



## CHEMISTRY

### BOOKS - PATHFINDER CHEMISTRY (BENGALI ENGLISH)

## SOLUTION

#### Question Bank

1. What is the van't Hoff factor of benzoic acid if it undergoes dimerisation to the extent of 99 % in benzene?

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2. An X molal solution of a compound in benzene has mole fraction equal to 0.2. What is the value of X?

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3. The vapour pressure of a solvent decreases by 10 mm of Hg when a non-volatile solute is added to it. The mole fraction of the solute in solution is equal to 0.2. What should be the mole fraction of solvent if the decrease in vapour pressure is to be 20 mm Hg?

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4. A 500g tooth paste sample 0.3 g fluoride. What is the concentration of fluoride in ppm?

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5. Which colligative property is most suitable for the determination of molecular masses of polymer?

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6. Name any two compounds which can be used as semipermeable membrane.

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7.  $FeCl_3$  on reaction with  $K_4[Fe(CN)_6]$  in aqueous solution gives blue colour. These are separated by a semipermeable membrane into side X containing  $0.01MK_4[Fe(CN)_6]$  and side Y containing  $0.01MFeCl_3$ . Will there be any appearance of blue colour in side X?

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8. Why do aquatic species feel more comfortable in the lakes in winter than in summer?

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9. Why is care taken in intravenous injection to have comparable concentration of solution to be injected to blood plasma?

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10. Addition of  $HgI_2$  to an aqueous solution of KI shows an increase in vapour pressure. Why?

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11.  $FeCl_3$  on reaction with  $K_4[Fe(CN)_6]$  in aqueous solution gives blue colour. These are separated by a semipermeable membrane into side X containing  $0.01MK_4[Fe(CN)_6]$  and side Y containing  $0.01MFeCl_3$ . Will there be any appearance of blue colour in side X?

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12. Equimolar solution of NaOH and urea are not isotonic. Explain.

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13. A storage battery contains a solution of  $H_2SO_4$  38 % by weight. At this concentration, van't Hoff factor is 2.5. At what temperature will the battery contents freeze? ( $k_f$  for water =  $1.86 K kg mol^{-1}$ )

- A.
- B.
- C.
- D.

**Answer:**

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14. Calculate the amount of ice that will separate out on cooling a solution containing 50g ethylene glycol in 200g water to  $-9.3^{\circ}\text{C}$ . ( $k_f$  for water =  $1.86\text{Kkgmol}^{-1}$ )

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15. If  $N_2$  is bubbled through water at 293 K, how many milli moles of  $N_2$  gas would dissolve in 1 litre of water. Assume that  $N_2$  exerts a partial pressure of 0.987 bar. Given that Henry's law constant for  $N_2$  at 293 K is 76.48 k bar.

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16. At  $80^{\circ}\text{C}$ , the vapour pressure of pure liquid 'A' is 50 mm Hg and that of pure liquid 'B' is 1000 mm Hg. If a solution of 'A' and 'B' boils at  $80^{\circ}\text{C}$  and 1 atm pressure find the amount of 'A' in the mixture in mol fraction.

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17. Mixture of chloroform and acetone shows a negative deviation from Raoult's law. Explain.

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18. What volume of 95 % sulphuric acid (density  $1.85\text{gcm}^{-3}$ ) and what mass of water must be taken to prepare  $100\text{cm}^3$  of 15 % solution of sulphuric acid ( $d = 1.1\text{gcm}^{-3}$ )?

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19. Show graphically how the vapour pressures of a solvent and a solution of a non-volatile solute in it change with temperature. Show on the graph boiling point of the solvent and the solution. Which is higher and why?

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20. Why does a solution of non-volatile solute freeze at a lower temperature? Draw a neat diagram to prove your point.

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21. What do you mean by Raoult's law? What are the limitations of Raoult's law?

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22. What is reverse osmosis?

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23. At 298 K, 100 cm<sup>3</sup> of a solution containing 3.02 g of an unidentified solute exhibits an osmotic pressure of 2.55 atmosphere. What is the molecular mass of solute?



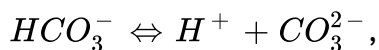
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24. Two liquids X and Y on mixing form an ideal solution. At  $30^{\circ}C$ , the vapour pressure of the solution containing 3 mol of X and 1 mol of Y is 550 mm Hg. But when 4 mol of X and 1 mol of Y are mixed, the vapour pressure of the solution thus formed is 560 mm Hg. What would be the vapour pressure of pure X and Y at this temperature?

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25. The freezing point of 0.08 molal solution of  $NaHCO_3$  is 272.8 K.

Calculate the dissociation constant for the reaction



$$K_f(H_2O) = 1.86 K mol^{-1}$$

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26. Why it takes more time to cook a vegetable in hills than in plains?



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27. The boiling point of a solution containing 1.5 g of dichlorobenzene in 100 g of benzene was higher by  $0.268^{\circ}C$ . Calculate the molar mass of dichlorobenzene.  $K_b$  for benzene =  $2.42Kkgmol^{-1}$



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28. Will 1 molal aqueous solution of  $NaCl$ ,  $BaCl_2$ ,  $AlCl_3$  and sugar have same boiling point? Explain.



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29. Calculate the mass percentage of benzene ( $C_6H_6$ ) and carbon tetrachloride ( $CCl_4$ ) if 22g of benzene is dissolved in 122g of carbon tetrachloride.



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**30.** Calculate the mole fraction of benzene in solution containing 30% by mass in carbon tetrachloride.

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**31.** Calculate the molarity and normality of a solution containing 5g  $Na_2CO_3$  in 250 mL solution.

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**32.** Calculate the mass of urea ( $NH_2CONH_2$ ) required in making 2.5 kg of 0.25 molal aqueous solution.

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**33.** Henry's law constant for  $CO_2$  in water is  $1.67 \times 10^8$  Pa at 298 K. Calculate the quantity of  $CO_2$  in 500 mL of soda water packed under 2.5 atm  $CO_2$  pressure at 298 K.

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**34.** Vapour pressure of chloroform ( $CHCl_3$ ) and dichloromethane ( $CH_2Cl_2$ ) at 298 K are 200 mm Hg and 415 mm Hg respectively.

Calculate the vapour pressure of the solution prepared by mixing 25.5 g of  $CHCl_3$  and 40 g of  $CH_2Cl_2$  at 298 K and,

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**35.** A solution containing 30 g of non-volatile solute exactly in 90 g of water has a vapour of 2.8 kPa at 298 K. Further, 18g of water is then added to the solution and the new vapour pressure becomes 2.9 kPa at 298 K. Calculate,  
molar mass of the solute



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**36.** A solution containing 30 g of non-volatile solute exactly in 90 g of water has a vapour of 2.8 kPa at 298 K. Further, 18g of water is then added to the solution and the new vapour pressure becomes 2.9 kPa at 298 K. Calculate,  
molar mass of the solute



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**37.** A mixture of chloroform and acetone shows negative deviation from Raoult's law. Explain it



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**38.** The vapour pressure of pure liquids A and B are 450 and 700mm Hg respectively, at 350K. Find out the composition of the liquid mixture if

total vapour pressure is 600 mm Hg. Also find the composition of the vapour phase.

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**39.** The vapour pressure of pure benzene at a certain temperature is 0.850 bar. A non-volatile, non-electrolyte solid weighing 0.5 g when added to 39.0 g of benzene (molar mass  $78 \text{ g mol}^{-1}$ ), vapour pressure of the solution, then, is 0.845 bar. What is the molar mass of the solid substance ?

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**40.** Vapour pressure of pure water at 298 K is 23.8 mm Hg. 50 g of urea ( $\text{NH}_2\text{CONH}_2$ ) is dissolved in 850 g of water. Calculate the vapour pressure of water for the solution and its relative lowering.

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41. Boiling point of water at 750 mm Hg is  $99.63^{\circ}C$ . How much sucrose is to be added to 500 g of water such that it boils at  $100^{\circ}C$  ?

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42. Calculate the mass of ascorbic acid (Vitamin C,  $C_6H_8O_6$ ) to be dissolved in 75 g of acetic acid to lower its melting by  $1.5^{\circ}C$ .  $K_f = 3.9Kkgmol^{-1}$ .

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43. 0.6 mL of acetic acid ( $CH_3COOH$ ), having density  $1.06gmL^{-1}$ , is dissolved in 1 litre of water. The depression in freezing point observed for this strength of acid was  $0.0205^{\circ}C$ . Calculate the van't Hoff factor and the dissociation constant of acid

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44. 2g of benzoic acid ( $C_6H_5COOH$ ) dissolved in 25 g of benzene shows a depression in freezing point equal to 1.62 K. Molal depression constant for benzene is  $4.9\text{kgmol}^{-1}$ . What is the percentage association of acid if it forms dimer in solution ?

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45. Calculating the osmotic pressure in pascals exerted by a solution prepared by dissolving 1.0 g of a polymer of molar mass 185,000 in 450 mL of water at  $37^\circ C$ .

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46. The vapour pressure of a given liquid will decrease if :

- A. surface area of liquid is decreased
- B. the volume of liquid in the container is decreased
- C. the volume of the vapour phase is increased



D. the temperature is decreased

**Answer:**

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47. Raoult's law is obeyed by each constituent of a binary liquid solution when :

- A. the force of attraction between like molecules are greater than those between unlike molecules
- B. the force of attraction between like molecules are smaller than those between unlike molecules
- C. the force of attraction between like molecules are identical with those between unlike molecules
- D. the volume occupied by unlike molecules are different

**Answer:**



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**48.** For a dilute solution, Raoult's law states that :

- A. the lowering of vapour pressure is equal to the mole fraction of solute
- B. the relative lowering of vapour pressure is equal to the mole fraction of solute.
- C. the relative lowering of vapour pressure is proportional to the amount of solute in solution
- D. the vapour pressure of the solution is equal to the mole fraction of solvent

**Answer:**



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49. 6.0 g of urea (molecular weight=60) was dissolved in 9.9 moles of water. If the vapour pressure of pure water is  $P^\circ$ , the vapour pressure of solution is :

A.  $0.10P^\circ$

B.  $1.10P^\circ$

C.  $0.90P^\circ$

D.  $0.99P^\circ$

**Answer:**

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50. The vapour pressure of an aqueous solution of sucrose at 373 K is found to be 750 mm Hg. The molality of the solution at the same temperature will be :

A. 0.26

B. 0.73

C. 0.74

D. 0.039

**Answer:**



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51. If two liquid A and B form minimum boiling azeotrope at same specific composition then

A. A-B interactions are stronger than those between A-A or B-B

B. Vapour pressure of solution increases because more number of molecules of liquid A and B can escape from the solution.

C. Vapour pressure of solution decreases because less number of molecules of only one of the liquids escape from the solution

D. A-B interaction are weaker than those between A-A or B-B

**Answer:**

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52. On adding acetone to methanol some of the hydrogen bonds between methanol molecules break. Hence

A. at specific composition, methanol-acetone mixture will form minimum boiling azeotrope and will show positive deviation from Raoult's law

B. at specific composition, methanol-acetone mixture will form maximum boiling azeotrope and will show positive deviation from Raoult's law

C. at specific composition, methanol-acetone mixture will form minimum boiling azeotrope and will show negative deviation from Raoult's law

D. at specific composition, methanol-acetone mixture will form maximum boiling azeotrope and will show negative deviation from Raoult's law

**Answer:**

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53. Which of the following solutions can be separated into its pure components by fractional distillation ?

A. Benzene-toluene

B. Water- $HNO_3$

C. Water-HCl

D. Water- $C_2H_5OH$

**Answer:**

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54. A solution is made by mixing the two components. It is said to be ideal if

- A.  $\Delta V = 0$ ,  $\Delta H = +V_e$ , Raoult's law is obeyed
- B.  $\Delta V = +V_e$ ,  $\Delta H = -V_e$ , Raoult's law is obeyed
- C.  $\Delta V = 0$ ,  $\Delta H = 0$ , Raoult's law is obeyed
- D.  $\Delta V = 0$ ,  $\Delta H = -V_e$ , Raoult's law is obeyed

**Answer:**



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55. Select correct statements):

- A. Heat of evaporation 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 smaller than the entropy change between pure solvent and vapour.
- C. Boiling point of the solution is large than that of the pure solvent.
- D. All are correct statements

**Answer:**

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56. One molal solution of a carboxylic acid in benzene shows the elevation of boiling point of 1.518 K. The degree of association for dimerization of the acid in benzene is ( $K_b$  for benzene =  $2.53 \text{Kkgmol}^{-1}$ ):

- A. 60 %
- B. 70 %
- C. 75 %
- D. 80 %



**Answer:**

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57. The boiling point elevation constant for toluene is  $3.32 \text{ K kg mol}^{-1}$ . The normal boiling point of toluene is  $110.7^\circ \text{C}$ . The enthalpy of evaporation of toluene would be nearly :

A.  $17.0 \text{ kJ mol}^{-1}$

B.  $34.0 \text{ kJ mol}^{-1}$

C.  $51.0 \text{ kJ mol}^{-1}$

D.  $68.0 \text{ kJ mol}^{-1}$

**Answer:**

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58. Two solutions of glucose have osmotic pressure 1.5 and 2.5 atm. respectively. 1 L of first solution is mixed with 2 L of second solution. The osmotic pressure of the resultant solution will be :

A. 1.62 atm

B. 6.12 atm

C. 1.26 atm

D. 2.16 atm

**Answer:**



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59. Calculating the depression in the freezing point of water when 10g of  $CH_3CH_2CHClCOOH$  is added to 250g of water.  $K_a=1.4 \times 10^{-3}$ ,  $k_f=1.86 \text{ K kgmol}^{-1}$

A. 0.56

B. 0.84

C. 0.65

D. 0.27

**Answer:**



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**60.** Following are equimolal aqueous solutions

Urea

KCl

$MgCl_2$

$Na_3PO_4$  Arrange them in order of increasing osmotic pressure

A.  $A < B < C < D$

B.  $D < A < B < C$

C.  $B < A < C < D$

D.  $C < A < B < D$

**Answer:**

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61. 18 g glucose ( $C_6H_{12}O_6$ ) is added to 178.2 g water. The vapor pressure of water (in torr) for this aqueous solution is.

A. 759

B. 7.6

C. 76

D. 752.4

**Answer: D**

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62. The van't Hoff factor ( $i$ ) for a dilute aqueous solution of the strong electrolyte barium hydroxide is

A. 3

B. 0

C. 1

D. 2

**Answer: A**



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**63.** Which one of the following is incorrect for ideal solution ?

A.  $\Delta G_{mix} = 0$

B.  $\Delta H_{mix} = 0$

C.  $\Delta U_{mix} = 0$

D.  $\Delta P_{obs} - P_{calculated\ by\ Raoult's\ law} = 0$

**Answer: A**



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64. Which of the following statements about the composition of the vapour over an ideal 1:1 molar mixture of benzene and toluene is correct ? Assume that that the temperature is constant at  $25^{\circ}C$ . (Given, Vapour pressure Data at  $25^{\circ}C$ , benzene = 12.8 KPa, toluene = 3.85 KPa)

- A. The vapour will contain equal amounts of benzene and toluene.
- B. Not enough information is given to make a prediction.
- C. The vapour will contain a higher percentage of benzene.
- D. The vapour will contain a higher percentage of toluene.

**Answer: C**

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65. At  $100^{\circ}C$  the vapour pressure of a solution of 6.5 g of a solute in 100 g water is 732 mm. If  $K_b = 0.52$ , the boiling point of this solution will be.

A.  $102^{\circ} C$

B.  $103^{\circ} C$

C.  $101^{\circ} C$

D.  $100^{\circ} C$

**Answer: C**

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**66.** Consider the following liquid - vapour equilibrium Liquid  $\rightleftharpoons$  Vapour

Which of the following relations is correct ?

A.  $\frac{d/nP}{dT^2} = \frac{-\Delta H}{T^2}$

B.  $\frac{d/nP}{dT} = \frac{\Delta H}{R} T^2$

C.  $\frac{d/nG}{dT^2} = \frac{\Delta H}{R} T^2$

D.  $\frac{d/nP}{dT} = \frac{-\Delta H}{RT}$

**Answer: B**

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67. If  $P^0$  and  $P$  are the vapour pressure of the pure solvent and solution and  $n_1$  and  $n_2$  are the moles of solute and solvent respectively in the solution then the correct relation between  $P$  and  $P^0$  is

A.  $P^0 = P \left[ \frac{n_1}{n_1 + n_2} \right]$

B.  $P^0 = P \left[ \frac{n_2}{n_1 + n_2} \right]$

C.  $P = P^0 \left[ \frac{n_2}{n_1 + n_2} \right]$

D.  $P = P^0 \left[ \frac{n_1}{n_1 + n_2} \right]$

**Answer: C**

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68. The vapour pressure of acetone at  $20^\circ C$  is 185 torr. When 1.2 g of a non-volatile solute was dissolved in 100 g of acetone at  $20^\circ C$  its vapour pressure was 183 torr. The mass ( $gmol^{-1}$ ) of the substance is.



A. 64

B. 128

C. 488

D. 32

**Answer: A**



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**69.** Of the following 0.10 m aqueous solutions, which one will exhibit the largest freezing point depression ?

A. KCl

B.  $C_6H_{12}O_6$

C.  $Al_2(SO_4)_3$

D.  $K_2SO_4$

**Answer: C**



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70. A solution of 1.25 g of 'P' in 50g of water lowers freezing point by  $0.3^\circ\text{C}$ . Molar mass of 'P' is 94.  $K_{f(\text{water})}$  is  $1.86\text{ K kg mol}^{-1}$ . The degree of association of 'P' in water is [Assume dimerisation of P]

A. 80 %

B. 60 %

C. 65 %

D. 75 %

Answer: A



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71.  $25\text{cm}^3$  of oxalic acid completely neutralised 0.064g of sodium hydroxide. Molarity of the oxalic acid solution is

A. 0.064

B. 0.045

C. 0.015

D. 0.032

**Answer: D**

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**72.** 5.5 mg of nitrogen gas dissolves in 180 g of water at 273K and 1 atm pressure due to nitrogen gas. The mole fraction of nitrogen in 180g of water at 5 atm nitrogen pressure is approximately.

A.  $1 \times 10^{-6}$

B.  $1 \times 10^{-5}$

C.  $1 \times 10^{-3}$

D.  $1 \times 10^{-4}$

**Answer: D**

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73. What will be the value of molality for an aqueous solution of 10 % w/w NaOH? (Na = 23, O = 16, H = 1)

A. 5

B. 2.778

C. 10

D. 2.5

**Answer: B**

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74. If 10ml of 0. 1M aqueous solution of NaCl is divided into 1000 drops of equal volume, what will be the concentration of one drop ?

A. 0.10M

B. 0.01M

C. 0.001M

D. 0.0001M

**Answer: A**



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**75.** What is the molality of a solution containing 200 mg of urea (molar mass  $60\text{g mol}^{-1}$ ) dissolved in 40g of water?

A. 0.0825

B. 0.825

C. 0.498

D. 0.0013

**Answer: A**



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76. The molarity of a solution obtained by mixing 750 mL of 0.5(M) HCl with 250 mL of 2(M) HCl will be

A. 0.875 M

B. 1

C. 1.75 M

D. 0.0975 M

Answer: A

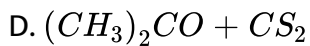
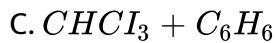


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77. Identify the mixture that shows positive deviation from Raoult's law.

A.  $CHCl_3 + (CH_3)_2CO$

B.  $(CH_3)_2CO + C_6H_5NH$



**Answer: D**

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**78.** The temperature at which the vapour pressure of a liquid becomes equal to external (atmospheric) pressure is its

A. melting point

B. sublimation point

C. inversion point

D. BOILING POINT

**Answer: D**

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79. An aqueous solution freezes at  $-0.186^{\circ}C$  then elevation in boiling point is ( $K_b = 0.512$ ,  $K_f = 1.86$ )

- A.  $0.0512^{\circ}C$
- B.  $100.0512^{\circ}C$
- C.  $-0.0512^{\circ}C$
- D. None of these

**Answer: A**

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80. Which one of the following solutions exhibits the maximum elevation in boiling point ?

- A.  $0.1\text{ m NaCl}$
- B.  $0.1\text{ m FeCl}_3$
- C.  $0.1\text{ m CaCl}_2$



D.  $0.1mBaCl_2$

**Answer: B**

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**81.** Which colligative property is most suitable for the determination of molecular masses of polymer?

- A. elevation in boiling point
- B. osmotic pressure
- C. optical activity
- D. relative lowering of vapour pressure

**Answer: C**

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82. Which one of the statements given below concerning properties of solution, describes a colligative effect ?

A. Boiling point of pure water decreases by the addition of ethanol.

B. Vapour pressure of pure water decreases by the addition of nitric acid

C. Vapour pressure of pure benzene decreases by the addition of naphthalene.

D. Vapour pressure of pure benzene increases by the addition of toluene.

**Answer: C**

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83.  $6.02 \times 10^{20}$  molecules of urea are present in 100 mL of its solution.

The concentration of solution is

A. 0.02 M

B. 0.01 M

C. 0.001 M

D. 0.1 M

**Answer: B**



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**84.** How many gram of concentrated nitric acid solution should be used be prepare 250 mL of 2.0 M  $\text{HNO}_3$  ?

A. 45.0 g conc.  $\text{HNO}_3$

B. 90.0 g conc.  $\text{HNO}_3$

C. 70.0 g conc.  $\text{HNO}_3$

D. 50.0 g conc.  $\text{HNO}_3$

**Answer: A**



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85. Distribution law was given by

A. Ostwald

B. Nernst

C. Henry

D. van't Hoff

**Answer: B**



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86. Which of the following is not a colligative property ?

A. Depression in freezing point

B. Osmotic pressure

C. Elevation of boiling point

D. Increase in freezing point

**Answer: D**

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**87.** The osmotic pressure of 12 % solution of cane sugar at  $17^{\circ}C$  is

A. 2.42 atm

B. 4.33 atm

C. 8.35 atm

D. 16.30atm

**Answer: C**

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88. The normality of orthophosphoric acid having purity of 70 % by weight and specific gravity 1.54 is

- A. 11 N
- B. 22 N
- C. 33 N
- D. 44 N

**Answer: C**

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89. The molarity of  $H_2SO_4$  solution, which has a density 1.84 g/cc at  $35^\circ C$  and contains 98 % by weight is

- A. 1.84 M
- B. 18.4 M
- C. 20.6 M

D. 24.5 M

**Answer: B**

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90. 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  $2^\circ C$ . Assuming concentration of solute is much lower than the concentration of solvent, the vapour pressure (mm of Hg) of the solution is ( $take\ k_b = 0.76\ K\ kg\ mol^{-1}$ ).

A. 726

B. 740

C. 736

D. 718

**Answer: A**

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91.  $k_f$  for water is  $1.86 \text{ k kg mol}^{-1}$ . If your automobile radiator holds 1.0 kg of water, how many grams of ethylene glycol ( $C_2H_6O_2$ ) must you add to get the freezing point of the solution lowered to  $-2.8^\circ C$ ?

A. 72 g

B. 93 g

C. 39 g

D. 27 g

**Answer: B**



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92. The density of a 3M sodium thiosulphate ( $Na_2S_2O_3$ ) solution is 1.25 g/mL. Calculate the percent by weight of sodium thiosulphate.

A. 12.65 %



B. 37.92 %

C. 0.87 %

D. 63.21 %

**Answer: B**



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**93.** Two solutions of HCl, A and B have concentrations of 0.5 N and 0.1 M respectively. The volume of solutions A and B required to make 2 L of 0.2 N HCl are

A. 0.5 L of A + 1.5 L of B

B. 1.5 L of A + 0.5 L of B

C. 1.0 L of A + 1.0 L of B

D. 0.75 L of A + 1.25 L of B

**Answer: A**



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94. The highest osmotic pressure corresponds to the following solution

A.  $\frac{M}{10}$  urea

B.  $\frac{M}{10}$  glucose

C.  $\frac{M}{10}$  HCl

D.  $\frac{M}{10}$   $BaCl_2$

Answer: D



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95. The correct order of increasing boiling points of the following aqueous solutions

(I) 0.0001 M NaCl (II) 0.000 1 M Urea (III) 0.001 M  $MgCl_2$  (IV) 0.01 M NaCl

A.  $I < II < III < IV$

B.  $IV < III < II < I$

C.  $II < I < III < IV$

D.  $III < II < IV < I$

**Answer: C**

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**96.** 58.4 g of NaCl and 180 g of glucose were separately dissolved in 1000 mL of water. Identify the correct statement regarding the elevation of boiling point (b.p.) of the resulting solutions.

A. NaCl solution will show higher elevation of boiling point

B. Glucose solution will show higher elevation of boiling point

C. Both the solutions will show equal elevation of boiling point

D. The boiling point elevation be shown by neither of the solutions

**Answer: A**

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97. Mixture of chloroform and acetone shows a negative deviation from Raoult's law. Explain.

- A. Acetone-benzene
- B. Acetone-ethanol
- C. Benzene-methanol
- D. Acetone-chloroform

**Answer: D**

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98. The relative lowering of vapour pressure of a dilute solution is equal to mole fraction of solute present in the solution. Which of the following low is state this ?

- A. Henry low
- B. Avogadro's law
- C. Raoult's law
- D. Law of definite proportion

**Answer: C**

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99. The mass of a non-volatile solute of molar mass  $40 \text{ g mol}^{-1}$  that should be dissolved in 114 g of octane to lower its vapour pressure by 20 % , is

- A. 11.4 g
- B. 9.8 g
- C. 12.8 g
- D. 10 g

**Answer: D**



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**100.** The relative lowering of vapour pressure of an aqueous solution containing a non-volatile solute is 0.0125. The molality of the solution is

A. 0.7

B. 0.3

C. 0.125

D. 0.07

**Answer: A**



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**101.** Which of the following will represent the normality of 10%  $\left(\frac{w}{V}\right)$  acetic acid

A. 1.66 N

B. 16.6 N

C. 3.32 N

D. 33.2 N

**Answer: A**



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**102.** Milk is an emulsion. Identify the dispersed phase and the emulsifier in milk.



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**103.** In which case van't Hoff factor are equal ?

A. 0.5

B. 1

C. 2

D. 6

**Answer: C**

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**104.**  $P_A$  and  $P_B$  are the vapour pressure of pure liquid components, A and B, respectively of an ideal binary solution. If  $X_A$  represents the mole fraction of component A, the total pressure of the solution will be

A.  $P_A + X_A(P_B - P_A)$

B.  $P_A + X_A(P_A - P_B)$

C.  $P_B + X_A(P_B - P_A)$

D.  $P_B + X_A(P_A - P_B)$

**Answer: D**

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**105.** Vapour pressure of chloroform ( $CHCl_3$ ) and dichloromethane ( $CH_2Cl_2$ ) at 298 K are 200 mm Hg and 415 mm Hg respectively.

Calculate the vapour pressure of the solution prepared by mixing 25.5 g of  $CHCl_3$  and 40 g of  $CH_2Cl_2$  at 298 K and,

- A. 17.9 mmHg
- B. 615.0 mmHg
- C. 347.9 mmHg
- D. 90.63 mmHg

**Answer: D**



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**106.** A solution has higher osmotic pressure than its standard solution.

Which of the following term will be used for this solution ?

- A. Isotonic
- B. Hypertonic
- C. Dilute
- D. Hypotonic

**Answer: B**

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**107.** The vapour pressure lowering caused by the addition of 100 g of sucrose (molecular mass = 342) to 1000 g of water, if the vapour pressure of pure water at  $25^{\circ}C$  is 23.8 mm Hg, is

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**108.** Molarity of a given orthophosphoric acid solution is 3 M. Its normality is

A. 9 N

B. 0.3 N

C. 3 N

D. 1 N

**Answer: A**



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**109.** 138 g of ethyl alcohol is mixed with 72 g of water. The ratio of mole fraction of alcohol to water is

A. 3 : 4

B. 1 : 2

C. 1 : 4

D. 1 : 1

**Answer: A**



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110. In which case Raoult's law is not applicable ?

- A. 1 M NaCl
- B. 1 M urea
- C. 1M glucose
- D. 1 M sucrose

Answer: A



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111. The freezing point of one molal NaCl solution assuming NaCl to be 100 % dissociated in water is (molal depression constant is 1.86)

- A.  $-2.72^{\circ}C$
- B.  $-3.72^{\circ}C$

C.  $2.72^{\circ}C$

D.  $3.72^{\circ}C$

**Answer: B**

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**112.** The vapour pressure of water depends upon

A. Surface area of container

B. Volume of container

C. Temperature

D. All

**Answer:**

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**113.** A vessel has nitrogen gas and water vapour in equilibrium with liquid water at a total pressure of 1 atm. The partial pressure of water vapours is 0.3 atm. The volume of this vessel is reduced to one third of the original volume, at the same temperature, then total pressure of the system is: (Neglect volume occupied by liquid water)

A. 3.0 atm

B. 1 atm

C. 3.33 atm

D. 2.4 atm

**Answer:**



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**114.** For a dilute solution, Raoult's law states that :

- A. The lowering of vapour-pressure is equal to the mole-fraction of solute.
- B. The relative lowering of vapour-pressure is equal to the mole-fraction of solute.
- C. The relative lowering of vapour-pressure is proportional to the amount of the solution is equal to the mole-fraction of solvent.
- D. The vapour-pressure of the solution is equal to the mole-fraction of solvent.

**Answer:**

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**115.** The mathematical expression of Raoult's law is:

Where  $n$  is no. of moles of solute &  $N$  is no. of moles of solvent

$$A. \frac{P^\circ - P}{P^\circ} = n/N$$

$$B. \frac{P^\circ - P}{P^\circ} = N/n$$

$$C. \frac{P^\circ - P}{P} = n/N$$

$$D. \frac{P^\circ - P}{P^\circ} = n \times N$$

**Answer:**



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**116.** 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

- A. there is positive deviation from Raoult's law
- B. boiling point has been lowered
- C. force of attraction between A and B is smaller than that between A and A or between B and B
- D. all the above statement are correct



**Answer:**

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117. Two liquids A and B have vapour pressure in the ratio  $P_A^\circ : P_B^\circ = 2:3$  at a certain temperature. Assume A and B form an ideal solution and the ratio of mole fractions of A to B in the vapour phase is 1:3, then the mole fraction of A in the solution at the same temperature is :

A. 1/3

B. 2/3

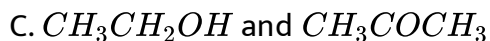
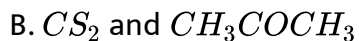
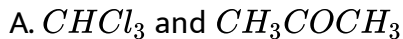
C. 1/4

D. 3/4

**Answer:**

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118. Which of the following azeotropic solutions has the b.p. less than b.p. of the constituents A and B ?



**Answer:**



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119. The mass of glucose that should be dissolved in 100 g of water in order to produce same lowering of vapour pressure as is produced by dissolving 1 g of urea in 50 g of water is

A. 1g

B. 2g

C. 6g

D. 12g

**Answer:**



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**120.** The vapour pressure of water at room temperature is lowered by 5% by dissolving a solute in it, then the approximate molality of solution is

A. 2

B. 1

C. 4

D. 3

**Answer:**



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121. The vapour pressure of a dilute aqueous of glucose is 750 mm of mercury at 373 K. The mole fraction of solute is

A. 44470

B. 1/7.6

C. 1/35

D. 1/76

Answer:

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122. Relative decrease in vapour pressure of an aqueous solution containing 2 moles  $[Cu(NH_3)_3Cl]$  Cl in 3 moles  $H_2O$  is 0.50. On reaction with  $AgNO_3$  this solution will form (assuming no change in degree of ionisation of substance on adding  $AgNO_3$ ).

A. 1mol AgCl

B. 0.25mol AgCl

C. 0.5 mol AgCl

D. 0.40 mol AgCl

**Answer:**



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**123.** A solution of one mole of benzoic acid in 15 moles of benzene produces a relative lowering in vapour pressure of  $\frac{1}{31}$ . The mol. wt. of benzoic acid is

A. 122

B. 244

C. 61

D. 189

**Answer:**

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**124.** When mercuric iodide is added to the aqueous solution of potassium iodide

- A. freezing point is raised
- B. freezing point is lowered
- C. freezing point is does not change
- D. boiling point is does not change

**Answer:**

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**125.** 50g of antifreeze (ethylene glycol) is added to 200 g water. What amount of ice will separate out at  $-9.3^{\circ}C$ ?

A. 42 mg

B. 42 g

C. 38.71 g

D. 38.71 mg

**Answer:**

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**126.** Which of the following 0.1 M aqueous solution will have the lowest freezing point ?

A. Potassium sulphate

B. Sodium chloride

C. Urea

D. Glucose

**Answer:**



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127. The freezing point of equimolal aqueous solutions will be highest for

A.  $C_6H_5NH_3Cl$ (aniline hydrochloride)

B.  $Ca(NO_3)_2$

C.  $La(NO_3)_3$

D.  $C_6H_{12}O_6$

Answer:



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128. 15 g of a solute in 100 g water makes a solution freeze at  $-1^\circ C$ . 30 g of a solute in 100 g of water will give a depression in freezing point equal to :

A.  $-2^\circ C$



B.  $0.5^{\circ}C$

C.  $2^{\circ}C$

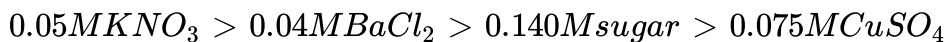
D.  $1^{\circ}C$

**Answer:**

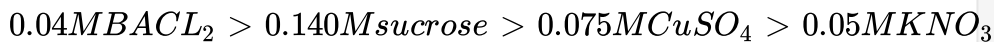
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**129.** Which of the following has been arranged in order of decreasing freezing point ?

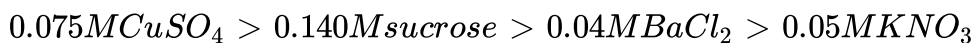
A.



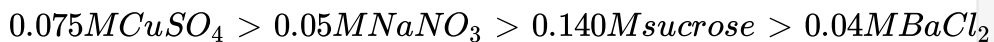
B.



C.



D.



**Answer:**



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

- A. ionization of benzoic acid
- B. dimerization of benzoic acid
- C. trimerization of benzoic acid
- D. solvation of benzoic acid

**Answer:**



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131. The fraction of phenol dimerised in benzene if 20 g of phenol in 1 kg benzene exhibits a freezing point depression of 0.69 K. ( $K_f$  benzene) = 5.12 kkg/mol), (MW of phenol = 94)

A. 0.74

B. 0.37

C. 0.46

D. 0.64

Answer:

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132. When 20 g of naphthoic acid ( $C_{11}H_8O_2$ ) is dissolved in 50 g of benzene ( $K_f = 1.72 K kg mol^{-1}$ ), a freezing point depression of 2 K is observed. The van't Hoff factor (i) is

A. 0.5

B. 1

C. 2

D. 3

**Answer:**



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**133.** Pressure cooker reduces cooking time because

A. the heat is more evenly distributed inside the cooker

B. a large flame is used

C. boiling point of water is elevated

D. whole matter is converted into steam

**Answer:**



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134.  $y$  g of non-volatile solute of molar mass  $M$  is dissolved in 250 g benzene. If  $K_b$  is molal elevation constant, the value of  $\Delta T$  is given by

A.  $\frac{4M}{k_b y}$

B.  $\frac{4k_b y}{M}$

C.  $k_b \frac{y}{4M}$

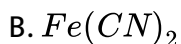
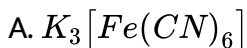
D.  $k_b \frac{y}{M}$

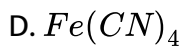
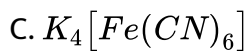
**Answer:**



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135. A complex of iron and cyanide ions is 100 % ionised at 1m (molal). If its elevation in b.p. is  $2.08^\circ C$ . Then the complex is ( $K_b = 0.52 K mol^{-1} kg$ ):





**Answer:**

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**136.** The elevation in boiling point of a solution of 13.44 g of  $CuCl_2$  in 1 Kg of water using the following information will be:

(Molecular weight of  $CuCl_2 = 134.4$  and  $K_b = 0.52Kmolal^{-1}$ )

A. 0.16

B. 0.05

C. 0.1

D. 0.2

**Answer:**

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137. 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

- A. 4 g/l
- B. 8 g/l
- C. 12 g/l
- D. 14 g/l

**Answer:**

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138. Osmotic pressure of 30 % solution of glucose is 1.20 atm and that of 3.42 % solution of cane sugar is 2.5 atm. The osmotic pressure of the mixture containing equal volumes of the two solutions will be

A. 2.5 atm

B. 3.7 atm

C. 1.85 atm

D. 1.3 atm

**Answer:**

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**139.**  $0.004M Na_2SO_4$  is isotonic with  $0.01 M$  glucose. Degree of ionisation of  $Na_2SO_4$  is :

A. 75 %

B. 50 %

C. 25 %

D. 85 %

**Answer:**





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**140.** We have 100 mL of 0.1 M KCl solution. To make it 0.2 M,

- A. evaporate 50 mL water
- B. evaporate 50 mL solution
- C. add 0.01 mol KCl
- D. both (1) and (3)

**Answer:**



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**141.** A molal solution is one that contains one mole of a solute in :

- A. 1000 g of the solvent
- B. 1 L of the solvent

C. 1 L of the solution

D. 22.4 L of the solution

**Answer:**

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**142.** At higher altitudes, water boils at temperature  $> 100^{\circ}C$  because

A. temperature of higher altitudes is low

B. atmospheric pressure is low

C. the proportion of heavy water increases

D. atmospheric pressure becomes more.

**Answer:**

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**143.** The solubility of a specific non-volatile salt is 4 g in 100 g of water at  $25^{\circ}\text{C}$ . If 2.0 g, 4.0 g and 6.0 g of the salt added to 100 g of water at  $25^{\circ}\text{C}$ , in system X, Y and Z. The vapour pressure would be in the order :

A.  $X < Y < Z$

B.  $X > Y > Z$

C.  $Z > X = Y$

D.  $X > Y = Z$

**Answer: D**



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

A. Temperature

B. Pressure

C. BOTH (1) & (2)

D. None of these

**Answer: B**

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**145.** Calculate the concentration of  $CO_2$  in a soft drink that is bottled with a partial pressure of  $CO_2$  of 4 atm over the liquid at  $25^\circ C$ . The Henry's Law constant for  $CO_2$  in water is  $3.1 \times 10^{-2}$  mol/litre atm at  $25^\circ C$ .

A. 1.24 mol/lit.

B. 0.24 mol/lit

C. 0.124 mol/lit

D. 12.4 mol/lit

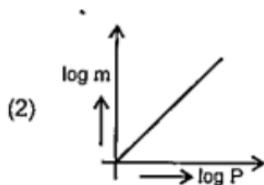
**Answer: C**



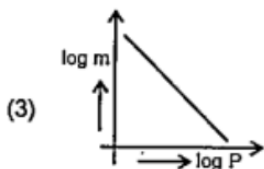
146. Which of the following curves represents the Henry's law ?



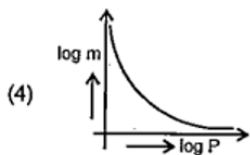
A.



B.



C.



D.

Answer: A

147. An ideal solution has two components A and B. A is More volatile than B, i.e.,  $p_A^0 > p_B^0$  and also  $p_A^0 > P_{\text{total}}$  . If  $x_A$  and  $y_A$  are mole fractions of components A in liquid and vapour phases, then:

A.  $x_A = y_A$

B.  $x_A > y_A$

C.  $x_A < y_A$

D. Data insufficient

Answer: C



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148. Two liquids A and B form an ideal solution. At 300 k, the vapour pressure of a solution containing 1 mole of A and 3 moles of B is 550 mm of Hg. At the same temperature, if one mole of B is added to this solution, the vapour pressure of the solution increases by 10 mm of Hg. Determine the vapour pressure of A and B in their pure states.

A. 400, 600

B. 500, 500

C. 600, 400

D. None of these

**Answer: A**



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**149.** Water and chlorobenzene are immiscible liquids. Their mixture boils at  $90^\circ C$  under a reduced pressure of  $7.82 \times 10^4$  Pa. The vapour pressure of pure water at  $90^\circ C$  is  $7.03 \times 10^4$  Pa. On weight percent basis, chlorobenzene in the distillate is equal to (mol. wi. of chlorobenzene is  $112.5 \text{ gmol}^{-1}$ )

A. 50

B. 60

C. 41

D. 80

**Answer: C**

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**150.** Two liquids having vapour pressures  $p_1^0$  and  $p_2^0$  in pure state in the ratio of 2:1 are mixed in the molar ratio of 1:2. The ratio of their moles in the vapour state would be:

A. 1:1

B. 1:2

C. 2:1

D. 3:2

**Answer: A**

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151. For a binary ideal liquid solution, the total pressure of the solution is given as :

A.  $P_{\text{total}} = p_A^0 + (p_A^0 - p_B^0)x_B$

B.  $P_{\text{total}} = p_B^0 + (p_A^0 - p_B^0)x_A$

C.  $P_{\text{total}} = p_B^0 + (p_B^0 - p_A^0)x_A$

D.  $P_{\text{total}} = p_B^0 + (p_B^0 - p_A^0)x_B$

**Answer: B**



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152. The correct order for the bond dissociation enthalpy of Halogen molecules:

A. (A) Bromine > Iodine > Fluorine > Chlorine

B. (B) Fluorine > Chlorine > Bromine > Iodine

C. (C) Iodine > Bromine > Chlorine > Fluorine

D. (D) Chlorine > Bromine > Fluorine > Iodine

**Answer: A**



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**153.** When non ideal solution was prepared by mixing 30 mL chloroform and 50 mL acetone, the volume of mixture will be

A.  $> 80mL$

B.  $= 80mL$

C.  $< 80mL$

D.  $\geq 80mL$

**Answer: C**



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154. Two liquids A and B form an ideal solution. What is the vapour pressure of solution containing 2 moles of A and 3 moles of B at 300 K?

[Given : At 300 K, vapour pressure of pure liquid A

$(p_A^0) = 100$  torr and vapour pressure of pure liquid B

$(p_B^0) = 300$  torr]

- A. 200 torr
- B. 140 torr
- C. 180 torr
- D. None of these

**Answer: D**



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155. The vapour pressure of pure liquid A is 70 torr at  $27^\circ C$ . 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  $27^{\circ}C$ . The vapour pressure of pure liquid B at  $27^{\circ}C$  is

- A. 140 torr
- B. 50 torr
- C. 14 torr
- D. 70 torr

**Answer: A**

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**156.** At  $40^{\circ}C$ , the vapour pressure of pure liquids, benzene and toluene, are 160 mm Hg and 60 mm Hg respectively. At the same temperature, the vapour pressure of an equimolar solution of the two liquids, assuming the ideal solution should be

- A. 140 mmHg
- B. 110 mm Hg

C. 220 mm Hg

D. 100 mm Hg

**Answer: B**

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157. At  $40^\circ\text{C}$  the vapour pressures in torr, of methyl alcohol ethyl alcohol solutions is represented by the equation.  $P = 119X_A + 135$  where  $X_A$  is mole-fraction of methyl alcohol, then the value of  $\lim_{X_A \rightarrow 1} \frac{P}{X_A}$  is :

A. 254 torr

B. 135 torr

C. 119 torr

D. 140 torr

**Answer: A**

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**158.** Two liquids A and B form an ideal solution. The ratio of vapour pressures of pure liquids A and B are 3: 5. If the mole fraction of A in the liquid solution at equilibrium with vapours is 0.4, then the mole-fraction of B in the liquid is

A. 0.3

B. 0.6

C. 4

D. 4.3

**Answer: B**



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**159.** Which will form maximum boiling point azeotrope ?

A.  $C_6H_6 + C_6H_5CH_3$  solution

B.  $C_2H_5OH + H_2O$  solution

C.  $HNO_3 + H_2O$  solution

D. Both (2) and (3)

**Answer: C**

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**160.** The relative lowering of vapour pressure is equal to the ratio between the number of

A. solute molecules to the solvent molecules

B. solute molecules to the total molecules in solution

C. solvent molecules to the total molecules in the solution

D. solvent molecules to the total number of ions in solution

**Answer: B**

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**161.** The vapour pressure of a solvent is found to be 400 mm Hg at 300 K. When a certain amount of a nonvolatile solute is added to 50 mol of the solvent its vapour pressure decreases to 360 mm Hg. The amount of solute added is

- A. 2.41 mol
- B. 3.42 mol
- C. 4.54 mol
- D. 5.55 mol

**Answer: D**



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**162.** If relative decrease in vapour pressure is 0.4 for a solution containing 1 mol NaCl in 3 mol of  $H_2O$ , then % ionization of NaCl is



A. 60 %

B. 80 %

C. 40 %

D. 100 %

**Answer: A**



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**163.** When a solution containing non-volatile solute freezes, which equilibrium would exist ?

A. solid solvent  $\Leftrightarrow$  liquid solvent

B. solid solute  $\Leftrightarrow$  liquid solution

C. solid solute  $\Leftrightarrow$  liquid solvent

D. solid solvent  $\Leftrightarrow$  liquid solution

**Answer: D**



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**164.** 2.56 g of sulphur in 100 g of  $CS_2$  has depression in freezing point of  $0.010^\circ$  .  $K_f = 0.1^\circ kg(mol)^{-1}$  . Hence atomicity of sulphur in the solution is

A. 2

B. 4

C. 6

D. 8

**Answer: D**



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**165.** The temperature of a city was found to be  $-9.30^\circ C$ . A car was used, whose radiator was filled with 5 L of water. What quantity of anti freezing

agent ethylene glycol were added to water of radiator in order to use the car for travelling ? ( $K_f$  of water  $1.86 \text{ K kg mol}^{-1}$ )

A. 3200 g

B. 1670 g

C. 1550 g

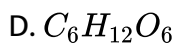
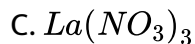
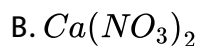
D. 2100 g

**Answer: C**



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**166.** The freezing point of equimolal aqueous solutions will be highest for



**Answer: D**

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**167.** KBr is 80 % dissociated in aqueous solution. The freezing point of a 0.5 molal solution is  $K_f = 1.86 K kg mol^{-1}$

A. 271.5 K

B. 273 K

C. 277 K

D. 218 K

**Answer: A**

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**168.** A 0.2 molal aqueous solution of weak acid HX is 20 % ionized. The freezing point of solution is ( $K_f = 1.86$ )

A.  $-0.45^{\circ}C$

B.  $-0.9^{\circ}C$

C.  $-0.31^{\circ}C$

D.  $-0.53^{\circ}C$

**Answer: A**

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**169.** Which of the following aqueous solutions has minimum freezing point ?

A. 0.01 m NaCl

B. 0.005m  $MgI_2$

C. 0.005 m  $C_2H_5OH$

D. 0.005m  $MgSO_4$

**Answer: A**



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170. A .001 molal solution of a complex  $[MA_8]$  in water has the freezing point of  $-0.0054^\circ C$ . Assuming 100 % ionization of the complex salt and  $K_f$  for  $H_2O$   $1.86 K m^{-1}$ , write the correct representation for the complex

- A.  $[MA_8]$
- B.  $[MA_7]A$
- C.  $[MA_6]A_2$
- D.  $[MA_5]A_3$

Answer: C



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171. Ratio of  $\frac{\Delta T_b}{K_b}$  of 10 g  $AB_2$  and 14 g  $A_2B$  per 100 g of solvent in their respective, solution ( $AB_2$  and  $A_2B$  both are non-electrolytes) is 1 mol/kg in both cases. Hence, atomic wt. of A and B are respectively

A. 100, 40

B. 60, 20

C. 20, 60

D. None of these

**Answer: B**

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**172.** The elevation in boiling point, when 13.44 g. of freshly prepared  $CuCl_2$ , are added to 1 kg of water is [some useful data,  $K_b(H_2O) = 0.52$  kg K mol<sup>-1</sup> and M.W of  $CuCl_2 = 134.4g$ ]

A. 0.05

B. 0.1

C. 0.16

D. 0.21

**Answer: A**

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**173.** A water sample contains 9.5 %  $MgCl_2$  and 11.7 %  $NaCl$  (by weight).

Assuming 80 % ionisation of each salt boiling point of water will be (

$K_b = 0.52$ )

A.  $110.01^\circ C$

B. 377.16 K

C. 277.25 K

D.  $102.5^\circ C$

**Answer: B**

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174. Consider equimolal aqueous solutions of  $NaHSO_4$  and  $NaCl$  with  $\Delta T_b$  and  $\Delta 'T_b$ , as their respective boiling point elevations. The value of  $\lim_{m \rightarrow 0} \frac{\Delta T_b}{\Delta 'T_b}$  will be

- A. 1
- B. 1.5
- C. 3.5
- D. 44257

**Answer: B**



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175. Blood cells retain their normal shape in solutions which are

- A. hypotonic to blood
- B. isotonic to blood
- C. hypertonic to blood

D. equi normal to blood

**Answer: B**

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**176.** The osmotic pressures of equimolar solutions of urea,  $BaCl_2$  and  $AlCl_3$  will be in the order :

A.  $AlCl_3 > BaCl_2 > \text{urea}$

B.  $BaCl_2 > AlCl_3 > \text{urea}$

C.  $\text{urea} > BaCl_2 > AlCl_3$

D.  $BaCl_2 > \text{urea} > AlCl_3$

**Answer: A**

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177. Which of the following pair of solutions can be expected to be isotonic at the same temperature ?

- A. 0.1 M urea and 0.1 M NaCl
- B.  $0.1MNaCl$  and  $0.1MNa_2SO_4$
- C.  $0.1MCa(NO_3)_2$  and  $0.1MNa_2SO_4$
- D. 0.1 M glucose and 0.2 M  $MgCl_2$

**Answer: C**

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178. Sulphur-Dioxide is passed through acidified Potassium-Dichromate solution. Write the reaction with observation.

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**179.** In the phenomenon of osmosis through the semipermeable membrane

- A. solvent molecules pass from solution to solvent
- B. solvent molecules pass from solvent to solution
- C. solute molecules pass from solution to solvent
- D. solute molecules pass from solvent to solution

**Answer: B**



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**180.** Consider following solution

- (i) 1M aqueous glucose solution
- (ii) 1M aqueous sodium chloride solution
- (iii) 1 M aqueous ammonium phosphate solution
- (iv) 1M benzoic acid in benzene

Select correct statements for the above solution

A. All are isotonic solution

B. (ii) is hypotonic with (i), (ii) and (iv)

C. (iv) is hypertonic with (i), (ii) and (iii)

D. (ii) is hypotonic with (iii) but hypertonic with (i) and (iv)

**Answer: A**



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**181.** Osmotic pressure of blood is  $7.40 \text{ atm}$  at  $27^\circ \text{C}$ . 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

A. 0.3

B. 0.2

C. 0.1

D. 0.4

**Answer: A**



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**182.** Which has maximum osmotic pressure at temperature T

- A. 100 mL of 1 M urea solution
- B. 300 mL of 1 M glucose solution
- C. mixture of 100 ml. of 1 M urea solution and 300 mL of 1 M glucose solution
- D. all are isotonic

**Answer: D**



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**183.** The relationship between osmotic pressures ( $\pi_1$ ,  $\pi_2$  and  $\pi_3$ ) at a definite temperature when 1 g glucose, 1 g urea and 1 g sucrose are

dissolved in 1 litre of water is

(assume  $i = 1$  for all)

A.  $\pi_1 > \pi_2 > \pi_3$

B.  $\pi_3 > \pi_1 > \pi_2$

C.  $\pi_2 > \pi_1 > \pi_3$

D.  $\pi_2 > \pi_3 > \pi_2$

**Answer: C**

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**184.** Which of the following would have the highest osmotic pressure

(Assume that all salts are 90 % dissociated) ?

A. Decimolar aluminium sulphate

B. Decimolar barium sulphate

C. Decimolar sodium sulphate

D. A solution obtained by mixing equal volume of (2) and (3) and filtering

**Answer: A**



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**185.** 2 millimolar solution of sodium ferrocyanide is 60% dissociated at  $27^{\circ}C$  Osmotic pressure of the solution is

A. 2.14 atm

B. 1.02 atm

C. 0.167 atm

D. 0.0234 atm

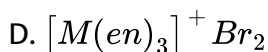
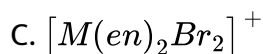
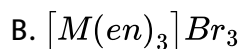
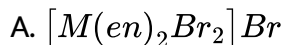
**Answer: C**



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186. A complex is written as  $M(en)_y \cdot xBr$ . Its 0.05 molar solution shows 2.46 atm osmotic pressure at  $27^\circ C$ . Assuming 100% ionization and coordination number of metal (III) is six, complex may be



Answer: A



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187. If  $M_{\text{normal}}$  is the normal molecular mass and  $\alpha$  is the degree of ionization of  $K_3[Fe(CN)_6]$ , then the abnormal molecular mass of the complex in the solution will be

A.  $M_{\text{normal}}(1 + 2\alpha)^{-1}$

B.  $M_{\text{normal}}(1 + 3\alpha)^{-1}$

C.  $M_{\text{normal}}(1 + \alpha)^{-1}$

D. equal to  $M_{\text{normal}}$

**Answer: B**

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**188.** The van't Hoff factor  $i$  for an infinitely dilute solution of  $\text{NaHSO}_4$  is

A. 44228

B. 44256

C. 3

D. 2

**Answer: C**

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189. One mole of a solute A is dissolved in a given volume of a solvent.

The association of the solute take place as follows,  $nA \rightleftharpoons A_n$

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

A.  $i = 1 - \alpha$

B.  $i = 1 + \frac{\alpha}{n}$

C.  $i = (1 - \alpha + \alpha/n)/1$

D.  $i = 1$

**Answer: C**



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190. The values of observed and calculated molecular mass of  $Ca(NO_3)_2$  are 65.4 and  $164 \text{ g mol}^{-1}$  respectively. The degree of dissociation of  $Ca(NO_3)_2$  will be

A. 75 %

B. 50 %

C. 98 %

D. 80 %

**Answer: C**



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**191.** Acetic acid dimerises in benzene solution, The Van't Hoff factor for the dimerisation of acetic acid is 0.8. The % of dimerisation of acetic acid is

A. 20 %

B. 40 %

C. 60 %

D. 80 %

**Answer: B**

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**192.** The value 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 %

**Answer: B**

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193. When some NaCl was dissolved in water, the freezing point depression was numerically equal to twice the molal depression constant. The relative lowering of vapour pressure of the solution is

A. 0.117

B. 0.036

C. 0.0585

D. none

**Answer: B**



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194.  $\Delta T_b$  or  $\Delta T_f$  for ethanoic acid in benzene will be (i) of normal value and molar mass will be (ii) of expected value.

Here (i) and (ii) refer to

A. (i) = half, (ii) = half

B. (i) = twice, (II) = half

C. (i) = half, (II) = twice

D. (i) = twice, (II) = twice

**Answer: C**



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**195.** The b.p. of 0.2 mol  $kg^{-1}$  solution of x in  $H_2O$  is greater than equimolal solution for y in  $H_2O$ . Which one of the following statements is true ?

A. y is undergoing dissociation in  $H_2O$  while x undergoes no change

B. x is undergoing dissociation in  $H_2O$  while y undergoes no change

C. molecular mass of x is greater than molecular mass of y

D. molecular mass of x is less than the molecular mass of y

**Answer: B**

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**196.** Acetic acid exists in benzene solution in the dimeric form. In an actual experiment the vant Hoff factor was found to be 0.52. Then the degree of association of acetic acid is

A. 0.48

B. 0.88

C. 0.96

D. 0.52

**Answer: C**

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**197.** The mole fraction of a solute in a binary solution is 0.1. At 298 K, molarity of this solution is same as its molality. Density of this solution at



298 K is  $2.0 \text{ g cm}^{-3}$ . The ratio of molecular weights of the solute and the solvent ( $M_{\text{solute}} / M_{\text{solvent}}$ ) is

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**198.** Identify the mixture that shows positive deviation from Raoult's law.

- A. carbon tetrachloride + methanol
- B. carbon disulphide + acetone
- C. benzene + toluene
- D. phenol + aniline

**Answer:**

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**199.** If the freezing point of a 0.01 molal aqueous solution of a cobalt (III) chloride-ammonia complex (which behaves as a strong electrolyte) is -

$0.0558^\circ\text{C}$ , the number of chloride(s) in the coordination sphere of the complex is  $[K_f\text{ of water} = 1.86\text{Kkgmol}^{-1}]$

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**200.** A compound  $\text{H}_2\text{X}$  with molar weight of 80 g is dissolved in a solvent having density of  $0.4\text{ g ml}^{-1}$ . Assuming no change in volume upon dissolution, the molality of a 3.2 molar solution is

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**201.** Benzene and naphthalene form an ideal solution at room temperature. For this process, the true statement(s) is/are

- A.  $\Delta G$  is positive
- B.  $\Delta S_{\text{system}}$  is positive
- C.  $\Delta S_{\text{surroundings}} = 0$
- D.  $\Delta H = 0$

**Answer:**



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**202.** 29.2 % (wiW) HCl stock solution has density of  $1.25\text{gmL}^{-1}$ . The molecular weight of HCl is  $36.5\text{gmol}^{-1}$ . The volume (mL) of stock solution required to prepare a 200 mL solution 0.4 M HCl is

- A. 5.0 mL
- B. 6.0 mL
- C. 8.0 mL
- D. 15.0 mL

**Answer:**



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**203.** In which case van't Hoff factor are equal ?

A.  $KCl$ , 50 % ionised

B.  $K_2SO_4$ , 40 % ionised

C.  $FeCl_3$ , 30 % ionised

D.  $SnCl_4$ , 20 % ionised

**Answer:**

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**204.** The total vapour pressure of a binary solution is given by

$$P = (100x_A + 260x_B)mmHg$$

where  $x_A$  and  $x_B$  are the mole fraction of components A and B. This indicates that the :

A. vapour pressure of solution is less than the pure B component

B. vapour pressure of solution is more than that of pure A component

C. vapour pressure of pure A is 100 mm Hg and that of pure B is 260

mm Hg

D. the vapour pressure of pure A and B are 260 mm Hg and 100 mm Hg respectively

**Answer:**

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**205.** Which has the equal elevation of boiling point ?

A. 0.1 M  $Na_2SO_4$

B. 0.1 M  $C_6H_{12}O_6$  (glucose)

C. 0.1 M  $MgCl_2$

D. 0.1 M  $Al(NO_3)_3$

**Answer:**

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206. Which of the following is correct for an ideal solution ?

A. Raoult's law is obeyed for entire concentration range and temperatures

B.  $\Delta H_{mix} = 0$

C.  $\Delta V_{mix} = 0$

D.  $\Delta S_{mix} = 0$

Answer:

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207. Which of the following will form non-ideal solution ?

A.  $C_2H_5OH$  and water

B.  $HNO_3$  and water

C.  $CHCl_3$  and  $CH_3COCH_3$

D.  $C_6H_6$  and  $C_6H_5CH_3$

**Answer:**

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**208.** Which of the following is/are correct for an ideal binary solution of two volatile liquids (eg. benzene & toluene) ?

- A. its vapour is always richer in the more volatile component  
(compared to the liquid)
- B. The liquid will gradually become richer in the less volatile component if such a mixture is boiled (distilled)
- C. The  $P_T$  (ie. the total pressure) above the solution will be the sum of the vapour pressures of the two pure components.
- D. The boiling point of the solution will be less than the boiling of the two components.

Answer:

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209. Draw and state correct Geometry and hybridization for  $\text{XeF}_4$

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210. In which of the following pairs of solutions will the values of the colligative properties be the same?

A.  $0.05M\text{K}_4[\text{Fe}(\text{CN})_6]$  and  $0.10M\text{FeSO}_4$

B.  $0.10M\text{K}_4[\text{Fe}(\text{CN})_6]$  and  $0.10M\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$

C.  $0.20M\text{NaCl}$  and  $0.10M\text{BaCl}_2$

D.  $0.05M\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$  and  $0.05M\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$

Answer:

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**211.** Why will copper and HCl(aq) not evolve Hydrogen gas?

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**212.** Match Column - I with Column - II



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**213.** Match Column - I with Column - II



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**214.** Match Column - I with Column - II





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215. Match Column - I with Column - II



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216. What is the maximum value of van't Hoff factor for  $AlCl_3$  ?



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217. Phenol ( $C_6H_5OH$ ) is found to exist as polymer. If there is 100 % polymerisation, determine number of phenol molecules polymerised in aqueous solution if 9.4 g of phenol solution in 100 g water freezes at  $-0.93^\circ C$ .

$$K_f H_2O = 1.86^\circ C mol^{-1} kg$$



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218. The freezing point depression of a  $1.00 \times 10^{-3}$  m solution of  $K_x[Fe(CN)_6]$  is  $7.10 \times 10^{-3}$  K. Determine  $x$  given

$K_f = 1.86 K kg mol^{-1}$  for  $H_2O$ . Assume 100 % dissociation.

$K_f = 1.86 K kg mol^{-1}$  for  $H_2O$



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219. The concentration of pollutant in ppm (w/w). that has been measured at 450 mg per 150 kg of sample is :



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220. An aqueous solution of 0.01 M  $CH_3COOH$  has Van't Hoff factor 1.01. If  $pH = -\log[H^+]$ , pH of 0.01 M  $CH_3COOH$  solution would be



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221. Insulin  $(C_2H_{10}O_5)_n$  is dissolved in a suitable solvent and the osmotic pressure  $\pi$  of the solution of various concentration ( $\text{in kg/m}^3$ ) is measured at  $20^\circ\text{C}$ . The slope of a plot of  $\pi$  against  $c$  is found to be  $8.134 \times 10^{-3}$  (SI units) The molecular weight of the insulin

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222. Relative decrease in vapour pressure of an aqueous NaCl is 0.181. Number of moles of NaCl present in 180g of  $H_2O$  is (consider 100% dissociation of NaCl)

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223. One would expect proton to have very large:

A. (a) charge

B. (b) ionization potential

C. (c) hydration energy

D. (d) radius

**Answer:**

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**224.** Which of the following statements is true for all the alkali metals?

A. (a) Their nitrates decomposes on heating to give the corresponding nitrites and oxygen.

B. (b) Their chlorides are deliquescent and crystallise as hydrates.

C. (c) They react with water to form hydroxide and hydrogen.

D. (d) They readily react with halogens to form ionic halides.

**Answer:**

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225. What is the vapour pressure of pure water at  $100^{\circ}C$  temperature?

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226. 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.

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227. A very small amount of a nonvolatile solute (that does not dissociate) is dissolved in  $56.8\text{ cm}^3$  of benzene (density  $0.889\text{ g cm}^{-3}$ ). At room temperature, vapour pressure of this solution is 98.88 mm Hg while that of benzene is 100 mm Hg. Find the molality of this solution. If the freezing temperature of this solution is 0.73 degree lower than that of benzene, what is the value of molar freezing point depression constant of benzene ?

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**228.** A solution of .73 g of 'A' in 100 cc of water is found to be isotonic with a 3.42 % (wt./vol.) solution of sucrose ( $C_{12}H_{22}O_{11}$ ). Calculate molecular weight of A. ( $C_{12}H_{22}O_{11} = 342$ ). Assume no dissociation/association.

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**229.** A solute 'A' undergoes association in a medium as  $nA \rightleftharpoons A_n$

If the degree of association is ' $\alpha$ ', then Van't Hoff factor may be given as

:

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**230.** Ethylene glycol is used as antifreezing agent to prevent the freezing of water in car radiator in cold climate. Calculate the amount of ethylene

glycol to be added to 5 kg of water to prevent it from freezing at  $-6^{\circ}C$ .

Given  $K_f$  for water =  $1.85 \text{ kg mol}^{-1}$ .

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**231.** What is the weight of 1 mole of a solute, 0.132 g of which in 29.7 g benzene gave a freezing point depression of  $0.108^{\circ}C$ ? ( $K_f$  for benzene = 5.12)

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**232.** A solution containing 28 g phosphorus in 315 g  $CS_2$  (b. pt.  $46.3^{\circ}C$ ) boils at  $47.98^{\circ}C$ .  $K_b$  for  $CS_2$  is  $2.34 \text{ K mol}^{-1} \text{ kg}$ . Calculate m.wt. of phosphorus and deduce its molecular formula. Assume its complete association.

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233. A binary liquid (AB) shows positive deviation from Raoult's law when

A.  $P_A > P_A^0 X_A^{liq}$  and  $P_B > P_B^0 X_B^{liq}$

B. Intermolecular forces :  $A - A, B - B > A - B$

C.  $\Delta V_{mix} > 0$

D.  $\Delta H_{mix} > 0$

Answer:

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234. Consider 0.1 M solutions of two solutes X and Y. The solute X behaves as univalent electrolyte, will the solute Y dimerises in solution.

Selected correct statement

(s) regarding these solutions:

A. The boiling point of solution of 'X' will be higher than that of 'Y'

- B. The osmotic pressure of solution of 'Y' will be higher than that of 'X'.
- C. The freezing point of solution of 'X' will be lower than that of 'Y'.
- D. The relative lowering of vapour pressure of both the solution will be the same

**Answer:**

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**235.** Which of the following statements is (are) incorrect ?

- A. 0.1 M KCL solution will have the same osmotic pressure as 0.1 M glucose solution.
- B. 0.1 M KCl solution will have the same boiling point as 0.1 M urea solution.
- C. 0.1 m glucose and 0.1 m urea isotonic.

D. 0.1 m  $MgCl_2$  solution will have less relative lowering of vapour pressure than 0.1 m NaCl.

**Answer:**

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**236.** Consider following solutions :

0.1 m  $C_6H_5NH_3^+ Cl^-$  : 0.1 m Glucose , 0.1 m  $Na_2C_2O_4 \cdot 10H_2O$

- A. the solution with highest boiling point is 0.1 m  $Na_2C_2O_4 \cdot 10H_2O$
- B. the solution with highest freezing point 0.1 m glucose
- C. 0.1 m  $C_6H_5NH_3Cl$  and 0.1 m NaCl will have the same osmotic pressure
- D. 0.1 m glucose solution will have the lowest osmotic pressure

**Answer:**

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**237.** The azeotropic solutions of two miscible liquids

- A. can be separated by simple distillation
- B. may show positive or negative deviation from Raoult's Law
- C. are supersaturated solution
- D. behave like a single component and boil at a constant temperature

**Answer:**

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**238.** For a nonvolatile solute which statement (s) is/are correct ?

- A. vap. pressure of solution = vap. pressure of pure solvent
- B. vap. pressure of solute is zero
- C. vap. pressure of solution = vap. pressure of solvent in solution

D. vap. pressure of solution  $>$  vap. pressure of pure solvent

**Answer:**

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**239.** In the depression of freezing point experiment it is found that

- A. the vap. pressure of the solution is less than that of pure solvent
- B. the vap. pressure of solution is more than that of pure solvent
- C. only solute molecules solidify at freezing point
- D. only solvent molecules solidify at the freezing point

**Answer:**

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**240.** Addition of non-volatile solute to a solvent always increases the colligative properties such as osmotic pressure.  $\Delta P$ ,  $\Delta T_b$  and  $\Delta T_f$ . All these colligative properties are directly proportional to molality if solutions are dilute. The increases in colligative properties on addition of non-volatile solute is due to increases in number of solute particles.

For different aqueous solutions of 0.1 N NaCl, 0.1 N urea, 0.1 N  $Na_2SO_4$  and 0.1 N  $Na_3PO_4$  solution at  $27^\circ C$ , the correct statements are :

1. The order of osmotic pressure is  $NaCl = Na_2SO_4 = Na_3PO_4 = urea$
2.  $\pi = \frac{\Delta T_b}{k_b} \times RT$  for urea solution
3. Addition of salt on ice increases its melting point
4. Addition of salt on ice bring in melting of ice earlier

A. 2,3,4

B. 2,4

C. 1,2,3

D. 3,4

**Answer: B**

**241.** Addition of non-volatile solute to a solvent always increases the colligative properties such as osmotic pressure.  $\Delta P$ ,  $\Delta T_b$  and  $\Delta T_f$ . All these colligative properties are directly proportional to molality if solutions are dilute. The increases in colligative properties on addition of non-volatile solute is due to increases in number of solute particles.

For different aqueous solutions of 0.1 N NaCl, 0.1 N urea, 0.1 N  $Na_2SO_4$  and 0.1 N  $Na_3PO_4$  solution at  $27^\circ C$ , the correct statements are :

1. The order of osmotic pressure is  $NaCl = Na_2SO_4 = Na_3PO_4 = urea$
2.  $\pi = \frac{\Delta T_b}{k_b} \times RT$  for urea solution
3. Addition of salt on ice increases its melting point
4. Addition of salt on ice bring in melting of ice earlier

A. 1,2,3

B. 1,2,3,5

C. 2,4,5

D. 1,4,5

**Answer: A**



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**242.** An aqueous solution of 0.1 molal concentration of sucrose should have freezing point ( $k_f = 1.86 \text{ kmol}^{-1} \text{ kg}$ )

A.  $0.186^\circ \text{ C}$

B.  $1.86^\circ \text{ C}$

C.  $-1.86^\circ \text{ C}$

D.  $-0.186^\circ \text{ C}$

**Answer: D**



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**243.** When 250 mg of eugenol is added to 100 g of camphor ( $k_f = 39.7 \text{ kmolality}^{-1}$ ), it lowered the freezing point by  $0.62^\circ \text{ C}$ . The



molar mass of eugenol is :

A.  $1.6 \times 10^2 \text{ g/mol}$

B.  $1.6 \times 10^4 \text{ g/mol}$

C.  $1.6 \times 10^3 \text{ g/mol}$

D. 200 g/mol

**Answer: A**

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**244.** Match column - I with Column - II



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**245.** Match column - I with Column - II



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**246.** Match column - I with Column - II



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**247.** The vapour pressure of two pure liquid A and B are 5 and 10 torr respectively. Calculate the total pressure of the solution (in torr) obtained by mixing 2 moles of A and 3 moles of B.

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**248.** The vapour pressure of a liquid solution containing A and B is 99 torr. Calculate mole % of B in vapour phase.

(Given :  $P_A^0 = 100$  torr ,  $P_B^0 = 80$  torr)

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**249.** Calculate elevation in boiling point for 2 molal aqueous solution of glucose.

$$(Given: k_b(H_2O) = 0.5Kkg. mol^{-1})$$

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**250.** A solution containing 500 g of a protein per litre is isotonic with a solution containing 3.42 g sucrose per litre. The molecular mass of protein is  $5 \times 10^x$  hence x is

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**251.** An aqueous solution of urea has a freezing point of  $-0.515^\circ C$ . Predict the osmotic pressure (in atm) of the same solution at  $37^\circ C$ .

$$k_f = 1.86kkg(mol)^{-1}$$

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**252.** Calculate the concentration of NaOH solution in g/mL which has the same normality as that of a solution of HCl of concentration 0.0365 g/mL.

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**253.** 10 g of solute A and 20 g of solute B both are dissolved in 500 mL of water. The solution has the same osmotic pressure as 6.67 g of A and 30 g of B are dissolved in the same volume of water at the same temperature. What is the ratio of molar masses of A and B ?

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**254.** Arrange the osmotic pressure in increasing order for the following (assume salts are 100 % dissociated).

I. 0.M urea

II. 0.1 M NaCl

III. 0.1MNa<sub>2</sub>SO<sub>4</sub>

IV. 0.1MNa<sub>3</sub>PO<sub>4</sub>

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**255.** If equal volumes of two isotonic solutions are mixed then calculate the osmotic pressure of the net resultant solution obtained.

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**256.** Dry air was successively passed through a solution of 5 g solute in 80 g water & then through pure water. The loss in weight of solution was 2.5 g & that of pure water was 0.04 g. What is the mol. wt. of solute ?

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**257.** A beaker containing 20 g sugar in 100 g water and another containing 10 g sugar in 100 g water are placed under a bell-jar and allowed to stand until equilibrium is reached. How much water will be transferred from one beaker to another ?

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**258.** A solution containing 0.5 g of naphthalene in 50 g  $CCl_4$  yield a boiling point elevation of 0.4 k, while a solution of 0.6 g of an unknown solute in the same mass of the solvent gives a boiling point elevation of 0.65 k. Find the molar mass of the unknown solute.



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**259.** Calculate the freezing point of a solution of a non-volatile solute in a unknown solvent of molar mass 30 g/mol having mole fraction of solvent equal to 0.8. Given that latent heat of fusion of solid solvent =  $2.7 \text{ kcal mol}^{-1} \text{K}^{-1}$ , freezing point of solvent =  $27^\circ \text{C}$  and  $R = 2 \text{ cal mol}^{-1} \text{K}^{-1}$



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**260.** Two liquids A and B form an ideal solution. At 300 K, the vapour pressure of a solution containing 1 mole of A and 3 moles of B is 550 mm of Hg. At the same temperature, if one mole of B is added to this solution, the vapour pressure of the solution increases by 10 mm of Hg. Determine the vapour pressure of A and B in their pure states.

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**261.** Vapour pressure of  $C_6H_6$  and  $C_7H_8$  mixture at  $50^\circ C$  is given  $P$  (mm Hg) =  $180X_B + 90$ , where  $X_B$  is the mole fraction of  $C_6H_6$ . A solution is prepared by mixing 936 g benzene and 736 g toluene and if vapours over this solution are removed and condensed into liquid and again brought to the temperature  $50^\circ C$ , what would be mole fraction of  $C_6H_6$  in the vapour state. (At. wt. of C 12, H = 1)

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**262.** At a constant temperature liquid 'A' has vapour pressure of 170 mm Hg and liquid 'B' has vapour pressure of 280 mm Hg. A solution of the two at the same temperature in which mole fraction of A is 0.7 has a total vapour pressure of 376 mm. Identify whether the solution process is Endothermic or Exothermic ?



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**263.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : The difference in the boiling points of equimolar solution of HCl and HF decreases as their molarity is decreased.

Statement - II : The extent of dissociation decreases steadily with increasing dilution.

A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I



- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: C**

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**264.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : When 'a' mL of a 0.1 molal urea solution is mixed with another 'b' mL of 0.1 molal glucose solution, the boiling point of the solution is no different from the boiling points of the samples prior to mixing but if a mL of molal urea is mixed with 'b' mL of 0.1 molal HF the boiling point is different from the separate samples

Statement -II : HF is an electrolyte (weak) whereas glucose is a non electrolyte.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I
- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: A**



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**265.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : The freezing point of water is depressed by the addition of glucose.

Statement - II : Entropy of solution is less than entropy of pure solvent.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I
- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: C**

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**266.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : In binary ideal solution more volatile component boils at less temperature and less volatile component boils at high temperature than their normal boiling point of pure component.

Statement -II : For any composition, mixture boils at temperature in between the their normal boiling point temperature of pure component.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I
- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: D**



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**267.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : The boiling point of 0.1 M urea solution is less than that of 0.1 M KCl solution.

Statement -II : Elevation of boiling point is directly proportional to the number of moles of non-volatile solute particles present in the solution.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I
- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: A**



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**268.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : The observed molar mass of acetic acid in benzene is more than the normal molar mass of the acetic acid

Statement -II : Molecules of acetic acid dimerise in benzene due to hydrogen bonding.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I
- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: A**



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**269.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : Molarity and molality of 111 mg  $CaCl_2$  in 1 kg  $H_2O$  is nearly same.

Statement -II : In dilute solution molarity and molality are approximately equal.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I
- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: A**



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**270.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : At ice  $\rightleftharpoons$  water equilibrium, on increasing the pressure freezing point of water decreases.

Statement -II : Ice have low density so equilibrium shift in forward direction when pressure is increased.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I
- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: A**



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**271.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : An increase in surface area increases the the rate of evaporation.

Statement -II : Stronger the intermolecular attraction forces, faster is the rate of evaporation at a given temperature.



- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I
- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: B**



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**272.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : An ideal solution obeys Raoult's law.

Statement -II : In an ideal solution, solute - solute as well as solvent - solvent, interactions are similar to solute solvent interactions.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I
- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: A**



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**273.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : If a liquid solute more volatile than the solvent is added to the solvent, the vapour pressure of the solution is greater than vapour pressure of pure solvent.

Statement -II : Vapour pressure of solution is equal to vapour pressure of solvent.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I
- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: C**



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**274.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I :  $\Delta V_m^i x$  and  $\Delta S_m^i x$  for an ideal solution is zero.

Statement -II : A... B interaction in an ideal solution are same as between A...A and B...B.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I
- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: D**



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**275.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : Elevation in boiling point will be high if the molal elevation constant of the liquid is high.

Statement - II : Elevation in boiling point is a colligative property.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I
- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: B**

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**276.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : Addition of ethylene glycol to water lowers the freezing point of water, therefor, used as antifreeze substance.

Statement -II : Ethylene glycol is soluble in water.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I
- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: B**

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**277.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : Osmotic pressure is a colligative property.

Statement -II : Osmotic pressure developed in a column due to osmosis.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I

- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: B**

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**278.** This question has statement I and II. Of the four choices given after the statements, choose the one that best describes the two statements.

Statement - I : Osmosis involves movement of solvent molecules from its higher concentration to its lower concentration.

Statement -II : Solutions having the same osmotic pressure are called isotonic solutions.

- A. Statement - I is true, Statement - II is true. Statement - II is a correct explanation of Statement - I

- B. Statement - I is true, Statement - II is true. Statement - II is not correct explanation of Statement - I
- C. Statement - I is true, Statement - II is false.
- D. Statement - I is false, Statement - II is true.

**Answer: D**

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## Question Bank

1.  $pH$  of a 0.1 M monobasic acid is measured to be 2. Its osmotic pressure at a given temperature  $T$  K is

- A. 0.1 RT
- B. 0.11 RT
- C. 1.1 RT



D. 0.01 RT

**Answer:**



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