE-M	AIN					
1.	(2)	2.	(1)	3.	(4)	4.	(3)	5.	(4)	6.	(2)	7.	(4)
8	(1)	9	(4)		( )		(-)		( )		(=)		( )
0.	(1)	э.	()										
						PAR	RT - II						
1.	(C)	2.	(B)	3.	(B)	4.	(A)	5.	(C)	6.	(A)	7.	(A)
8.	(A)	9.	(A)	10.	(A)	11.	(BD)	12.	(A)				

## Additional Problems For Self Practice (APSP)

Marked Questions may have for Revision Questions.

# **PART - I : PRACTICE TEST PAPER**

This Section is not meant for classroom discussion. It is being given to promote self-study and self testing amongst the Resonance students.

### Max. Marks : 120

### **Important Instructions :**

- **1.** The test is of **1 hour** duration.
- 2. The Test Booklet consists of **30** questions. The maximum marks are **120**.
- 3. Each question is allotted 4 (four) marks for correct response.
- 4. Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question. ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
- 5. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 4 above.

1.	of glycerine is :								
	(1) 0.46	(2) 0.36	(3) 0.20	(4) 0.40					
2.	Colligative properties have many pract I : Melting of snow by salt III : Determination of molar mass		ctical uses, some of them may be : II : Desalination of sea water IV : Determination of melting point and boiling point of solve						
	Actual practical us (1) I, II	ses are : (2) III, IV	(3) I, II, III	(4) II, III, IV					
3.	Select correct stat (1) When solid Ca (2) When solid Ca (3) Both (1) and (2 (4) None of the ab	tement(s) : aCl <sub>2</sub> is added to liqui aCl <sub>2</sub> is added to ice a 2) pove	d water, the boiling temperat at 0°C, the freezing temperat	ure rises ure falls					
4.	If $pK_a = -\log K_a =$	$4$ , and $K_a = Cx^2$ the	n Van't Hoff factor for weak r	nonobasic acid when C	= 0.01 M is :				
_		(2) 1.02	(5) 1.10	(4) 1.20					
5.	Consider following	g terms (m = molality	y):						
	I : mK♭ ; Terms which can	II : mK₀i be expressed in deឲ	$III: \frac{\Delta I_{b}}{i}$ gree (temperature) are	IV : K <sub>b</sub>					
	(1) III, IV	(2) I, II	(3) I, II, IIII	(4) I, III					
6.	Elevation in b.p. o in this solution is :	f an aqueous urea s	solution is 0.52°. ( $K_b = 0.52^\circ$ r	nol <sup>₋1</sup> kg) Hence, mole-fr	action of urea				
	(1) 0.982	(2) 0.567	(3) 0.943	(4) 0.018					
7.	Insulin (C <sub>2</sub> H <sub>10</sub> O <sub>5</sub> ) <sub>n</sub> is dissolved in a suitable solvent and the osmotic pressure $\pi$ of the solution of various								

concentration (in kg/m<sup>3</sup>) is measured at 20°C. The slope of a plot of  $\pi$  against c is found to be 8.134 x

Max. Time : 1 Hr.

(4)  $8.314 \times 10^{5}$ 

10-3

(SI units) The molecular weight of the insulin (in kg/mol) is :

- (1)  $4.8 \times 10^5$  (2)  $9 \times 10^5$  (3)  $293 \times 10^3$
- 8. What is the normal boiling point of the solution represented by the phase diagram ?



- 9. An aqueous solution of a solute AB has b.p. of 101.08°C (AB is 100% ionised at boiling point of the solution) and freezes at -1.80°C. Hence, AB (K<sub>b</sub> / K<sub>f</sub> = 0.3)
  - (1) is 100% ionised at the f.p. of the solution
  - (2) behaves as non-electrolyte at the f.p. of the solution
  - (3) forms dimer
  - (4) none of the above
- **10.** Density of 1M solution of a non-electrolyte  $C_6H_{12}O_6$  is 1.18 g/mL. If K<sub>f</sub> (H<sub>2</sub>O) is 1.86° mol<sup>-1</sup> kg, solution freezes at :
  - $(1) 1.58^{\circ}C$   $(2) 1.86^{\circ}C$   $(3) 3.16^{\circ}C$   $(4) 1.86^{\circ}C$
- **11.** Mole fraction of a non-electrolyte in aqueous solution is 0.07. If  $K_f$  is 1.86° mol<sup>-1</sup> kg, depression in f.p.,  $\Delta T_f$ , is:

(1)  $0.26^{\circ}$  (2)  $1.86^{\circ}$  (3)  $0.13^{\circ}$  (4)  $7.78^{\circ}$ 

12. What is the normal freezing point of the solution represented by the phase diagram ?



- **13.** Total vapour pressure of mixture of 1 mol of volatile component A ( $p_A^\circ = 100 \text{ mmHg}$ ) and 3 mol of volatile component B ( $p_B^\circ = 60 \text{ mmHg}$ ) is 75 mm. For such case :
  - (1) there is positive devitation from Raoult's low
  - (2) boiling point has been lowered
  - (3) force of attraction between A and B is smaller than that between A and A or between B and B
  - (4) all the above statements are correct
- **14.** A colligative property of a solution depends on the :
  - (1) arrangement of atoms in solute molecule
  - (3) number of molecules of solute in solution
- (2) total number of molecules of solute and solvent
- (4) mass of the solute molecules

15.	Which has maximum f (1) 6g urea solution in (3) 6g sodium chloride	reezing point ? 100 g H₂O in 100 g H₂O	(2) 6g acetic acid solution in 100g H <sub>2</sub> O (4) All have equal freezing point								
16.	<ul> <li>Select correct statements :</li> <li>(1) The fundamental cause of all colligative properties is the higher entropy of the solution relative to that of the pure solvent</li> <li>(2) The freezing point of hydrofluoride solution is larger than that of equimolal hydrogen chloride solution</li> <li>(3) 1M glucose solution and 0.5 M NaCl solution are isotonic at a given temperature</li> <li>(4) All are correct statements</li> </ul>										
17.	The vapour pressure of a pure liquid A is 40 mmHg at 310 K. The vapour pressure of this liquid i solution with liquid B is 32 mmHg. Mole fraction of A in the solution, if it obeys Raoult's law is : (1) 0.8 (2) 0.5 (3) 0.2 (4) 0.4										
18.	Mole fraction of the tol 120 Torr) and toluene (1) 0.50	uene in the vapour phase (p° = 80 Torr) having 2.0 (2) 0.25	e which is in equilibrium mol of each is (3) 0.60	with a solution of benzene (p° = (4) 0.40							
19.	An azeotropic solution (1) shows negative dev (3) shows ideal behavi	of two liquids has a boiliı viation from Raoult's law our	ng point lower than eithe (2) shows positive devi (4) is saturated	r of them when it : ation from Raoult's low							
20.	Depression of freezing freezes at – 1.86°C. As (1) 2	g point of 0.01 molal aq. ssuming molality equal to (2) 3	CH <sub>3</sub> COOH solution is molarity, pH of CH <sub>3</sub> COC (3) 3.2	0.02046°. 1 molal urea solution DH solution is : (4) 4.2							
21.	Which of the following a A and B ? (1) CHCl <sub>3</sub> and CH <sub>3</sub> CO (3) CH <sub>3</sub> CH <sub>2</sub> OH and CH	azeotropic solutions has t CH <sub>3</sub> 1 <sub>3</sub> COCH <sub>3</sub>	he boiling point more tha (2) CS2 and CH3COCH (4) CH3CHO and CS2	n boiling point of the constituents I <sub>3</sub>							
22.	A 0.50 molal solution of water is 1.86° per m (1) 1.56°C	of ethylene glycol in water olal, at which temperatur (2) – 0.93°C	r is used as coolant in a c e will the mixture freeze (3) – 1.86°C	car. If the freezing point constant ? (4) 0.93°C							
23.	The depression of free measured. a. NaCl Which one of the abov (1) c	b. K <sub>2</sub> SO <sub>4</sub> b. K <sub>2</sub> SO <sub>4</sub> e compounds will exhibit (2) b	olal aqueous solution o c. C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> the maximum depressio (3) d	f the following compounds are d. Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub> n of freezing point ? (4) a							
24.	On mixing 10 mL of ac (1) < 50 mL	etone with 40 mL of chlo (2) > 50 mL	roform , the total volume (3) = 50 mL	of the solution is : (4) Cannot be predicted							
25.	Select correct stateme	nt ?									

(1) Heats of vaporisation for a pure solvent and for a solution are similar because similar intermolecular forces between solvent molecules must be overcome in both cases

(2) Entropy change between solution and vapour is smaller than the entropy change between pure solvent and vapour

- **SOLUTIONS & COLLIGATIVE PROPERITES**
- (3) Boiling point of the solution is larger than that of the pure solvent
- (4) All are correct statements
- **26.** What will be the molecular weight of NaCl determined experimentally from elevation in the boiling point or depression in freezing point method ?

(1) < 58.5 (2) > 58.5 (3) = 58.5 (4) None of these

- 27. Which characterises the weak intermolecular forces of attraction in a liquid ?
  - (1) High boiling point (2) High vapour pressure
  - (3) High critical temperature (4) High heat of vaporization
- **28.** On the basis of intermolecular forces predict the correct order of decreasing boiling points of the compounds:

 $(1) CH_{3}OH > H_{2} > CH_{4} \quad (2) CH_{3}OH > CH_{4} > H_{2} \quad (3) CH_{4} > CH_{3}OH > H_{2} \quad (4) H_{2} > CH_{4} > CH_{3}OH = H_{2} \quad (4) H_{2} = CH_{4} \quad (4) H_{4} = C$ 

### **29.** During depression of freezing point in a solution the following are in equilibrium :

- (1) Liquid solvent, solid solvent (2) Liquid solvent, solid solute
- (3) Liquid solute, solid solute (4) Liquid solute, solid solvent
- 30. Which of the following liquid pairs shows a positive deviation from Raoult's law ?
  - (1) Acetone chloroform

(2) Benzene – methanol

(3) Water - nitric acid

(4) Water – hydrochloric acid

(4) 2.05 M

## Practice Test (JEE-Main Pattern) OBJECTIVE RESPONSE SHEET (ORS)

Que.	1	2	3	4	5	6	7	8	9	10
Ans.										
Que.	11	12	13	14	15	16	17	18	19	20
Ans.										
Que.	21	22	23	24	25	26	27	28	29	30
Ans.										

# **PART - II : PRACTICE QUESTIONS**

- 1.\_ The density of a solution prepared by dissolving 120 g of urea (molar mass = 60) in 1000 g of water is 1.15 g/mL. The molarity of this solution is :
  - (1) 0.50 M (2)1.78 M

2.

(2)1.78 M (3) 1.02 M

A 6.90 M solution of KOH in water has 30% by weight of KOH. Calculate density of solution. (1) 1.288 g mL<sup>-1</sup> (2) 12.88 g mL<sup>-1</sup> (3) 24.88 g mL<sup>-1</sup> (4) 2.488 g mL<sup>-1</sup>

- **3.** If 0.1 M solution of glucose and 0.1 M urea solution are placed on two sides of a semipermeable membrane to equal heights, then it will be correct to say that :
  - (1) There will be no net movement across the membrane
  - (2) Glucose will flow towards urea solution
  - (3) Urea will flow towards glucose solution
  - (4) Water will flow from urea solution towards glucose solution.

4.	Osmotic pressure of a solution (density is 1g/ml) containing 3g of glucose (molecular weight = 180) in g of water at 15°C is										
	(1) 0.34 atm	(2) 0.65 atm	(3) 6.25	(4) 5.57 atm							
5	A solution of 17.00 g of a polymer in 200.0 mL of toluene had an osmotic pressure of 0.036 atm at $27^{\circ}$ C. What is the apparent formula weight of the polymer ?										
•	(1) 40, 000	(2) 58,000	(3) 80, 000	(4) 94, 000							
6.	(1) Relative lowering in	perty used for the deterr	nination of molecular ma	sses of polymers is :							
	(3) Elevation in boiling	point	(4) depression in freezi	na point							
7	Among the following su	' Ibstances, the lowest var	our prossure is everted	by -							
7.	(1) Water	(2) Mercury	(3) Kerosene	(4) Rectified spirit							
8.	The vapour pressure of molecular weight 65	f CCl <sub>4</sub> (density = $1.58 \text{ g}$ ) is dissolved in 100 ml of	cm <sup>-3</sup> ) at 30°C is 143 mm CCl <sub>4</sub> . Calculate the vapo	A 0.5 g of a non-volatile solute our pressure of the solution-							
	(1) 141.93 mm	(2) 14.193 mm	(3) 1.4193 mm	(4) NOTE							
9	Vapour pressure of ber g of benzene, its vapou (1) 35.67 g	nzene at 30ºC is 121.8 m ir pressur is decreased to (2) 356.7 g	im. When 15 g of a non-v o 120.2 mm. The molecu (3) 432.8 g	volatile solute is dissolved in 250 lar weight of the solute is (4) 502.7 g							
10.	The vapour pressure of of the solvent at the sa weight of the solute, wh	f a solution of a non-vola me temperature. If the m nat is the ratio of weight o	tile solute B in a solvent a nolecular weight of the so of solvent to solute.	A is 95% of the vapour pressure olvent is 0.3 times the molecular							
		(2) 5.7	(3) 0.2								
11.	The lowering of vapour	pressure of 0.1 M aqueo	ous solution of NaCl, Cus	SO <sub>4</sub> and K <sub>2</sub> SO <sub>4</sub> are :							
	(1) All equal $(3)$ In the ratio of $3:2:$	1	(4) In the ratio of 1.5 : 1 : 2.5								
10		fouro wator at 26°C is 26	5 21 torr What is the yap	our proceure of a colution which							
12.	contains 20.0 g glucose	$e_1$ C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> , in 70 g water	· ?	our pressure of a solution which							
	(1) 22.5 torr	(2) 23.4 torr	(3) 24.4 torr	(4) 24.5 torr							
13.	The vapour pressure o 5.40 g of a nonvolatile solute.	f pure water at 25°C is substances in 90.0 g w	23.76 torr. The vapour p ater is 23.32 torr. Comp	ressure of a solution containing ute the molecular weight of the							
	(1) 51.24 g/mol	(2) 54.22 g/mol	(3) 57.24 g/mol	(4) 59.26 g/mol							
14.	Vapour pressure of se	olution containing 6g o	f a non-volatile solute i	n 180 g water is 20.0 torr. If							
	1 mol water is further a (1) 20.22 torr	idded vapour pressure in (2) 21.22 torr	creases by 0.02 torr. Cal (3) 20.04 torr	culate vapour pressure of water. (4) 22.22 torr							
15.	The correct relationship the same molar concer	between the boiling poir ntration is :	nts of very dilute solution of	of AICI <sub>3</sub> ( $t_1$ ) and CaCl <sub>2</sub> ( $t_2$ ), having							
	(1) $t_1 = t_2$	(2) $t_1 > t_2$	(3) $t_2 < t_1$	(4) $t_2 \leq t_1$							
16.	Consider equimolal aqu	ueous solutions of NaHS	O₄ and NaCl with $\Delta T_{b}$ an	d $\Delta T'_{b}$ as their respective boiling							
		Lt $\frac{\Delta T_{b}}{\Delta T_{b}}$									
	point elevations. The va	alue of $\overset{m\to 0}{\longrightarrow} \Delta T'_{b}$ will be	:								
	(1) 1	(2) 1.5	(3) 3.5	(4) 2 / 3							

## **SOLUTIONS & COLLIGATIVE PROPERITES**

17	A solution containing 0.1 g of a non-volatile organic substance P (molecular mass 100) in 100 g of benzene raises the boiling point of benzene by 0.2°C, while a solution containing 0.1 g of another non-volatile substance Q in the same amount of benzene raises the boiling point of benzene by 0.4°C. What is the ratio of molecular masses of P and Q?									
	(1) 1 : 2	(2) 2 : 1	(3) 1 : 4	(4) 4 : 1						
18.	A complex of iron and cyanide ions is 100% ionised at 1m (molal). If its elevation in b.p. is 2.08K. ( $K_b$ 0.52K mol <sup>-1</sup> kg), then the complex is :									
	(1) K <sub>3</sub> [Fe(CN) <sub>6</sub> ]	(2) Fe(CN) <sub>2</sub>	(3) K <sub>4</sub> [Fe(CN) <sub>6</sub> ]	(4) Fe(CN) <sub>4</sub>						
19.	<b>19.</b> The boiling point of an aqueous solution of a non volatile solute is 100.15°C. What is the freezing of an aqueous solution obtained by diluting the above solution with an equal volume of water ? the of $K_b$ and $K_f$ for water are 0.512 and 1.86 K molality <sup>-1</sup> :									
	(1) – 0.544°C	(2) – 0.512°C	(3) – 0.272°C	(4) – 1.86°C						
20	50 g of antifreeze (ethy 9.3°C ? (K <sub>f</sub> =1.86K kg r	/lene glycol) is added to nol <sup>-1</sup> )	200 g water. What amo	ount of ice will separate out at -						
	(1) 45 mg	(2) 42 g	(3) 38.71 g	(4) 38.71 mg						
21.	For a solution of 0.849 g of mercurous chloride in 50 g of HgCl <sub>2</sub> ( $\ell$ ) the freezing point depression is 1.24°C.									
	K <sub>f</sub> for HgCl <sub>2</sub> is 34.3. Wh (1) as Hg <sub>2</sub> Cl <sub>2</sub> molecules	nat is the state of mercure s (2) as HgCl molecules	ous chloride in HgCl₂ ? (I (3) as Hg⁺ and Cl⁻ ions	Hg – 200, Cl – 35.5) (4) as Hg₂²+ and Cl⁻ ions						
22.	The vapour pressure of a pure liquid 'A' is 70 torr at 27°C. It forms an ideal solution with another liquid 'B'. The mole fraction of 'B' is 0.2 and total vapour pressure of the solution is 84 torr at 27°C. The vapour pressure of pure liquid 'B' at 27°C is									
	(1) 14	(2) 56	(3) 140	(4) 70						
23.	The vapour pressure of of solution obtained by	two liquids 'P' and 'Q' ar mixing 3 mole of P and 2	e 80 and 60 torr, respect 2 mol of Q would be :	ively. The total vapour pressure						
	(1) 68 torr	(2) 140 torr	(3) 72 torr	(4) 20 torr						
24	On mixing heptane and components (heptane a obtained by mixing 25 g (Molar mass of heptane	d octane form an ideal s and octane) are 105 kPa g of heptane and 35 g of e = 100 g mol <sup>-1</sup> ; Molar m	olution. At 373K, the vap and 45 kPa respectively. octane will be : lass of octane = 114 g m	oour pressures of the two liquid Vapour pressure of the solution ol <sup>-1</sup> )						
	(1) 96.2 kPa	(2) 144.5 kPa	(3) 72 kPa	(4) 36.1 kPa						
<b>0</b> E	Accuration the formetics	a af an islaal aalusian da	المرامع بممالكم مطالم مراحد	of a minimum applaining 1500 g						

**25.** Assuming the formation of an ideal solution, determine the boiling point of a mixture containing 1560 g benzene (molar mass = 78) and 1125 g chlorobenzene (molar mass = 112.5) using the following against an external pressure of 1000 Torr.



	APSP Answers												
					_	PA	RT - I						
1.	(3)	2.	(3)	3.	(3)	4.	(3)	5.	(3)	6.	(4)	7.	(3)
8.	(4)	9.	(2)	10.	(2)	11.	(4)	12.	(1)	13.	(4)	14.	(3)
15.	(1)	16.	(4)	17.	(1)	18.	(4)	19.	(2)	20.	(2)	21.	(1)
22.	(2)	23.	(3)	24.	(1)	25.	(4)	26.	(1)	27.	(2)	28.	(2)
29.	(1)	30.	(2)										
						PA	RT - II						
1.	(4)	2.	(1)	3.	(1)	4.	(3)	5.	(2)	6.	(2)	7.	(2)
8.	(1)	9.	(2)	10.	(2)	11.	(2)	12.	(4)	13.	(3)	14.	(4)
15.	(2)	16.	(2)	17.	(2)	18.	(1)	19.	(3)	20.	(3)	21.	(1)
22.	(3)	23.	(3)	24.	(3)	25.	(2)						