CHEMISTRY

BOOKS - GRB CHEMISTRY (HINGLISH)

LIQUID SOLUTIONS

1

1. Mole fraction of $C_3H_5(OH)_3$ in a solution of 36 g of water and 46 g of glycerine is :

A. 0.46

B. 0.36

C. 0.2

D. 0.4

Answer: C

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2. There is AP_3 and sucrose solution with 0.1 M concentration each . If osmotic pressure of AB_3 and sucrose solution is 0.72 atm and 0.24 atm respectively at same temperature . The fraction of AB_3 dissociated will be :

A. 0.25

B. 0.50

C. 0.67

D. 0.90

Answer: C

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3. An aqueous solution of a protein has an osomatic pressure of 3.8 mm of Hg at temperature of $300K$. If concentration of protein is $\frac{1}{49.26}$ % w/v

, then calculate molecular mass of protein.

A. 2000

B. 20000

C. 200

D. 1000

Answer: D

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4. Assuming each salt to be 80% dissociated , which of the following aqueous solution will have lowest vapour pressure ?

A. $0.1 M Al_2(SO_4)_3$

B. $0.1 M BaCl_2$

C. $0.1 M Na_2SO_4$

D. A solution obtained by mixing equl volume of (b) and (c)

Answer: A

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5. 1 mole of a compound $Co(NH_3)_5Cl_2Br$ gives 2 moles of curdy white precipitate , when treated with excess of $AgNO_3$ solution . Which of the following is incorrect about the compound ?

A. The compound may be represented as $\left[Co(NH_3)_5Br\right]Cl_2$.

B. The van't Hoff factor (i) is 3 , when $\alpha = 1.0$

C. The boiling point of 1 M-aq. Solution of $Co(NH_3)_5Cl_2Br$ should be triple of its value , when it were non-electrolyte .

D. The osmotic pressure of 1 M-aq. Solution of $Co(NH_3)_5Cl_2Br$ should be triple of its value , when it were non-electrolyte.

Answer: C

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6. Determination of the molar mass of acetic acid in benzene using freezing point depression is affected by :

A. association

B. dissociation

C. complex formation

D. partial ionization

Answer: A

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7. 20 moles of liquid A are mixed with 20 moles of liquid B to form an ideal binary solution. Calculate moles of A in liquid state when half of the solution has vaporized :

(Given : $P_A^{\circ} = 100 \text{ torr}, P_B^{\circ} = 121 \text{ torr}$)

A. $\frac{11}{21}$

B. $\frac{110}{21}$

C. $\frac{200}{21}$

D. $\frac{220}{21}$

Answer: D

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8. Which of the following solution can have boiling point less than that of both the individual components?

A. n-Hexane and n-Heptane

B. $CHCl_3$ and CH_3COOH_3

C. HNO_3 and H_2O

D. C_2H_5OH and H_2O

Answer: D

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9. Which of the following interface cannot be obtained?

A. Liquid-Liquid

B. Solid-Liquid

C. Liquid- Gas

D. Gas- Gas

Answer: D

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10. Statement-1 : The freezing of water is an endothermic process.

Statement-2 : Heat must be removed from the water to make it freeze.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

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11. A non-volative solute X completely dimerises in water, if the temperature is below $-3.72^{\circ} C$ and the solute completely dissociates as $X \rightarrow Y + Z$, if the temperature is above $100.26^{\circ} C$. In between these temperature, (including both temperature) X is neither dissociated nor associted. One mole of X is dissolved in 1 kg water.

Given : K_b of water $= 0.52K.\,kg\text{mol}^{-1}$

K_f of water $= 1.86Kkg\text{mol}^{-1}$

Which of the following statement(s) is/are true regarding the solution?

A. The freezing point of solution is $-1.86^{\circ} C$

B. The boiling point of solution is $101.04\,^{\circ}C$

C. When the solution is cooled is $-7.44\,^{\circ}C$, $75\,\%$ of water presents initially will separate as ice.

D. When the solution is heated to $102.08\,^{\circ}C$, $50\,\%$ of water present initially will escape out as vapour.

Answer: A::B::D

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12. An ideal solution is prepared from A and B (both are volatile). The composition of the solution is such that the total vapour pressure is harmonic mean of vapour pressures of pure $A\left(P_A^{\circ}\right)$ and pure $B\left(P_B^{\circ}\right)$. $\left[P_A^{\circ} \neq P_B^{\circ}\right]$

If x_A, x_B represents mole freaction of A and B in solution respectively and y_A and Y_B represents mole fraction of A and b in vapour phase, then answer the following questions.

The value of x_A is :

A. $1 - y_A$

B. $1 - y_B$

C. $\dfrac{P_A^\circ}{P_A^\circ + P_B^\circ}$

D. $\dfrac{P_B^\circ}{P_A^\circ + P_B^\circ}$

Answer: D

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13. Consider two cylinder piston assembly as shown in figure (a) and in figure (b) are kept in vacuum. Assume both piston are massless. Let two masses m_1 and m_2 are kept on the piston as shown in figure. Values of m_1 and m_2 are in the range in which both liquid and vapour phase coexist and are in equilibrium.

Solution I contains 10 moles of liquid A and 10 moles of liquid B while solution II contains 8 moles of liquid A and 12 moles of liquid B. Let liquids

A and B are completely miscible and form an ideal binary solution.

Given : $P_A^{\circ} = 100$ torr, $P_B^{\circ} = 60$ torr,

Let $X_A =$ mole fraction of A in liquid phase in solution I

$X'_A =$ mole fraction of A in liquid phase in solution II

$Y_A =$ mole fraction of A in vapour phase in solution I

$Y'_A =$ mole fraction of A in vapour phase in solution II

If $m_1 = m_2$ then :

A. $X_A = X'_A$

B. $X_A > X'_A$

C. $X_A < X'_A$

D. X_A and X'_A can't be co-related

Answer: A

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14. An ideal solution is prepared at 25° C by disolving $0.4 kg$ of 5 moles liquid A in 20 moles liquid B. The solid is non-volatile and non-electrolyte in the solution. At $25\,^{\circ}C$, The vapour pressures of pure liquids A and B are 100 torr and 200 torr respectively and the vapour pressure of solution is 150 torr. The shortest distance between two A^{+} ions in the solid is $200\sqrt{2}$ pm. $\left(N_A = 6 \times 10^{23}\right)$

The molar mass of solid AB is :

A. $100g/\text{mol}$

B. $80g/\text{mol}$

C. $40g/\text{mol}$

D. $160g/\text{mol}$

Answer: B

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15. Colligative properties i.e., the properties of solution which depend upon the particles present in solution are osmotic pressure, depression in freezing point, elevation in boiling point and relative lowering of vapour pressure. Experimental values of colligative properties for electrolytes are always higher than those obtained theoreticallu. The ratio of experimental colligative properties to theoretical colligative properties is called as van't Hoff factor (i).

A weak monoprotic acid (molar mass $= 180$) aqeous solution of $0.18\,\%$ w/v at $300K$ has observed osmoles pressure 0.369 atm. What should be its van't Hoof factor(i) $(R = 0.082 atm \times L/K/\text{mole})$?

A. 1.2

B. 1.5

C. 1

D. 0.5

Answer: B

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16. Properties such as boiling point, freezing point and vapour pressure of a pure solvent change when solute molecules are added to get homogenous solution. These are called colligative properties. Application of colligative properties are very useful in day-to-day life. One of its example is the use of ethylene glycol and water mixture as anti-freezing liquid in the radiator of automobiles.

A solution M is prepared by mixing ethanol and water. The mole fraction of ethanol in the mixture is 0.9.

Given : Freezing point depression constant of water $\left(K_f^{water}\right) = 1.86 K mol^{-1}$

Freezing point depression constant of ethanol $\left(K_f^{ethonal}\right) = 2.0 K kg mol^{-1}$

Boiling point elevation constant of water $\left(K_b^{water}\right) = 0.52 K kg mol^{-1}$

Boiling point elevation constant of ethanol $\left(K_b^{ethonal}\right) = 1.2 K kg mol^{-1}$

Standard freezing point of water $= 273 K$

Standard freezing point of ethonal $= 155.7 K$

Standard boiling point of water $= 373 K$

Standard boiling point of ethanol $= 351.5 K$

Vapour pressure of pure water $= 32.8 mmHg$

Vapour pressure of pure ethonal $= 40 mmHg$

Molecular weight of water $= 18 g mol^{-1}$

Molecular weight of ethonal $= 45 g mol^{-1}$

In answering the following questions, consider the solution to be ideal

ideal solutions and solutes to be non-volatile and non-dissociative.

The freezing point of the solution M is :

A. $268.7K$

B. $268.5K$

C. $234.2K$

D. $150.9K$

Answer: D

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17. Addition of non-volatile solute to a solvent always inceases the colligative properties such as osmotic pressure, $\Delta P, \Delta T_b$ and ΔT_f. All these colligative properties are direactly propertional to molality if solutions are dilute. The increase in colligative properties on addition of non-volatile solute is due to incease 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 statement are :

(P) The order of osmotic pressure is, $NaCl > Na_2SO_4 > Na_3PO_4 >$ urea

(Q) $\pi = \frac{\Delta T_b}{K_b} \times ST$ for urea solution

(R) Addition of salt on ice increases its melting point

(S) Addition of salt on ice brings in melting earlier

A. Q, R, S

B. P, Q, S

C. P, Q, R

D. R, S

Answer: B

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18. Addition of non-volatile solute to solvent lowers its vapoure pressure. Therefore, the vapour pressure of a solution (i.e, V.P. of solvent in a solution) is lower than that of pure solvent in a solution) is lower than that of pure solvent, at the same temperature. A higher temperature is needed to raise the vapour pressure upto one atmosphere pressure, when boiling point is attined. However, increase in b.pt. is small . for example, 0.1 molal aqueous sucrose solution boils at $10.05\,^{\circ}C$

Sea water, an aqueous solution, which is rich in Na^{+} and Cl^{-} ions, freezes about $1\,^{\circ}C$ lower than frozen water . At the freezing point of a pure-solvent, the reates at which two molecule stick together to form the solid and leave it to return to liquid are equal when solute is present. Few solvent molecules are in contact with surface of solid. However, the rate at which the solvent molecules leave, surface of solid remains unchanged. That is why, temperature is lowered to restore the equalibrium. The freezing depression in a dilute solution is proportional to molality of the solute.

When $250mg$ of eugonal is added to $100g$ of camhor $\left(K_f = 29.7\text{Kmolality}^{-1}\right)$. it lowered the freezing point by $0.62\,^{\circ}C$. The molar mass of eugonal is :

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

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

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

D. $200g/\text{mol}$

Answer: A

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19. 10 mole of liquid $'A'$ and 10 mole of liquid $'B'$ is mixed in a cylindrical vessel containing a piston arrangement. Initially a pressure of 2 atm is maintained on the solution. Now, the piston is raised slowly and isothermally. Assuming A and B to be completely miscible and forming an ideal solution.

$P_A^\circ = 0.6$ atm and $P_B^\circ = 0.9$ atm

The pressure below which the evaporation of liquid solution will start is :

A. 0.6 atm

B. 0.8 atm

C. 0.75 atm

D. 0.9 atm

Answer: C

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20. 1 mole of liquid A and 9 moles of liquid B are mixed to form a solution. If $P_B^\circ = 400\text{mm}$ of Hg and $P_A^\circ = 20\text{mm}$ of Hg at a temperature 'T' and normal boiling point of liquid B is 300K then answer the questions that follow.

Given data: $K_b = 2.7\text{K kg mol}^{-1}$, Molar mass of B=100

It is observed that pressure of vapour above the solution at 'T' Kelvin is 350 mm Hg. The true statement is :

A. The liquids form ideal solution.

B. The solute-solvent interactions ar weaker than solvent-sovlent or solute-solute interactions.

C. The volume of final solution will be lower than sum of individual volumes.

D. The enthalpy change due to mixing will be zero.

Answer: C

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21. An isotope of hydrogen atom is represented as X which follows Bohr'r model and exists as diatomic gaseous molecule X_2. Also the normal boiling point of a compound X_2O liquid is found to be $101\,^{\circ}C$ and that of a solution obtained on dissolved 0.1 moles of NaCl in 1 Kg of X_2O liquid is $101.4\,^{\circ}C$. It is also known that the ionization energy of X is equal to 14eV The value of ebullioscopic constant of X_2O is given by:

A. $4 K kg mol^{-1}$

B. $2 K kg mol^{-1}$

C. $0.4 K kg mol^{-1}$

D. $1 K kg mol^{-1}$

Answer: B

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22. Match column I containing magnitude of observed colligative property with column II having concentration of electrolytes. Assume all solutions to behave like very dilute aqueous solution with perfectly non-volatile solute.

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23. 10 milimoles of a solid A when dissolved in 10 noles of a liquid solvent B starts trimerisation process obeying first order kinetics (with the trimer also soluble in the solvent B). On addition of 5 mili-moles of another soluble substance C after 10 minutes the trimarisation compeletely stops. The reresulting solution is cooled to some temperature lower than 49.96° C (melting point of solution obtained after mixing C) to cause solidification of some B. The remaining solution after removal of solid B is heated to 70° Cwhere vapour pressure was found to be 200 mm of Hg.

Given : Vapour pressure of liquid B at 70° C =201 mm Of Hg, Normal melting point of B = 50° C,

Cryoscopic constant = 2 K kg mol^{-1}, molar mass of B = 50 g mol^{-1}.

Calcualate a four digit number abcd where

ab=half life of trimarisation of A (in min)

cd=moles of B solidified.

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2

1. Calculate the amount of water by which 50 mL of a solution having concentration 20% w/v and density 2 g/mL should be diluted to obtain a solution of concentration 7.5% w/v:

A. 133.33 mL

B. 33.33 mL

C. 83.33 mL

D. 50 mL

Answer: C

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2. A $0.003MAl_2(SO_4)_3$ solution is isotonic with 0.01 M solution of glucose . The percentage dissociation of aluminium sulphate will be :

A. $75\ \%$

B. $58.33\ \%$

C. $23.97\ \%$

D. $43.\ 12\ \%$

Answer: B

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3. 200 mL of a very dilute aqueous solution of a protein contains 1.9 gm of the protein . If osmotic rise of such a solution at 300K is found to be 38 mm of solution then calculate molar mass of the protein .

(Take R = 0.008 L atm $mol^{-1}K^{-1}$)

A. 24630 g/ mole

B. 123150 milli g / mole

C. 517230 g / mole

D. 62016 g / mole

Answer: D

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4. Calculate solubility (in moles/litre) of a saturated aqueous solution of Ag_3PO_4 if the vapour pressure of the solution becomes 750 torr at 373 K:

A. $\frac{2}{15}$

B. $\frac{1}{30}$

C. $\frac{10}{54}$

D. $\frac{20}{27}$

Answer: C

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5. For a liquid, normal boiling point is $-173^\circ C$. Then at 2 atm pressure , it's boiling point should be nearly .

(Δ_{vap} = 200 cal/mole, R = 2 cal/mol-K , In 2 = 0.7)

A. $-73^\circ C$

B. $333^\circ C$

C. $60^\circ C$

D. $103^\circ C$

Answer: C

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6. The van't Hoff factor of an aqueous solution of storage battery containing $49\,\%\,H_2SO_4$ by weight and a depression in freezing point of 27.9 K is approximately .

(Given : $K_f = 1.86K$ - kg/mole)

A. 1

B. 1.5

C. 2

D. 3

Answer: D

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7. Acetone and chloroform form a non-ideal solution. If 116 g of acetone is mixed with 239 g of chloroform and their vapour pressures in pure state at 298 K are 360 torr and 300 torr respectively then what would be vapour pressure of the above solution at 298 K?

A. 330 toor

B. 350 toor

C. 250 toor

D. 370 toor

Answer: C

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8. Which of the following statements regarding solubility of gas in water is correct?

A. As temperature increases, solubility of gas also increses.

B. A more polar gas will have lesser solubililty as compared to non-polar gas.

C. Gases will be more soluble when dissolved at higher pressures.

D. The dissolution process is always endothemic

Answer: C

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9. There are some of the characteristics of the supersaturated solution

(P) Equilibrium exists between solution and solid solute.

(Q) If a crystal of solute is added to supersaturated solution, crystallisation occurs rapidly

®Supersaturated solutions contain more solute than they should have at a particular temperature.

Correct characteristics of supersaturated solutions are:

A. P,Q,R

B. Q,R

C. P,R

D. P,Q

Answer: B

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10. Statement-1 : The difference in the boiling points of equimolar solution of HCl and HF decreases as their molarity is decreased.

Statement-2 : The extent of dissociation decreases steadily with increasing dilution.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: C

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11. A mixture of $A(g)$ and $B(g)$ is formed, where mole fraction of gas A is 0.8.

Given : $P_A^{\circ} = 400$ torr, $P_B^{\circ} = 200$ torr

Mixture of A and B obey Raoult's law. Then :

A. Composition of first drop of condensate is $\left(X_A = \frac{2}{3}\right)$

B. Total pressure when first drop of condensate form is $1000/3$ torr

C. The composition of last bubble is $\left(Y_A = \frac{8}{9}\right)$

D. Composition of A in vapour when mole fraction of A and B in liquid are equal $\left(Y_A = \frac{2}{3}\right)$

Answer: A::B::C::D

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12. An ideal solution is prepared from A and B (both are volatile). The composition of the solution is such that the total vapour pressure is harmonic mean of vapour pressures of pure $A\left(P_A^\circ\right)$ and pure $B\left(P_B^\circ\right)$. $\left[P_A^\circ \neq P_B^\circ\right]$

If x_A, x_B represents mole freaction of A and B in solution respectively and y_A and Y_B represents mole fraction of A and b in vapour phase, then answer the following questions.

The value of y_A is equal to :

A. x_A

B. x_B

C. $\frac{1}{2}$

D. zero

Answer: C

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13. Consider two cylinder piston assembly as shown in figure (a) and in figure (b) are kept in vacuum. Assume both piston are massless. Let two masses m_1 and m_2 are kept on the piston as shown in figure. Values of m_1

and m_2 are in the range in which both liquid and vapour phase coexist and are in equilibrium.

Solution I contains 10 moles of liquid A and 10 moles of liquid B while solution II contains 8 moles of liquid A and 12 moles of liquid B. Let liquids A and B are completely miscible and form an ideal binary solution.

Given : $P_A^\circ = 100$ torr, $P_B^\circ = 60$ torr,

Let $X_A =$ mole fraction of A in liquid phase in solution I

$X'_A =$ mole fraction of A in liquid phase in solution II

$Y_A =$ mole fraction of A in vapour phase in solution I

$Y'_A =$ mole fraction of A in vapour phase in solution II

If $m_1 = m_2$ then :

A. $Y_A = Y'_A$

B. $Y_A > Y'_A$

C. $Y_A < Y'_A$

D. Y_A and Y'_A can't be co-related

Answer: A

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14. An ideal solution is prepared at 25° C by disolving $0.4kg$ of 5 moles liquid A in 20 moles liquid B. The solid is non-volatile and non-electrolyte in the solution. At $25^{\circ}C$, The vapour pressures of pure liquids A and B are 100 torr and 200 torr respectively and the vapour pressure of solution is 150 torr. The shortest distance between two A^{+} ions in the solid is $200\sqrt{2}$ pm. $\left(N_A = 6 \times 10^{23}\right)$

The density of solid AB is :

A. $\dfrac{25}{3}gm/cm^3$

B. $\dfrac{50}{3}gm/cm^3$

C. $\dfrac{25}{6}gm/cm^3$

D. $\dfrac{25}{8}gm/cm^3$

Answer: A

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15. Colligative properties i.e., the properties of solution which depend upon the particles present in solution are osmotic pressure, depression in freezing point, elevation in boiling point and relative lowering of vapour pressure. Experimental values of colligative properties for electrolytes are always higher than those obtained theoreticallu. The ratio of experimental colligative properties to theoretical colligative properties is called as van't Hoff factor (i).

What is observed molar mass of weak acid in soluton in above equation?

A. $270g$

B. $180g$

C. $120g$

D. $90g$

Answer: C

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16. Properties such as boiling point, freezing point and vapour pressure of a pure solvent change when solute molecules are added to get homogenous solution. These are called colligative properties. Application of colligative properties are very useful in day-to-day life. One of its example is the use of ethylene glycol and water mixture as anti-freezing liquid in the radiator of automobiles.

A solution M is prepared by mixing ethanol and water. The mole fraction of ethanol in the mixture is 0.9.

Given : Freezing point depression constant of water $\left(K_f^{\text{water}}\right) = 1.86 K \text{mol}^{-1}$

Freezing point depression constant of ethanol $\left(K_f^{\text{ethonal}}\right) = 2.0 Kkg\text{mol}^{-1}$

Boiling point elevation constant of water $\left(K_b^{\text{water}}\right) = 0.52 Kkg\text{mol}^{-1}$

Boiling point elevation constant of ethanol $\left(K_b^{\text{ethonal}}\right) = 1.2 Kkgmol^{-1}$

Standard freezing point of water $= 273K$

Standard freezing point of ethonal $= 155.7K$

Standard boiling point of water $= 373K$

Standard boiling point of ethanol $= 351.5K$

Vapour pressure of pure water $= 32.8 mmHg$

Vapour pressure of pure ethonal $= 40 mmHg$

Molecular weight of water $= 18 g\text{mol}^{-1}$

Molecular weight of ethonal $= 45 g\text{mol}^{-1}$

In answering the following questions, consider the solution to be ideal ideal solutions and solutes to be non-volatile and non-dissociative.

The vapopur pressure of the solution M is :

A. $39.3 mmHg$

B. $36.0 mmHg$

C. $29.5 mmHg$

D. $28.8 mmHg$

Answer: B

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17. Addition of non-volatile solute to a solvent always inceases the colligative properties such as osmotic pressure, $\Delta P, \Delta T_b$ and ΔT_f. All these colligative properties are direactly propertional to molality if solutions are dilute. The increase in colligative properties on addition of non-volatile solute is due to incease 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 statement are :

$1g$ mixture of glucose and urea present in $250 mL$ aqueous solution shows an osmotic pressure of 0.74 atm at $27^\circ C$. Assuming solution to be dilture, which are correct ?

(P) Percentage of urea in solute mixture is 17.6

(Q) Relative lowering in vapour pressure of this solutions is 5.41×10^{-4}.

(R) The solution will boil at $100.015^\circ C$, if K_b of water is $0.5 K \text{molality}^{-1}$

(S) If glucose is replaced by same amount of sucrose, the solution will show higher osmotic pressure at $27^\circ C$

(T) If glucose is repalced by same amount of $NaCl$, the solution will show lower osmotic pressure at $27^\circ C$.

A. P, R

B. P, Q, R, T

C. Q, S, T

D. P, S, T

Answer: A

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18. Addition of non-volatile solute to solvent lowers its vapoure pressure. Therefore, the vapour pressure of a solution (i.e, V.P. of solvent in a solution) is lower than that of pure solvent in a solution) is lower than that of pure solvent, at the same temperature. A higher temperature is needed to raise the vapour pressure upto one atmosphere pressure, when boiling point is attined. However, increase in b.pt. is small . for example, 0.1 molal aqueous sucrose solution boils at $10.05\ ^{\circ}C$

Sea water, an aqueous solution, which is rich in Na^{+} and Cl^{-} ions, freezes about $1\ ^{\circ}C$ lower than frozen water . At the freezing point of a pure-solvent, the reates at which two molecule stick together to form the solid and leave it to return to liquid are equal when solute is present. Few solvent molecules are in contact with surface of solid. However, the rate at which the solvent molecules leave, surface of solid remains unchanged. That is why, temperature is lowered to restore the equalibrium. The freezing depression in a dilute solution is proportional to molality of the solute.

The freezing point of a $5 g CH_3COOH(aq)$ per $100 g$ water is $-1.576^\circ C$. Then van't Hoff factor (K_f of water $= 1.86 K mol^{-1} kg$) :

A. 0.996

B. 2

C. 0.5

D. 1.016

Answer: D

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19. 10 mole of liquid $'A'$ and 10 mole of liquid $'B'$ is mixed in a cylindrical vessel containing a piston arrangement. Initially a pressure of 2 atm is maintained on the solution. Now, the piston is raised slowly and isothermally. Assuming A and B to be completely miscible and forming an ideal solution.

$P_A^\circ = 0.6$ atm and $P_B^\circ = 0.9$ atm

If $\frac{1}{4}$ of the total amount of liquid solution taken initially is converted to vapour, then moles of A in the vapour will be :

[Given : $\sqrt{2425} = 49.25$]

A. 2.125

B. 3.875

C. 4

D. 1

Answer: A

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20. 1 mole of liquid A and 9 moles of liquid B are mixed to form a solution. If $P_B^\circ = 400\text{mm}$ of Hg and $P_A^\circ = 20\text{mm}$ of Hg at a temperature 'T' and normal boiling point of liquid B is 300K then answer the questions that follow.

Given data: $K_b = 2.7\text{K kg mol}^{-1}$, Molar mass of B=100

If 'A' is assumed to be perfectly non volatile then what will be normal boiling point of the solution.

A. 300

B. 300.3

C. 303

D. 300.03

Answer: C

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21. An isotope of hydrogen atom is represented as X which follows Bohr's model and exists as diatomic gaseous molecule X_2. Also the normal boiling point of a compound X_2O liquid is found to be 101° C and that of solution obtaind on dissolving 0.1 moles of $NaCl$ in 1 kg of X_2Oliquid is $101.4^\circ C$. It is also known that the ionization energy of X is equal to $14eV$. The energy required to excite electron from ground state of IInd excited state is given by :

A. $10.2eV/\text{atm}$

B. $12.1eV/\text{atm}$

C. $12.44eV/\text{atm}$

D. $10.5eV/\text{atm}$

Answer: C

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22. Assuming all the solutes are non volatile, all solutions are ideal and neglect any hydrolysis of cation and anion.

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23. The freezing point of an aqueous solution of KCN containing 0.1 mol kg^{-1} was -0.38° C. On adding 0.005 moles of $Hg(CN)_2$ per kg of solvent, the freezing point of the solution remined as -0.38° C. Assuming following reaction to be occured to $100\,\%$ extent and none of the $Hg(CN)_2$ remaining.

$$Hg(CN)_2(aq) + x(CN)^- \rightarrow Hg(CN)_{x+2}^{x-}(aq)$$

calculate the value of 'x'.

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3

1. Which of the following options does not represent concentration of semi-molal aqueous solution of NaOH having d_{solution} = 1.02 g/ml?

A. Molarity = $\frac{1}{2}$ M

B. $X_{NaOH} = \frac{9}{1009}$

C. $\%\,\frac{w}{w} = 10\,\%$

D. $\%\,\frac{w}{v} = 2\,\%$

Answer: C

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2. Consider following cases:

(P) $2MCH_3COOH$ solution in benzene at 27° C where there is dimer formation to the extent of 100%.

(B) 0.5 MKCl aq. Solution at 27°, which ionises 100%.

What is/are ture statement(s) ?

A. Both are isotonic

B. P is hypertonic

C. Q is hypotonic

D. None is correct

Answer: A

3. Osmotic pressure of urea solution is 56.6 mm Hg at a temperature of $10\,^{\circ}C$. The solution is diluted and the temperature is raised to $40\,^{\circ}$ C such that the osmotic pressure is found to be 31.3 mm Hg . The extent of dilution will be :

A. $V_{\text{final}} = 10V_{\text{initial}}$

B. $V_{\text{final}} = 2V_{\text{initial}}$

C. $2V_{\text{final}} = 3V_{\text{initial}}$

D. $V_{\text{final}} = 20V_{\text{initial}}$

Answer: B

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4. Which of the following aqueous solutions will have maximum vapour pressure?

A. $0.05MK_4\left[Fe(CN)_6\right]$

B. $0.02 M BaCI_2$

C. $20\ \%\ w/w$glucose solution

D. An aqueous solution of $i_2(s)$ in water having mole fraction of iodine

equal to 0.01

Answer: B

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5. 1 molal aqueous solution of an electrolyte AB_2 is $80\ \%$ ionized into A^{+2}

and B^{-1} ions . The boiling point of the solution at 1 atm is :

$\left[K_b\left(H_2O\right) = 0.5$ kg $mol^{-1}]$

A. $274.3K$

B. $373.5K$

C. $374.3K$

D. $100.5K$

Answer: C

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6. 0.2 molal solution each of glucose (I) , magnesium chloride (II) and Aluminium sulphate (III) is taken . The correct order freezing point of the solutions will be :

A. all same

B. $(\text{freezing point})_{I} < (\text{freezing point})_{II} < (\text{freezing point})_{III}$

C. $(\text{freezing point})_{III} < (\text{freezing point})_{I} < (\text{freezing point})_{II}$

D. $(\text{freezing point})_{I} > (\text{freezing point})_{II} > (\text{freezing point})_{III}$

Answer: D

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7. Two liquids A and B are partially miscible (Molecular mass $A = 20$, Molecular mass $B = 40$). On mixing 1 mol of A with 3 moles of B, two different layers M and N are formed with layer M containing 0.2 mole fraction of A and layer N containing 0.6 mole fraction of A. The ratio of masses of layer M to layer N will be :

A. $1:3$

B. $3:1$

C. $1:9$

D. $9:1$

Answer: D

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8. Azeotropic mixture:

A. are those which can be fractionally distilled

B. have definite constant boiling point

C. have same definite composition at any pressure

D. are those which have different composition in liquid and vapour state

Answer: B

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9. When KCl dissolves in water (assume endothermic dissolution):

A. $\Delta H = + \text{ve}, \Delta S = + \text{ve}, \Delta G = + \text{ve}$

B. $\Delta H = + \text{ve}, \Delta S = - \text{ve}, \Delta G = - \text{ve}$

C. $\Delta H = + \text{ve}, \Delta S = + \text{ve}, \Delta G = - \text{ve}$

D. $\Delta H = - \text{ve}, \Delta S = - \text{ve}, \Delta G = + \text{ve}$

Answer: C

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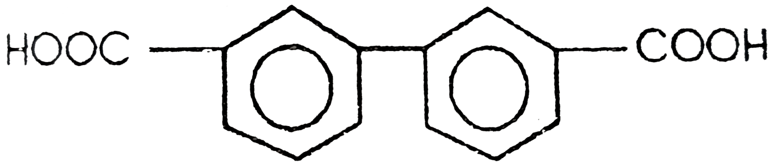
10. Statement-1 : The molar mass obtained for benzoic acid in benzene acid in benzene is found to be nearly 244.

Statement-2 : Benzoic acid has the formula



A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: C

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11. An ideal binary liquid solution of A and B has a vapour pressure of $900 mm$ of Hg.It is distilled at constant temperature till $\frac{2}{3}$ of the original amount is distilled. If the mole fraction of A in residuce and mole fraction of B is condensate is 0.3 and 0.4 respectively and vapour pressure of residue is 860 mm of Hg then identify the correct options.

A. The initial mixture taken should be an equimolar mixture of A and B

B. The first vapours formed will have more moles of A as compared to moles of B.

C. $P_A^{\circ} = 1000 mm$ of Hg

D. The vapour pressure above the condensate will be $920 mm$ of Hg at same temperature

Answer: A::B::C::D

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12. An ideal solution is prepared from A and B (both are volatile). The composition of the solution is such that the total vapour pressure is harmonic mean of vapour pressures of pure $A\left(P_A^\circ\right)$ and pure $B\left(P_B^\circ\right)$. $\left[P_A^\circ \neq P_B^\circ\right]$

If x_A, x_B represents mole freaction of A and B in solution respectively and y_A and Y_B represents mole fraction of A and b in vapour phase, then answer the following questions.

If the total vapour pressure is half the value mentioned in the above comprehension, then which of the following must be ture?

A. The composition of this ideal solution can be determined

B. the solution exhibits positive as well as negative of P_a° and P_B°

C. $A....B$ attractions are stronger than $A.....A$ and $B.....B$ interactions.

D. A and B form a maximum boiling point azeotropic mixture.

Answer: C::D

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13. Consider two cylinder piston assembly as shown in figure (a) and in figure (b) are kept in vacuum. Assume both piston are massless. Let two masses m_1 and m_2 are kept on the piston as shown in figure. Values of m_1 and m_2 are in the range in which both liquid and vapour phase coexist and are in equilibrium.

Solution I contains 10 moles of liquid A and 10 moles of liquid B while solution II contains 8 moles of liquid A and 12 moles of liquid B. Let liquids A and B are completely miscible and form an ideal binary solution.

Given : $P_A^{\circ} = 100$ torr, $P_B^{\circ} = 60$ torr,

Let $X_A =$ mole fraction of A in liquid phase in solution I

$X'_A =$ mole fraction of A in liquid phase in solution II

$Y_A =$ mole fraction of A in vapour phase in solution I

$Y'_A =$ mole fraction of A in vapour phase in solution II

Mole fraction of A in liquid phase when 10 moles of solution is vapoursied in solution II is :

A. 0.45

B. 0.632

C. 0.25

D. 0.34

Answer: B

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14. Colligative properties i.e., the properties of solution which depend upon the particles present in solution are osmotic pressure, depression in freezing point, elevation in boiling point and relative lowering of vapour pressure. Experimental values of colligative properties for electrolytes are always higher than those obtained theoreticallu. The ratio of experimental colligative properties to theoretical colligative properties is called as van't Hoff factor (i).

If equal volume of $0.01 MMaOH$ is added in the solution of above weak acid solution then what will be new observed osmotic pressure at same temperature? Neglect the hydrolysis, dissociation of water and any volume concentration or expansion. Assume 10% dissociation of salt formed.

A. 0.246 atm

B. 0.369 atm

C. 0.123 atm

D. 0.492 atm

Answer: A

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15. Properties such as boiling point, freezing point and vapour pressure of a pure solvent change when solute molecules are added to get homogenous solution. These are called colligative properties. Application of colligative properties are very useful in day-to-day life. One of its example is the use of ethylene glycol and water mixture as anti-freezing liquid in the radiator of automobiles.

A solution M is prepared by mixing ethanol and water. The mole fraction of ethanol in the mixture is 0.9.

Given : Freezing point depression constant of water

$\left(K_f^{\text{water}}\right) = 1.86K\text{mol}^{-1}$

Freezing point depression constant of ethanol $\left(K_f^{\text{ethonal}}\right) = 2.0Kkg\text{mol}^{-1}$

Boiling point elevation constant of water $\left(K_b^{\text{water}}\right) = 0.52Kkg\text{mol}^{-1}$

Boiling point elevation constant of ethanol $\left(K_b^{\text{ethonal}}\right) = 1.2Kkgmol^{-1}$

Standard freezing point of water $= 273K$

Standard freezing point of ethonal $= 155.7K$

Standard boiling point of water $= 373K$

Standard boiling point of ethanol $= 351.5K$

Vapour pressure of pure water $= 32.8mmHg$

Vapour pressure of pure ethonal $= 40mmHg$

Molecular weight of water $= 18g\text{mol}^{-1}$

Molecular weight of ethonal $= 45g\text{mol}^{-1}$

In answering the following questions, consider the solution to be ideal ideal solutions and solutes to be non-volatile and non-dissociative.

Water is added to the solution M such lthat the molecules fraction of water in t he solution becomes 0.9. The boiling point of this solution is :

A. $380.4K$

B. $376.2K$

C. $375.5K$

D. $354.7K$

Answer: B

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16. Addition of non-volatile solute to solvent lowers its vapoure pressure. Therefore, the vapour pressure of a solution (i.e, V.P. of solvent in a solution) is lower than that of pure solvent in a solution) is lower than that of pure solvent, at the same temperature. A higher temperature is needed to raise the vapour pressure upto one atmosphere pressure, when boiling point is attined. However, increase in b.pt. is small . for example, 0.1 molal aqueous sucrose solution boils at $10.05\,^{\circ}C$

Sea water, an aqueous solution, which is rich in Na^{+} and Cl^{-} ions, freezes about $1\,^{\circ}C$ lower than frozen water . At the freezing point of a pure-solvent, the reates at which two molecule stick together to form the solid and leave it to return to liquid are equal when solute is present. Few solvent molecules are in contact with surface of solid. However, the rate at which the solvent molecules leave, surface of solid remains unchanged. That is why, temperature is lowered to restore the equalibrium. The freezing depression in a dilute solution is proportional to molality of the solute.

The freezing point of benzene solution was $5.4^{\circ}C$. The osmotic pressure of same solution at $10^{\circ}C$ is (freezing point of benzene $= 5.5^{\circ}C$). Assume solution to be dilute. [K_f for C_6H_6 is $4.9K\text{molality}^{-1}$].

A. 0.274 atm

B. 0.474 atm

C. 0.674 atm

D. 0.874 atm

Answer: B

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17. 10 mole of liquid $'A'$ and 10 mole of liquid $'B'$ is mixed in a cylindrical vessel containing a piston arrangement. Initially a pressure of 2 atm is maintained on the solution. Now, the piston is raised slowly and isothermally. Assuming A and B to be completely miscible and forming an ideal solution.

$P_A^{\circ} = 0.6$ atm and $P_B^{\circ} = 0.9$ atm

The minimum pressure for the existance of liquid solution is :

A. 0.6 atm

B. 0.8 atm

C. 0.72 atm

D. 0.9 atm

Answer: C

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18. 1 mole of liquid A and 9 moles of liquid B are mixed to form a solution. If $P_B^{\circ} = 400\text{mm}$ of Hg and $P_A^{\circ} = 20\text{mm}$ of Hg at a temperature 'T' and normal boiling point of liquid B is 300K then answer the questions that follow.

Given data: $K_b = 2.7 \text{K kg mol}^{-1}$, Molar mass of B=100

If 'A' is perfectly non volatile and it dimerises to and extent of 60% then what will be the vapour pressure of the solution.

A. $360mm$ of Hg

B. $\frac{3600}{9.7}mm$ of Hg

C. $\frac{4000}{9.7}mm$ of Hg

D. $36mm$ of Hg

Answer: B

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19.

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20. Calculate the number of binary liquid solutons which are expected to follow Raoult's law.

(1) Solution of benzene and toluene

(2) Solution of hexane and heptane

(3) Solution of chloform and methanol

(4) Solution of methanol and acetone

(5) Solution of chloform and acetone

(6) Solution of HNO_3 and water

(7) Solution of aniline and phenol

(8) Solution of two volatile liquids which can give maximum boiling azeotrope.

(9) Very dilute aqueous solution of glucose

(10) Solution of two volatile liquids which on mixing do not show contraction/expansion of volume.

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4

1. An aqueous solution of glucose is labelled as 0.05 m . Which of the following options correctly represent the concentration of the solution is density of solution is 1.009 g/mL is :

A. 0.05 M

B. $X_{\text{glucose}} = \frac{9}{10000}$

C. $\% \, w/v = 0.9 \, \%$

D. $\% \, w/w = \frac{9}{10.09} \, \%$

Answer: A

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2. pH of 0.1 M monobasic acid is found to be 2 . Hence its osmotic pressure at a given temp. T K is :

A. 0.1RT

B. $0.11RT$

C. $1.1RT$

D. 0.01RT

Answer: B

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3. Availabe are $1L$ of 0.1 M NaCl and 2L 0.25 M $CaCl_2$ solution . Using only these two solutions what maximum volume of a solution can be prepared having $\left[Cl^-\right]=0.34$ M exactly ? Both electrolytes are strong .

A. 2.5L

B. 2.4L

C. 2.3L

D. None of these

Answer: A

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4. An aqueous solution of a non volatile solute is such that the vapour pressure is 25% lesser than that of water at same temperature.The molatiy of the solution will be:

A. $\frac{1000}{(54)m}$

B. $\frac{1000}{72}m$

C. $\frac{3000}{54}m$

D. $\frac{3000}{72}$

Answer: A

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5. Calculate mass of the final solution obtained on heating a solution comprising of 0.5 moles of urea in 2000 g of H_2O to a temperature of $101\,^{\circ}C$ if $K_b\left(_{H_2O}\right) = 0.5K$ kg/mole .

A. 250 g

B. 280 g

C. 1030 g

D. 530g

Answer: B

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6. The freezing point of an aqueous solution of 0.1 m Hg_2Cl_2 will be :

(If Hg_2Cl_2 is 80% ionised in the solution to give Hg_2^{2+} and Cl^- :

A. $-0.26K_f$

B. $-2.6K_f$

C. $-4.2K_f$

D. $0.42K_f$

Answer: A

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7. A liquid solution is formed by mixing 10 moples of aniline with 20 moles of phenol at a temperature T. If vapour pressure of phenol and aniline is 90 and 87 mm of Hg respectively at the temperature T, then identify that could be the possible value of vapour pressure of the solution?

A. 89 mm

B. 80 mm

C. 93 mm

D. 90 mm

Answer: B

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8. Which of the following liquid pairs shows a positive deviation from Raoult's law?

A. Acetone-chloroform

B. Benzene-methanol

C. Water-nitric acid

D. Water-hydrochloric acid

Answer: B

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9. Which statement best explains the meaning of the phases "like dissolve like"?

A. A solvent will easily dissolve a solute of similar mass

B. A solvent and solute with similar intermolecular forces will readily readily form a solution.

C. Only true solution are formed when water dissolves a non-polar solute

D. Only true solutions are formed when water dissolves a polar solute

Answer: B

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10. Statement-1 : 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 boiling points of the samples prior to mixing but if $'a'$ mL of 0.1 molal urea is mixed with $'b'$ mL of 0.1 molal HF the boiling point of the mixture is different from the boiling points of the separate samples.

Staement-2 : HF is an electrolyte (weak) whereas glucose is a non electrolyte.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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11. An aqueous solution of glucose is labelled as $0.05m$. Which of the following options correctly respresent the concentration of the solution if density of solution is $1.009g/mL$ is :

A. $0.05M$

B. $X_{\text{glucose}} = \frac{9}{10000}$

C. $\% w/v = 0.9\%$

D. $\% w/w = \frac{9}{10.09}\%$

Answer: A::C::D

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12. An ideal solution is prepared from A and B (both are volatile). The composition of the solution is such that the total vapour pressure is harmonic mean of vapour pressures of pure $A\left(P_A^{\circ}\right)$ and pure $B\left(P_B^{\circ}\right)$. $\left[P_A^{\circ} \neq P_B^{\circ}\right]$

If x_A, x_B represents mole freaction of A and B in solution respectively and y_A and Y_B represents mole fraction of A and b in vapour phase, then answer the following questions.

According to the comprehensin, what shall be vapour pressure of distillate ?

A. Arithmetic mean of vapour pressure of pure A and pure B.

B. Geometric mean of vapour pressure of pure A and pure B.

C. Half the Harmonic mean of vapour pressure of pure A and pure B.

D. Twice the Harmonic mean of vapour pressure of pure A and pure B.

Answer: A

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13. Addition of non-volatile solute to solvent lowers its vapoure pressure. Therefore, the vapour pressure of a solution (i.e, V.P. of solvent in a solution) is lower than that of pure solvent in a solution) is lower than that of pure solvent, at the same temperature. A higher temperature is needed to raise the vapour pressure upto one atmosphere pressure, when boiling point is attined. However, increase in b.pt. is small . for example, 0.1 molal aqueous sucrose solution boils at $10.05\,^{\circ}C$

Sea water, an aqueous solution, which is rich in Na^{+} and Cl^{-} ions, freezes about $1\,^{\circ}C$ lower than frozen water . At the freezing point of a pure-solvent, the reates at which two molecule stick together to form the solid and leave it to return to liquid are equal when solute is present. Few solvent molecules are in contact with surface of solid. However, the rate at which the solvent molecules leave, surface of solid remains unchanged. That is why, temperature is lowered to restore the equalibrium. The freezing depression in a dilute solution is proportional to molality of the solute.

The freezing point of a solution containing $50 cm^{3}$ of ethylene glycol in

$50g$ water is found to be $-34^{\circ}C$. Density of ethylene glycol is : Assuming solution is dilute $[K_f$ for $H_2O = 1.86K\text{molality}^{-1}]$

A. $1.133g/cm^3$

B. $2.133g/cm^3$

C. $0.133g/cm^3$

D. $1.62g/cm^3$

Answer: A

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14.

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15. Melting point of any solid depends on pressure as

$$\left(P_2 - P_1\right) = \frac{\Delta H_{\text{fusion}}}{V_l - V_s} \cdot \ln\frac{T_2}{T_1}.$$

calculate freezing point of water (in $^\circ$ C) at a pressure of 1001 bar if freezing pooint of water at 1 bar is 0° C. Molar volume of ice and liquid water is 19.65 mL and 18 mL respectively and increase in enthalpy due to melting is 6600 J/mole

[In 0.975=-0.025]

[Instruction : Neglect sign of the temperature therefore if your answer is -8.65° C, express answer is 9]

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5

1. 6.02×10^{20} molecules of urea are present in $100 mL$ solution. The concentration of urea solution is:

A. $0.001M$

B. $0.01M$

C. $0.02M$

D. 0.1M

Answer: B

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2. Barium ion , CN^- and Co^{2+} form an ionic complex . If that complex is supposed to be 75 % ionised in water with van't Hoff factor $'i'$ equal to four , then the coordination number of Co^{2+} in the complex can be :

A. six

B. five

C. four

D. six and Four both

Answer: B

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3. Calculate the osmotic pressure of the solution prepared in the above question T = 300 K , (R = 0.08 L atm $mol^{-1}K^{-1}$)

A. 10.8 atm

B. 12.7 atm

C. 5.6 atm

D. None of these

Answer: B

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4. Two beakers, one contaning $20ml$ of a $0.05M$ aqueous solution of a non volatile, non electrolyte and the other, the same volume of $0.03M$ aqueous solution of $NaCl$, are placed side by side in a closed enclose. What are the volumes in the two beakers when equation is attached ? Volume of the solution in the first and second beaker are respectively.

A. 21.8 mL and 18.2 mL

B. 18.2mL and 21.8mL

C. 20 mL and 20mL

D. 20 mL and 25mL

Answer: B

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5. A solute S undergoes a reversible trimerization when dissolved in a certain solvent . The boiling point elevation of its 0.1 molal solution was found to be identical to be boiling point elevation in case of a 0.08 molal solution of a solute which neither undergoes association nor dissociation. To what percent had the solute S undergoes trimerization ?

A. $30\ \%$

B. $40\ \%$

C. $50\ \%$

D. $60\ \%$

Answer: A

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6. Ebullioscopic and cryoscopic constant for water are 0.52 K -kg - mole and 1.86 K - kg - mole respectively . If on dissolving 5 g of $NaSO_4$ in 45g of H_2O causes freezing point to be decreased to -$3.72\,^\circ C$. Calculate van't Hoff coefficient of Na_2SO_4 :

A. 1

B. 2.52

C. 3

D. 1.286

Answer: B

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7. Benzene and toluene forms an ideal solution. Vapour pressure of pure benzene is 100 torr while that of pure toluene is 50 torr. If mole faction of benzene in liquid phase is $\frac{1}{3}$. Then calculate the mole fraction of benzene in vapour phase :

A. $\frac{2}{3}$

B. $\frac{1}{2}$

C. $\frac{2}{5}$

D. $\frac{1}{3}$

Answer: B

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8. which of the following option is correct with respect to comparison of Henry's constant K_H of different gases at different temperatures?

A. K_H of O_2 at 293 K $<$ K_H of Ar at 293 K

B. K_H of O_2 at 293K $>$ K_H of N_2 at 293K

C. K_H of CH_4 at 298 K $<$ K_H of O_2 at 293K

D. K_H of He at 293K $<$ K_H of N_2 at 293K

Answer: C

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9. A solution of KNO_3 in water is prepared for which the following data have been obtained: masses of solute and solvent

molar masses of solute and solvent

Which of these quantitive descriptions of the solution can be determined?

(P) molarity

(Q) molality

density of solution

A. P only

B. Q only

C. P and Q only

D. P,Q and R

Answer: B

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10. Statement-1 : The freezing point of water is depressed by the addtion of glucose.

Statement-2 : Entropy of solution is less than entropy of pure solvent.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: C

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11. Which of the following options(s) is/are correct w.r.t. Henry's law? [Assuming solvent to be water]

A. Value of K_H (Henry's constant) increases with increases in temperature

B. Value of K_H (Henry's constant) will be more for O_2 than for H_2 at same temperature

C. Henry's law is not applicable for $HCl(g)$

D. Henry's law is applicable when solubility of gas is low

Answer: A::C::D

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12. An ideal solution is prepared from A and B (both are volatile). The composition of the solution is such that the total vapour pressure is harmonic mean of vapour pressures of pure $A\left(P_A^\circ\right)$ and pure $B\left(P_B^\circ\right)$. $\left[P_A^\circ \neq P_B^\circ\right]$

If x_A, x_B represents mole freaction of A and B in solution respectively and y_A and Y_B represents mole fraction of A and b in vapour phase, then answer the following questions.

In the above comprehension, isothermal fractional distillation(s) will never form a solution :

A. for which y_A - x_A is maximum

B. for which vapour pressure is geometric mean of pure v.p. of A and B

C. for which $y_A = y_B$ and $y_B = x_A$

D. all of these

Answer: D

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13. Addition of non-volatile solute to solvent lowers its vapoure pressure. Therefore, the vapour pressure of a solution (i.e, V.P. of solvent in a solution) is lower than that of pure solvent in a solution) is lower than that of pure solvent, at the same temperature. A higher temperature is needed to raise the vapour pressure upto one atmosphere pressure, when boiling point is attined. However, increase in b.pt. is small . for example, 0.1 molal aqueous sucrose solution boils at $10.05\,^{\circ}C$

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The amount of ice seperated out on cooling a solution containing $50g$

ethylene glycol in $200g$ water to $-9.3\,^{\circ}C$ is : $[K_f$ for $H_2O = 1.86K\text{molality}^{-1}$

$]$

A. $38.71g$

B. $61.29g$

C. $138.71g$

D. $161.29g$

Answer: A

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14.

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15. Find the percentage decrese in vapour pressure with respectt to solution when saturated solution of Ag_3PO_4 is prepared.

Given : $K_{sp} of Ag_3PO_4 = \left(\frac{3}{16}\right)^3 \times 10^{-12}$

Report your answer by divideng 10^{-4}

View Text Solution

6

1. Density of $2.05M$ solution of acetic acid in water is $1.02g/mL$. The molality of same solution is:

A. 3.28 mol kg^{-1}

B. 2.28 mol kg^{-1}

C. 0.44 mol kg^{-1}

D. 1.14 mol kg^{-1}

Answer: B

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2. A $0.004M$ solution of Na_2SO_4 is isotonic with 0.010 M solution of glucose at same temperature . The apparent percentage dissociation of $NaSO_4$ is :

A. $25\ \%$

B. $50\ \%$

C. $75\ \%$

D. $85\ \%$

Answer: C

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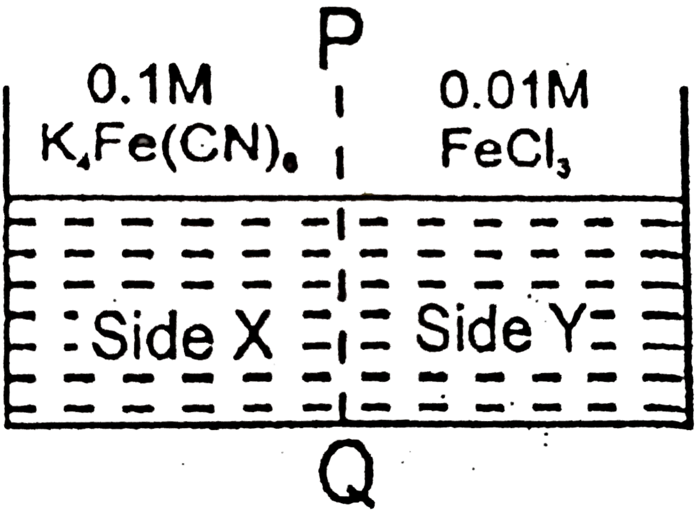
3. $FeCl_3$ on reaction with $K_4\left[Fe(CN)_6\right]$ in aq. Solution gives blue colour.

These are separated by a semipermeable membrane PQ as shown. Due to

osmosis there is-



A. blue colour formation in side X

B. blue colour formation in side Y

C. blue colour formation in both of the sides X and Y

D. no blue colour formation

Answer: D

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4. Calculate relative lowering of vapour pressure in an aqueous solution of $CaCI_2$ haing 1 mole of $CaCI_2$ dissolve3d in 324 g of water if degree of dissociain is 60%

A. $\frac{1}{19}$

B. $\frac{3}{19}$

C. $\frac{11}{101}$

D. $\frac{2.2}{19}$

Answer: C

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5. The elevation in boiling point of a solution of 13.44g of $CuCl_2$ (molecular weight $=134.4$, $k_b = 0.52K\text{molality}^{-1}\Big)$ in 1 kg water using the following information will be:

A. 0.156

B. 0.05

C. 0.1

D. 0.2

Answer: A

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6. Two elements A and B form compounds having molecular formula AB_2 and AB_4. When dissolved in $20g$ of benzene, $1g$of AB_2 lowers the freezing point by $2.3K$, whereas $1.0g$ of AB_4 lowers it by $1.3K$. The molar depression constant for benzene is $5.1 Kkgmol^{-1}$. Calculate the atomic mass of A and B.

A. can't be predicted

B. 42.6, 25.59

C. 30.60

D. 25.59, 42.6

Answer: D

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7. A liquid system consists of two immiscible liquids water and n-butyl chloride distills at one atmosphere pressure. If vapour pressuse of water at that temperature is 570 mm of Hg, then the ratio of masses of water and n-butyl chloride distilled is :

A. $3:1$

B. $0.58:1$

C. $1:1$

D. $1:3$

Answer: B

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8. Which of the following solution can have boiling point less than that of both the individual components?

A. C_2H_5OH and H_2O

B. $\overset{\overset{O}{||}}{C}\ H_3CCH_3$

C. HNO_3 and H_2O

D. Both option (b) and(c)

Answer: A

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9. Some entropy change are represented in fig. Select correct entropy change:

A. $\Delta S_1, \Delta S_2, \Delta S_3$

B. $\Delta S_1, \Delta S_2, \Delta S_4$

C. $\Delta S_1, \Delta S_2, \Delta S_3, \Delta S_4$

D. ΔS_2 and ΔS_4

Answer: C

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10. Statement-1 : In binary ideal solution more volatile component boils at less temperature and less volatile component boils lat high temperature than their normal boiling point of pure component.

Statement-2 : For any composition, mixture boils at temperature in between their normal boiling point temperature of pure component.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

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11. 1 mole of a non-voltile non-dissociative solid solute is dissolved in 200 moles of water. The solution is taken to a temperature T_K (lower than freezing point of solution) to cause ice formation. After removal of ice the remaining solution is taken to $373K$ where vapour pressure is observed is to be $740mm$ of Hg. Identify the correct options :

Given data : $K_f\left(H_2O\right) = 2Kkgmol^{-1}$ and normal boiling point of $H_2O = 373K$.

A. 163 moles of ice will be formed.

B. Temperture to which original solution was colled should be $\frac{2000}{37 \times 18}K$.

C. Freezing point of orignial solution should be $-\frac{10}{18}.\,^{\circ}C$.

D. Ralative lowering of vapour pressure of final solution will be $\frac{1}{201}$.

Answer: A::C

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12. Addition of non-volatile solute to solvent lowers its vapoure pressure. Therefore, the vapour pressure of a solution (i.e, V.P. of solvent in a solution) is lower than that of pure solvent in a solution) is lower than that of pure solvent, at the same temperature. A higher temperature is needed to raise the vapour pressure upto one atmosphere pressure, when boiling point is attined. However, increase in b.pt. is small . for example, 0.1 molal aqueous sucrose solution boils at $10.05\ ^{\circ}C$

Sea water, an aqueous solution, which is rich in Na^{+} and Cl^{-} ions, freezes about $1\ ^{\circ}C$ lower than frozen water . At the freezing point of a pure-solvent, the reates at which two molecule stick together to form the solid and leave it to return to liquid are equal when solute is present. Few solvent molecules are in contact with surface of solid. However, the rate at which the solvent molecules leave, surface of solid remains unchanged.

That is why, temperature is lowered to restore the equalibrium. The freezing depression in a dilute solution is proportional to molality of the solute.

$2g$ of benzoic acid dissolved in $25g$ of C_6H_6 shows a depression in f.pt, equal to $1.62K. K_f$ for C_6H_6 in 4.9Kmolality^{-1}. The percentage of dimerisation is :

A. 0.8%

B. 99.2%

C. 90.2%

D. 9.8%

Answer: B

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13.

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14. 4 mL of a gas at 1 atm pressure and 300 K is dissolved in 1 L of solution. Calculate the volume of the gas dissolved at 4 atm pressure and 300 K in $\frac{1}{2}$L of solution in mL.

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7

1. Two solutions of a substance (non-electrolyte) are mixed in the following manner , 480 mL of 1.5 M [first solution] + 520 mL of 1.2 M [second solution] . What is the molarity of the final mixture ?

A. 1.20 M

B. 1.50M

C. 1.344 M

D. 2.70 M

Answer: C

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2. The van't Hoff factor for $0.1 M Ba(NO_3)_2$ solution is 2.74 . The degree of dissociation is :

A. $91.3\ \%$

B. $87\ \%$

C. $100\ \%$

D. $74\ \%$

Answer: B

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3. Human blood gives rise to an osmotic pressure of approximately 7.65 atm at body temperature , $37\ ^{\circ}$ C Hence , molarity of an intravenous glucose solution be to have the same osmotic pressure as blood is :

A. $0.30M$

B. 0.20M

C. 0.10 M

D. 0.50 M

Answer: A

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4. The vapour pressure of a saurated solution of sparingly soluble salt $\left(XCI_3\right)$ was Hg at $27\,^\circ$ C.If the vapour pressure of pure H_2O is 17.25 souble salt XCI_3 in mole/litre?

A. 4.04×10^{-2}

B. 8.08×10^{-2}

C. 2.02×10^{-2}

D. 4.04×10^{-3}

Answer: A

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5. Which of the following solutions will exhibit highest boiling point?

A. $0.01MNa_2SO_4$

B. $0.01MKNO_3$

C. $0.015M$urea

D. 0.015 M glucose

Answer: A

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6. $PtCl_4.6H_2O$ can exist as hydrated complex 1 molal aq. Solution has depression in freezing point of 3.72° . Assume 100% ionisation and $K_f(H_2O) = 1.86^{\circ} mol^{-1}$ kg , then complex is :

A. $\left[Pt\left(H_2O\right)_6\right]Cl_4$

B. $\left[Pt\left(H_2O\right)_4Cl_2\right]Cl_2\dot{}2H_2O$

C. $\left[Pt\left(H_2O\right)_3Cl_3\right]Cl\dot{}3H_2O$

D. $\left[Pt\left(H_2O\right)_2Cl_4\right]\dot{}4H_2O$

Answer: C

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7. What will be the relative lowering in vapour pressure when 1 mole of A(l) is dissolved in 9 moles of B(l). Given both are volatile with vapour pressures as 100 mm of Hg and 300 mm of Hg respectively?

A. 0.1

B. 0.067

C. 20

D. 30

Answer: B

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8. Select the mixture in which volume of solution is less than 2 V mL on mixing V mL each of the two miscible liquids:

A. $\mathrm{CCl}_4 + CS_2$

B. Benzene+ Toluene

C. $CH_3COCH_3 + CHCl_3$

D. Hexane+ Pentane

Answer: C

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9. Select the corrcet statement:

A. Solution has more molecular radomness than a pure solvent has, the entropy change between solution and solid is larger than the entropy change between pure solvent and solid.

B. Heat of fusion of solution and solvent are similar since similar intermolecular forces are involved.

C. Sugar containing solution freezes at a lower temperature than pure water.

D. All are correct statements.

Answer: D

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10. Statement - The boiling point of $0.1M$ urea solution is less than that if $0.1MKCl$ solution.

Explanation -Elevation of boiling point is directly proportional to the number of species present in the solution.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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11. Which of the option(s) regarding true/false nature of the statement is/are correct ?

S-1 out of all colligative properties, osmotic pressure is easiest to determine experimentally.

S-2 Chemisorption is a multilayer process.

S-3 Solubility of gases in water increases with increase in temperature

S-4 Addition of NaCl can cause coagulation in both + vely charged and -

vely charged sols.

S-5 Enzymes catalysed reactions are elementry reactions.

S-6 NaCl crystal shows Frenkel defects.

A. There are more false statements than true statements

B. S-3 and S-5 are fakse statements

C. S-1 and S-4 are the only true statements

D. Only S-1 is a true statement.

Answer: A::B::C

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12. A sample of water contains 12% w/w $MgSO_4$ and 9.5% w/w $MgCl_2$. If the sulphate dissociates to 8 extent and chloride to 60% extent then calculate the boliling point of the solution.

Given : $K_b\left[H_2O\right] = 0.785K\text{-}kg/\text{mole}^{-1}$

[Express your answer in Kelvin scale]

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8

1. We have 100 mL of 0.1 MKCI solution . To make it 0.2 M

A. evaporate 50 mL water

B. evaporate 50 mL solution

C. add 0.1 mol KCI

D. add 0.01 mol KCI

Answer: D

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2. If α is the degree of dissociation of Na_2SO_4, the van,t Hoff factor (i) used for calculating molaecular mass is:

A. $1 + \alpha$

B. $1 - \alpha$

C. $1 + 2\alpha$

D. $1 - 2\alpha$

Answer: C

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3. The total concentration of dissolved particles inside red blood cells is approximately 0.30 M and membrane surrounding the cells is semipermeable . What would be the osmotic pressure (in atmospheric) inside the cells become if the cell were removed from the blood plasma and placed in pure water at 298 K ?

A. 7.34 atm

B. 1.78 atm

C. 2.34 atm

D. 0.74 atm

Answer: A

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4. Consider the following arrangement

volume of liquid in container I and II at equlibrium are:

A. I=100 mL, II=100mL

B. I=200mL, II=0mL

C. I=0 mL, II=200mL

D. I=110 mL, II=90mL

Answer: B

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5. Consider the following terms (m = molarity) :

$(P) mK_b, \quad (Q) mK_b i$

(R) $\frac{\Delta T_b}{i}$ $(S) K_b$

Terms which can be expressed in degree (temperature) are :

A. R,S

B. P,Q

C. P,Q ,R

D. P, R

Answer: C

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6. When only a little quantity of $HgCl_2$(s) is added to excess KI(aq) to obtain a clear solution , which of the following is true for this solution ? (no volume change on mixing)

A. Its boiling and freezing points remains same

B. Its boiling point is lowered

C. Its vapour pressure is lowered

D. Its freezing point is lowered .

Answer: B

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7. For an ideal binary liquied solution of A and B where A is more volatile, which relationship between X_A, Y_A, X_B and Y_B is correct?

[$X \rightarrow$ represents mole fraction in liquid phase,

$Y \rightarrow$ represents mole fraction in vapour phase]

A. $Y_A > Y_B$

B. $X_A < X_B$

C. $\frac{Y_A}{X_A} > \frac{Y_B}{X_B}$

D. None of these

Answer: C

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8. Which of the following mixtures has dipole- dipole interaction?

A. Acetone+ethanenitrile

B. KCl+ water

C. Benzen+ toluene

D. $\mathrm{CCl}_4 + CS_2$

Answer: A

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9. A colligative property of a solution depends on the :

A. arrangement of atoms in solute molecule

B. total number of molecules of solute and solvent

C. number of molecules of solute in solution

D. mass of the solute molecules.

Answer: C

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10. Statement-1 : The observed molar mass of acetic acid in benzene is more than the nomal molar mass of acetic acid.

Statement-2 : Molecules of acetic and dimerise in benzene due to hydrogen same.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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11. Which of the following solutions are isotonic w.r.t. an aqueous NaCl solution having molarity $0.2M$ and 50% dissociation?

A. $0.3M$ aqueous glucose solution

B. $0.15M$ aqeous Na_2SO_4 solution showing complete dissociation.

C. $0.15M$ aqueous KHF_2 solution showing complete dissociation.

D. $0.1M$ aqueous $BaCl_2$ solution showing 80% dissociatio/n

Answer: A::C

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12. Calculate elevation in boiling point of final solution (in kelvin) obtained after removal of of solid solvent from a solution having 1 mole of non-volatile non electrolyte solute in 1000g solvent and cooled to a temperature of $3\,^{\circ}$ C below the freezing point of solvent .

Given : Cryoscopic constant of solvent =1.5 K kg mol^{-1} and ebullioscopic constant of solvent = 1 K kg mol^{-1}.

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9

1. All of the water in a $0.20M$ solution of $NaCl$ was evaporated and a 0.150 mol of $NaCl$ was obtained. What the original volume of the sample?

A. 30 mL

B. 333 mL

C. 750 mL

D. 1000 mL

Answer: C

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2. Vapour density of PCl_3 (g) and Cl_2 (g) is 100 . Hence , van't Hoff factor for the case :

$PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$

A. 1.85

B. 3.70

C. 1.085

D. 1.0425

Answer: D

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3. The relationship between osmotic pressure at $273K$ when $10g$ glucose (P_1), $10g$ urea (P_2) and $10g$ sucrose (P_3) are dissolved in $250mL$ of water is:

A. $P_1 > P_2 > P_3$

B. $P_3 > P_1 > P_2$

C. $P_2 > P_1 > P_3$

D. $P_2 > P_3 > P_1$

Answer: C

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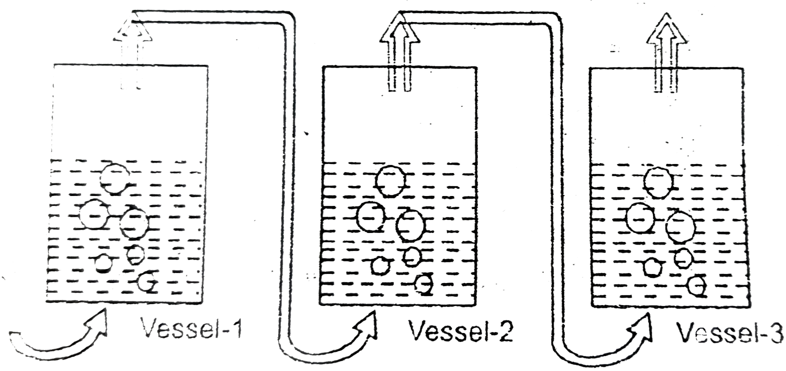
4. Dry air is slowly passed through three solutions of different concentrations, C_1, C_2 and C_3, each containing (non-volatile) $NaCl$ as solute and water as solvent, as shown in the Fig. If the vessel 2 gains weight and the vesel 3 loses weight then:

(D) equal



A. $c_1 > c_2$

B. $c_1 < c_2$

C. $c_1 < c_3$

D. $c_2 > c_3$

Answer: B

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5. Elevation in $b.p.$ of an aqueous urea solution is 0.52°, $\left(K_b = 0.52^\circ \text{mol}^{-1} kg\right)$ Hence, mole-fraction of urea in this solution is :

A. 0.982

B. 0.567

C. 0.943

D. 0.018

Answer: D

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6. 3.24 g of $Hg\left(NO_3\right)_2$ (molar mass = 324) dissolved in 1000 g of water constitutes a solution having freezing point of $-0.0558^\circ C$ while 21.68 g of $HgCl_2$ (molar mass = 271) in 2000 g of water constitutes a solution with a freezing point of $0.0744^\circ C$. The K_f for water is $1.86\frac{K - Kg}{\text{Mol}}$. About the state of ionization of these two solids in water it can be inferred that

:

A. $Hg(NO_3)_2$ and $HgCl_2$ both are completely ionized .

B. $Hg(NO_3)_2$ is fully ionized but $HgCl_2$ is fully unionized .

C. $Hg(NO_3)_2$ and $HgCl_2$ both are completely unionized .

D. $Hg(NO_3)_2$ a is fully unionized but $HgCl_2$ is fully ionized .

Answer: B

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7. Liquid A and B form an ideal solution. The boiling point of solution is 72° C, when the external pressure is 0.6 bar. If then solution contains 200 moles of liquid A, then moles of liquid B is :

$\left[Given : P_A^\circ = 0.4 \text{barand} P_B^\circ = 1.0 \text{barat} 72^\circ C\right]$

A. 200

B. 100

C. 300

D. 400

Answer: B

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8. At a particular temperature and at a pressure of 1 atm, mass and volume of O_3 that can be dissolved in 1 L of H_2O is m gram and V ml repectively (Assuming ideal gas behaviour of O_3 and assuming O_3 does not associate of dissociate in solution). Mass and volulme of O_3 dissolved in 2L of H_2O at same temperature and at a pressure of 5 atm will be:

A. 5 M gram, 5V mL

B. 10 M gram, 10 V mL

C. 10 M gram, 2 V mL

D. 10 M gram, 5 V mL

Answer: C

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9. Which characterises the weak intermolecular forces of attraction in a liquid?

A. High boiling point

B. High vapour pressure

C. High critical temperature

D. High heat of vaporization

Answer: B

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10. Statement-1 : Molarity of molality of 111 mg $CaCl_2 \text{in} / kgH_2O$ is nearly same.

Statement-2 : In dilute solution molarity and molality are approximately equal.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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11. Two liquids X and Y when mixed form a solutions which shows significant positive deviation from Raoult's law. Also, it is known that normal boiling point of X is more than that of Y. Identify the incorrect option(s) :

A. Boiling point of the mixture will always be less than that of X.

B. Azeotropic composition obtained wil have lower boiling point will decrease.

C. If a small amount of Y is added into the solution, boiling point will decrease.

D. When distilled the solution will give pure Y as distillate and pure X as residuce.

Answer: C::D

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12. 4×10^{-2} moles of a non-volatile solute is added into 10 moles of solvent.The solute plymerises into soluble solid following first order kinetics with rate constant equal to 0.693 $\min^{-1}$. If after 2 min, elevation in boiling point is observed to be 0.01° then calculate which form the solute is getting polymerised into?

Given : Molar mass of solvent=100 g/mole.

K_b of solvent =0.5 K-kg mol^{-1}

[Instruction : Mark 2 if polymer is dimer, 3 if trimer and so on.]

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10

1. A $20.0 mL$ sample of $CuSO_4$ solution was evaporated to dryness, leaving $0.967 g$ of residue. What was the molarity of the original solution ? $(Cu = 63.5)$

A. 48.4 M

B. 0.0207 M

C. 0.0484 M

D. 0.303 M

Answer: B

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2. Which has the 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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3. Equal volumes of 0.4 M glucose solution at 300K and 0.6 M fructose solution at 300K are mixed , without change in temperature . If the osmotic pressure of glucose solution , fructose solution and the mixtures are $\pi_1 \pi_2 \text{and} \pi_3$, respectively , then :

A. $\pi_1 = \pi_2 = \pi_3$

B. $\pi_1 < \pi_2 < \pi_3$

C. $\pi_1 < \pi_3 < \pi_2$

D. $\pi_2 < \pi_3 < \pi_1$

Answer: C

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4. The vapour pressure of water at 20° C is 17.5 mm Hg. If 18 g of gulucose $\left(C_6H_{12}O_6\right)$ is added to 178.2 g of water at 20° C, the vapour pressure of the resulting solution will be:

A. 15.750 mm Hg

B. 16.500 mm Hg

C. 17.325 mm Hg

D. 17.675 mm Hg

Answer: C

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5. Select the correct statement :

A. heats of vaporisation for a pure solvent and for a solution are similar because similar intermolecular forces between solvent molecules must be overcome in both cases.

B. entropy change between solution and vapour is smaller than the entropy change between pure solvent and vapour .

C. boiling point of the solution is larger than that of the pure solvent .

D. all are correct

Answer: D

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6. Which of the following options are correctly representing the increasing order of freezing points of aqueous solutions ?

A. $0.01mAl_2(SO_4)_3 > 0.01mBaCl_2 > 0.01mNaCl > 0.01m$ glucose

B. $0.01mBaCl_2 > 0.01mNaCl > 0.01mCH_3COOH$

C. $0.01m\text{glucose} > 0.01mCH_3COOH > 0.01mKCl$

D. $0.01mBaCl_2 = 0.01mKCl = 0.01m$ glucose

Answer: C

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7. Given at 350 K, P_A° = 300 torr and P_B° =800 torr the composition of the mixture having a normal boiling point of 350 K is :

A. $X_A = 0.08$

B. $X_A = 0.06$

C. $X_A = 0.04$

D. $X_A = 0.02$

Answer: A

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8. Some liquid on mixing, form azeotropes. Which of the following is only incorrect statement regarding azeotropic binary mixture of liquids?

A. The composition in liquid and vapour phases are same.

B. The boiling point of azeotropic mixture does not depend on exernal pressure.

C. Solutions having large positive deviation form minimum boiling azeotrope at a specific composition.

D. Solution having large negatice deviation form maximum boiling azeotrope at a specific composition.

Answer: B

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9. The temperature at which molarity of pure water is equal to its molality is :

A. 273K

B. 298K

C. 277K

D. none of these

Answer: C

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10. Statement-1 : Addition of ethylene glycol (non-volatile) to water lowers the freezing point of water hence used as freezing point.

Statement-2 : Addition of any substance to water lowers its freezing point.\

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: C

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11. Acetone and carbon disulphide form binary liquid solution showing positive deviation from Raoult's law. The normal boiling point (T_b) of pure acetone is less than that of pure CS_2. Pick out the incorrect statement among the following :

A. Boiling temperature of mixture is always less than boiling temperature of acetone.

B. Boiling temperature of Azeotropic mixture is always less than boiling temperature of pure CS_2

C. When a small amount of CS_2 (less volatile comoponent) is added to excess of aceton boiling point of resulting mixture increases.

D. A mixture of CS_2 and CH_3COCH_3 can be completely separated by simple fractional distillation.

Answer: A::C::D

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12. Assuming same expression og colligative property to be aplicable for solid in solid solution, calculate what will be the melting point of an alloy of lead and tin if 12 g of tin is present for every 100 g of lead. The molal depression constant of lead is 8.5 K-kg mole^{-1}.

[Given : Atomic mass Sn=120, Pb=208, Melting point of Pb=327° C]

[Express your answer in Kelvin]

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11

1. Persons are medically considered to have lead poisoning if they have a concentration greater than 10 micrograms of lead per decilitre of blood. What is the concentration in parts per billion?

A. 1000

B. 100

C. 0.1

D. 1

Answer: B

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2. A complex containing K^{+} , Pt(IV) and Cl^{-} is 100% ionised giving $i = 3$.

Thus , complex is :

A. $K_2[PtCl_4]$

B. $K_2[PtCl_6]$

C. $K_2[PtCl_5]$

D. $K[PtCl_3]$

Answer: B

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3. Which aqueous solution has the highest osmotic pressure at 25°C ?

(Assume all ionic componds ionize completely in solution)

A. $0.1MAl_2(SO_4)_3$

B. $0.1MNa_2CO_3$

C. $0.2MKMnO_4$

D. $0.3MC_6H_{12}O_6$

Answer: A

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4. Relative decrease in vapour pressure in vapour pressure of an aqueous solution NaCl is 0.1067, Number of moles of NaCl present in 180 g H_2O is:

A. 2mol

B. 1mol

C. 3 mol

D. 4 mol

Answer: B

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5. Ratio of $\Delta T_b / K_b$ for $6\% AB_2$ and $9\% A_2B$ (AB_2 and A_2B both are non-electrolytes) is 1 mol/kg in both cases. Hence , atomic masses of A and B are respectively :

A. 60, 90

B. 40 , 40

C. 40 , 10

D. 10 , 40

Answer: C

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6. 0.1 moles of $K_4[Fe(CN)_6]$ is dissolved in 500 gm water . The freezing point of solution is :

[Given : Molal depression constant for water = 1.86 K-kg/mole]

A. $1.86\,^{\circ}C$

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

C. - $1.488^{\circ}C$

D. - $1.86K$

Answer: B

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7. An ideal mixture of liquids A and B with 2 moles of A and 2 moles of B has a total vapour pressure of 1 atm at a certain temperature. Another mixture with 1 mole of A and 3 moles of B has a vapour pressure greater than 1 atm. But if 4 moles of C are added to second mixture, the vapour pressure comes down to 1 atm. Vapour pressure of $C, P_C^{\circ} = 0.8$ atm. Calculate the vapour pressure of pure A and B :

A. $P_A^{\circ} = 1.4atm, P_B^{\circ} = 0.7atm$

B. $P_A^{\circ} = 1.2atm, P_B^{\circ} = 0.6atm$

C. $P_A^{\circ} = 1.4atm, P_B^{\circ} = 0.6atm$

D. $P_A^{\circ} = 0.6atm, P_B^{\circ} = 1.4atm$

Answer: D

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8. 10 mL liquid chloroform is mixed with 100mL liquid acetone at $25^{\circ}C$.

Which of the following may be the final volume of resulting solution?

A. 200mL

B. 203mL

C. 198mL

D. any of these

Answer: C

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9. A teacher one day pointed out to his students the peculiar fact that water is a unique liquid which freezes exactly at $0^{\circ} C$.and boils exactly at $100^{\circ} C$. He asked the students to find the correct statement based on this fact.

A. Water dissolved anything however sparingly the dissociation may be

B. Water is a polar molecule

C. Boiling and freezing temperature of water were used to define a temperature scale

D. Liquid water is denser than ice

Answer: C

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10. Statement-1 : At is $\Leftrightarrow$ water equilibrium, on incrasing the pressure freezing point of water decreases.

Statement-2 : Ice have low density so equilibrium shift in forward direction when pressure is increased.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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11. Which of the following concentration terms is independent on temperature ?

A. Molality (M)

B. ppm (in terms of volume)

C. Mole fraction

D. Mass by volume percentage

Answer: A::C

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12. Dissociation of a salt $A_2B_3(aq)$ in water follows first order kinetics in terms of concentration of $[A_2B_3]$ as $A_2B_3(aq) \rightarrow 2A^{+3}(aq) + 3B^{2-}(aq)$. Starting from t=0, solution is taken out at different instant and its osmotic rise is measured. From the given data calculate abcd.

ab=$t_{3/4}$ of the dissociation of A_2B_3 in water in minutes.

cd= Osmotic pressure in Pascal after 20 min.density of solution is 1 g/mL.

Given data :	$t = 0$	$t = 10$ min
osmotic rise	$2mm$	$6mm$

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12

1. The concentration of pollutant in $p \pm (w/w)$. That has been measured at $450mg$ per $150kg$ of sample is

A. 3 ppm

B. 6 ppm

C. 3000 ppm

D. 330 ppm

Answer: A

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2. In which case, van't Hoff factor I remains unchanged ? (Assume common complexes of these ions)

A. PtCl_4 reacts with KCl

B. Aq.$ZnCl_3$ reacts with aq. NH_3

C. Aq.$FeCl_3$ reacts with aq.$K_4[Fe(CN)]_6$

D. $KMnO_4$ reduced to MnO_2 in alkaline medium $\left(MnO_2\right.$ a black ppt)

Answer: B

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3. Interferon is a water-soluble protein . A solution prepared by dissolving 15.0 mg of interferon in 2.50 mL of H_2O exhibits an osmotic pressure of 5.80 mm Hg at 25 $^\circ$ C . What is the molar mass of interferon ?

A. $1.92 \times 10^4 \dot{g} \, mol^{-1}$

B. $1.92 \times 10^7 \dot{g} \, mol^{-1}$

C. $1.95 \times 10^6 g\, mol^{-1}$

D. $1.61 \times 10^3 g\, mol^{-1}$

Answer: A

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4. In the following solutions:

(P) 1 m sucrose

(Q) 1 m potassium ferricyanide and

(R) 1 m potassium sulphate

maximum value of vapour pressure of solutions is that of :

A. P

B. Q

C. R

D. equal

Answer: A

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

(P) the vapour pressure of the solution is less than that of pure solvent .

(Q) the vapour pressure of the solution is more than that of pure solvent

.

(R) only solute molecules solidify at the freezing point .

(S) only solvent molecules solidify at the freezing point .

A. P,Q

B. Q,R

C. P,S

D. P,Q,R

Answer: C

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6. The vapour pressure of benzene, toluene and xylene are 75 torr, 22 torr and 10 torr respectively at 20° C. Which of the following is not a possible value of the vapour pressure of an equimolar binary/ternary solution of these at 20° C? Assume, all form ideal solution with each other :

A. $48\frac{1}{2}$

B. 16

C. $35\frac{2}{3}$

D. $53\frac{1}{2}$

Answer: D

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7. 5.0 L water dissolves 80mL N_2 gas at 10 bar and $25^\circ C$. The volume of water needed to dissolve 40mL N_2 gas at 20 bar at $25^\circ C$, is:

A. 5.0L

B. 2.5L

C. 10.0L

D. 1.25L

Answer: B

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8. When an ideal binary solution is in equilibrium with its vapour, molar ratio of the two components in the solution and in the vapur phase is :

A. same

B. different

C. may or may not be same depending upon volatile nature of the two components

D. none of the above

Answer: C

Watch Video Solution

9. Statement-1 : When metyl alcohol is added to water, boliling point of water increases.

Statement-2 : When a volatile solute is added to a volatile solvent elevation in boiling point is observed.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

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10. Which of the following solutions are isotonic with respect of $0.5 M NaCl$ solution having degree of dissociation $= 0.8$?

A. $153.9g$ of Sucrose dissolved in $500mL$ of solution.

B. $0.3M$ aq. Na_2SO_4 solution undergoing 100% ionization.

C. $1.8\% w/w$ aq. $NaOH$ solution undergoing 100% ionization

D. $1.2M$ benzoic acid in a solution of benzene where the acid dimerizes to an extent of 50%

Answer: A::B::C::D

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11. A current of dry air was passed through a solution containing 2.0 g of a solute A_2B in 98 g of water and then through pure water. The loss in weight of the solution was 0.98 g and the loss in weight of pure water is 0.01 g. If the molar mass of A_2B is 90 g/mol and it dissociates into A^+ and B^{-2} ions, then its percentage dissociations in water is.

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13

1. If $pK_a = -\log K_a = 4$, and $K_a = Cx^{2-}$ then Van't Hoff factor for weak monobasic acid when $C = 0.01M$ is:

A. 1.01

B. 1.02

C. 1.10

D. 1.20

Answer: C

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2. A 5.25% solution of a substance is isotonic with a 1.5% solution of urea (molar mass $= 60 g mol^{-1}$) in the same solvent. If the densities of both the solutions are assumed to be equal to $1.0 gcm^{-3}$, molar mass of the substance will be:

A. $105.0 gmol^{-1}$

B. Aq.$ZnCl_3$ reacts with aq. NH_3

C. $90.0 gmol^{-1}$

D. $15.0 gmol^{-1}$

Answer: B

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3. The vapour pressure of pure benzene , C_6H_6 at $50\,^{\circ}C$ is 268 Torr. How many moles of non-volatile solute per mole of benzene is required to prepare a solution of benzene having a vapour pressure of 167 Torr at $50\,^{\circ}$C ?

A. 0.377

B. 0.605

C. 0.623

D. 0.395

Answer: B

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4. A solution prepared by dissolving a 2.50 g sample of an unknown compound dissolved in 34.0 g on benzene , C_6H_6 , boils $1.38\,^\circ C$ higher than pure benzene . Which expression gives the molar mass of the unknown compound ?

A. $2.53 \times \dfrac{2.50}{1.38}$

B. $1.38 \times \dfrac{34.0}{2.53} \times 2.50$

C. $2.50 \times 10^3 \times \dfrac{2.53}{1.38} \times \dfrac{1}{34}$

D. $2.50 \times 10^3 \times \dfrac{2.53}{1.38} \times 2.53$

Answer: C

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5. To $500cm^3$ of water, $3.0 \times 10^{-3}kg$ acetic acid is added. If 23% of acetic acid is dissociated, what will be the depression in freezing point? K_f and density of water are $1.86Kkgmol^{-1}$ and $0.997gcm^{-3}$ respectively.

A. $0.186K$

B. $0.228K$

C. $0.372K$

D. 0.556K

Answer: B

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6. A mixture of ethyl alcohol and propylalcohol has a vapour pressure of 290 mm at 300 K. The vapour pressure of propylalcohol is 200 mm. If the mole fraction of ehtyl is 0.6, its vapour pressure (in mm) at same temperature will be:

A. 700

B. 360

C. 350

D. 300

Answer: C

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7. Solubility of gas at 1 bar pressure and 300K is 2×10^{-3} M. What will be its solubility at same pressure and 400K if $\Delta H_{\text{solution}}$ of the gas is -9.96 kJ. [Take : R=8.3J/K mole,e=2.72]

A. 2×10^{-3} M

B. 7.35×10^{-4}M

C. 6.67×10^{-4} M

D. $5 \times 10^{-4} M$

Answer: B

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8. Maximum amount of a solid slute that can be dissolved in a specified amount of a given liquid solvent does not depend upon ....

A. Temperature

B. Nature of solute

C. Pressure

D. Nature of solvent

Answer: C

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9. Statement-1 : Addition of Hgl_2 is aqueous solution of KI increases the freezing point.

Statement-2 : A complex $K_2\left[HgI_2\right]$ is formed.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: A

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10. Solution among the following is/are showing singnificant deviation from ideal behaviour :

A. $C_6H_6 + C_6H_5CH$

B. $C_2H_5OH + H_2O$

C. $CHCl_3 + CH_3COCH_3$

D. $C_5H_5N + H_2O$

Answer: B::C::D

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11. 5 milli-moles of a solid A was dissolved in 5 moles of H_2O. On adding to the solvent , A sstarts spolymerising into another insoluble solid following zero order kinetics. On adding 6 milli-moles of another solid solute C (after 20 minute) the polymerisation compeletly stops. The insoluble solid polymer is removed and the resulting solution was cooled tova temperature less then $-0.186\,^{\circ}$ C(melting point of solution) to cause solidification of some liquid water. Calculate the value of 'X' if rate constant for polymerisation reaction is represented as 10^{-X}mole/minute. [$K_f\left(H_2O\right)$=1.86 K-kg mole^{-1}]

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14

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

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2. If 'A' contains 2% NaCl and is separated by a semipermeable membrance from 'B' which contain 10 % NaCl ,which event will occur ?

A. NaCl will flow from A to B

B. NaCl will flow from B to A

C. Water will flow from A to B

D. Water will flow from B to A

Answer: C

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3. If relative decrease in vapour pressure is 0.4 for a solution containing 1 mol $NaCl$ in 3 mol H_2O, $NaCl$ is..... $\%$ ionised.

A. $60\ \%$

B. 50%`

C. $100\ \%$

D. $40\ \%$

Answer: C

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4. Which solute produces the highest boiling point in a 0.15 m aqueous solution ?

A. $CaCl_2$

B. NaBr

C. $CuSO_4$

D. CH_3OH

Answer: A

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5. During depression of freezing point in a solution , the following are in equilibrium :

A. liquid solvent-solid solvent

B. liquid solvent -solid solute

C. liquid solute -solid solute

D. liquid solute -solid solvent

Answer: A

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6. Benzene and toluene form nearly ideal solutions. At 20° C, the vapour pressure of benzene is 75 torr. The partial vapour pressure of benzene at 20° C for a solution containing 78 g of benzene and 46 g of toluene in torr is :

A. 50

B. 25

C. 37.5

D. 53.5

Answer: A

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7. The vapour pressure of the solution of two liquids A$\left(P^{\circ} = 80mm\right)$and B$\left(P^{\circ} = 120mm\right)$is found to $100mm$ when $x_A = 0.4$ .The result shows that

A. Solution eshibits ideal behaviour

B. solution shows positive deciation

C. solution shows negative deviation

D. Solution will show positive deviation for lower concentration and negative deviation for higher concentrations.

Answer: C

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8. On dissolving sugar in water at room temperature solution feels cool to touch. Under which of the following cases dissolution of sugar will be most rapid?

A. Sugar crystals in cold water.

B. Sugar crystals in hot water.

C. Powdered sugar in cold water.

D. Powered sugar in hot water.

Answer: D

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9. Statement-1 : On evaporation of a solution of two volatile liquids, vapour will always be rich in more volatile component.

Statement-2 : More volatile component has lowest boiling point.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

Answer: D

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10. Identify correct statements.

A. Vapour pressure is a colligative property.

B. Freezing point of a solution containing non-volatile solute in liquid solvent is always lower than that of the pure solvent.

C. Acetic acid undergoes association in benzene. The molar mass of acetic acid, determined by elevation of boiling point of solution of acetic acid in benzene is always higher than its normal molar mass.

D. Osmatic pressure measurements can be used for determination of fairly accurate molar mass of polymers.

Answer: B::C::D

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11. The freezing point of 0.1 molal aq. Solution of $K_X\left[Fe(CN)_6\right]$ is $-0.744\,^\circ$C. The molal depression constant of water is 1.86 K-kg mol^{-1}. If the salt behaves as strong electrolyte in water, the value of X is :

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15

1. Assuming each salt to be 90% dissociated which of the following will have highest osmotic pressure ?

A. Decimolar $Al_2(SO_4)_3$

B. Decimolar $BaCl_2$

C. Decimolar Na_2SO_4

D. A solution obtained by mixing equal volumes of (b) and (c) and filtering .

Answer: A

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2. A solution of glucose $\left(C_6H_{12}O_6\right)$is isotonic with 4g of urea $\left(NH_2 - CO - NH_2\right)$ per litre of solution .The concentration of glucose is :

A. 4 g/litre

B. 8 g / litre

C. 12 g/litre

D. 14 g/litre

Answer: C

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3. Vapour pressure of CCl_4 at $25\,^{\circ}C$ is 143 mm Hg . 0.5 g of a non-volatile solute (molar mass = $65 mol^{-1}$) is dissolved in 100 mL of CCl_4 (density = 1.538g mL^{-1}) Vapour pressure of solution is :

A. 141.9 mm Hg

B. 94.4 mmHg

C. 99.3 mm Hg

D. 144.1 mm Hg

Answer: A

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4. When 0.1 M aqueous solutions of aluminium nitrate , magnesium nitrate , sodium nitrate and urea , $(NH_2)_2CO$, are arranged in order of increasing boiling point , which order is correct?

A. $Al(NO_3)_3 = Mg(NO_3)_2 = (NH_2)_2CO = NaNO_3$

B. $Mg(NO_3)_2 < (NH_2)_2CO < NaNO_3 < Al(NO_3)_3$

C. $(NH_2)_2CO < NaNO_3 < Mg(NO_3)_2 < Al(NO_3)_3$

D. $NaNO_3 < Mg(NO_3)_2 < Al(NO_3)_3 < (NH_2)_2CO$

Answer: C

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

A. 0.5

B. 1

C. 2

D. 3

Answer: A

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6. At 80° C, the vapour pressure of pure liquid A is 520 mm Hg and that of pure liquid B is 1000 mm Hg. If a mixture solution of A and B boils at 80° C and 1 atm pressure, the amount of A in the mixture is :

(1 atm=760 mm Hg)

A. 34 mol percent

B. 48 mol percent

C. 50 mol percent

D. 52 mol percent

Answer: C

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7. A binary liquid solution is prepared by mixing n-heptane and ethanol. Which one of the following statements is correct regarding the behaviour of the solution?

A. The solution is non-ideal, showing +ve deviation from Raoult's law

B. The solution is non-ideal, showing -ve deviation from Raoult's law

C. n-heptane shows +ve deviation while ethnol shows -ve deviation from Raoult's law.

D. The solution formed in an ideal solution.

Answer: A

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8. What is the purpose of this apparatus?

A. Distilling

B. Filtering

C. Refluxing

D. Titrating

Answer: C

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9. Vapour pressure of a solution containing $6.0 gm$ of a non-volatile solute in $180 gm$ water at $25^{\circ} C$ is 20 torr. If 1mole of water is further added, the

vapour pressure at $25^\circ C$ increases by 0.02 torr. Identify the correct information :

A. The molar mass of solute is $54gm/\text{mol}$.

B. The vapour pressure of pure water at $25^\circ C$ its $\frac{182}{9}$ torr.

C. The molariy of solution taken initially was $\frac{1}{1.62}m$

D. The molarity of final solution is $\frac{1}{1.782}m$.

Answer: A::B::C::D

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10. When 0.98% (w/v) aqueous solution of noon-volatile polymeric solute of molar mass 3×10^5 g/mol is allowed for osmosis at 27° C, the height of solution increased by X mm at osmotic equilibrium .

The density of final solution is $1.103g/cm^3$. The value of X is :

[Given : R=0.08L-atm/K-mol,g=9.80 ms^{-2}]

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1. The van't Hoff factory i for an infinitely dilute solution of $NaSO_4$is :

A. $\frac{1}{2}$

B. $\frac{1}{3}$

C. 3

D. 2

Answer: C

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2. A solution of substance containing 1.05 g per 100 mL was found to be isotonic with 3% glucose solution . The molecular mass of the substance is :

A. 31.5

B. 6.3

C. 630

D. 63

Answer: D

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3. The vapour pressure of water at $20\ ^{\circ}C$ is 17.54 mm Hg . What will be the vapour pressure of the water in the apparatus shown after the piston is lowered , decreasing the volume of the gas above the liquid to one half of its initial volume (assume temperature constant)?

A. 8.77 mm Hg

B. 17.54 mm Hg

C. 35.08 mm Hg

D. Between 8.77 and 17.54 mm Hg

Answer: B

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4. Boiling point of an ideal liquid solution containing non-volatile solute depends on:

A. concentration of non-volatile solute in the solution

B. boiling point of pure solvent

C. enthalpy of vaporisation of pure solvent

D. all of these

Answer: D

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5. Equimolar solutions is the same solvents have :

A. same boiling point but different freezing point

B. same freezing point but different boiling point

C. same boiling point and same freezing points .

D. different boiling point and freezing points .

Answer: C

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

A. 300 and 400

B. 400 and 600

C. 500 and 600

D. 200 and 300

Answer: B

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7. The dissolving process is exothermic when :

A. The energy released in solvation exceeds the energy used in breaking up solute- solute and solvent-solvent interactions.

B. The energy used in solvation exceeds the energy used in breaking up solute- solute and solvent-solvent interactions.

C. The energy released in solvation is about the same as the energy used in breaking up solute- solute and solvent-solvent interactions.

D. The energy used in solvation about the same as the energy used in breaking up solute- solute and solvent-solvent interactions.

Answer: A

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8. The molar mass of a volatile liquid (b.p. $< 90\,^{\circ}C$) is to be detemined by measuring the density of its vapour in an Erlenmeyer flask cpped with Al foil with a pinhole to allow the vapour to escape. A sample of the liquid is added to the pre-weighed flask that is heated in a water bath until the liquid has evaporated, after which the flask is dried and reweighed. Which piece of information is not required to determine the molar mass of the liquid?

A. Barometric pressure

B. Mass of liquid sample

C. Temperature of water

D. Volume of the flask

Answer: B

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9. In which case van't Hoff factor are equal

A. $KCl, 50\%$ ionised

B. $K_2SO_4, 40\%$ ionized

C. $FeCl_3, 30\%$ ionized

D. $SnCl_4, 20\%$ ionized

Answer: B::D

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10. 60 g of a non-volatile solid AB(having crystals like NaCl or CaCl) is dissolved in 0.50 kg water. The normal boiling point of solution is found to be 102.08° C. The molal elevation of water is 0.52 K-kg mol^{-1}. The density of solid AB is 6.25 g$/cm^3$ and the edge-lengthh of unit cell is 400 pm.The coordination number for A^{+} ion in the solid is :

$(N_A = 6 \times 10^{23})$

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17

1. We have three aqueous solutions of NaCl labelled as A, B and C with concentration $0.1M, 0.01 \text{and} 0.001$ M , respectively . The value of van't Hoff factor for these solutions will be in the order :

A. $i_A < i_B < i_C$

B. $i_A > i_B > i_C$

C. $i_A = i_B = i_C$

D. $i_A < i_B > i_C$

Answer: A

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2. Osmotic pressure of 30% solution of glucose is 1.20 atm and that of 3.42% solutin 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.

D. 1.3 atm

Answer: C

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3. Which combination of (I) vapour pressure , (II) intermolecular forces and (III)ΔH_{vap} (latent heat of vaporisation) is matched correctly ?

A. $\begin{array}{cccc} & I & II & III \\ (a) & \text{High} & \text{Weak} & \text{Small} \end{array}$

B. $\begin{array}{cccc} & I & II & III \\ (b) & \text{High} & \text{Strong} & \text{Large} \end{array}$

C. $\begin{array}{cccc} & I & II & III \\ (c) & \text{Low} & \text{Weak} & \text{Large} \end{array}$

D. $\begin{array}{cccc} & I & II & III \\ (d) & \text{Low} & \text{Strong} & \text{Small} \end{array}$

Answer: A

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4. For 0.1 m aq. Solution of given electrolytes correct order of their increasing order of boiling point :

A. $CH_3COOH < HCOOH < NaCl < Na_2SO_4$

B. $HCL < HCOOH < NaCl < Na_2SO_4$

C. $HCOOH < CH_3COOH < NaCl < Na_2SO_4$

D. $Na_2SO_4 < NaCl < HCOOH < CH_3COOH$

Answer: A

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5. The freezing point of aqueous solution that contains 3% of urea, 7.45% KCl and 9% of glucose is (given K_f of water = 1.86 and assume molality = molarity).

A. 290 K

B. $285.5K$

C. 266 K

D. 250 K

Answer: C

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6. On mixing , heptane and octane form an ideal solution . At 373 K , the vapour pressures of the two liquid components (heptanes and octane) are 105 kP_a and $45kP_a$ respectively . Vapour pressure of the solution obtained by mixture 25.0 g of heptane and 25 g of octane will be : (Molar mass of heptane - $100gmol^{-1}$ and of octane = $114gmol^{-1}$)

A. $77.0kP_a$

B. $38.5kP_a$

C. $96.2kP_a$

D. $154kP_a$

Answer: A

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7. Consider the following four liquids :

1.Water : highly polar, H - bonging 2. Hexanol : slightly polar, some H - bonding

3.Chloroform : slightly polar, noH - bonding 4. Octane : non-polar , no H - bonding

Which pair of liquids is immiscible ?

The solutions of water and octance are immiscible. Why?

A. water and octane

B. water and hexanol

C. Hexanol and chloroform

D. Chloroform and octane

Answer: A

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8. Which terms are matched correctly?

A. High vapour pressures= high ΔH_{vap} values

B. High ΔH_{vap} values= low boiling points

C. Low vapour pressure= high boiling points

D. Low boiling point= low vaporization rate

Answer: C

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9. For the given electrolyte A_xB_y. The degree of dissociation $'\alpha'$ can be given as:

A. $\alpha = \dfrac{i - 1}{x + y - 1}$

B. $I = (1 - \alpha) + x\alpha + y\alpha$

C. $\alpha = \dfrac{1 - i}{1 - x - y}$

D. $i = (x + y - 1)\alpha$

Answer: A::B::C

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10. Dry air is passed through bulbs containing a solution 40 grams of non-electrolytic solute in 360 grams of water, then through bulbs containing pure water at the same temperature and finally through a tube in pumice moistened in with strong H_2SO_4 was kept. The water bulbs lost 0.0870 grams and the sulphuric acid tube gained 2.175 grams. Calculate the molecular weight of solute.

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18

1. Which one of following pairs of aqueous solution will not be isotonic at same temperature ?

A. $1M$ NaCl and 2 M urea

B. $1.5 M AlCl_3 \text{and} 2 M Na_2SO_4$

C. $2.5 M KCl \text{and} 1 M Al_2(SO_4)_3$

D. $1 M CaCl_2 \text{and} 1 M NaCl$

Answer: D

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2. The vapour pressure of benzene is $53.3 kP_a$ at 60.6° but it falls to $51.5 kP_a$ when 19 g of a non-volatile organic compound is dissolved in 500

g benzene . The molar mass of the non-volatile compound is close to :

A. 82

B. 85

C. 88

D. 92

Answer: B

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3. A liquid is in equilibrium with its vapour at its boiling point . On an average the molecules in the two phases have equal :

A. potential energy

B. kinetic energy

C. total energy

D. intermolecular force

Answer: B

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4. 25 mL of an aqueous solution of KCl was found to require 20 mL of $1MAgNO_3$ solution when titrated using K_2CrO_4 as indicator . Depression in freezing point of KCl solution with 100% ionization will be :

$(K_f = \frac{10}{9}$ k /molal)

A. $\frac{20}{45}$

B. $\frac{80}{45}$

C. $\frac{40}{45}$

D. $\frac{160}{45}$

Answer: B

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5. The vapour pressure of a pure liquid A is 40 mm Hg at 310 K . The vapour pressure of this liquid in a solution with liquid B is 32 mm Hg . Mole fraction of A in the solution , if it obeys Raoult's law is :

A. 0.8

B. 0.5

C. 0.2

D. 0.4

Answer: A

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6. The solubility of gases in liquids:

A. increases with increase in pressure and temperature

B. decreases with increase in pressure and temperature

C. increases with increase in pressure and decrease in temperature

D. decreases with increase in pressure and increases in temperature

Answer: C

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7. Which parameter affects the vapour pressure of a liquid?

A. Volume of the liquid

B. Surface area of the liquid

C. Volume of space above the liquid

D. Temperature of the liquid

Answer: D

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8. Which of the following have equal boiling point ?

A. $0.1MNa_2SO_4$

B. $0.1MC_6H_{12}O_6$(glucose)

C. $0.1MMgCl_2$

D. $0.1MAl(NO_3)_3$

Answer: A::C

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9. The vapour pressure of fluorobenzene at t° C is given by the equation

log p (mm Hg)= 7.0 - $\dfrac{1250}{t + 220}$

Calculate the boiling point of the liquid in C° if the external (applied) pressure is 5.26% more than required for normal boiling point(log2=0.3)

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1. Which of the following is isotonic with 15% w/w glucose solution (sp.gr = 1.2)?

A. $1MCaCl_2$

B. $1NCaCl_2$

C. $0.5MNaCl$

D. 0.5 M urea

Answer: C

Watch Video Solution

2. Which of the following would lead to an increase in the vapour pressure of a liquid ?

(P) Increasing the temperature

(Q) Adding a non-volatile solute

A. P only

B. Q only

C. Both P and Q

D. Neither P nor Q

Answer: A

Watch Video Solution

3. A solution of 3.00 g of which substance , dissolved in $100gH_2O$, has the highest boiling point ?

A. $HOCH_2CH(OH)CH_2OH(M = 92.1)$

B. $RbF(M = 104.5)$

C. $AlCl_3(M = 133.3)$

D. $TlNO_3(M = 390.4)$

Answer: C

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4. How many moles of sucrose should be dissolved in 500 g of water so as to get a solution which has a difference of $104\,^{\circ}C$ between boiling point and freezing point ? ($K_f = 1.86$ K kg mol^{-1}, $K_b = 0.52 Kkgmol^{-1}$)

A. 1.68

B. 1.492

C. 8.40

D. 0.840

Answer: D

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5. Mole fraction of the toluene in the vapour phase which is in equilibrium with a solution of benzene ($p^{\circ} = 120$ torr) and toluene (p° =80 torr) having 2.0 mol of each is :

A. 0.5

B. 0.25

C. 0.6

D. 0.4

Answer: D

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6. The solubility of $N_2(g)$in water exposed to the atmosphere, when the partial pressure is 593mm is 5.3×10^{-4}M. Its solubility at 760 mm and at the same temperature is

A. $4.1 \times 10^{-4}M$

B. $6.8 \times 10^{-4}M$

C. 1500M

D. 2400M

Answer: B

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7. The first vertical line in the diagram represents a thermometer with the boiling and freezing points for a pure solvent. The numbered lines represent possible boiling and freezing points for a solution of a non-volatile solute in the same solvent. Which line best represents the boiling point and freezing point of a solution relative to values for the pure solvent ?

Note: The differences in temperatures are not to scale

A. 1

B. 2

C. 3

D. 4

Answer: D

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

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

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

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

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

Answer: A::B::C

Watch Video Solution

9. $1g$ of a monobasic acid dissolved in $200g$ of water lowers the freezing point by $0.186^{\circ}C$. On the other hand when $1g$ of the same acid is dissolved in water so as to make the solution $200mL$, this solution requires $125mL$ of $0.1NNaOH$ for complete neutralization. Calculate % dissociation of acid ? $\left(K_f = 1.86\frac{K\text{-}kg}{\text{mol}}\right)$

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20

1. The order of osmotic prssure of equimolar solutions of $BaCl_2$, $NaCl$ and glucose will be:

A. glucose $>$ NaCl $> BaCl_2$

B. $BaCl_2 >$ NaCl $>$ glucose

C. NaCl $> BaCl_2 >$ glucose

D. NaCl $>$ glucose $> BaCl_2$

Answer: B

Watch Video Solution

2. Four containers are taken at the same temperature , as shown in the figure :

(A) 500 mL of 10% (w/w) urea solution

(B) 500 mL of 10% (w/w) urea solution

(C) 400 mL of 10% (w/w) urea solution

(D) 500 mL of 20% (w/w) urea solution

The correct order of vapour pressure of these solution is :

A. $P_C < P_A < P_B < P_D$

B. $P_D < P_C < P_A < P_B$

C. $P_D < P_A = P_B = P_D$

D. $P_A = P_B = P_C < P_D$

Answer: C

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

A. $\frac{1}{10}$

B. $\frac{1}{7.6}$

C. $\frac{1}{35}$

D. $\frac{1}{76}$

Answer: D

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4. x mole of KCl and y mole of $BaCl_2$ are both dissolved in 1 kg of water . Given that $x+y=0.1$ and K_f for water is 1.85 k/molal , what is the observed range of ΔT_f, if the ratio of x to y is varied ?

A. $0.37^\circ \text{to} 0.555^\circ$

B. $0.185^\circ \text{to} 0.93$

C. $0.56^\circ \text{to} 0.93^\circ$

D. 0.37° to 0.93°

Answer: A

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5. For an ideal binary solution with $p_A^{\circ} / p_B^{\circ}$ which relation between X_A (mole fraction A in liquid phase) and Y_A (mole fraction of A in vapour phase) is correct, X_B and Y_B are mole fraction of B in liquid and vapour phase respectively:

(Given :$p_A^{\circ} > p_B^{\circ}$)

A. $X_A = Y_A$

B. $X_A > Y_A$

C. $\frac{X_A}{X_B} < \frac{Y_A}{Y_B}$

D. $X_A, Y_A, X_B \text{ and} Y_B$ cannot be correlated

Answer: C

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6. Total vapour pressure of mixture of 1 mol of volatile component A($p_A^\circ = 100$mm Hg) and 3 mol of volatile component B(p_B° =60 mm Hg) is 75 mm. For such case:

A. there is positive deviation from Raoult's low

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 of above statements are correct.

Answer: D

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7. A homogenous liquid reacation mixture is often heated to increase the rate of reaction. This is best explained by the fact that raising the temperature:

A. increases the heat of reaction.

B. decreases the energy of activation.

C. increases the vapour pressure of the liquid

D. increases the averge kinetic energy of the reactants.

Answer: B

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8. 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: A::B::C

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9. The amount of benzene that will seprete out (in grams) if a solution containing 7.32 g of triphenylmethane in 1000 g of benzene is cooled to a temperature which is 0.02° C below the feezing point of benzene ? ($K_f = 5.12K\text{-}kg/mol$)

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21

1. A sample of a voltage liquid is introduced to an evacuated container with a movable piston . Which change occurs as the piston is raised ? (Assume some liquid remains.)

(P) The fraction of the molecules in the gas phase increases .

(Q) The pressure in the container decreases .

A. P only

B. Q only

C. Both P and Q

D. Neither P nor Q

Answer: A

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2. Y g of non-volatile organic substance of molecular mass M is dissolved in 250 g benzene . Molal elevation constant of benzene is K_b . Elevation in its boiling point is given by :

A. $\frac{M}{K_bY}$

B. $\frac{4K_bY}{M}$

C. $\frac{K_bY}{4M}$

D. $\frac{K_bY}{M}$

Answer: B

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3. If sodium sulphate is considered to be completely dissociated into cations and anions in aqueous solution , the change in freezing point of water $\left(\Delta T_f\right)$ when 0.01 mole of sodium sulphate is dissociated in 1 kg of water is : ($K_f = 1.86$ K kg mol^{-1})

A. $0.0372K$

B. $0.0558K$

C. $0.0744K$

D. $0.0186K$

Answer: B

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4. At $40\ ^\circ C$, vapour pressure in torr of methanol and ethanol solution is P=119x+135, where x is the mole fraction of methanol. Hence :

A. vapour pressure of pure methanol is 119 torr

B. vapour pressure of pure ethanol is 135 torr

C. Vapour pressure of equimolar mixture of each is 127 torr

D. mixture is completely immiscible

Answer: B

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5. Water and Chlorobenzene are immiscible liquids. Their mixture boils at $90\,^{\circ}C$ under a reduced pressure of 7.82×10^{10} Pa. The vapour pressure of pure water at $90\,^{\circ}C$ is 7.03×10^{4} Pa. On weight percent basis, chlorobenzene in the disillate is equla to :(Mol. wt. of chlorobenzen is 112.5g mol^{-1})

A. 30

B. 59

C. 41

D. 70

Answer: C

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6. What is the proper way to dispose of a two milliliter sample of hexane after completing experiments with it ?

A. Return it to the solvent bottle.

B. Place it in a waste bottle with compatible organic materials

C. Flush it down the drain with large quantities of water.

D. Pour it on a solid absorbant so it can be thrown away with solid waste.

Answer: D

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7. Which of the following is/are correct for an ideal binary correct of two volatile liquid (e.g., benzene and toluene)?

A. Its vapour is always richer in the more volatile component (compared to the liquid).

B. The liquid will gradully become richer in the less volatile component if such a mixutre is boiled (distilled).

C. The P_T (i.e, 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 points of the two components.

Answer: A::B

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8. What is the osmotic pressure of a solution (in torr) made by mixing 20 mL of 0.01 M $BaCl_2$ with 30 mL of 0.01 M NaF at 27° C? $K_{sp}(BaF_2) = 2.4 \times 10^{-5}$.R=0.082 lit atm $mol^{-1}K^{-1}$, 1 atm=760 torr.

View Text Solution

22

1. For a sample of liquid in a closed container , which aspects (s) of vaporization depends on the surface area of the liquid

(P) Rate of vaporization

(Q) Vapour pressure

A. P only

B. Q only

C. Both P and Q

D. Neither P nor Q

Answer: A

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2. A solution containing 28 g of phosphorus in 315 g $CS_2\left(b.p. 46.3\,^\circ C\right)$ boils at $47.98\,^\circ C$. If K_b for CS_2 is 2.34 K kg mol^{-1}. The formula of phosphorus is (at , mass of P = 31).

A. P_6

B. P_4

C. P_3

D. P_2

Answer: B

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3. Colligative properties have many practical uses , some of them may be :

(P) melting of snow by salt

(Q) desalination of sea water

(R) determine of molar mass

(S) determine of melting point and boiling point of solvent

Actual practicle uses are :

A. P, Q

B. R,S

C. P,Q,R

D. Q,R,S

Answer: C

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4. Which of the following statements is FALSE ?

A. Two different solutions of sucrose of same molality prepared in different solvents will have the same depression in freezing point.

B. The osmotic pressure of a solution is given by the equation $\prod = \text{CRT}$(where C is the molarity of the solution).

C. Decreasing order of osmotic pressure for 0.01 M aqueous solution of barium chloride, potassium chloride, acetic acid and sucrose is $BaCl_2 > KCl > CH_3COOH >$ sucrose.

D. According to Raoult's law, the vapour pressure exerted by a volatile component of a solution is directly proportional to its mole fraction in the solution.

Answer: A

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5. An azeotropic solution of two liquids has a boiling point lower than either of them when it:

A. shows negative deviation from Raoult's law

B. Shows positive deviation from Raoult's law

C. shows ideal behaviour

D. is saturated

Answer: B

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6. Which change increases the solubility of a gas in water?

(P) an increases in water temperature

(Q) a decrease in gas pressure

A. P only

B. Q only

C. Both P and Q

D. Neither P nor Q

Answer: C

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7. For chloroform and acetone or for a solution of chloroform and acetone if P_s (observed (actual)) is compared with P_s (Theoretical (Raoult)) then which of the following is fare true ?

A. $p_s(\text{actual}) < p_s(\text{Raoult})$

B. $\lim X_{\text{Choloform}} \rightarrow 0\left(p^{\circ}_{\text{acetone}} - p^{\circ}_{\text{s actual}}\right) = 0$

C. $\lim X_{\text{acetone}} \rightarrow 0\left(p^{\circ}_{\text{cholorform}} - p_s(actual)\right) = 0$

D. $p^{\circ}_{\text{acetone}} > p^{\circ}_{\text{chloroform}}$ near room temperature

Answer: A::B::C::D

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8. If osmotic presssure of 1M aqueous solution of H_2SO_4 at 500 K is 90.2 atm. Calculate K_{a2} of H_2SO_4. Give your answer after multiplying 1000 with K_{a_2}. (Assumme ideal solution) [Given : K_{a_1} of $H_2SO_4 = \infty$,R=0.082 L atm/mol-K]

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23

1. The vapour pressure of water depends upon :

A. Surface area of container

B. Volume of container

C. Temperature

D. All of the above

Answer: C

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2. Consider equimolal aqueous solutions of $NaHSO_4$ and NaCl with ΔT_b and $\Delta T'_b$ as their respective boiling point elevation . The value of $\lim_{m \to 1} \frac{\Delta T_b}{\Delta T'_b}$ will be :

A. 1

B. 1.5

C. 3.5

D. $\frac{2}{3}$

Answer: B

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3. Select the correct statement (s) :

A. When solid $CaCl_2$ is added to liquid water , the boiling point temperature rises

B. When solid $CaCl_2$ is added to ice at $0^{\circ}C$, then freezing point temperature falls

C. Both (a) and (b)

D. None of these

Answer: C

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4. The vapour pressure of two pure isomeric liquids X and Y are 200 torr and 100 torr respectively at a given temperature. Assuming a solution of these components to obey Raoults law, the mole fraction of component X in vapour phase in equilibrium with the solution containing equal amounts of X and Y, at the same temperature is :

A. 0.33

B. 0.5

C. 0.66

D. 0.8

Answer: C

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5. A solution of sulphuric acid in water exhibits:

A. negative deviations from Raoult's law

B. positive deviation from Raoult's law

C. ideal properties

D. the applicability of Henry's law

Answer: A

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6. Hexane, C_6H_{14}, is immiscible with water and ethanol. Water and ethanol are miscible. C_6H_{14} has the lowes density. Which diagram represents the results when equal volumes of these three liquids are placed in a test tube and shaken?

A. 1

B. 2

C. 3

D. 4

Answer: D

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7. In which of the following pairs of solutions will the values of the vant Hoff factor be the same?

A. $0.05MK_4\left[Fe(CN)_6\right]$ and $0.10MFeSO_4$

B. $0.10MK_4\left[Fe(CN)_6\right]$ and $0.05MFeSO_4\left(NH_4\right)_2SO_4 \cdot 6H_2O$

C. $0.20MNaCl$ and $0.10MBaCl_2$

D. $0.05MFeSO_4\left(NH_4\right)_2SO_4.6H_2O$ and $0.02MKCl \cdot MgCl_2 \cdot 6H_2O$

Answer: B::D

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8. Assume liquefied petroleum gas (LPG) is a 50-50 (by mole) mixtures of n-pentene and n-butane. Calculate the calorific value (in kJ/mol) of gas available from a newly purchased cylinder. Will the calorific value increase, decrease or remain the same during use?

	n-butane, C_4H_{10}	n-pentane, C_5H_{12}
vapour pressure	1800 torr	600 torr
calorific value	2800 kJ/mol	3600 kJ/mol

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1. A sample of air saturated with benzene (vapour pressure = 100 mm Hg at 298 K , 750 mm Hg pressure . If it is isothermally compressed to one third of its initial volume , the final pressure of the system is :

A. 2250 torr

B. 2150 torr

C. 2050 torr

D. 1950 torr

Answer: C

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2. Aluminium phosphate is 100% ionised in 0.01molal aqueous solution,Hence,$\Delta T_b / K_b$is :

A. 0.01

B. 0.015

C. 0.0175

D. 0.02

Answer: D

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3. An aqueous solution of a solute AB has b.p of $101.08\,^{\circ}C$ (AB is $100\,\%$ ionised at boiling point of the solution) and freezes at $-1.80\,^{\circ}C$. Hence , AB $\left(K_b / K_f = 0.3\right)$:

A. is $100\,\%$ ionised at the f.p. of the solution

B. behaves as non-electrolyte at the f.p. of the solution

C. forms dimer

D. None of these

Answer: B

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4. A solution is prepared containing a 2:1 mol ration of dibromoethane $\left(C_2H_4Br_2\right)$ and dibromopropane $\left(C_3H_6Br_2\right)$. What is the total vapour pressure over the solution assuming ideal behaviour?

A. 300mm Hg

B. 158 mm Hg

C. 150 mm Hg

D. 142mm Hg

Answer: B

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5. The boiling point of an azeotropic mixture of water and ethyl alcohol is less than that of the theoretical value of water and alcohol mixture.

Hence the mixture shows

A. that solution is highly saturated

B. positive deviation from Raoult's law

C. negative deviation from Raoult's law

D. nothing can be said

Answer: B

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6. Which property does not indcate strong intemolecular forces?

A. High enthalpy of vaporization

B. High viscosity

C. High critical temperature

D. High vapour pressure

Answer: A

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7. According to Henry's law, the partial pressure of gas $\left(p'_g\right)$ is directly proportional to mole fraction of gas in dissolved state, i.e., $P_{\text{gas}}' = K_H, X_{\text{gas}}$ where K_H is Henry's constant. Which are correct?

A. K_H is characteristic constant for a given gas-solvant system.

B. Higher is the value of K_H, lower is solubility of gas for a given particle pressure of gas

C. K_H has temperature dependence

D. K_H increases with temperature

Answer: A::B::C::D

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8. 1.22 g of benzoic acid is dissolved in 100 g of acetone and 100 g of acetone seperately. Boiling point of the solution in acetone increases by $0.17\,^{\circ}$ C, while that of solution, in benzene increases by $0.13\,^{\circ}$ C , K_b for acetone and benzene is 1.7 K kg mol^{-1} and 2.6 K kg mol^{-1}. Find molecular weight of benzoic acid in two cases. Hence, find their sum.

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25

1. A vessel has N_2 gas and water vapours at a total pressure of $1atm$. The partial pressure of water vapours is $0.3atm$. The contents of this vessel are transferred to another vessel having one-third of the capacity of original volume, completely at the same temperature the total pressure of this system in the new vessel is

A. 3.0 atm

B. 1 atm

C. 3.33 atm

D. 2.4 atm

Answer: D

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2. 1.0 molal aqueous solution of an electrolyte X_3Y_2 is 25 % ionised . The boiling point of the solution is :

(K_b for $H_2O = 0.52K$ kg/mol)

A. $375.5K$

B. $374.04K$

C. $377.\ 12K$

D. $373.25K$

Answer: B

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3. Density of 1M solution of a non-electrolyte $C_6H_{12}O_6$ is 1.18 g/mL . If $K_f(H_2O)$ is $1.86\,^{\circ}\,mol^{-1}$ kg , solution freezes at :

A. $-1.58\,^{\circ}$

B. $-1.86\,^{\circ}C$

C. $-3.16\,^{\circ}C$

D. $1.86\,^{\circ}C$

Answer: B

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4. A solution is of 0.0400 mol of $C_2H_4Br_2$ and 0.0600 mol of $C_3H_6Br_2$ exerts a vapour pressure of 145.4 mm Hg at a certain temperature . Determine the vapour pressure of pure $C_3H_6Br_2$ at this temperature . Assume the vapour pressure of $C_2H_4Br_2$ at this temperature is 173 mm Hg and that the solution obeys Raoult's Law:

A. 76.2 mm Hg

B. 118 mm Hg

C. 127 mm Hg

D. 138 mm Hg

Answer: c

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5. On mixing $10mL$ of acetone with $40mL$ of chloroform, the total volume of the solution is:

A. $< 50mL$

B. $> 50mL$

C. $= 50mL$

D. Cannot be predicted

Answer: A

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6. Which letter indicates where a thermometer should be placed to determine the boiling point of a distillate?

A. A

B. B

C. C

D. D

Answer: D

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7. Which is//are true about ideal solutions ?

A. The volume of mixing is zero

B. The enthalpy of mixing is zero

C. The entropy of mixing is zero

D. The entropy of mixing is negative

Answer: A::B

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8. How many grams of sucrose must be added to $360g$ of water to lower the vapour pressure by $1.19mmHg$ at a temperatue at which vapour pressure of pure water is $25mmHg$?

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1. At a constant temperature , ΔS will be maximum for which of the following processes:

A. Vaporisation of pure solvent .

B. Vaporisation of solvent from a solution containing non-volatile and non-electrolytic solute in it.

C. Vaporisation of solvent from a solution containing non-volatile but electrolytic solute in it .

D. Entropy change will be same in all the above cases.

Answer: A

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2. Mole fraction of a non-electrolyte in aqueous solution is 0.07 . If $K_f(H_2O)$ is $1.86\,^\circ mol^{-1}$ kg , depression in f.p ., ΔT_f is :

A. $0.26\,^\circ$

B. $1.86\,^\circ$

C. $0.13\,^\circ$

D. 7.78°

Answer: D

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3. Ethanol $\left(C_2H_5OH\right.$, M=46) and methanol $\left(CH_3OH,\right.$ M= 32) form an ideal solution when mixed. What is the vapour pressure of a solution prepared by mixing equal masses of ethanol and methanol ? (The vapour pressure of ethanol and methanol are 44.5 mm Hg and 88.7 mm Hg, respectively.)

A. 133 mm Hg

B. 70.6 mm Hg

C. 66.6 mm Hg

D. 44.5 mm Hg

Answer: B

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4. Which of the following azeotropic solution has the $b.p.$ less than $b.p.$ of the constituents A and B ?

A. $CHCl_3$ and CH_3COOH

B. CS_2 and CH_3COCH_3

C. CH_3CH_2OH and CH_3COCH_3

D. CH_3CHO and CS_2

Answer: C

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5. A 50mL sample of gas is collected over water. What will be the effect on the calculated molar mass of the gas if the effect of the water vapour is ignored?

It will be:

A. high because of the mass of water in the collection flask.

B. high because of omitting the vapour pressure of the water in the calculation.

C. low because of the mass of water in the collection flask.

D. low because of omitting the vapour pressure of the warter in the calculation.

Answer: A

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6. Freezing point lowering expression is

$\Delta T_f = K_f m$ (molality)

Which of the following assumptions are considered for the validity of above equation ?

A. The solution is dilute

B. The ΔH_f (latent heat of fusion of solvent) is independent of temperature between the actual and normal freezing point.

C. The solid-phase consists of pure solvent when solution is allowed to cool

D. ΔT_f is not equal to $3K_f$ is not equal to $3K_f$ for $3molL^{-1}$ solution

Answer: A::B::C

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

$K_l\left(H_2O\right) = 1.86\,^\circ \text{mol}^{-1}kg$

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1. If P° and P_S are the vapour pressure of the solvent and solution respectively, n_1 and n_2 are the mole fractions of the solvent and solute respectively, then:

A. $P = P_0 N_2$

B. $P = P_0 N_1$

C. $P_0 = P N_1$

D. $P = P_0 \left(\frac{N_1}{N_2}\right)$

Answer: B

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2. Which statement comparing solutions with pure solvent is not correct ?

A. A solution containing a non-volatile solute has a lower vapour pressure than pure solvent .

B. A solution containing a non-volatile solute has a lower boiling point than pure solvent .

C. A solution containing a non-volatile solute has a lower freezing point than pure solvent .

D. A solution will have a greater mass than an equal volume of pure solvent if the solute has a molar greater than the solvent .

Answer: B

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3. Benzene and toluene from an ideal solution. The vapour pressure of benzene at 55°C is 400 mm Hg while the vapour pressure of toluene at $55^{\circ}C$ is 130 mm Hg. What is the vapour pressure of a solution consisiting of 0.5 mole fraction of benzene and 0.5 mole fraction of toluene at $55^{\circ}C$?

A. Lower than 130mm Hg

B. Between 130 and 400 mm Hg

C. Exactly 400 mm Hg

D. Greater than 400 mm Hg

Answer: B

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4. Some of the following gases are soluble in water due to formation of their ions :

$I: CO_2, II: NH_3, III: HCL, IV: CH_4, V: H_2$

Water insoluble gases can be:

A. P,S,T

B. P,T

C. P,Q,R

D. S,T

Answer: D

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5. Which property(ies) of a liquid increases when the temperature is raised?

(P) Vapour pressure

(Q) Surface tension

A. P only

B. Q only

C. Both P and Q

D. Neither P nor Q

Answer: D

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6. Select the correct statement :

A. Gases which have high value of van der Waal's constant $'a'$ are easily liquefied

B. Easily liquidfied gases are water soluble

C. Ions forming gases in a solvent are soluble in that solvent.

D. Under same conditions, NH_3 has low solubility than that of CO_2

Answer: A::B::C

Watch Video Solution

7. 1000 g of 1 molal aqueous solution of sucrose is cooled and maintained at $-3.534^{\circ}C$. Find out how much ice will separate out at this temperature. $\left(K_f \text{ for water } = 1.86km^{-1}\right)$

Watch Video Solution

1. The vapour pressure of pure liquid solvent A is $0.80 atm$. When a non-volatile substance B is added to the solvent, its vapour pressure drops to $0.60 atm$, the mole fraction of component B in the solution is

A. 0.50

B. 0.25

C. 0.75

D. 0.40

Answer: B

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2. Which has maximum freezing point ?

A. 6 g of urea solution in 100 g H_2O

B. 6 g acetic acid solution in 100 g H_2O

C. 6 g sodium chloride in 100 g H_2O

D. All have equal freezing point .

Answer: A

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3. What is the mole ration of benzene $\left(P_B^\circ\right.$=150 torr) and toluene $\left(P_T^\circ\right.$ =50 torr) in vapour phase if the given solution has a vapour pressure of 120 torr?

A. $7:1$

B. $7:3$

C. $8:1$

D. $7:8$

Answer: A

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4. Select incorrect Statement :

A. Higher the value of K_h (Henry's law constant) at a givenpressure, the lower is the lower is the solubilty of the gas in the liquid.

B. Solubitity of a gas in a liquid decreases with incerease in temperature and pressure.

C. to minimise the painful effects accompanying the decompression of deep sea diver, O_2 diluted with less soluble He gas Is used as breathing gas .

D. The solubility of a gas in a liquid is governed byHenry's law.

Answer: B

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5. A 1.0L portion of a 0.30 m solution of which of the following would be most effective at removing ice from a sidewalk?

A. $C_6H_{12}O_6$

B. NaBr

C. KNO_3

D. $CaCl_2$

Answer: A

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6. Which of the following concentration factors cen be calculated if the mole fraction and density of an aqueous solutions of HCl are known ?

A. Molality

B. Molarity

C. Percent by mass

D. Normality

Answer: A::B::C

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7. A mixture of two immiscible liquids nitrobenzene and water boiling point at 99° C has a partial vapour pressure of water 733 mm and that of nitro benzene 27mm. Calculate the ratio of the weights of water to nitro benzene in the distillate.

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29

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

A. 100 amu

B. 90 amu

C. 75 amu

D. 120 amu

Answer: B

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2. van't Hoff factors of aqueous solutions of X , Y , Z are $1.8, 0.8$ and 2.5 . Hence , their : (assume equal concentrations in all three cases)

A. b.p. : X $<$ Y $<$ Z

B. f.p. : $Z < X < Y$

C. osmotic pressure : X = Y =Z

D. v.p.: $Y < X < Z$

Answer: B

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3. Liquid A and B form an ideal solution. At $25^{\circ} C$. 5 moles of vapours of liquid 'A' and 10 moles of vapour of liquid B are taken in a cylinder piston arrangement and a pressure of 0.6 bar is maintained. At $25^{\circ} C, P_A^{\circ} = 0.5$ bar , P_B° =1.0 bar. The only correct statement about the system is :

A. Some vapour will condense into liquid solution having A as well as B.

B. Vapour of A will condense completely into liquid but vapours of B will not condense at all.

C. No condensation will occur of either vapours.

D. Complete condensation will occur of vapours.

Answer: C

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4. At 35° C the vapour pressure of CS_2 is 512 mm Hg and of asetone is 344 mm Hg.A solution of Cs_2 and acetone in which the mole fraction of CS_2 is 0.25, has a total vapour pressure of600 mmHg .which of the following Statement is /are correct?

A. A mixture of 100mL of acetone and 100mL of CS_2has a volume of 200mL

B. when acetone and CS_2 are mixed at 35°C ,Heat must be absorbed in order to produce a solution at35°C.

C. Process of maxing is exothermic.

D. Entropy of mixing I szero.

Answer: B

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5. For which property is the value greater for a solution of a non-volatile solute than for the pure solvent?

A. Boiling point

B. Freezing point

C. Triple point

D. Vapour pressure

Answer: A

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6. Consider following solutions :

(P) $1M$ aqueous glucose solution

(Q) $1M$ aqueous sodium chloride solution

(R) $1M$ aqueous ammonium phosphate solution

(S) $1M$ benezoic acid in benezene

A. All are isotonic solutions

B. R is hypertonic of P, Q and S

C. S is hypotonic of P, Q and R

D. Q is hypotonic of R but hypertonic of R but hypertonic of P and S

Answer: B::C::D

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7. The following is a table of the vapour pressure of pure benzene and chlorobenzene. Determine the boiling point of a mixture containing 40 mole percent of benzene and 60 mole percent of chlorobenzene at a pressure of 1000 mm Hg.

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1. The vapour pressure of a solution of a non-volatile electrolyte B in a solvent A is 95% of the vapour pressure of the solvent at the same temperature. If the molecular weight of the solvent is 0.3 times, the molecular weight of solute, the weight ratio of the solvent and solute are:

A. 0.15

B. 5.7

C. 0.2

D. None of these

Answer: B

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2. Select correct statements :

A. The fundamental cause of all colligative properties is the higher entropy of the solution relative to that of the pure solvent .

B. The freezing point of hydrofluoride solution is larger than that of equimolar hydrogen chloride solution .

C. 1M glucose and 0.5 M NaCl solution are isotonic at a given temperature .

D. all are correct

Answer: D

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3. A solution at $20^{\circ} C$ is composed of 1.5 mol of benzene and 3.5 mol of toluene. If the vapour pressure of pure benzene and pure toluene at this temperature are 74.7 torr and 22.3 torr, respectively, then the total vapour pressure of the solution and the benzene mole fraction in equilibrium with it will be, respectively:

A. 38.0 torr and 0.589 torr

B. 30.5 torr and 0.389

C. 3.8 torr and 0.280

D. 35.0 torr and 0.480

Answer: A

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4. K_H value for Ar(g),CO(g), HCHO(g) and $CH_4(g)$ are 40.39 , 1.67 , 1.83×10^{-5} and 0.413 respectively. Arrange these gases in the order of their increastively solubility.

A. $HCHO < CH_4 < CO_2 < Ar$

B. $HCHO < CO_2 < CH_4 < Ar$

C. $Ar < CO_2 < CO_2 < HCHO$

D. $Ar < CH_4 < CO_2 < HCHO$

Answer: C

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5. Liquid exhibits all these properties except:

A. definite volume.

B. definte shape

C. incompressibility.

D. slow difffusion

Answer: B

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6. Which is//are correct statement(s) ?

A. When mixture is more volatile, there is positive deviation from Raoult's law

B. When mixture is less volatile, there is negative deviation from Raoult's law

C. Ethanol and water form ideal solution

D. $CHCl_3$ and water form ideal solution

Answer: A::B

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7. What is the apparent molecular mass of a weak acid HA (molecular mass= 30 g/mole) in an aqueous solution, which shows elevation in boiling point by 0.0156° C.

Given : $K_a(HA) = 10^{-2}, K_b\left(H_2O\right) = 0.52 Kkgmol^{-1}$

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

:

A. 2

B. 1

C. 4

D. 3

Answer: D

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2. Depression of freezing point of 0.01 molal aq. CH_3COOH solution is $0.02046\,^{\circ}$. 1 molal urea solution freezes at $-1.86\,^{\circ}$C . Assuming molarity equal to molarity , pH of CH_3COOH solution is :

A. 2

B. 3

C. 3.2

D. 4.2

Answer: B

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3. Mixture of volatile components A and B has a total vapour pressure (in torr)p=254 - $119x_A$is where$x_A$mole fraction of A in mixture .HenceP_A° and P_B° are(in torr)

A. 254119

B. 119254

C. 135254

D. 119373

Answer: C

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4. On the basic of information given below mark the Correct option .Information:

(P)In bromoethane and choroethane mixture intermolar interactions of A.A and B.B tupesare nearly same as A .B type intersections.

(Q) In ethanol and acetone mixture A.A or B.B type inetermolecular interaction are stronger than A.B type interactions.

(R) In chloroform and acetone mixture A.A or B.B type intermolecular interactions are weaker than A. B type interactions.

A. Solution (Q) and (R)will follow Raoult's law

B. Solution (P) will follow Raoult's law

C. Solution (Q) will show negative deviation from Raoult's law

D. Solution (R) will show positive deviation from Raoult's law.

Answer: B

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5. Which statement is true about a substance that is subjected to a lower external pressure at a constant temperature?

A. A liquid will boil at a lower temperature

B. A liquid wil exhibit a lower vapour pressure.

C. A gas in an insulated container will change into a liquid.

D. A gas in a non-rigid container will exhibit a smaller volume.

Answer: A

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6. Which one of the following given below concerning properties of solutions, describe 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. Boiling point of pure benzene increases by the addition of toluene

Answer: B::C

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7. A solution of 0.1 M CH_3COOH is placed between parallel electrodes of cross-section area 4 cm^2, seperated by 2 cm. For this solution, resistence measured is 100Ω. Calculate elevation in boiling point of the 0.1 M CH_3COOH solution, using following information.

$K_b = 0.5Kkg/mol, \ \wedge_m^{\infty}\left(H^+\right) = 300Scm^2 \text{ mole}^{-1}, \ \wedge_m^{\infty}\left(CH_3COO^-\right) = 100Scm^2$

write ypur answer by multiplying it with 160.

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1. The relative decreases in the vapour pressure of an aqueous solution containing $2mol\left[Cu\left(NH_3 \_ (3)Cl\right]$ in $3molH_2O$ is 0.50. On reaction with $AgNO_3$, this solution will form

A. 1 mol AgCl

B. 0.25 mol AgCl

C. 0.5 mol AgCl

D. 0.40 mol AgCl

Answer: A

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2. What will be the molecular weight of $NaCl$ determined experimentally following elevation in the boiling point or depression in freezing point method?

A. < 58.5

B. > 58.5

C. $= 58.5$

D. None of these

Answer: A

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3. A mixture contains 1 mole of volatile liquid A $\left(P_A^0 = 80\text{mm Hg}\right)$. and 3 moles of volatile liquid B $\left(P_A^0 = 80\text{mm Hg}\right)$. If solution behaves ideally, the total vapour pressure of the distillate is

A. 25 mm Hg

B. 85 mm Hg

C. 90 mm Hg

D. 92 mm Hg

Answer: B

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4. On the basis of information given below mark the correct option.

Information : On adding acetone to methanol some of the hydrogen bonds between methanol molecules breaks.

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

B. At specific composition, methanol- acetone mixture forms 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 show negative deviation from Raoult's law.

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

Answer: A

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5. A 1:1 mixture of pentane and hexane is seperated by fractional distillation in the apparatus shown. At what temperature does the first drop of condensate appear on the thermometer?

A. less than 30°C

B. $36^{\circ}C$

C. between $36^{\circ}C$ and $69^{\circ}C$

D. more than $69^{\circ}C$

Answer: B

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6. If P° and P_s, the V.P. of solvent and solution respectively and N_1 and N_2 are the mole fraction of solvent then :

A. $P_s = P^{\circ} N_2$

B. $P^{\circ} - P_s = P^{\circ} N_2$

C. $P_s = P^{\circ} N_1$

D. $\dfrac{\left(P^{\circ} - P_s\right)}{P_s} = \left(\dfrac{N_1}{N_2}\right)$

Answer: B::C

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7. The vapour pressure of two pure liquids A and B are 50 and 40 torr respectively. If 8 moles of A is mixed with x moles of B, then vapour pressure of solution obtained is 48 torr. Calculate the value of x.

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33

1. Moles of K_2SO_4 to be dissolved in 12mol water to lower its vapour pressure by 10mmHg at a temperature at which vapour pressure of pure water is 50mm is:

A. 3 mol

B. 2 mol

C. 1 mol

D. 0.5 mol

Answer: C

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2. The depression of freezing points of 0.05 molal aqueous solution of the following compounds are measured:

(P) NaCl $(Q)K_2SO_4$

(R) $C_6H_{12}O_6$ $(S)Al_2(SO_4)_3$

Which one of the above compounds will exhibit the maximum depression of freezing point ?

A. (R)

B. (Q)

C. (S)

D. (P)

Answer: C

Watch Video Solution

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

A. 250mm

B. 140mm

C. 260mm

D. 20mm

Answer: C

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4. Value of Henry's constant K_H...

A. Increases with increase in temperature.

B. Decreases with increase in temperature.

C. Remains constant.

D. First increases then decreases.

Answer: A

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5. Cyclohexane and water can be seperated by using a separatory funnel.

Which property contributes to this seperation?

A. Cyclohexane and water are immiscible

B. Cyclohexane ahd a lower viscosity than water.

C. Cyclohexane has a greater molar mass than water.

D. Cyclohexane has a greater vapour pressure than water.

Answer: A

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6. If P° and P_s, the V.P. of solvent and solution respectively and N_1 and N_2 are the mole fraction

A. $\left(P^2 - P_s\right)/P^\circ = N_1/\left(N_1 + N_2\right)$

B. $\left(P^\circ - P_s\right)/P_s = N_1/N_2$

C. $\left(P^\circ - P_s\right)/P^\circ = N_1/N_2$

D. $\left(P^\circ - P_s\right)/P_s = \text{molality} \times \dfrac{M_{\text{solvent}}}{1000}$

Answer: A::B

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7. Find frezzing point temperature (in Kelvin) of liquid if vapour pressure of solid and liquid are given by following expression.

In $P_s = 10 - \dfrac{3000(K)}{T} where$P_(s) $= vapourpressureofsolidIn$P_(l)=5-(2000(K))/(T)P_(l)`=vapour pressure of liquid

Note : All terms are in SI unit

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34

1. The solubility of common salt is 36.0 g in 100 g of water at 20° C . If systems I , II and III contains $20.0, 18.0 and 15.0$ of the salt added to 50.0 g of water in each case , the vapour pressures would be in the order :

A. $I < II < III$

B. $I > II > III$

C. $I = II > III$

D. $I = II < III$

Answer: D

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2. A 0.50 molal solution of ethylene glycol in water is used as coolant in a car . If the freezing point constant of water is 1.86° per molal , at which temperature will the mixture freeze?

A. $1.56\,^{\circ}C$

B. $-0.93\,^{\circ}C$

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

D. $0.93\,^{\circ}C$

Answer: B

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3. The molar volume of X(l)(d=0.9g/mL) increases by a factor of 3000 as it vaporises at $27\,^{\circ}C$ and that of Y(l)(d=0.88 g/mL) increases by a factor of 8000 at $27\,^{\circ}$. A miscible liquid solution of X and Y at $27\,^{\circ}$C has a vapour pressure of 50 torr. The mole fraction of Y in solution is : (Given : 0.082 atm/L/mol/K, Molar mass of X=75, Molar mass of Y=88)

A. 0.48

B. 0.52

C. 0.62

D. 0.247

Answer: A

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4. Which gas is least suitable for collection over water?

A. Ar

B. O_2

C. CO_2

D. NH_3

Answer: D

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5. When a non- volatile solute is dissolved in a volatile solvent, which characteristics is greater for the solution than for the solvent?

A. Boiling point

B. Freezing point

C. Rate of evaporation

D. Vapour pressure

Answer: A

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6. The vapour pressure of a dilute solution of a solute is influenced by :

A. temperature of solution

B. mole fraction of solute

C. m.p. of solute

D. degree of dissociation of solute

Answer: A::B::D

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7. When 0.1 M $Pb\left(NO_3\right)_2(aq)$ solution is titrated with 0.1 M KI(aq) solution at 300 K temperature then what will be the osmotic pressure of final solution (in atm) at equivalence point?

[Use : R=0.08 L-atm $mol^{-1}K^{-1}$]

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35

1. Decomposition of non-volatile solute 'A' into another non-volatile solute B and C , when dissolved in water follows first order kinetics as A $\rightarrow$ 2B + C . Vapour pressure of a solution in which 1 mole of A was dissolved in 180 g of water was found to be 20 mm of Hg after 12 hrs . What will the vapour pressure after 24 hrs ? [Given : Vapour pressure of H_2O at the given temperature = 24 mm Hg]

A. 19.2 mm of Hg

B. 20 mm of Hg

C. 10 mm of Hg

D. 12 mm of Hg

Answer: C

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2. The fundamental cause of ΔT (depression is) :

A. higher entropy of the solution relative to that of pure solvent

B. lower entropy of the solution relative to that of pure solvent .

C. higher enthalpy of the solution relative to that of pure solvent .

D. lower enthalpy of the solution relative to that of pure solvent

Answer: A

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3. What is the most likely boiling point of an equimolar mixture of hexane, C_6H_{14}, and heptane, C_7H_{16}?

A. below $69^\circ C$

B. between $69^\circ C$ and $98^\circ C$

C. $69^\circ C$

D. $98^\circ C$

Answer: B

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4. According to the following informatin, in what physical state(s) does bromine exist at -$7.4\,^{\circ}$C and 400mm Hg? [Triple point -$7.3\,^{\circ}C$, 44 mm Hg Liquid density 3.1 g cm^{-3}, Solid density 3.4 g. cm^{-3}]

A. Solid only

B. Liquid only

C. Liquid and solid only

D. Gas, liquid and solid

Answer: A

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5. Which of the following forms ideal solution?

A. C_6H_5Cl - C_6H_5Br

B. C_6H_6 - $C_6H_5CH_3$

C. Henxane-heptane

D. HNO_3 - H_2SO_4

Answer: A::B::C

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6. An ideal binary solution of two volatile compenents A and B are in equilibrium with atmospheric pressure at T kelvin. Find $\left(P_A^{\circ} + P_B^{\circ}\right)$ in atmosphere if the mole fraction of more volatille component in solution is $\frac{1}{2}$.

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36

1. A cylinder filled with a movable piston contains liquid water in equilibrium with water vapour at $25^{\circ}C$. Which one of the following operations results in a decrease in the equilibrium vapour pressure ?

A. Moving the piston downward a short distance

B. Removing a small amount of vapour

C. Removing a small amount of liquid water

D. Dissolving some salt in the water.

Answer: C

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2. The amount of ice that will separate out on cooling a solution containing 50 g ethylene glycol in 200 g water to $-9.3^{\circ}C$ is : ($K'_f = 1.86K\text{molality}^{-1}$)

A. $38.71g$

B. 38.71 g

C. 42g

D. 42 mg

Answer: A

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3. Solubility of a gas in a liquid solvent increases with

A. P only

B. Q only

C. Both P and Q

D. Neither P nor Q

Answer: A

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4. Which statement about the triple point of a substance is correct?

A. The triple point for a substance varies with the pressure.

B. The three phases (solid,liquid, gas) have the same density

C. The three phases (solid, liquid, gas) are in equilibrium.

D. Three phases (solid,liquid, gas) are indistinguishable in appearance.

Answer: C

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

A. Vapour pressure of the solution is less than that of pure solvent

B. Vapour pressure of the solution is more than that of pure solvent

C. Only solute molecules solidify at the freezing point

D. Only solvent molecules solidfy at the freezing point.

Answer: A::D

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6. If 1 g of solute dimerise upto 75% in 100 g of H_2O and depression in freezing point 0.093° C. Find average molecular weight of solute after dimerisation $\left(K_{f\left(H_2O\right)} = 1.86\right)$.

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37

1. 1mol each of the following solutes are taken in 5mol water,

(a)$NaCl$ (b)K_2SO_4(C)$Na(3)PO_4$(d) glucose

Assuming 100% ionisation of the electrolyte ,relative decrease in vapour pressure will be in order

A. $A < B < C < D$

B. $D < C < B < A$

C. $D < A < B < C$

D. equal

Answer: C

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2. Which of the following statements is FALSE?

A. Units of atmospheric pressure and osmotic pressure are the same .

B. In reverse osmosis , solvent molecules move through a semipermeable membrane from a region of lower concentration of solute to a region of higher concentration.

C. The value of molal depression constant depends on nature of solvent .

D. Relative lowering of vapour pressure , is a dimensionless quantity.

Answer: B

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3. Which gas should not be collected over water because of its high solubility in water?

A. H_2

B. CO

C. CH_4

D. HCl

Answer: D

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4. Which physical property decreases with increases in intermolecular molecular forces?

A. Boiling point

B. Enthalpy of vaporization

C. Vapor pressure

D. Viscosity

Answer: C

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5. A graph between $\frac{P}{d} vsd$ (where, P is osmotic pressure of solution of a solute of mol. Wt. m and d is $\left(\frac{\text{wt. of solute}}{\text{volume of solution}}\right)$ at temperature T). Pick the correct statement about the plots :

A. $\left[\frac{p}{d}\right]_{d \to \theta} = \frac{ST}{m}$

B. The intercept of the plot $= \frac{ST}{m}$

C. The intercept of the plot $= \left[\frac{p}{d}\right]_{d \to \theta}$

D. $\left[\frac{p}{d}\right]_{d \to \theta}$ is independent of temperature

Answer: A::B::C

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6. Elevation in boiling point of 0.25 M aq. Solution weak acid HX is 0.14 .

What is molarity of of H^+ solution ?

$HX_{aq} \Leftrightarrow H^+_{aq} + X^-_{aq}$

Given : $K_b(H_2O) = 0.5$

Molality = Molarity

[Give : Answer as $[H^+] \times 100]$

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38

1. Equal volume of 1.0 M KCl and $1.0 M AgNO_3$ are mixed . The depression of freezing point of the resulting solution will be :

$(K_f(H_2O) = 1.86 K kg mol^{-1}$, Assume : 1M = 1m)

A. $3.72K$

B. $1.86K$

C. $0.93K$

D. None of these

Answer: B

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2. Under which conditions is the solubility of oxygen gas in water the greatest?

A.

Pressure	Temperature
high	high

B.

Pressure	Temperature
high	low

C.

Pressure	Temperature
low	high

D.

Pressure	Temperature
low	low

Answer: B

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3. A student is seperating $CHCl_3$ (b.p.=$61^{\circ}C$) from $CHCl_2CHCl_2$ (b.p.= $146^{\circ}C$) by distillation. She has just begun to collect the first distillate in the receiving flask. At what position in the below apparatus will the temperature be $61^{\circ}C$?

A. A

B. B

C. C

D. D

Answer: B

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4. Which of the following statements are correct van't Hoff factor $'I'$ of a solution of weak electron A_xB_y?

A. $i = 1 - \alpha + x\alpha + y\alpha$ (where $'\alpha'$ is degree dissociation)

B. $i > 1$ at normal dilution

C. i increases more rapidly with dilution attains a limiting value of $(x + y)$ at infinite dilution

D. The increases in i more rapidly with dilution is due to increase in molarity of solution with dilution.

Answer: A::B::C

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1. Benzene melts at $5.50^\circ C$ and has a freezing point depression constant of $5.10^\circ C\dot{}m^{-1}$. Calculate the freezing point of a solution that contains 0.0500 mole of acetic acid, CH_3COOH, in 125 g of benzene if acetic acid forms a dimer in this solvent :

A. $3.46^\circ C$

B. $4.48^\circ C$

C. $5.24^\circ C$

D. $6.01^\circ C$

Answer: B

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2. When equal volmues of the following pairs of liquids are mixed thoroughly and allowed to stand, which pair is most likely to separate into two layers?

A. Ethanol and methanol

B. Carbon tetrachloride and methanol

C. Hexanol and pentene

D. Carbon tetrachloride and hexane

Answer: B

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3. A solid can be seperated from a liquid by all the following means except:

A. decantation

B. distillation

C. filtration

D. hydration

Answer: D

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4. For a dilute solution having molality m for a given solute in a solvent of mol. Wt. M,b.pt.T_b and heat vaporisation per mole ΔH, $\left[\frac{\partial T_b}{\partial m}\right]_{m \to 0}$ is equal to

A. Molal elevation constant of solvent

B. $\frac{RT_b^2 M}{\Delta_{vap}H}$, where M in kg , $\Delta_{vap}H$ and R is SI unit

C. $\frac{RT_b^2 M}{\Delta_{vap}S}$, Where M in kg , $\Delta_{vap}S$ and R in SI unit

D. $\frac{RT_b^2 M}{1000\Delta_{vap}H}$, where M in g, R and $\Delta_{vap}H$ in SI unit

Answer: A::B::D

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1. Which aqueous solution has a freezing point closest to that of $0.30 M C_{12}H_{22}O_{11}$?

A. $0.75 MAlCl_3$

B. $0.15 MCuCl_2$

C. 0.30 M NaCl

D. $0.60 MC_6H_{12}O_6$

Answer: A

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2. The Henry's law constant for oxygen gas in water at $25\,^{\circ}C$ is 1.3×10^{-3} M atm^{-1}. What is the partial pressure of O_2 above a solution at $25\,^{\circ}$C with an O_2 concetration of 2.3×10^{-4} M at equilibrium?

A. 5.7 atm

B. 0.18 atm

C. 1.3×10^{-3} atm

D. 3.0×10^{-7} atm

Answer: B

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3. The experiment is carried out to determine the molar mass of a compound by the freezing point depression method using the equation mass solute

$$MM = 7.05\frac{\text{mass solute}}{\Delta T \times \text{kgsolvent}}$$

The data are collected.

Mass of empty test tube 42.0 g

Mass of test tube and solvent 73.6 g

Mass of solute dissolved in solvent 2.000 g

Freezing pint of pure solvent 78.1° C

Frreeszing point of solution 77.6°)

How many significatn fuigures can be reported for the molar mass of the solute?

A. 1

B. 2

C. 3

D. 4

Answer: A

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4. Which facts are true when we use van't Hoff equation $PV = CST$ for osmotic pressure P of dilute solutions ?

A. The equations is identical to that of ideal equation

B. The solute particles in solution ar analogy the gas molecules and the solvent is analogy the empty space between the gas molecules

C. Solute molecules are dispared in the solvent the way the gas molecules are dispared empty space

D. The equation is not identical to that of ideal equation

Answer: A::C

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41

1. Which 0.10 M aqueous solution has the smallest change in freezing point relative to pure water ?

A. $HC_2H_3O_2$

B. HCl

C. $CaCl_2$

D. $AlCl_3$

Answer: A

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2. Choose the correct statement regarding ideal solution :

A. 0.01 molar NaCl solution evaporates completely when placed in a closed container fitted with piston at temperature which is just higher than its boiling point.

B. boiling point of 0.1 M aq. NaCl is greater than boiling point of 0.1 M aq. Glucose solution.

C. melting point 0.1 M NaCl which is formed by dissolving in H_2O(l) or NH_3(l) is same.

D. solublility of $N_2(g)$ is same in water or in liquid NH_3 umder same T and P

Answer: B

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3. Osmosis is involved in:

A. excretion of urine

B. interchange of nutrients and waste products between tissue cells and their surroundings

C. in both cases

D. in none of the above cases

Answer: C

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4. Which statement are correct about antifreeze mixture use to melt ice or snow on roads?

A. Antifreeze mixture of $CaCl_2$ +water (f.pt. $-50^\circ C$) is preferred over KCl of water (f.pt. $-10^\circ C$)

B. The low freezing point of aq. $CaCl_2$ solution is due to its van't Hoff factor is $I = 3$

C. The use of antifreeze for salt solutions causes major problems of corrosion of steel car bodies and reinforcement bas in concrete and structures.

D. More is the amount of salt spreaded on road easier is the melting of ice.

Answer: A::B::C::D

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42

1. Which aqueous solution freezes at the lowest temperature ?

A. $0.30mC_2H_5OH$

B. $0.25mKNO_3$

C. $0.20mCaBr_2$

D. $0.10mFeCl_3$

Answer: C

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2. Which of the following is less than zero for ideal solutions ?

A. ΔH_{mix}

B. ΔV_{mix}

C. ΔG_{mix}

D. ΔS_{mix}

Answer: C

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3. Ebullioscopic constatn $\left(K_b\right.$ and cryoscopic constant $\left(K_f\right.$ depend on following factor :

A. moles of solute added in solvent .

B. molar mass of solute added.

C. freezing point and boiling point of solvent respectively

D. latent heat of vaporisation and fusion of solvent respectively.

Answer: D

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4. For solutin of ethanol and water at room temperature the correct option is/are :

A. ΔG is zero

B. ΔS_{system} is +ve

C. $\Delta_{\text{surrounding}}$ is -ve

D. ΔH is zero

Answer: B::C

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43

1. Aqueous solutions of electrolytes that produce two ions upon ionization typically exhibit freezing point depressions that are twice as large as solutions of non-electrolytes with the same concentration . Which 0.10 M electrolyte solution will show the smallest depression ?

A. HCl

B. NaBr

C. KNO_3

D. $MgSO_4$

Answer: D

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2. If vapour pressure of pure liquids $'a'$ $\%$ $'B'$ are 300 and 800 torr respectively at $25^{\circ}C$. When these two liquids are mixed at this temperature to form a solution in which mole percentage of $'B'$ is 92, then the total vapour pressure is observed to be 0.95 atm. Which of the following is true for this solution.

A. $\Delta V_{\text{mix}} > 0$

B. $\Delta H_{\text{mix}} < 0$

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

D. $\Delta H_{\text{mix}} = 0$

Answer: B

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3. 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. atmosheric pressure becomes more

Answer: B

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4. As a gas (insoluable in liquid) is bubbled throuogh a liquid part of the liquid vapories and these vapours are carried off with the gas. As a sample of dry nitrogen gas is bubble through a liquid, it is found that under identical conditions of temperature and pressure, definite volume of wet nitrogen gas weighs more than the equal volume of dry nitrogen gas. Hence, the liquid through which dry nitrogen gas was passed, may be:

A. water

B. benzene

C. CCl_4

D. heavy Water

Answer: B::C

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44

1. Which aqueous solution exhibits the largest freezing point depression ?

A. 1.0m KBr

B. $0.75mC_6H_{12}O_6$

C. $0.5mMgCl_2$

D. $0.25mGa_2(SO_4)_3$

Answer: A

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2. Identify the false statement :

A. The volum of a solution cannot be less than the sum of volumes of the pure solvent and solute used to prepare the solution (binary solution of two liquids)

B. At constant T and P, ΔG_{mix} will be necessarily negative for an ideal solution.

C. An ideal binary solution $\left(p_A^{\circ} \neq p_B^{\circ}\right)$ cannot form an azeotropic mixture

D. In binary solution ideality is more of an exception rather than a rule.

Answer: A

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3. A 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: C

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45

1. How would the freezing point depression of a 0.05m $CaCl_2$ solution compare with that of a NaCl solution ? It would be :

A. less than that for a 0.10 m NaCl solution.

B. between that for a 0.10 m NaCl solution and a 0.20 m NaCl solution

.

C. between that for a 0.20 m NaCl solution and a 0.30 m NaCl solution

.

D. greater than that of a 0.30 m NaCl solution .

Answer: A

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2. Consider a binary mixture of volatile liquides. If at $X_A = 0.4$, the vapour pressure of solution is 580 torr then the mixture could be $\left(p_A^{\circ} = 300\text{torr}, P_B^{\circ} = 800\text{torr}\right)$:

A. $CHCl_3 - CH_3COCH_3$

B. $C_6H_5Cl - C_6H_5Br$

C. C_6H_6 - $C_6H_5CH_3$

D. nC_6H_{14} - nC_7H_{16}

Answer: A

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3. Among the following substances, the lowest vapour pressure is exerted by

A. water

B. mercury

C. kerosene

D. rectified spirit

Answer: B

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1. The melting point of most of the solid substances increases with an increase of pressure acting on them . However , ice melts at a temperature lower than its usual melting point when the pressure increases . This is because :

A. ice is less dense than water pressure generates heat

B. pressure generates heat

C. the bonds break under pressure

D. ice is not a true solid

Answer: A

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2. Which of the following shows negative deviation from Raoult's law?

A. $CHCl_3$ and acetone

B. $CHCl_3$ and C_2H_5OH

C. $C_6H_5CH_3$ and C_6H_6

D. C_6H_6 and CCl_4

Answer: A

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3. Mole fractions are typically used to calculate which properties for solutions containing non-volatile solutes ?

(P) Freezing point depression

(Q) Osmotic pressure

(R) Vapour pressure

A. P only

B. R only

C. P and Q only

D. Q and R only

Answer: B

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47

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

A. $0.05MKNO_3 > 0.04MCaCl_2 > 0.140M\text{sugar} > 0.075MCuSO_4$

B. $0.04MBaCl_2 > 0.140M\text{sucrose} > 0.075MCuSO_4 > 0.05MKNO_3$

C. $0.075MCuSO_4 > 0.140M\text{sucrose} > 0.04MBaCl_2 > 0.05MKNO_3$

D. $0.075MCuSO_4 > 0.05MNaNO_3 > 0.140M\text{sucrose} > 0.04MBaCl_2$

Answer: A

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2. A maxima or minima obtained in the temperature composition curve of a mixture of two liquids indicates:

A. an azeotropic mixture

B. an eutectic mixture

C. that the liquids are immiscible with one another

D. that the liquids are partially miscible at maximum or minimum

Answer: A

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3. Select the correct statement:

A. Osmosis , like all colligative properties , result from an increases in entropy as pure solvent passes, through the membrane and mixes with the solution

B. Desalination of sea-water is done by reverse osmosis

C. Both are correct statement

D. none of these

Answer: C

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48

1. Aqueous solution of braium phosphate which is 100% ionised has $\Delta T_f / \Delta K_f$ as 0.05 Hence , given solution is :

A. $0.01 molal$

B. $0.02 molal$

C. $0.04 mmolal$

D. $0.05 molal$

Answer: A

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2. A liquid is kept in a closed vessel. If a glass plate (negligible mass) with a small hole is kept of top the liquid surface, then the vapour pressure of the liquid in the vessel is :

A. more than what would be if the glass plate were removed

B. same as what would be if the glass plate were removed

C. less than what would be if the glass plate were removed

D. Cannot be predicted

Answer: B

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3. An unripe mango placed in a concentrated salt solution to prepare pickle, shrinks because___

A. it gains water due to osmosis

B. it loses water due to reverse osmosis .

C. it gains water due to reverse osmosis.

D. it loses water due to osmosis .

Answer: D

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49

1. A 0.2 molar aqueous solution of a weak acid (HX) is 20% ionised . The freezing point of the solution is:

$\left(Given : K_f = 1.86\ ^\circ Ckg \quad mol^{-1} \text{ for water}\right)$

A. $-0.45\ ^\circ C$

B. $-0.90\ ^\circ C$

C. $-0.31\ ^\circ C$

D. $-0.05\ ^\circ C$

Answer: A

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2. A mixture of A and B in the molar ratio 1:2 forms a maximum boiling azeotrope. Identify the incorrect statement, if A is more volatile. [Molar mass of A=100, Molar mass of B=50]

A. A liquid solution of A and B having mass % of A=50 will have vapours having mass % of A=50.

B. A liquid solution of A and B having mass % of $A > 50\%$ will have vapours having mass % of Agt50%.

C. A mixture of A and B in the molar mass ratio 1:3 can be seperated into azeotopic mixture and pure A

D. A mixture of A and B in the molar ratio 2:3 can be seperated into azeotropic mixture and pure A.

Answer: C

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3. The normal boiling point and vapour pressure at $25^{\circ} C$ are measured for liquids in two flasks . Flask a contains pure water and flask B contains a 1.0 M aqueous NaCl solution . Which flask contains the liquid with the higher boiling point ? Which flask contains the liquid with the higher vapour pressure ?

Higher boiling point	Higher vapour pressure
(a)Flask$A$	Flask$A$
(b)Flask$A$	Flask$B$
(c)Flask$B$	Flask$A$
(d)Flask$B$	Flask$B$

Watch Video Solution

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

A. $K_3\left[Fe(CN)_6\right]$

B. $Fe(CN)_2$

C. $K_4\left[Fe(CN)_6\right]$

D. $Fe(CN)_4$

Answer: A

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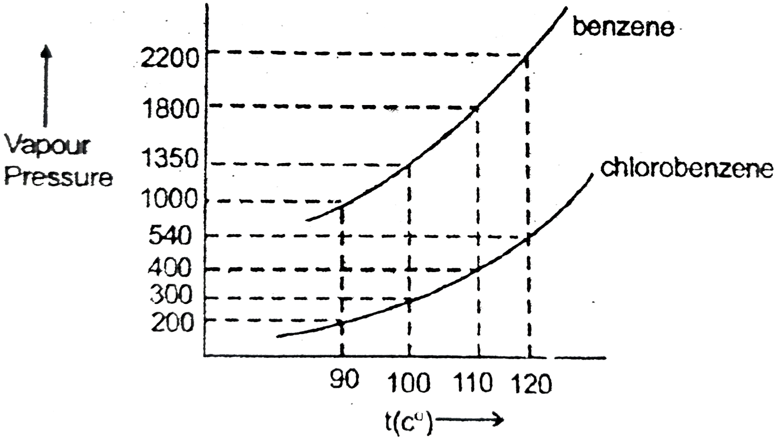
2. Assuming the formation of an ideal solution, determine the boiling point of a mixture containing $1560g$ benzene (molar mass $= 78$) and $1125g$ chlorobenzene (molar mass $= 112.5$) using the following against an external pressure of 1000 Torr.



A. $120\ ^{\circ}C$

B. $110\ ^{\circ}C$

C. $100\ ^{\circ}C$

D. $90\ ^{\circ}C$

Answer: C

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3. A student prepares four 0.10 M solutions , each containing one of the solutes below . Which solution has the lowest freezing point ?

A. $CaCl_2$

B. KOH

C. $NaC_2H_3O_2$

D. NH_4NO_3

Answer: A

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51

1. The fraction of phenol dimerised in benzene if 20 g of phenol in 1 kg benzene exhibts a freezing point depression of 0.69 K. $\left(K_f\text{benzene} = 5.12\frac{K\text{ - }kg}{mol}\right)$ ltbgt (MW phenol =94)

A. 0.74

B. 0.37

C. 0.46

D. 0.64

Answer: A

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2. Two liquid A and B form an ideal solution. The solution has a vapour pressure of 700 torr at $90^{\circ} C$. It is distilled till 2/3 rd of the solution is collected as condensate. The composition of the condensate is $X'_A = 0.75$ and that of the residue is $X''_A = 0.3$. If the vapour pressure of the residue at 90° is 600 torr, which of the following option is incorrect?

A. The composition of the original liquid was $X_A = 0.6$

B. The composition of the original liquid was $X_A = 0.4$

C. $P_A^{\circ} = \frac{2500}{3}$ torr

D. $P_B^{\circ} = 500$ torr

Answer: B

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3. A solution of glucose received from some research laboratory has been marked mole fraction x and molality (m) at $10^{\circ}C$. When you will calculate its molality and mole fraction in your laboratory at $24^{\circ}C$ you will find :

A. mole fraction (x) and molality (m)

B. mole fraction (2x) and molality (2m)

C. mole fraction $\left(\frac{x}{2}\right)$ and molality $\left(\frac{m}{2}\right)$

D. mole fraction (x) and $(m \pm \mathrm{dm})$ molality

Answer: A

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1. For a solution of 0.89 g of mercurous chloride in 50 g of $HgCl_2(l)$ the freezing point depression id $1.24\,^\circ$C. K_f for $HgCl_2$ is 34.3 . What is the state of mercurous chloride in $HgCL_2$? (Hg-200, Cl-35.5).

A. as Hg_2Cl_2 molecules

B. as "HgCl molecules"

C. as Hg^{+} and Cl^{-} ions

D. as Hg_2^{2+} and Cl^{-} ions

Answer: A

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2. Which of the following option is correct with respect to True/False nature of statements.

Statement-1: Experimental determination of Osmotic pressure is easiest as compared to other colligative properties.

Statement-2: Henry's constant of a gas is directly dependent on pressure.

Statement-3: The exent of adsorption increases with increase of surface area per unit mass of the adsorbent at given temperature and pressure.

ltbr. Statement -4: H_2O which is diamagneitc substance when kept in a magnetic field will experience no interactions.

A. All statements are correct

B. Only statement -4 is incorrect

C. Statement-1 and Statement-2 are the only correct statements

D. Statement-1 and Statement-3 are the only correct statements

Answer: D

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1. A solution of x moles of sucrose in 100grams of water freeze at $-0.2\,^\circ C$ As. Ice separates the freezing point goes down to $0.25\,^\circ C$. How many grams of ice would have separated ?

A. 18 grams

B. 20 grams

C. 25 grams

D. 23 grams

Answer: A

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2. The Henry's law constant for the solubility of N_2 gas in water at $298K$ is $1.0 \times 10^5 atm$. The mole fraction of N_2 in air is 0.8. The number of moles of N_2 from air dissolved in 10 moles of water at $298K$ and $5atm$. Pressure is:

A. 4×10^{-4}

B. 4.0×10^{-5}

C. 5.0×10^{-4}

D. 4.0×10^{-6}

Answer: A

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54

1. The freezing pont depression of a $-0.2046^\circ C$. What is the equlibrium constant for the reaction at 298 K ?

$HCOO^-(aq) + H_2O(l) \Leftrightarrow HCOOH(aq) + OH^-(aq)$

$\left(Given : K_f\left(H_2O\right) = 1.86 Kkgmol^-$, " Molartiy = molality")

A. 1.1×10^{-3}

B. 9×10^{-12}

C. 9×10^{-13}

D. 1.1×10^{-11}

Answer: B

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2. The solubility of a solid in H_2O at different temperatures is indicated in the accompying diagram. What mass of the solid will crystallize when 40mL of a solution that is saturated at $80\,^{\circ}C$ is cooled to $20\,^{\circ}$C?

A. 12g

B. 24g

C. 30g

D. 36g

Answer: A

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55

1. How many grams of sucrose (molecular weight 342) should be dissolved in $100g$ water in order to produce a solution with $105\,^{\circ}C$ difference between the freezing point and the boiling point ? $\left(K_b = 0.51\,^{\circ}Cm^{-1}, \left(K_f = 1.86\,^{\circ}Cm^{-1}\right)\right.$

A. $34.2g$

B. $72g$

C. $342g$

D. $460g$

Answer: B

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56

1. A non - volatile solute is added to $H_2O(s) \Leftrightarrow H_2O(l)$ equilibrium mixture at its melting point 273 K . Select the options which correctly represent the true//false nature of statements.

Statement -1: Reaction will moves in forwared direction

Statement -2: Equilibrium will remain unaffected .

Statement -3: All the ice will melt .

A. All the Statements is incorrect

B. Only Statement -2 is incorrect .

C. Only Statement -1 is correct .

D. Only Statement -3 is incorrect.

Answer: B

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