ETOOS

TARGET
JEE (ADVANCED) : 2014

PHYSICAL CHEMISTRY
DAILY PRACTICE PROBLEMS
D P P

COURSE NAME : UMANG (UP) **DATE : 01.04.2013 to 06.04.2013** **DPP No. 01 TO 02**

DPP No. # 1

*** Marked Questions are having more than one correct option.**

1. The volume of water that must be added to a mixture of 250 ml of 0.6 M HCl and 750 ml of 0.2 M HCl to obtain 0.25 M solution of HCl is :
(A) 750 ml (B) 100 ml (C) 200 mℓ (D) 300 mℓ

2. What approximate volume of 0.40 M $Ba(OH)_2$ must be added to 50.0 mL of 0.30 M NaOH to get a solution in which the molarity of the OH^- ions is 0.50 M?
(A) 33 mL (B) 66 mL (C) 133 mL (D) 100 mL

3. 500 ml of 0.1 M KCl , 200 ml of 0.01 M $NaNO_3$ and 500 ml of 0.1 M $AgNO_3$ was mixed. The molarity of K^+, Ag^+, Cl^-, Na^+, NO_3^- in the solution would be
(A) $[K^+] = 0.0416$ $[Ag^+] = 0.04$ $[Na^+] = 0.002$
$[C\ell^-] = 0.04$ $[NO_3^-] = 0.042$
(B) $[K^+] = 0.0416$ $[Na^+] = 0.00166$
$[NO_3^-] = 0.0433$
(C) $[K^+] = 0.04$ $[Ag^+] = 0.05$ $[Na^+] = 0.0025$
$[C\ell^-] = 0.05$ $[NO_3^-] = 0.0525$
(D) $[K^+] = 0.05$ $[Na^+] = 0.0025$
$[NO_3^-] = 0.0525$

4. Mole fraction of A in H_2O is 0.2. The molality of A in H_2O is :
(A) 13.9 (B) 15.5 (C) 14.5 (D) 16.8

5. What is the molarity of H_2SO_4 solution that has a density of 1.84 g/cc and contains 98% by mass of H_2SO_4? (Given atomic mass of S = 32)
(A) 4.18 M (B) 8.14 M (C) 18.4 M (D) 18 M

6. The molality of a sulphuric acid solution is 0.2. Calculate the total weight of the solution having 1000 gm of solvent.
(A) 1000 g (B) 1098.6 g (C) 980.4 g (D) 1019.6g

7. Mole fraction of $C_3H_5(OH)_3$ in a solution of 36 g of water and 46 g of glycerine is :
(A) 0.46 (B) 0.36 (C) 0.20 (D) 0.40

8.

Column-I	**Column-II**
(a) 4.5 m solution of $CaCO_3$ density 1.45 g/ml	(P) mole fraction of solute is 0.2
(b) 3 M 100 ml H_2SO_4 mixed with 1 M 300 ml H_2SO_4 solution	(Q) mass of the solute is 360 g
(c) 14.5 m solution of Ca	(R) molarity = 4.5
(d) In 4 M 2 litre solution of NaOH, 40 gm of NaOH is added.	(S) molarity = 1.5

DPP No. # 2

1. Mixture of volatile components A and B has total vapour pressure (in Torr) $p = 254 - 119\,x_A$ where x_A is mole fraction of A in mixture. Hence p_A^0 and p_B^0 are (in Torr)

(A) 254, 119 (B) 119, 254 (C) 135, 254 (D) 119, 373

2. What is the mole ratio of benzene ($P_B{}^0$= 150 torr) and toluene ($P_T{}^0$ = 50 torr) in vapour phase if the given solution has a vapour pressure of 120 torr?

(A) 7 : 1 (B) 7 : 3 (C) 8 : 1 (D) 7 : 8

3. At 323 K, the vapour pressure in millimeters of mercury of a methanol-ethanol solution is represented by the equation $p = 120\,X_A + 140$, where X_A is the mole fraction of methanol. Then the value of $\lim\limits_{x_A \to 1} \dfrac{p_A}{X_A}$ is

(A) 250 mm (B) 140 mm (C) 260 mm (D) 20 mm

4. Two liquids A and B form ideal solution at 300 K. The vapour pressure of a solution containing one mole of A and four mole of B is 560 mm of Hg. At the same temperature if one mole of B is taken out from the solution, the vapour pressure of solution decreases by 10 mm of Hg. Vapour pressures of A and B in pure state will be:

(A) 330, 550 (B) 200, 300 (C) 400, 600 (D) 800, 1200

5. The vapour pressure of two volatile liquid mixture is $P_T = (5.3 - 2X_B)$ in cm of Hg ; where X_B is mole fraction of B in mixture. What are vapour pressure of pure liquids A and B ?

(A) 3.3 and 2.1 cm of Hg (B) 2.3 and 3.3 cm of Hg
(C) 5.3 and 2.3 cm of Hg (D) 5.3 and 3.3 cm of Hg

6. At 40ºC the vapour pressure in torr of methanol and ethanol solution is P = 119 x + 135 where x is the mole fraction of methanol, hence,

(A) vapour pressure of pure methanol is 119 torr
(B) vapour pressure of pure ethanol is 135 torr
(C) vapour pressure of equimolar mixture of each is 127 torr
(D) mixture is completely immiscible

7. Solution of two volatile liquids A and B obey Raoult's law. At a certain temperature, it is found that when the total vapour pressure above solution is 400 mm of Hg, the mole fraction of A in vapour phase is 0.45 and in liquid phase 0.65 then the vapour pressures of two pure liquids at the same temperature will be -

(A) 138.4 mm, 628.57 mm (B) 276.9 mm, 628.57 mm
(C) 276.9 mm, 314.28 mm (D) 138.4 mm, 314.28 mm

8. The vapour pressure of benzene and toluene at 20ºC are 75 mm of Hg and 22 mm of Hg respectively. 23.4 g of benzene and 64.4g of toluene are mixed. If two forms ideal solution, the mole fraction of benzene in vapour phase when vapours are in equilibrium with liquid mixture, is -

(A) 0.59, 0.41 (B) 0.25, 0.75 (C) 0.5, 0.5 (D) 0.35, 0.65

9. The vapour pressure of two liquids are 15000 and 30000 in a unit. When equimolar solution of liquids is made. Then the mole fraction of A and B in vapour phase will be :

(A) $\frac{2}{3}, \frac{1}{3}$ (B) $\frac{1}{3}, \frac{2}{3}$ (C) $\frac{1}{2}, \frac{1}{2}$ (D) $\frac{1}{4}, \frac{3}{4}$

10. At 90ºC, the vapour pressure of toluene is 400 mm and that of xylene is 150 mm. The composition of liquid mixture that will boil at 90ºC when the pressure of mixture is 0.5 atm, is -
(A) 0.8, 0.2 (B) 0.75 , 0.25 (C) 0.92 , 0.08 (D) 0.66 , 0.34

11. Mole fraction of a liquid A in an ideal mixture with another liquid b is X_A. If X'_A is the mole fraction of component A in the vapour in equilibrium, the total pressure of the liquid mixture is -
(P^o_A = vapour pressure of pure A ; P^o_B = vapour pressure of pure B)
(A) $P^o_A \frac{X'_A}{X_A}$ (B) $\frac{P^o_A X_A}{X'_A}$ (C) $\frac{P^o_B X'_A}{X_A}$ (D) $\frac{P^o_B X_A}{X'_A}$

Revision Problem

1. 4.48 litres of methane at N.T.P. correspond to :
(A) 1.2×10^{22} molecules of methane. (B) 0.5 mole of methane.
(C) 3.2 gm of methane. (D) 0.1 mole of methane.

2. 5.6 litre of a gas at N.T.P. weighs equal to 8 gm. The vapour density of gas is :
(A) 32 (B) 16 (C) 8 (D) 40

3. The number of oxygen atoms present in 14.6 g of magnesium bicarbonate [$Mg(HCO_3)_2$] is :
(A) $6N_A$ (B) $0.6N_A$ (C) N_A (D) $0.5\ N_A$

4. One mole of P_4 molecules contains :
(A) 1 molecule. (B) 4 molecules.
(C) $1/4 \times 6.022 \times 10^{23}$ atoms. (D) 24.088×10^{23} atoms.

5. What is correct for 10 g of $CaCO_3$?
(A) It contains 1g-atom of carbon. (B) It contains 0.3 g-atom of oxygen.
(C) It contains 12 g of calcium. (D) None of these.

ANSWER KEY

DPP No. # 1

1. (C) **2.** (A) **3.** (B) **4.** (A) **5.** (C) **6.** (D) **7.** (C)

8. (a – R ; b – S ; c – P ; d – Q,R)

DPP No. # 2

1. (C) **2.** (A) **3.** (C) **4.** (C) **5.** (D) **6.** (B) **7.** (B)

8. (A) **9.** (B) **10.** (C) **11.** (B)

Revision Problem

1. (C) **2.** (B) **3.** (B) **4.** (D) **5.** (B)

TARGET
JEE (ADVANCED) : 2014

PHYSICAL CHEMISTRY
DAILY PRACTICE PROBLEMS
D P P

COURSE NAME : UMANG (UP) **DATE : 08.04.2013 to 13.04.2013** **DPP NO. 03 TO 04**

DPP No. 03

1. The vapour pressure of ether at 20ºC is 442 mm. When 7.2 g of a solute is dissolved in 60 g ether, vapour pressure is lowered by 32 units. If molecular weight of ether is 74 then molecular weight of solute is -
(A) 113.77 (B) 150.35 (C) 116.23 (D) 190.26

2. The vapour pressure of pure benzene at 25ºC is 639.7 mm of Hg and the vapour pressure of a solution of a solute in C_6H_6 at the same temperature is 631.9 mm of Hg. Molality of solution is -
(A) 0.079 mol/kg of solvent (B) 0.256 mol/kg of solvent
(C) 0.158 mol/kg of solvent (D) 0.316 mol/kg of solvent

3. A 6% (by weight) of non-volatile solute in isopentane at 300 K has a vapour pressure of 1426 mm Hg. 20 g of isopentane is now added to the solution. The resulting solution has a vapour pressure of 1445 mm of Hg at the same temperature. Then :
(i) Molecular weight of solute is -
(A) 28. 32 (B) 92.81 (C) 113.30 (D) 56.65
(ii) Vapour pressure of isopentane at 300 K is -
(A) 1541.68 mm (B) 770.89 mm (C) 1212.46 mm (D) 981.32 mm

4. Find out the weight of solute (M. wt. 60) that is required to dissolve in 180 g water to reduce the vapour pressure to 4/5th of pure water -
(A) 130 g (B) 150 g (C) 300 g (D) 75 g

5. The molality of a solution containing a non-volatile solute if the vapour pressure is 2% below the vapour pressure of pure water, will be -
(A) 2.213 (B) 2.518 (C) 1.133 (D) 1.891

6. The weight of a non-volatile solute (m. wt. 40). Which should be dissolved in 114 g octane to reduce its vapour pressure to 80%, is -
(A) 20 gm (B) 10 gm (C) 7.5 gm (D) 5 gm

7. Twenty gram of a solute are added to 100 g of water at 25ºC. The vapour pressure of pure water is 23.76 mm Hg, vapour pressure of solution is 22.41 mm Hg. The mass of this solute that is required in 100 g water to reduce the vapour pressure to one-half of the pure water is -
(A) 333 g (B) 666 g (C) 166 g (D) 256 g

8. Vapour pressure of pure water is 40 mm. If a non-volatile solute is added to it vapour pressure falls by 4 mm. Hence, molality of solution is -
(A) 6.173 molal (B) 3.0864 molal (C) 1.543 molal (D) 0.772 molal

9. The vapour pressure of pure liquid solvent A is 0.80 atm. When a non-volatile substance B is added to the solvent, its vapour pressure drops to 0.60 atm ; mole fraction of the component B in the solution is
(A) 0.50 (B) 0.25 (C) 0.75 (D) 0.40

10. Vapour pressure of CCl_4 at 25ºC is 143 mm Hg. If 0.5 gm of non-volatile solute (mol. mass 65) is dissolved in 100 ml CCl_4, then the vapour pressure of the solution at 25ºC is -
[Given : Density of CCl_4 = 1.58 g/cm^3]
(A) 141.93 mm (B) 94.39 mm (C) 199.34 mm (D) 143.99 mm

DPP No. 04

1. Lowering of vapour pressure of 1.00 m solution of a non-volatile solute in a hypothetical solvent of molar mass 40 g at its normal boiling point, is -

(A) 29.23 torr (B) 30.4 torr (C) 35.00 torr (D) 40.00 torr

2. The vapour pressure of a liquid decreases by 10 torr when a non-volatile solute is dissolved. The mole fraction of the solute in solution is 0.1. What would be the mole fraction of the liquid if the decrease in vapour pressure is 20 torr, the same solute being dissolved -

(A) 0.2 (B) 0.9 (C) 0.8 (D) 0.6

3. The mole fraction of the solvent in the solution of a non-volatile solute is 0.980. The relative lowering of vapour pressure is -

(A) 0.01 (B) 0.980 (C) 0.02 (D) 0.49

4. The vapour pressure of a solution of a non-volatile solute B in a solvent A is 95% of the vapour pressure of the solvent at the same temperature. If the molecular weight of the solvent is 0.3 times the molecular weight of the solute, what is the weight ratio of solvent to solute.

(A) 0.15 (B) 5.7 (C) 0.2 (D) none of these

5. The vapour pressure of water at room temperature is 23.8 mm Hg. The vapour pressure of an aqueous solution of sucrose with mole fraction 0.1 is equal to –

(A) 23.9 mm Hg (B) 24.2 mm Hg (C) 21.42 mm Hg (D) 31.44 mm Hg

6. The vapour pressure of pure A is 10 torr and at the same temperature when 1 g of B is dissolved in 20 g of A, its vapour pressure is reduced to 9.0 torr. If the molecular mass of A is 200 amu, then the molecular mass of B is –

(A) 100 amu (B) 90 amu (C) 75 amu (D) 120 amu

7. The vapour pressure of pure benzene C_6H_6 at 50ºC is 260 Torr. How many moles of nonvolatile solute per mole of benzene are required to prepare a solution of benzene having a vapour pressure of 167.0 Torr at 50ºC ?

(A) 0.305 mol (B) 0.605 mol (C) 0.336 mol (D) 0.663 mol

8. Lowering of vapour pressure due to a solute in 1 molal aqueous solution at 100ºC is -

(A) 13.44 Torr (B) 14.12 Torr (C) 312 Torr (D) 352 Torr

9. How many grams of sucrose must be added to 360 g of water to lower the vapour pressure by 1.19 mmHg at a temperature at which pressure of pure water is 25 mm Hg ?

(A) 342 g (B) 360 g (C) 375 g (D) 380 g

Revision Problems

1. The atomic weight for a triatomic gas is a. The correct formula for the number of moles of gas in its w g is:

(A) $\frac{3w}{a}$ (B) $\frac{w}{3a}$ (C) 3wa (D) $\frac{a}{3w}$

2. 16 g of SO_x occupies 5.6 litre at S.T.P. Assuming ideal gas nature, the value of x is :

(A) 1 (B) 2 (C) 3 (D) none of these

3. Find the relative density of SO_3 gas with respect to methane.

4. Vapour density of a gas is 17 then find the weight of 11.2 L. of gas at STP.

5. Compounds of boron with hydrogen are called boranes. One of these boranes has the empirical formula BH_3 and a molecular weight of 28 amu. What is its molecular formula ?

6. Calculate vapour density of a sample containing 10 moles of CO_2, 5 moles of SO_2 & 400 g of SO_3 with respect to CH_4 gas.

7. Calculate total number of carbon atoms in a sample containing 160 g of CH_4, 600 g of acetic acid, 340 g of C_3O_2 & 360 g of pentane.

8. **Match the following :**

	Column - I		**Column - II**
(A)	49 g H_2SO_4	(p)	0.5 mole
(B)	20 g NaOH	(q)	1.5 N_A atoms
(C)	11.2 L of CO_2 at STP	(r)	0.5 N_A molecules
(D)	6.023×10^{23} atoms of Oxygen	(s)	2 mole of 'O' atom

9.

	Column - I		**Column - II**
(A)	32 gm each of O_2 and S	(p)	2 moles of Fe
(B)	2 gram molecule of $K_3[Fe(CN)_6]$	(q)	3 moles of ozone molecule
(C)	144 gm of oxygen atom	(r)	one mole
(D)	From 168 g of iron 6.023×10^{23} atoms of iron are removed the iron left	(s)	12 moles of carbon atoms

ANSWER KEY

DPP No. # 1

1. (C) **2.** (A) **3.** (B) **4.** (A) **5.** (C) **6.** (D) **7.** (C)

8. (a – R ; b – S ; c – P ; d – Q,R)

DPP No. # 2

1. (C) **2.** (A) **3.** (C) **4.** (C) **5.** (D) **6.** (B) **7.** (B)

8. (A) **9.** (B) **10.** (C) **11.** (B)

Revision Problem

1. (C) **2.** (B) **3.** (B) **4.** (D) **5.** (B)

TARGET
JEE (ADVANCED) : 2014

PHYSICAL CHEMISTRY
DAILY PRACTICE PROBLEMS
D P P

COURSE NAME : UMANG (UP) **DATE : 15.04.2013 to 20.04.2013** **DPP No. 05 TO 07**

*** Marked Questions are having more than one correct option.**

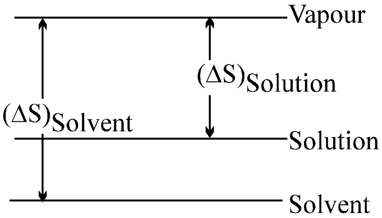
DPP NO. # 05

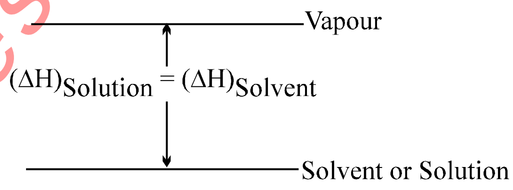
1. A complex of iron and cyanide ions is 100% ionized at 1 molal. If its elevation in boiling point is 2.08°, then the complex is (Given: $K_b = 0.52°C\ mol^{-1}\ kg$)
(A) $Fe_4^{III}[Fe^{II}(CN)_6]_3$ (B) $K_3[Fe^{III}(CN)_6]$ (C) $K_4[Fe^{II}(CN)_6]$ (D) none

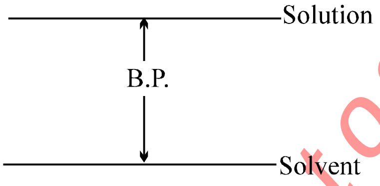
2. 15 g of a solute in 100 g water makes a solution freeze at –1°C. 30 g of a solute in 100 g of water will give a depression in freezing point equal to
(A) –2°C (B) 0.5°C (C) 2°C (D) 1°C

3. In cold countries, ethylene glycol is added to water in the radiators of cars during winters. It results in
(A) lowering of boiling point (B) reduced viscosity
(C) reduced specific heat (D) lowering of freezing point

4. Which represents correct difference?

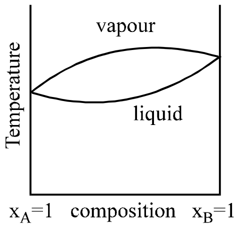
(I)


(II)


(III)


(A) I, II, III (B) I, III (C) II, III (D) I, II

5. Boiling point- composition diagram of the liquid-vapour equilibrium for propanol-2 (A) and 2-methyl-propanol-1 (B) is shown a side. If a binary liquid mixture of A and B is distilled fractionally, which of the following would be correct observation?



(A) composition of the still (residue) will approach pure liquid A
(B) composition of the distillate will approach pure B
(C) composition of distillate and residue will approach pure A and B respectively.
(D) Neither of the components can be obtained in pure state.

6. 4.00 g of substance A, dissolved in 100 g H_2O depressed the f. pt. of water by 0.1ºC. While 4 g of another substance B, depressed the f. pt. by 0.2 ºC. What is the relation between molecular weights of the two substance -
(A) $M_A = 4M_B$ (B) $M_A = M_B$ (C) $M_A = 0.5M_B$ (D) $M_A = 2M_B$

7. An aqueous solution containing 5% by weight of urea and 10% by weight of glucose. Freezing point of solution is [K_f for H_2O is $1.86\ K\ mol^{-1}\ kg$]
(A) 3.04º C (B) –3.04º C (C) –5.96º C (D) 5.96º C

8. The freezing point of a solution prepared from 1.25 gm of non-electrolyte and 20 gm of water is 271.9 K. If molar depression constant is 1.86 K molality^{-1}. Then molar mass of the solute will be -
(A) 105.68 (B) 106.7 (C) 115.3 (D) 93.9

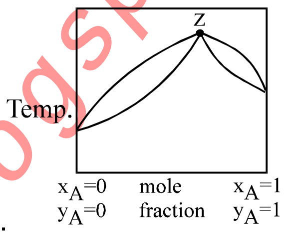
9. Elevation in boiling point of an aqueous urea solution is 0.52°. (K_b = 0.52K kg mol^{-1}). Hence mole fraction of urea in this solution is -
(A) 0.982 (B) 0.0567 (C) 0.943 (D) 0.018

10. The molal freezing point constant for water is 1.86 K. molarlity^{-1}. If 34.2 g of cane sugar ($C_{12}H_{22}O_{11}$) are dissolved in 1000g of water, the solution will freeze at
(A) –1.86°C (B) 1.86°C (C) –3.92°C (D) 2.42°C

11. 20 g of a binary electrolyte (mol.wt. = 100) are dissolved in 500 g of water. The freezing point of the solution is –0.74°C, K_f = 1.86 K.molality^{-1}. The degree of ionisation of the electrolyte is
(A) 50% (B) 75% (C) 100% (D) 0

DPP NO. 06

1. A liquid mixture having composition corresponding to point z in the figure shown is subjected to distillation at constant pressure. Which of the following statement is correct about the process
(A) The composition of distillate differs from the mixture
(B) The boiling point goes on changing
(C) The mixture has highest vapour pressure than for any other composition.
(D) Composition of an azeotrope alters on changing the external pressure.



2. At a temperature, total pressure in Torr of a mixture of volatile components A and B is given by

$$P = 120 - 75\,X_B$$

hence, vapour pressure of pure A and B respectively (in Torr) are:
(A) 120, 75 (B) 120, 195 (C) 120, 45 (D) 75, 45

3. The boiling point of 1.0 m $K_4[Fe(CN)_6]$ is (K_b for water = 0.52 K kg mol^{-1})
(A) 100.52°C (B) 100.10°C (C) 100.26°C (D) 102.6°C

4. For $CrCl_3 \cdot xNH_3$, elevation in boiling point of one molal solution is double than that of one molal urea solution, hence x would be (complex is 100% ionized)
(A) 4 (B) 5 (C) 6 (D) none of these

5. The amount of ice that will separate out from a solution containing 25 g of ethylene glycol in 100 g of water and is cooled to –10°C, will be - [Given : K_f for H_2O = 1.86 K mol^{-1} kg]
(A) 50.0 g (B) 25.0 g (C) 12.5 gm (D) 30.0 gm

6. In winter, the normal temperature in Kullu valley was found to be –11°C. Is a 28% (by mass) aqueous solution of ethylene glycol suitable for a car radiator ? K_f for water = 1.86 K kg mol^{-1}.
(A) Yes (B) No (C) can't predict (D) None of these

7. When a solution containing w g of urea in 1 kg of water is cooled to -.372°C, 200 g of ice is separated. If K_f for water is 1.86 K kg mol^{-1}, w is -
(A) 4.8 g (B) 12.0 g (C) 9.6 g (D) 6.0 g

8. Relative decrease in V. P. of an aqueous glucose dilute solution is found to be 0.018. Hence, elevation in boiling point is : (it is given 1 molal aq. urea solution boils at 100.54°C at 1 atm. pressure)
(A) 0.018° (B) 0.18° (C) 0.54° (D) 0.03°

9. Y g of non - volatile organic substance of molecular mass M is dissolved in 250 g benzene. Molal elevation constant of benzene is K_b. Elevation in its boiling point is given by
(A) $\frac{M}{K_b Y}$ (B) $\frac{4K_b Y}{M}$ (C) $\frac{K_b Y}{4M}$ (D) $\frac{K_b Y}{M}$

10. The values of observed and calculated molecular weights of silver nitrate are 92.64 and 170 respectively. The degree of dissociation of silver nitrate is
(A) 60% (B) 83.5% (C) 46.7% (D) 60.23%

DPP NO. 07

1. Which of the following has been arranged in the increasing order of freezing point?
(A) 0.025 M KNO_3 < 0.1 M NH_2CSNH_2 < 0.05 M $BaCl_2$ < 0.1 M NaCl
(B) 0.1 M NaCl < 0.05 M $BaCl_2$ < 0.1 M NH_2 $CSNH_2$ < 0.025 M KNO_3
(C) 0.1 M NH_2 $CSNH_2$ < 0.1 M NaCl < 0.05 M $BaCl_2$ < 0.025 M KNO_3
(D) 0.025 M KNO_3 < 0.05 M $BaCl_2$ < 0.1 M NaCl < 0.1 M NH_2 $CSNH_2$

2. Equal volumes of 1.0 M KCl and 1.0 M $AgNO_3$ are mixed. The depression of freezing point of the resulting solution will be ($K_f(H_2O)$ = 1.86 K kg mol^{-1}, 1 M = 1m)
(A) 3.72 K (B) 1.86 K (C) 0.93 K (D) none of these

3. The molal boiling point constant of water is 0.53ºC. When 2 mole of glucose are dissolved in 4000 gm of water, the solution will boil at -
(A) 100.53ºC (B) 101.06ºC (C) 100.265ºC (D) 99.47ºC

4. The boiling point of an aqueous solution of a non-volatile solute is 100.15ºC. What is the freezing point of an aqueous solution obtained by diluting the above solution with an equal volume of water ?
[K_b and K_f for water are 0.512 and 1.86 K $molality^{-1}$]
(A) -0.544ºC (B) -0.512ºC (C) -0.272ºC (D) -1.86ºC

5. Glucose is added to 1 litre water to such an extent that $\Delta T_f/K_f$ becomes equal to 1/1000, the weight of glucose added is
(A) 180 gm (B) 18 gm (C) 1.8 gm (D) 0.18 gm

6. At 40°C, the vapour pressures in torr, of methyl alcohol - ethy alcohol solution is represented by the equation.

P = $119X_A$ + 135 where X_A is mole fraction of methyl alcohol, then the value of $\lim\limits_{X_A \to 1} \dfrac{P_A}{X_A}$ is

(A) 254 torr (B) 135 torr (C) 119 torr (D) 140 torr

7. The amount of ice that will separate on cooling a solution containing 50g of ethylene glycol in 200g water to –9.3°C is : [K_f = 1.86 K $molality^{-1}$]
(A) 38.71 g (B) 38.71 mg (C) 42 g (D) 42 mg

8.* Select correct statement:
(A) 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.
(B) Entropy change between solution and vapour is similar to the entropy change between pure solvent and vapour
(C) Boiling point of the solution is larger than that of the pure solvent
(D) All are correct statements

Answer Key

DPP NO. # 05

1. (B) **2.** (C) **3.** (D) **4.** (A) **5.** (C) **6.** (D) **7.** (B)
8. (A) **9.** (D) **10.** (A) **11.** (D)

DPP NO. 06

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

DPP NO. 07

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

ETOOS

TARGET
JEE (ADVANCED) : 2014

PHYSICAL CHEMISTRY
DAILY PRACTICE PROBLEMS
D P P

COURSE NAME : UMANG (UP) **DATE : 22.04.2013 to 27.04.2013** **DPP NO. 08 TO 10**

*** Marked Questions are having more than one correct option.**

DPP NO. # 08

1. Maximum freezing point will be for 1 molal solution of, assuming equal ionisation in each case :
(A) $[Fe(H_2O)_6]Cl_4$ (B) $[Fe(H_2O)_5Cl]Cl_2.H_2O$
(C) $[Fe(H_2O)_4Cl_2]Cl.2H_2O$ (D) $[Fe(H_2O)_3Cl_3].3H_2O$

2. The osmotic pressure of 1 m solution at 27°C is *[CPMT 1999]*
(A) 2.46 atm (B) 24.6 atm (C) 1.21 atm (D) 12.1 atm

3. The concentration in gms per litre of a solution of cane sugar (M = 342) which is isotonic with a solution containing 6gms of urea (M = 60) per litre is : *[Orissa PMT 1989]*
(A) 3.42 (B) 34.2 (C) 5.7 (D) 19

4. A 0.6% solution of urea (molecular weight = 60) would be isotonic with *[NCERT 1982]*
(A) glucose (B) 0.1 M KCl
(C) 0.6% glucose solution (D) 0.6% KCl solution

5. 0.6 g of a solute is dissolved in 0.1 litre of a solvent which develops an osmotic pressure of 1.23 atm at 27ºC. The molecular mass of the substance is : *[BHU 1990]*
(A) 149.5 g mole^{-1} (B) 120 g mole^{-1} (C) 430 g mole^{-1} (D) None of these

6. Acetic acid dissolved in benzene shows a molecular weight of : *[MP PET 2002]*
(A) 60 (B) 120 (C) 180 (D) 240

7. For the solution of ethanoic acid in benzene, Van't Hoff factor is :
(A) 1 (B) 1/2 (C) 2 (D) None of these

8. Which of the following is incorrect :
(A) Molecular weight of NaCl found by osmotic pressure measurements in half of the theoretical value
(B) Molecular weight of CH_3COOH in benzene found by cryscopic methods is double of the theoretical values
(C) Osmotic pressure of 0.1 M glucose solution is half of that of 0.1 M NaCl solution
(D) Molecular weight of HCl found by any colligative property will be same in the aqueous solution and benzene solution.

9.* Which of the following aqueous solutions produce the same osmotic pressure : *[Roorkee 1999]*
(A) 0.1 M NaCl solution
(B) 0.1 M glucose solution
(C) 0.6 g urea in 100 ml solution
(D) 1.0 g of a non-electrolyte solute (X) in 50 ml solution (Molar mass of X = 200)

10.* In the depression of freezing point experiment, it is found that the : *[IIT 1999]*
(A) Vapour pressure of the solution is less than that of pure solvent
(B) Vapour pressure of the solution is more than that of pure solvent
(C) Only solute molecules solidify at the freezing point
(D) Only solvent molecules solidify at the freezing point

DPP NO. # 09

1. The vapour pressure of pure benzene at a certain temperature is 200 mm Hg. At the same temperture the vapour pressure of a solution containing 2g of non-volatile non-electrolyte solid in 78g of benzene is 195 mm Hg. The molecular weight of solid is : ***[UPSEAT 2001]***

(A) 50 (B) 70 (C) 85 (D) 78

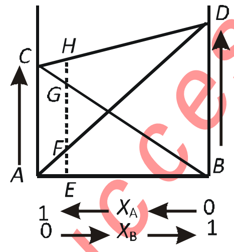
2. **Assertion (A) :** An increase in surface area increases the rate of evaporation

Reason (R) : Stronger the inter-molecular attractive forces, fast is the rate of evaporation at a given temperature ***[AIIMS 2002]***

(A) Both A and R are true and R is a correct explanation of A
(B) Both A and R are true but R is not a correct explanation of A
(C) A is true but R is false
(D) Both A and R are false

3. At 40°C, the vapour pressure in torr of methanol and ethanol solution is P = 119 x + 135 where, x is the mol fraction of methanol. Hence :
(A) Vapour pressure of the pure methanol is 119 torr.
(B) Vapour pressure of pure ethanol is 135 torr.
(C) Vapour pressure of equimolar mixture of of each is 127 mm
(D) Mixture is completely immiscible

4. Based on the given diagram, which of the following statements regarding the solutions of two miscible volatile liquids are correct :



(1) Plots AD and BC show that Raoult's law is obeyed for the solution in which B is a solvent and A is the solute and as well as for that in which A is solvent and B is solute.
(2) Plot CD shows that Dalton's law of partial pressures is observed by the binary solutions of components A and B.
(3) EF + EG = EH; and AC and BD correspond to the vapour pressures of the pure solvents A and B respectively.
Select the correct answer using the codes given below
Codes
(A) 1 and 2 (B) 2 and 3 (C) 1 and 3 (D) 1, 2 and 3

5. The rise in the boiling point of a solution containing 1.8 gram of glucose in 100g of a solvent is 0.1ºC. The molal elevation constant of the liquid is : ***[CPMT 1999]***

(A) 0.01 K/m (B) 0.1 K/m (C) 1 K/m (D) 10 K/m

6. Elevation in boiling point was 0.52ºC when 6 gm of a compound X was dissolved in 100 gm of water. Molecular weight of X is (K_b for water is 0.52) ***[CPMT 1989]***

(A) 120 (B) 60 (C) 180 (D) 600

7. The boiling point of 0.1 molal $K_4[Fe(CN)_6]$ solution will be (given K_b for water 0.52°C kg mol^{-1}) ***[Haryana CEET 1998]***

(A) 100.52°C (B) 100.104°C (C) 100.26°C (D) 102.6°C

8. An aqueous solution freezes at – 0.186ºC (k_f = 1.86º; k_b = 0.512º). What is the elevation in boiling point ***[MP PET/PMT 1998]***

(A) 0.186 (B) 0.512 (C) $\frac{0.512}{1.86}$ (D) 0.0512

9. The freezing point of a 0.01 M aqueous glucose solution at 1 atmosphere is – 0.18ºC. To it, an addition of equal volume of 0.002 M glucose solution will produce a solution with freezing point of nearly : ***[AMU 1999]***
(A) – 0.036ºC (B) – 0.108ºC (C) – 0.216C (D) – 0.422ºC

10.* Which of the following aqueous soltuon are isotonic (R = 0.082 atm K^{-1} mol^{-1}) ***[Roorkee Qualifying 1998]***
(A) 0.01 M glucose (B) 0.01 M $NaNO_3$
(C) 0.04 N HCl (D) 500 ml solution containing 0.3g urea

11.* Which is / are correct statement(s)
(A) When mixture is less volatile there is positive deviation from Raoult's law
(B) When mixture is more volatile, there is negative deviation from Raoult's law
(C) When mixture is less volatile, there is negative deviation from Raoult's law
(D) When mixture is more volatile, there is positive deviation from Raoult's law

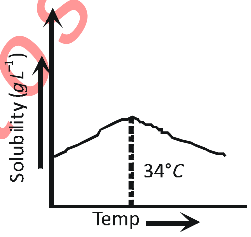
DPP NO. # 10

1. Which is correct about Henry's law : ***[Kurukshetra CET 2002]***
(A) The gas in contact with the liquid should behave as an ideal gas
(B) There should not be any chemical interaction between the gas and liquid.
(C) The pressure applied should be high
(D) All of these

2. A solid dissolved in water if :
(A) Lattice energy is greater than hydration energy
(B) Lattice energy is less than hydration energy
(C) Lattice energy is equal to hydration energy
(D) Dissolution is exothermic

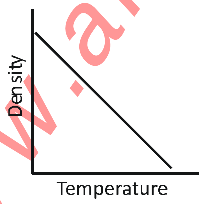
3. Dissolution of a solute is an exothermic process when :
(A) Hydration energy > Lattice energy (B) Hydration energy < Lattice energy
(C) Hydration energy = Lattice energy (D) None of these

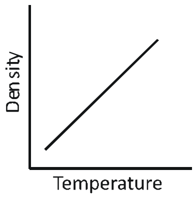
4. Solubility curve of $Na_2SO_4 . 10H_2O$ in water with temperature is given as :

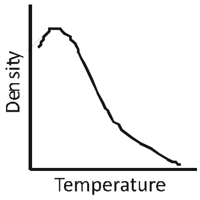


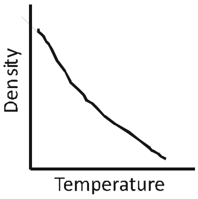
(A) Solution process is exothermic
(B) Solution process is exothermic till 34°C and endothermic after 34°C
(C) Solution process is endothermic till 34°C and exothermic there after
(D) Solution process is endothermic

5. Which one of the following plots correctly represents the variation in density of water with temperature : ***[AIIMS 1985]***

(A) 

(B) 

(C) 

(D) 

6. 5 ml of N HCl, 20 ml of $\frac{N}{2}$ H_2SO_4 and 30 ml of $\frac{N}{3}$ HNO_3 are mixed together. The normality of the resulting solution is : ***[Kerala CET (Med.) 2003]***

(A) $\frac{N}{5}$ (B) $\frac{N}{10}$ (C) $\frac{N}{20}$ (D) $\frac{5N}{11}$

7. A 0.01M ammonia solution is 5% ionised. The concentration of OH^- ions is : ***[KCET (Eng.)1993]***

(A) 0.005 M (B) 0.0005 M (C) 0.0001 M (D) 0.05 M

8. Formation of a solution from two components can be considered as : ***[CBSE 999]***

(i) Pure solvent → separated solvent molecules ΔH_1
(ii) Pure solute → separated solute molecules ΔH_2
(iii) Separated solvent and solute molecules → solution ΔH_3
Solution so formed will be ideal if :

(A) $\Delta H_{soln} = \Delta H_3 - \Delta H_1 - \Delta H_2$ (B) $\Delta H_{soln} = \Delta H_1 + \Delta H_2 + \Delta H_3$
(C) $\Delta H_{soln} = \Delta H_1 + \Delta H_2 - \Delta H_3$ (D) $\Delta H_{soln} = \Delta H_1 - \Delta H_2 - \Delta H_3$

9. A solution is obtained by dissolving 12 g of urea (mol. wt. 60) in a litre of water. Another solution is obtained by dissolving 68.4 g of cane sugar (mol. wt. 342) in a litre of water at are the same temperature. The lowering of vapour pressure in the first solution is : ***[CPMT 2001]***

(A) Same as that of 2nd solution (B) Nearly one-fifth of the 2nd solution
(C) Double that of 2nd solution (D) Nearly five times that of 2nd solution

10.* Toluene and benzene form an ideal solution over the whole range of composition. Two different solutions are made, solution I is one molar and solution II is one molal with respect to toluene. Assume both solutions to have same density (0.08 g/ml), then : ***[IIT Screening Paper 1992]***

(A) Solution I will have lower freezing point than solution II
(B) Solution I and II have the same freezing point
(C) The depression in the freezing point of solution I will be less than that of solution II with respect to the pure solvent
(D) The boiling point of solution I will be higher than that of solution II

11.* At 35°C, the vapour pressure of CS_2 is 512 mm Hg, and acetone is 344 mm Hg. A solution of CS_2 and acetone in, which the mol fraction of CS_2 is 0.25, has a total vapour pressure of 600 mm Hg. Which of the following statements is/are correct :

(A) A mixture of 100 mL of acetone and 100 mL of has a volume of 200 mL
(B) When acetone and are mixed at 35°C, heat must be absorbed in order to produce a solution at 35°C
(C) When acetone and are mixed at 35°C, heat is released
(D) There is negative deviation from Raoult's law

ANSWER KEY

DPP NO. # 08

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

DPP NO. # 09

1.	(D)	**2.**	(C)	**3.**	(B)	**4.**	(D)	**5.**	(C)	**6.**	(B)	**7.**	(C)
8.	(D)	**9.**	(B)	**10.***	(A(D)	**11.***	(CD)						

DPP NO. # 10

1.	(B)	**2.**	(B)	**3.**	(A)	**4.**	(C)	**5.**	(C)	**6.**	(D)	**7.**	(B)
8.	(B)	**9.**	(A)	**10.***	(AD)	**11.***	(BD)						

COURSE NAME : URJAA (UR) **DATE : 26.08.2013 to 31.08.2013** **DPP NO. 21 & 22**

*** Marked Questions are having more than one correct option.**

DPP No. # 21

1.* 1 M of glucose ($C_6H_{12}O_6$) solution (density = 1.18 g/ml) is equivalent to which of the following solution
(A) % w/w = 18% (solution) (B) 180 g solute per litre solution
(C) % w/v = 18% (solution) (D) 1 molal solution

2.* Which of the following molarity values of ions in a aqueous solution of 5.85 % w/v NaCl, 5.55% w/v $CaCl_2$ and 6% w/v NaOH are correct [Na = 23, Cl = 35.5, Ca = 40, O = 16]
(A) $[Cl^{-1}]$ = 2M (B) $[Na^+]$ = 1M (C) $[Ca^{2+}]$ = 0.5 M (D) $[OH^-]$ = 1.5 M

3. If 20 ml of 0.5 M Na_2SO_4 is mixed with 50 ml of 0.2 M H_2SO_4 & 30 ml of 0.4 M $Al_2(SO_4)_3$ solution, calculate. $[Na^+]$, $[H^+]$, $[SO_4^{2-}]$, $[Al^{3+}]$. Assuming 100% dissociation.

4. Calculate the osmotic pressure of a decimolar solution of cane sugar at 27°C.

5. An aqueous solution contains 18 g of glucose (mol wt. = 180) per 0.5 L. Assuming the solution to be ideal, calculate osmotic pressure at 27°C.

6. A solution of 1.73 g of 'A' in 100 cc of water is found to be isotonic with a 3.42% (weight/volume) solution of sucrose ($C_{12}H_{22}O_{11}$) Calculate molecular weight of A (given molecular weight of $C_{12}H_{22}O_{11}$ = 342)

7. At 12°C the osmotic pressure of a urea solution is 500 mm. The solution is diluted and the temperature is raised to 27°C, when the osmotic pressure is found to be 100 mm. Determine the extent of dilution.

8. A membrane permeable only to water separates a 0.01 M solution of sucrose from a 0.001 M solution. On which solution must pressure be applied to bring the system into equilibrium? Find this pressure if the T = 300 K.

9.

Column (I)	**Column (II)**
(A) 50 ml of 3M HCl + 150 ml of 1M $FeCl_3$	(p) 1.85 m
(B) mole fraction of NaCl in aqueous solution of NaCl is 0.1 then molality of the solution is	(q) $[Cl^-]$ = 3 M
(C) 10%(w/w) propanol (C_3H_7OH) solution has molality	(r) $[H^+]$ = 0.75 M
(D) 10.95% (w/v) HCl	(s) 6.1 m

DPP No. # 22

1. What weight of glucose, dissolved in 100 grams of water, will produce the same lowering of vapour pressure as one gram of urea dissolved in 50 grams of water, at the same temperature?
(A) 3 gms (B) 5 gms (C) 6 gms (D) 4 gms

2. In which case van't Hoff factor is maximum ?
(A) KCl, 50% ionised (B) K_2SO_4, 40% ionised (C) $SnCl_4$, 20% ionised (D) $FeCl_3$, 30% ionised

3. Solution having osmotic pressure nearer to that of an equimolar solution of $K_4[Fe(CN)_6]$ is:
(A) Na_2SO_4 (B) $BaCl_2$ (C) $Al_2(SO_4)_3$ (D) $C_{12}H_{22}O_{11}$

4. Osmotic pressure [atm] of a 0.1 M solution of $K_4[Fe(CN)_6]$, which undergoes 50% dissociation, will be ________ atm at 27^0C.
(A) 7.38 (B) 3.69 (C) 405.9 (D) none of these

5. Two aqueous solutions, one of the NaCl in water (A) and the other of $C_8H_{15}O_2Na$ in water (B) are isotonic. If w_A and w_B are weight fractions of NaCl and $C_8H_{15}O_2Na$ in solution A and B respectively, then (assuming that both the salts dissociate completely) :
(A) $w_A > w_B$ (B) $w_A = w_B$ (C) $w_A < w_B$ (D) none of these

6. Assuming the salts to be completely ionized in solution, which of the following has highest osmotic pressure at same temperature.
(A) 1% CsCl w/w (B) 1% RbCl w/w (C) 1% KCl w/w (D) 1% NaCl w/w

7.* In which of the following pairs of solutions will the values of the van't Hoff factor be the same?
(A) 0.05 M $K_4[Fe(CN)_6]$ and 0.10 M $FeSO_4$.
(B) 0.10 M $K_4[Fe(CN)_6]$ and 0.05 M $FeSO_4.(NH_4)_2SO_4.6H_2O$.
(C) 0.20 M NaCl and 0.10 M $BaCl_2$
(D) 0.05 M $FeSO_4.(NH_4)_2SO_4.6H_2O$ and 0.02 M $KCl . MgCl_2 . 6H_2O$

8.* Consider the following solution in water
(I) 1 M Sucorse (II) 1 M KCl (III) 1M Benzoic acid (IV) 1 M $(NH_4)_3PO_4$
Which of the following is/are true :
(A) All solutions are isotonic (B) III is hypertonic of II, IV
(C) I, II and III are hypotonic of IV (D) IV is hypertonic of I, II and III

9.

	Column-I **(Solute)**		**Column-II** **(van't Hoff factor, i)**
(A)	$AlCl_3$ if $\alpha = 0.8$.	(p)	i = 2.8.
(B)	$BaCl_2$ if $\alpha = 0.9$.	(q)	i = 3.4.
(C)	Na_3PO_4 if $\alpha = 0.9$.	(r)	i = 3.8.
(D)	$K_4[Fe(CN)_6]$ if $\alpha = 0.7$.	(s)	i = 3.7.

10.

Column-I	**Column-II**
(A) π_1 : 0.1M glucose ; π_2 : 0.1 M urea.	(p) π_1 and π_2 are isotonic.
(B) π_1 : 0.1M NaCl ; π_2 : 0.1M Na_2SO_4.	(q) No net migration of solvent across the membrane.
(C) π_1 : 0.1M NaCl ; π_2 : 0.1 M KCl	(r) π_1 is hypertonic to π_2 .
(D) π_1 : 0.1 M $CuSO_4$; π_2 : 0.1 M sucrose	(s) π_1 is hypotonic to π_2

ANSWER KEY

DPP No. # 21

1.* (BCD) **2.*** (ACD) **3.** 0.56 M **4.** 2.46 atm **5.** 4.92 atm.

6. 173. **7.** 5.3. **8.** 0.22 atm. **9.** [A – q, r] ; [B – s] ; [C – p] ; [D – q].

DPP No. # 22

1. (C) **2.** (D) **3.** (C) **4.** (A) **5.** (C) **6.** (D)

7.* (BD) **8.*** (CD) **9.** [A – q] ; [B – p] ; [C – s] ; [D – r]

10. [A – p,q] ; [B – s] ; [C – p,q] ; [D – r]

TARGET
JEE (ADVANCED) : 2015

PHYSICAL CHEMISTRY
DAILY PRACTICE PROBLEMS
D P P

COURSE NAME : URJAA (UR) **DATE : 02.09.2013 to 07.09.2013** **DPP NO. 23 & 24**

*** Marked Questions are having more than one correct option.**

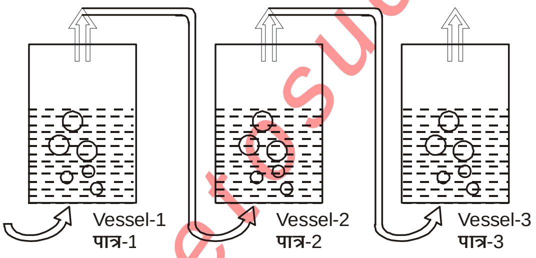
DPP No. # 23

1.* Which is the correct relation between osmotic pressure of 0.1 M NaCl solution & 0.1 M Na_2SO_4 solution :
(A) the osmotic pressure of Na_2SO_4 is less than NaCl solution
(B) the osmotic pressure of Na_2SO_4 is more than NaCl solution
(C) the osmotic pressure of Na_2SO_4 is 1.5 times that of NaCl solution
(D) the osmotic pressure of NaCl is 1.5 times that of Na_2SO_4 solution

2. Three solutions are prepared by adding 'w' gm of 'A' into 1kg of water, 'w' gm of 'B' into another 1 kg of water and 'w' gm of 'C' in another 1 kg of water (A, B, C are non electrolytic). Dry air is passed from these solutions in sequence ($A \longrightarrow B \longrightarrow C$). The loss in weight of solution A was found to be 2 gm while solution B gained 0.5 gm and solution C lost 1 gm. Then the relation between molar masses of A, B and C is :

(A) $M_A : M_B : M_C = 4 : 3 : 5$
(B) $M_A : M_B : M_C = \frac{1}{4} : \frac{1}{3} : \frac{1}{5}$
(C) $M_C > M_A > M_B$
(D) $M_B > M_A > M_C$

3.* Dry air is slowly passed through three solutions of different concentrations, c_1, c_2 and c_3 ; each containing (non volatile) NaCl as solute and water as solvent, as shown in the Fig. If the vessel 2 gains weight and the vessel 3 loses weight, then



(A) $c_1 > c_2$ (B) $c_1 < c_2$ (C) $c_1 < c_3$ (D) $c_2 > c_3$

4. A solution is prepared by dissolving 10 g of nonvolatile solute in 180 g of H_2O. If the relative lowering of vapour pressure is 0.005, find the mol. wt of the solute.

5. 1M of glucose solution has a freezing point of -1.86^0C. If 10 ml of 1M glucose is mixed with 30ml of 3M glucose, then the resultant solution will have a freezing point of
(A) -2.79^0C (B) -4.65^0C (C) -5.58^0C (D) -7.44^0C

6. 20g of a binary electrolyte (molecular weight = 100) are dissolved in 500 g of water. The freezing point of the solution is $-$ 0.74°C ; $K_f = 1.86$ K molality^{-1}. The degree of dissociation of electrolyte is
(A) 50% (B) 75% (C) 100% (D) Zero

7. 2.56g of sulfur in 100g of CS_2 has depression in freezing point of 0.01^0C.$K_f = 0.1^0$molal^{-1}. Hence, the atomicity of sulfur in CS_2 is
(A) 2 (B) 4 (C) 6 (D) 8

8. A solute'S' undergoes a reversible trimerization when dissolved in a certain solvent. The boiling point elevation of its 0.1 molal solution was found to be identical to the boiling point elevation in case of a 0.08 molal solution of a solute which neither undergoes association nor dissociation. To what percent had the solute 'S' undergone trimerization?
(A) 30% (B) 40% (C) 50% (D) 60%

9. 1g of arsenic dissolved in 86 g of benzene brings down the freezing point to 5.31 °C from 5.50 °C. If K_f of benzene is 4.9 $\frac{°C}{m}$, the atomicity of the molecule is : (As – 75)

(A) 8 (B) 2 (C) 3 (D) 4

10. **Statement-1 :** The freezing point of water is depressed by the addition of glucose.
Statement-2 : Entropy of solution is less than entropy of pure solvent.
(A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
(B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1
(C) Statement-1 is True, Statement-2 is False
(D) Statement-1 is False, Statement-2 is True

DPP No. # 24

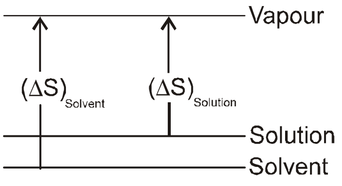
1. Liquids A and B form an ideal solution. At a certain temperature, the total vapour pressure of a mixture of A and B is 400 mm. The mole fraction of A in the liquid mixture, in equilibrium with the vapour phase, is 0.4. If the vapour pressure ratio (P_A^0/P_B^0) for the pure liquids at this temperature is 1/6, what is the partial pressure of A in the vapour phase?

(A) 50mm (B) 60mm (C) 70mm (D) 40mm

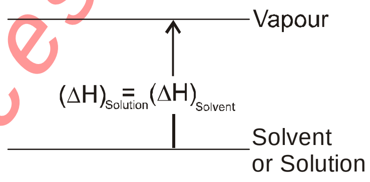
2. Mixture of volatile components A and B has total vapour pressure (in Torr) $p = 254 - 119\, x_A$, where x_A is mole fraction of A in mixture. Hence p_A^0 and p_B^0 are (in Torr)

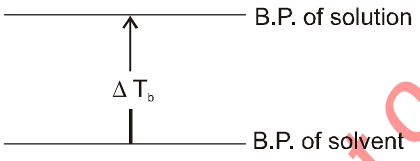
(A) 254, 119 (B) 119, 254 (C) 135, 254 (D) 119, 373

3. Which represents correct difference when non-volatile solute is present in an ideal solution ?

(I)


;

(II)


(III)


(A) I, II, III (B) I, III (C) II, III (D) I, III

4.* Which of the following are true for ideal solutions :

(A) $\Delta V_{mix} = 0$ (B) $\Delta H_{mix} = 0$ (C) $\Delta S_{mix} = 0$ (D) $\Delta G_{mix} = 0$
(E) Raoult's law is obeyed for entire concentration range and temperatures.

Comprehension #

Read the following comprehension carefully and answer the questions (5 to 9).

A system of greater disorder of molecules is more probable. The disorder of molecules is reflected by the entropy of the system. A liquid vaporises to form a more disordered gas. When a solute is present, there is additional contribution to the entropy of the liquid due to increased randomness. As the entropy of solution is higher than that of pure liquid, there is weaker tendency to form the gas. Thus, a solute (non volatile) lowers the vapour pressure of a liquid, and hence a higher boiling point of the solution.
Similarly, the greater randomness of the solution opposes the tendency to freeze. In consequence, a lower the temperature must be reached for achieving the equilibrium between the solid (frozen solvent) and the solution. Elevation of B.Pt. (ΔT_b) and depression of F.Pt. (ΔT_f) of a solution are the colligative properties which depend only on the concentration of particles of the solute, not their identity. For dilute solutions, ΔT_b and ΔT_f are proportional to the molality of the solute in the solution.

$\Delta T_b = K_b m$ $\quad K_b$ = Ebullioscopic constant = $\dfrac{RT_b^{o2} M}{1000\, \Delta H_{vap}}$

And $\Delta T_f = K_f m$ K_f = Cryoscopic constant = $\dfrac{RT_f^{o2} M}{1000\ \Delta H_{fus}}$ (M = molecular mass of the solvent)

The values of K_b and K_f do depend on the properties of the solvent. For liquids, $\dfrac{\Delta H_{vap}}{T_b^{\circ}}$ is almost constant.[**Troutan's Rule**, this constant for most of the **unassociated liquids**(not having any strong bonding like Hydrogen bonding in the liquid state) is equal to 90 J/mol.]
For solutes undergoing change of molecular state is solution (ionization or association), the observed ΔT values differ from the calculated ones using the above relations. In such situations, the relationships are modified as $\Delta T_b = i\, K_b\, m$; $\Delta T_f = i\, K_f\, m$
where i = Van't-Hoff factor, greater than unity for ionization and smaller than unity for association of the solute molecules.

5. Depression of freezing point of which of the following solutions does represent the cryoscopic constant of water?
(A) 6% by mass of urea is aqueous solution
(B) 100g of aqueous solution containing 18 g of glucose
(C) 59 g of aqueous solution containing 9 g of glucose
(D) 1 M KCl solution in water.

6. Dissolution of a non-volatile solute into a liquid leads to the -
(A) decrease of entropy
(B) increase in tendency of the liquid to freeze
(C) increases in tendency to pass into the vapour phase.
(D) decrease in tendency of the liquid to freeze

7. To aqueous solution of NaI, increasing amounts of solid HgI_2 is added. The vapor pressure of the solution
(A) decreases to a constant value
(B) increases to a constant value
(C) increases first and then decreases
(D) remains constant because HgI_2 is sparingly soluble in water.

8. A liquid possessing which of the following characteristics will be most suitable for determining the molecular mass of a compound by cryoscopic measurements?
(A) That having low freezing point and small enthalpy of freezing
(B) That having high freezing point and small enthalpy of freezing
(C) That having high freezing point and small enthalpy of vaporisation
(D) That having large surface tension

9. A mixture of two immiscible liquids at a constant pressure of 1 atm boils at a temperature
(A) equal to the normal boiling point of more volatile liquid
(B) equal to the mean of the normal boiling points of the two liquids
(C) greater than the normal boiling point of either of the liquid
(D) smaller than the normal boiling point of either of the liquid.

ANSWER KEY

DPP No. # 23

1.*	(BC)	**2.**	(C)	**3.***	(BD)	**4.**	M = 199.	**5.**	(B)	**6.**	(D)
7.	(D)	**8.**	(A)	**9.**	(D)	**10.**	(C)				

DPP No. # 24

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

TARGET
JEE (ADVANCED) : 2015

PHYSICAL CHEMISTRY
DAILY PRACTICE PROBLEMS
D P P

COURSE NAME : URJAA (UR) **DATE : 09.09.2013 to 14.09.2013** **DPP NO. 25 & 26**

*** Marked Questions are having more than one correct option.**

DPP No. # 25

1. How many grams of NaCl must be dissolved in 225 g of water to yield a solution having the same boiling point as that containing 20 g glucose (M – 180) and 30 g sucrose (M – 342) in 225 g of water? (Na – 23, Cl – 35.5)

(A) 5.8 (B) 11.6 (C) 12.3 (D) None of these

2. A solution of 0.2 mole KI (α = 100%) in 1000 g water freezes at T_1 °C. Now to this solution 0.1 mole HgI_2 is added and the resulting solution freezes at T_2 °C. Which of the following is correct :

(A) $T_1 = T_2$ (B) $T_1 > T_2$ (C) $T_1 < T_2$ (D) Cannot be predicted.

3. 0.1 mole of which of the following when added to 1 L water, the aqueous solution obtained will have the lowest freeing point?

(A) $C_6H_5NH_3Cl$ (B) $K_3[Fe(CN)_6]$ (C) $K_4[Fe(CN)_6]$ (D) $Al(NO_3)_3$.

4. An electrolyte A gives 3 ions and B is a non-electrolyte. If 0.1 M solution of B produces an osmotic pressure P, then 0.05 M solution of A will produce an osmotic pressure, assuming that the electrolyte is completely ionised -

(A) 1.5 P (B) P (C) 0.5 P (D) 0.75 P

5. How many mmoles of sucrose should be dissolved in 500 gms of water so as to get a solution which has a difference of 103.57°C between boiling point and freezing point.
(K_f = 1.86 K Kg mol^{-1}, K_b = 0.52 K Kg mol^{-1})

(A) 500 mmoles (B) 900 mmoles (C) 750 mmoles (D) 650 mmoles

6. In an ideal mixture of liquids A and B the mole fraction of A is 0.25. If the ratio of P_A^0 to P_B^0 is 7/3, how many repeated distillations would be required as a "minimum" to obtain a small quantity of distillate which has a mole fractionof A, better than 0.80?

(A) 4 (B) 2 (C) 3 (D) 5

7.* Two liquids A and B form an ideal solution. The solution has a vapor pressure of 700 Torr at 80°C. It is distilled till 2/3rd of the solution is collected as condensate. The composition of the condensate is $x'_A = 0.75$ and that of the residue is $x''_A = 0.30$. If the vapor pressure of the residue at 80°C is 600 Torr, which of the following is/are true?

(A) The composition of the original liquid was $x_A = 0.6$. (B) $P_A^0 = \dfrac{2500}{3}$ Torr.

(C) The composition of the original liquid was $x_A = 0.4$. (D) $P_B^0 = 500$ Torr.

8. To 100g of water some ethylene glycol ($\begin{matrix} CH_2OH \\ | \\ CH_2OH \end{matrix}$) was added and the solution was cooled to –10°C when 20g of ice was separated. What was the amount of ethylene glycol added to water? What will be its boiling point? (K_f for water is 1.86 and K_b is 0.513).

9. What is the degree of dissociation of trichloroacetic acid, if its 1.0 m solution has a freezing point of – 2.53 °C? $K_f = 1.86\ \dfrac{K}{molal}$

10.

	Column-I		**Column-II**
(A)	0.1 M $Al_2(SO_4)_3$	(p)	Solution with highest boiling point.
(B)	0.1 M $AlPO_4$	(q)	Van't Hoff factor is greater than 1.
(C)	0.1 M urea.	(r)	Solution with lowest osmotic pressure.
(D)	0.1 M $MgCl_2$	(s)	Solution with lowest freezing point.

DPP No. # 26

1. The osmotic pressure of equimolar solutions of $BaCl_2$, NaCl and glucose will be in the order
(A) glucose > NaCl > $BaCl_2$
(B) $BaCl_2$ > NaCl > glucose
(C) NaCl > $BaCl_2$ > glucose
(D) NaCl > glucose > $BaCl_2$

2. A 0.004 M solution of Na_2SO_4 is isotonic with 0.010 M solution of glucose at same temperature. The apparent percentage dissociation of Na_2SO_4 is -
(A) 25%
(B) 50%
(C) 75%
(D) 85%

2. Two liquids 'A' and 'B' are mixed in the molar ratio of 1 : 2 and the vapour pressure of the solution is 24 torr. When the two liquids are mixed in the reverse ratio, the vapour pressure of the solution increases by a fraction of $\frac{1}{4}$. The vapour pressures of pure 'A' and 'B' are respectively.
(A) 20 torr, 40 torr
(B) 40 torr, 20 torr
(C) 36 torr, 18 torr
(D) 18 torr, 36 torr

3. Two liquids X and Y are perfectly immiscible. If X and Y have molecular masses in ratio 1:2, the total vapour pressure of a mixture of X and Y prepared in weight ratio 2:3 should be (P_X^0 = 400 torr, P_Y^0 = 200 torr)
(A) 300 torr
(B) 466.7 torr
(C) 600 torr
(D) 700 torr

Comprehension # (Q.4 to Q.6)

Properties, whose values depend only on the concentration of solute particles in solution and not on the identity of the solute are called colligative properties. There may be change in number of moles of solute due to ionisation or association hence these properties are also affected. Number of moles of the product is related to degree of ionisation or association by vant Hoff factor 'i'

given by $i = [1 + (n - 1)\alpha]$ for dissociation

where n is the number of products (ions or molecules) obtained per mole of the reactant.

& $i = \left[1 + \left(\frac{1}{n} - 1\right)\alpha\right]$ for association

where n is number of reactant particles associated to give 1 mole product.
A dilute solution contains 't' moles of solute X in 1 Kg of solvent with molal elevation constant K_b . The solute dimerises in the solution according to the following equation. The degree of association is α .

$$2X \rightleftharpoons X_2$$

4. The vant Hoff factor will be [if we start with one mole of X]
(A) $i = 1 - 2\alpha$
(B) $i = 1 - \alpha/2$
(C) $i = 1 + \alpha/2$
(D) $i = 1 + \alpha$

5. The colligative properties observed will be
(A) $\Delta P_{theo} > \Delta P_{actual}$
$\Delta T_{b(theo)} > \Delta T_{b(actual)}$
$\Delta T_{f(theo)} > \Delta T_{f(actual)}$
(B) $\Delta P_{theo} = \Delta P_{actual}$
$\Delta T_{b(theo)} = \Delta T_{b(actual)}$
$\Delta T_{f(theo)} = \Delta T_{f(actual)}$
(C) $\Delta T_{b(theo)} < \Delta T_{b(actual)}$
$\Delta T_{f(theo)} < \Delta T_{f(actual)}$
$\Delta P_{theo} < \Delta P_{actual}$
(D) $\Delta P_{theo} \geq \Delta P_{actual}$
$\Delta T_{b(theo)} = \Delta T_{b(actual)}$
$\Delta T_{f(theo)} < \Delta T_{f(actual)}$

6. The equilibrium constant for the process can be expressed as

(A) $K = \dfrac{K_b \dfrac{t}{\Delta T_b}}{1 - \dfrac{K_b t}{\Delta T_f}}$ (B) $K = \dfrac{K_b\left(K_b t - \Delta T_b\right)}{[2\Delta T_b - K_b t]^2}$ (C) $K = \dfrac{2\left(K_{bt} - \Delta Tb\right)/\Delta T_b}{2t\left[1 - \dfrac{2(K_b t - \Delta T_b)^2}{\Delta T_b}\right]}$ (D) $K = \dfrac{\Delta T_{bobs}}{\Delta T_{fobs}}$

7. A 0.01 m solution of NH_4Cl (M – 53.5) solidifies at – 0.0358°C. Determine the degree of dissociation in this solution and the apparent molar mass of the salt if $K_f = 1.86 \dfrac{K}{kg - mol}$ for water ?

8. Calculate the molecular weight of cellulose acetate if its 0.2% (wt./vol.) solution in acetone (sp. gr. 0.8) shows an osmotic rise of 2.58 cm against pure acetone at 27°C.

9. If cost per gram were not a concern, which of the following substances would be the most efficient per unit mass for melting snow from side walks and roads : glucose, LiCl, NaCl, $CaCl_2$?
[C – 12, O – 16, Li – 7, Cl – 35.5, Na – 23, Ca – 40]

10. **Match the following :**

Column-I	**Column-II**
(A) n-hexane + n-heptane.	(p) Can be separated by fractional distillation.
(B) Acetone + chloroform	(q) Maximum boiling azeotrope.
(C) Chloro-benzene and bromo-benzene	(r) Cannot be separated by fractional distillation completely.
(D) Ethanol + water.	(s) Minimum boiling azeotrope.

ANSWER KEY

DPP No. # 25

1.	(A)	**2.**	(C)	**3.**	(C)	**4.**	(A)	**5.**	(C)	**6.**	(C)
7.*	(ABD)	**8.**	102.76ºC	**9.**	a = 0.36.	**10.**	(A) p,q,s ; (B) q ; (C) r ; (D) q.				

DPP No. # 26

1.	(B)	**2.**	(C)	**2.**	(C)	**3.**	(C)	**4.**	(B)	**5.**	(A)
6.	(B)	**7.**	0.9247, 27.796 g/mole.	**8.**	M = 24,600	**9.**	LiCl				
10.	(A) p ; (B) q,r ; (C) p ; (D) r,s										