CHEMISTRY

VMC MODULES ENGLISH

THEORY OF SOLUTIONS

Level 0

1. Why do gases always tend to be less soluble in liquids as the temperature is raised?

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2. State Henry's law.

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3. What is meant by positive deviation from Raoul's Law ? Give an example. What is the sign of ΔH_{mix} for positive deviation ?

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4. What is negative deviation?

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5. Suggest the most important type of intermolecular attractive interaction in the following pairs :

$a.\ n-$ Hexane and $n-$ octane

$b.\ I_2$ and CCl_4

$c.\ NaClO_4$ and water

$d.$ Methanol and acetone

$e.$ Acetonitrile (CHM_3CN) and acetone (C_3H_6O)

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6. Suggest the most important type of intermolecular attractive interactions in the following pairs. n-hexane and n-octane

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8. Suggest the most important type of intermolecular attractive interactions in the following pairs. n-hexane and n-octane

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9. Based on solute $-$ solvent interactions, arrange the following in order of increasing solubility in $n-$ octane and explain the result. Cyclohexane, $KCl, CH_3OH, CH_3CN.$

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10. What is the significance of Hanry's law constant K_H ?

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11. Give an example of a material used for makin gsemipermeable membrance for carrying out reverse osmosis.

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12. Amongst the following compounds. Identify which are insoluble, partially soluble and highly soluble in water?

(i). Phenol

(ii) toluene

(iii). Formic acid

(iv). Ethylene glycol chloroform

(vi). Pentanol.

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(vi). Pentanol.

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16. Components of a binarey mixture of two liquids A and B were being separted by distillation. After some time separation of components stopped and composition of

vapour phase vecame same as that of liquid phase. Both the components stated coming in the distillate. Explain why this happened ?

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17. Explain in why on addition of 1 mole of NaCl to 1L of water, the boiling point of water increases, while addition of 1 mole of methyl alcohol to 1 L of water decreases its boiling point .

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18. Explain the solubility rule "like dissolves like" in terms of intermolecular forces that exist in solutions,

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19. why are the aquatic species more comofortable in cold water in comparision to warm water?

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20. Bharath went to his grandfather's house in winter this year. As usual he went for fishing. His grandmother told him there will be no fishes in the lake. He noticed that it was more difficult to find fishes in winter. The fishes were deep inside the river. Whereas in summer they were on the surface and hence he was able to catch fishes.

(a) Why are fishes on the surface in water than in the

depth in summer?

Srisha wanted to keep ice creams without melting. So he had to keep it on ice taken in a container. His grandmother advised him to pour salt on the ice.

(a) Why? (b) What value can be derived from this?

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21. Srisha wanted to keep ice creams without melting. So he had to keep it on ice taken in a container. His grandmother advised him to pour salt on the ice.

(a) Why? (b) What is the value in this?

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22. The depression in freezing point of water observed for the same amount of acetic acid, trichloroacetic acid, and trifluoroacetic acid increases in the order given above. Explain briefly.

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23. Why is the vapous pressure of an aqueous solution of gulucose lower than that of water ?

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24. How does sprinking of salt help in clearing the snow covered roads in hilly areas? Explain the phenomenon

involved in the process.

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25. What is "semipermeble membrane"?

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26. Water is a universal solvent. But alcohol also dissolves most of the substances soluble in water. Boiling point of water is $100^{\circ}C$ and that of alcohol is $80^{\circ}C$. The specific heat of water is much higher than the specific heat of alcohol.

(a) List out three possible differences if instead of water as the liquid in our body we had alcohol.

(b) What value can you derive from this special property of water and its innumerable uses in sustaining life on earth?

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27. What are the applications of Henry's law

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28. When kept in water, raisin swells in size. Name and explain the phenomenon involved with the help of a diagram. Give thre applications of the phenomenon.

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29. Using Raoult's Law explain how the total vapour pressure over the solution is related to mole fraction of components in the following solution.

$CHCl_3 \quad (l) \text{ and } CH_2Cl_2(l) \qquad (b) NaCl(s) \text{ and } H_2O(l)$

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30. Why is it not possible to obtain pure ethanol by fractional distillation ? What general name is given to binary mixture which show deviation from Raoult's law and whose omponents cannot be separted by fractional distillation. How many types of such mixture are there?

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31. Discuss biological and industrial applications of osmosis.

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Level 1

1. Which of the following concentration terms is/are affected by a change in temperature ?

A. molarity

B. mass/volume

C. molality

D. normality

Answer:

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2. Which of the following units is useful in relating concentration of solution with its vapour pressure ?

A. Mole fraction

B. Parts per million

C. Mass percentage

D. Molality

Answer:

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3. The molality of a urea solution in which 0.0100 g of urea, $\left[(NH_2)_2CO\right]$ is added to $0.3000dm_3$ of water at S.T.P. is:

A. 0.555m

B. $5.55 \times 10^{-4}m$

C. $33.3m$

D. $3.33 \times 10^{-2}m$

Answer:

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4. A mixture of ethane and ethene occupies 41 L at 1 atm and 500 K. The mixture reacts compeletly with 10/3 mole of

oxygen to produce CO_2 and water. The mole fraction of ethane and ethene in the mixture are (R=0.0821L atm $K^{-1}mol^{-1}$ respectively

A. 0.50, 0.50

B. 0.75, 0.25

C. 0.67, 0.33

D. 0.28, 0.75

Answer:

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5. Out of following which one is not an example of a solution?

A. Air

B. Brass

C. Amalgam

D. Benzene in water

Answer:

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6. Henry's law is NOT applicable for

A. NH_3 in water

B. N_2 in water

C. CO_2 in water

D. Xe in water

Answer:

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7. How many grams of NaOH will be required to prepare 500 g solution containing 10% $\left(\frac{w}{w}\right)$ NaOH solution?

A. 100g

B. 50g

C. 0.5 g

D. 5.0 g

Answer:

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8. 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:

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9. Among the following the aromatic compound is

A. $CCl_4 + CHCl_3$

B. $C_6H_{14} + C_7H_{16}$

C. $C_2H_5Br + C_2H_5Cl$

D. chlorobenzene + bromobenzene

Answer:

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10. If molarity = molality and density of the solution is 2gm/ml then $W_{\text{solute}} : W_{\text{solvent}}$ would be

A. $1:2$

B. $2:1$

C. $1:1$

D. $1:3$

Answer:

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11. Which of following solution is most concentrated?

A. 4% NaOH aq.

B. 4% NaOH solution, $d_{\text{solution}} = 1.1$(gm/ml)

C. 4 grams of NaOH dissolved in 80 ml solution

D. all of these solutions are equally concentrated

Answer:

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12. 5 litre of a solution contains 25 mg of $CaCO_3$. What is its concentration in ppm? (mol.wt of $CaCO_3$ is 100)

A. 25

B. 1

C. 5

D. 2500

Answer:

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13. What is molarity of K^+ in aqueous solution that contains 17.4 ppm of $K_2SO_4\left(174 g \text{mol}^{-1}\right)$?

A. $2 \times 10^{-2} M$

B. $2 \times 10^{-3} M$

C. $4 \times 10^{-4} M$

D. $2 \times 10^{-4} M$

Answer:

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14. Molarity is related to molality (m) , density of the solution (d) and molar mass of the solute (M°) by which

of following relation.

A. $M = \frac{10md}{M^\circ}$

B. $M = \frac{1000md}{1000 + mM^\circ}$

C. $M = \frac{100md}{100 + mM^\circ}$

D. $M = \frac{10md}{100 + mM^\circ}$

Answer:

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15. What is the value of n/N? (Where n= moles of solute, N= moles of solvent , m=molaity , $M^\circ =$ molar mass of solvent)

A. $\frac{n}{N} = (100mM^\circ)$

B. $\frac{n}{N} = \left(\frac{mM^{\circ}}{1000}\right)$

C. $\frac{n}{N} = (1000mM^{\circ})$

D. $\frac{n}{N} = \left(\frac{m}{1000M^{\circ}}\right)$

Answer:

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16. According to William Henry,the solubility of a gas in liquid depends on the pressure of the gas .if 'm' is the molality of the gas and'P' is its pressure then which of the following plot is in accordance with the law:

A. The nature of gas

B. The temperature

C. The nature of solvent

D. All of the above

Answer:

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17. A solution of two liquids boils at a temperature more than the boiling point of either of them. Hence, the binary solution shows

A. negative deviation from Raoult's law

B. positive deviation from Raoult's law

C. no deviation from Raoult's law

D. positive or negative deviation from Raoult's law depending upon the composition

Answer:

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18. On mixing, heptane and octane form an ideal solution. At $373K$ the vapour pressure of the two liquid components (heptane and octane) are $105kPa$ and $45kPa$ respectively. Vapour pressure of the solution obtained by mixing 25.0 of heptane and $35g$ of octane will be (molar mass of heptane $= 100gmol^{-1}$ and of octane $= 114gmol^{-1}$):-

A. 75 kPa

B. 37.5 kPa

C. 150.0 kPa

D. 87.5 kPa

Answer:

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19. A solution weighing a g has molality b. The molecular mass of solute if the mass of solute is c g, will be:

A. $\frac{c}{b} \times \frac{1000}{(a-c)}$

B. $\frac{b}{a} \times \frac{1000}{(a-b)}$

C. $\frac{b}{c} \times \frac{1000}{(a-c)}$

D. $\frac{c}{a} \times \frac{1000}{(b-a)}$

Answer:

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20. A binary liquid solution is 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 formed is an ideal solution

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

C. The solution is non-ideal, showing negative deviation from Raoult's law

D. n-heptane shows positive deviation while n-hexane show negative deviation from Raoult's law

Answer:

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21. One component of a solution follows Raoult's over the entire range $0 \leq x_1 \leq 1$. The second component must follow Raoult's law in the range when x_2 is

A. close to zero

B. close to 1

C. $0 \leq x_2 \leq 0.5$

D. $0 \leq X_2 \leq 1$

Answer:

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22. At $80^\circ C$, the vapour pressure of pure liquid A is $520mm$ Hg and that of pure liquid B is $1000mmHg$. If a mixture of solution A and B boils at $80 \circ C$ and $1atm$ pressure, the amount of A in the mixture is $(1atm = 760mmHg)$

a. $50mol\ \%$, b.$52mol\ \%$,c.$34mol\ \%$,d.$48mol\ \%$

A. 52 mole per cent

B. 34 mole per cent

C. 50 mole per cent

D. 48 mole per cent

Answer:

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23. Two liquids X and Y form an ideal solution. The mixture has a vapour pressure of 400 mm at 300 K when mixed in the molar ratio 1:1. when mixed in the molar ratio of 1:2 at the same temperatre the vapour pressure of the mixture is 350 mm. The vapour pressure of the two pure liquids X and Y respectively are

A. 250 mm, 550 mm

B. 350 mm, 450 mm

C. 550 mm, 250 mm

D. 500 mm, 250 mm

Answer:

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24. A mixture of ethyl alcohol and propyl alcohol has a vapour pressure of 300 mm at 300 K. The vapour pressure of pure propyl alcohol is 200 mm. If the mole fraction of ethyl alcohol in the mixture is 0.375, then the vapour pressure (in mm) of pure ethyl alcohol at the same temperature will be :

A. 466

B. 300

C. 700

D. 360

Answer:

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25. An aqueous solution is 1.00 molalin KI. Which change will cause the vapour pressure of the solution to increase ?

A. Addition of water

B. Addition of NaCl

C. Addition of Na_2SO_4

D. Addition of 1.00 molal Kl

Answer:

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26. Two solution of H_2SO_4 of molarities x and y are mixed in the ratio of $V_1mL : V_2mL$ to form a solution of molarity M_1. If they are mixed in the ratio of $V_2mL : V_1mL$, they form a solution of molarity M_2. Given $V_1/V_2 = \frac{x}{y} > 1$ and $\frac{M_1}{M_2} = \frac{5}{4}$, then $x : y$ is

A. $2:1$

B. $4:1$

C. $1:2$

D. $3:1$

Answer:

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27. A and B are ideal gases. The molecular weights of A and B are in the ratio of $1:4$. The pressure of a gas mixture containing equal weights of A and B is P atm. What is the partial pressure (in atm.) of B in the mixture

A. $\frac{p}{5}$

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

C. $\frac{p}{2.5}$

D. $\frac{3p}{4}$

Answer:

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28. 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. Powdered sugar in hot water

Answer:

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29. At equlibirium the rate of dissolutiono of a solid solute in a valatile liquid slvent is .....

A. less than the rate of crystallisation

B. greater than the rate of crystallization

C. equal to the rate of crystallisation

D. zero

Answer:

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30. Maximum amount of a solid solute 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:

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31. Low concentration of oxygen in the blood and tissues of people living at high altitude is due to ___

A. low temperature

B. low atmospheric pressure

C. high atmospheric pressure

D. Both low temperature and high atmospheric pressure

Answer:

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32. The value of Henry's constant K_H.....

A. greater for gases with higher solubility

B. greater for gases with lower solubility

C. constant for all gases

D. not related to the solubility of gases

Answer:

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33. A 5% (w/V) solution of cane sugar (molecular mass = 342) is isotonic with 1% (w/V) solution of a subtance X. The molecular mass of X is :

A. 136.2

B. 171.2

C. 68.4

D. 34.2

Answer:

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34. Choose the correct statement:

When concentration of a salt solution is increased.

A. Boiling point increases while vapour pressure decreases

B. Boiling point decreases while vapour pressure increases

C. Freezing point decreases while vapour pressure increases

D. Freezing point increases while vapour pressure decreases

Answer:

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35. Which of the following would exert maximum osmotic pressure?

A. Decimolar aluminium sulphate

B. Decimolar barium chloride

C. Decimolar sodium chloride

D. A solution obtained by mixing equal volumes of (B) and (C) and filtering

Answer:

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36. At a constant temperature, which of the following aqueous solutions will have the maximum vapour pressure?

(Mol wt $NaCl = 58.5$, $H_2SO_4 = 98.0 gmol^{-1}$)

A. 1 molal NaCl (aq)

B. 1 molar NaCl (aq)

C. 1 molal H_2SO_4 (aq)

D. 1 molar H_2SO_4 (aq)

Answer:

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37. If 0.1 M solutions of the following electrolytes are taken and if all electrolytes are completely dissociated, then whose boiling point will be highest?

A. $AlCl_3$

B. KCl

C. $BaCl_2$

D. $K_4\left[Fe(CN)_6\right]$

Answer:

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38. An 1% solution of $KCI(I), NaCI(II), BaCI_2(III)$ and urea (IV), have their osmotic pressure at the same temperature in the ascending order (molar masses of $NaCI, KCI, BaCI_2$ and urea are respectively $58.5, 74.5, 208.4, 60 gmol^{-1}$ Assume 100% ionization of the electrolytes at this temperature

A. I lt III lt II lt IV

B. III lt I lt II lt IV

C. I lt II lt III lt IV

D. III lt IV lt I lt II

Answer:

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39. The vapour pressure of water at $25^\circ C$ is 18 mmHg. If 18 g of glucose$(C_6H_{12}O_6)$ is added to 178.2 g of water at $20^\circ C$, the vapour pressure of the resulting solution will be :

A. 17.70 mmHg

B. 15.750 mmHg

C. 16.500 mmHg

D. 17.82 mmHg

Answer:

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40. When 25 g of a non-volatile solute is dissolved in 100 g of water, the vapour pressure is lowered by $2.25 \times 10^{-1} mm$ of Hg. What is the molecular weight of the solute? [$P^{\circ} = 17.73$ mm of Hg]

A. 206

B. 302

C. 350

D. 276

Answer:

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41. On adding 1g arsenic to 80 g benzene, the freezing point of benzene is lowered by $0.213^{\circ}C$. The formula of arsenic molecule is : (Atomic mass of arsenic = 75) ($K_f = 5.12$ K kg/mol)

A. As

B. AS_2

C. AS_3

D. AS_4

Answer:

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42. The freezing point of water is depressed by $0.37^{\circ}C$ in a 0.01 molar NaCI solution. The freezing point of 0.02 molar solution is depressed by

A. $0.37^{\circ}C$

B. $0.74^{\circ}C$

C. $0.185^{\circ}C$

D. $0^{\circ}C$

Answer:

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43. Blood cells do not shrink in blood because blood is :

A. hypotonic

B. isotonic

C. equimolar

D. hypertonic

Answer:

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44. Solution A, B, C and D are respectively 0.1 M glucose, 0.05 M NaCl, 0.05 $MBaCl_2$ and 0.1 M $AlCl_3$. Which one of the following paris is istonic ?

A. A and B

B. B and C

C. A and D

D. A and C

Answer:

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45. Which of the following solution will have highest boiling point ?

A. $0.1MFeCl_3$

B. $0.1MBaCl_2$

C. $0.1MNaCl$

D. 0.1 M urea (NH_2CONH_2)

Answer:

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46. Maximum lowering of vapour pressure is observed in the case of :

A. 0.1 M glucose

B. $0.1MBaCl_2$

C. $0.1MMgSO_4$

D. 0.1 NaCl

Answer:

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47. Consider the following aqueous solutions and assume 100% ionisation in electrolytes :

I. $0.1m$ urea

II. $0.04mAl_2(SO_4)_3$

III. $0.0.5mCaCl_2$

IV. $0.005mNaCl$

The correct statement regarding the above solutions is :

A. freezing point will be lowest for solution I

B. freezing point will be highest for solution IV

C. boiling point will be highest for solution IV

D. vapour pressure will be highest for solution II

Answer:

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48. If P_A is the vapour pressure of a pure liquid A and the mole fraction of A in the mixture of two liquids A and B is x, the parial vapour pressure of A is:

A. $(1-x)P_A$

B. xP_A

C. $\frac{x}{(1-x)}P_A$

D. $\frac{1-x}{x}P_A$

Answer:

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49. At temperature $327^\circ C$ and concentration C, the osmotic pressure of a solution is P. The same solution at concentration C/2 and a temperature $427^\circ C$ of shows osmotic pressure of 2 atm. The value of P will be :

A. $\frac{12}{7}$ atm

B. $\frac{24}{7}$ atm

C. $\frac{6}{5}$ atm

D. $\frac{5}{6}$ atm

Answer:

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50. A solution of sucrose (Molar mass = 342 g/mol) is prepared by dissolving 68.4 g of it per litre of the solution, what is its osmotic pressure? (R = 0.0821 lit. atm/mol-K) at 273K

A. 3.92m

B. 4.48 atm

C. 5.92 atm

D. 29.4 atm

Answer:

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51. If the elevation in boiling point of a solution of 10 g of solute (molecular weight = 100) in 100 g of water is ΔT_b, the ebullioscopic constant of water is

A. 10

B. $100T_b$

C. ΔT_b

D. $\frac{\Delta T_b}{10}$

Answer:

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52. Which of the following graphs represent the behaviour of an ideal gas ?

A. Plot of $P_{\text{total}} vs y_A$ (mole fraction of A in vapour) is linear

B. Plot of $P_{\text{total}} vs y_B$ is linear

C. plot of $1 / P_{\text{total}} vs y_A$ is linear

D. Plot of $1 / P_{\text{total}} vs y_B$ is non linear.

Answer:

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53. If the vapour pressure of pure A and pure B at 298 K are 60 and 15 torr respectively, what would be the mole fraction of A in vapour phase (at this temperature) in a solution that contains 20 mole per cent of A in the (A + B) binary mixture in liquid phase ?

A. 0.2

B. 0.3

C. 0.5

D. 0.7

Answer:

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54. The freezing point of 1 percent solution of lead nitrate in water will be

A. $2^{\circ} C$

B. $1^{\circ} C$

C. $0^{\circ} C$

D. below $0^{\circ} C$

Answer:

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55. 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 ? Given that Kb of benzene = 2.53 unit

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

B. $1.38 \times \frac{34}{2.53} \times 2.50$

C. $2.5 \times \frac{2.53}{34} \times \frac{1}{1.38}$

D. $2.5 \times \frac{1.38}{34} \times 2.53$

Answer:

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56. Solution A contains 7 g/L of $MgCl_2$ and solution B contains 7 g/L of NaCl. At room temperature, the osmotic

pressure of :

A. solution A is greater than B

B. both have same osmotic pressure

C. solution B is greater than A

D. cannot be determined

Answer:

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57. Which of the following is incorrect ?

A. Relative lowering of vapour pressure is independent of the nature of the solute having same i and the

solvent

B. The relative lowering of vapour pressure is a colligative property

C. Vapour pressure of a solution is lower than the vapour pressure of the solvent

D. The relative lowering of vapour pressure is directly proportional to the original pressure

Answer:

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58. Ethylene glycol is added to water as an antifreeze. It will

A. decrease the freezing point of water in the winter and increase the boiling point of water in the summer

B. only decrease the freezing point of water

C. only increase the boiling point of water

D. be used for cleaning the radiator in a car

Answer:

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59. When 1.2 g of Sulphur is melted with 15 g of naphthalene, the solution freezes at $77.2^{\circ}C$. What is the molar mass of this form of Sulphur?

Deta for napthalene:

Melting point (f.pt.) $80.0^{\circ}C$

Freezing point depression constant $K_f 6.80 Km^{-1}$

A. $180 g \text{mol}^{-1}$

B. $190 g \text{mol}^{-1}$

C. $260 g \text{mol}^{-1}$

D. $450 g \text{mol}^{-1}$

Answer:

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60. Maximum freezing point fall is

A. camphor

B. naphthalene

C. benzene

D. water

Answer:

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61. The relationship between the values of osmotic pressure of 0.1 M solutions of $KNO_3(P_1)$ and $CH_3COOH(P_2)$ is

A. $p_1 > p_2$

B. $p_2 > p_1$

C. $p_1 = p_2$

D. $\frac{p_1}{p_1 + p_2} = \frac{p_2}{p_1 + p_2}$

Answer:

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62. Which of the following statement is true?

A. Passage of solvent molecules towards high concentration solution side through semipermeable membrane is osmosis

B. Passage of solute molecules towards solution side through semipermeable membrane is osmosis.

C. The boiling point of a solution is always lower than that of pure solvent

D. The boiling point of a liquid is the temperature at which its vapour pressure becomes equal to 260 mm

Answer:

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63. The freezing point among the following equimolal aqueous solutions will be highest for

A. $C_6H_5\overset{+}{N}H_3\overset{\ominus}{C}l$

B. $La(NO_3)_3$

C. $C_6H_{12}O_6$

D. $Ca(NO_3)_2$

Answer:

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64. Match the following :

	Column-I		Column-II
(A)	CH_3COOH in H_2O	(p)	Neither association nor dissociation
(B)	CH_3COOH in benzene	(q)	When a non-volatile solute is added
(C)	Polymer in water	(r)	Molecular mass observed greater than actual molecular mass
(D)	Vapour pressure of a liquid decrease	(s)	$\Delta T_{b(obs)} > \Delta T_{b(calc.)}$

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65. Match the following :

Column-I		Column-II	
(A)	0.1 M $Ca_3(PO_4)_2$	(p)	Solution with highest boiling point
(B)	0.1 M NaCl	(q)	Solution with van't Hoff factor greater than 1
(C)	0.1 M glucose	(r)	Solution with lowest osmotic pressure
(D)	0.1 M $CaCl_2$	(s)	Solution with lowest freezing point

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66. Which of the following representations of I (van't Hoff factor) is not correct ?

A. $\pi V = i.nRT$

B. $\Delta T_f = ik_f.m$

C. $\frac{p^\circ_{\text{solvent}} - p_{\text{solution}}}{p^\circ_{\text{solvent}}} = i\left(\frac{n}{N+n}\right)$

D. all of these solutions are equally concentrated

Answer:

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67. Choose the correct option :

A. 'A' represents vapour composition and 'B' the liquid composition

B. 'A' as well as 'B' represent liquid composition

C. Both 'A' and 'B' represent vapour composition

D. 'A' represents liquid composition and 'B' the vapour composition

Answer:

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68. Phenol dimerises in benzene having van't Hoff factor 0.54. what is the degree of association?

A. 1.92

B. 0.98

C. 1.08

D. 0.92

Answer:

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69. The elevation in boiling point for 13.44 g of $CuCl_2$ dissolved in 1 kg of water as solvent will be $\left(K_b = -0.52 Km^{-1}, \text{molar mass of} CuCl_2 = 134.4 gmol^{-1}\right)$

A. 0.16

B. 0.05

C. 0.1

D. 0.2

Answer:

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70. Which statement is incorrect about osmotic pressure (π), volume (V), and temperature (T)?

A. $P \propto \frac{1}{V}$ if T is constant

B. $P \propto T$ is v is constant

C. $P \propto V$ is T is constant

D. PV is constant if T is constant

Answer:

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71. When $0.004M Na_2SO_4$ is an isotonic acid with $0.01M$ glucose, the degree of dissociation of Na_2SO_4 is

A. 0.75

B. 0.5

C. 0.25

D. 0.85

Answer:

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

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

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

C. Vapour pressure of benzene changes by the addition of naphthalene

D. Boiling point of benzene does not change by the addition of toluene

Answer:

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73. Which of the following liquid paires shows a positive deviation from Raoult's law /

A. Chloroform and ethanol

B. Carbon tetrachloride and methanol

C. Acetone and carbon disulphide

D. All of these

Answer:

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74. The degree of association is given by the expression :

A. $\beta = \frac{1 - i}{\frac{1}{n} - 1}$

B. $\beta = 1 + (n - 1)i$

C. $\beta = \frac{i + 1}{\frac{1}{n} - 1}$

D. $\beta = \frac{i-1}{\frac{1}{n}-1}$

Answer:

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75. The van't Hoff factor can be expressed as :

A. the ratio of the freezing-point depression of an electrolyte to that of a non-electrolyte

B. the ratio of the freezing-point depression of a non-electrolyte to that of an electrolyte

C. the number of ions produced by a dissolved solute

D. the ratio of elevation of boiling point of a non-electrolyte to that of an electrolyte

Answer:

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Level 2

1. Assertion : If one component of a solution obeys Raoult's law over a certain range of composition, the other component will not obey Henry's law in that range.

Reason , Reoult' s law is a special case of Henry' s law.

A. Statement-1 is True, Statement-2 is True, Statement -2 is 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:

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2. Each question contains STATEMENT-I(Assertion) and STATEMENT-2(Reason).the statement carefully and mark the correct answer according to the instruction given

below:

STATEMENT - 1 : The boiling point of 0.1 M urea solution is less than that of 0.1 M KClsolution.

STATEMENT - 2 : Elevation of boiling point is directly proportional to the number of moles of non-volatile solute particles present in the solution.

A. Statement-1 is True, Statement-2 is True, Statement -2 is 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:

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3. Statement -1: Acetic acid has a molecular weight of 120 in benzene solution.

Statement -2: There is dimer formation by H-bonding.

A. Statement-1 is True, Statement-2 is True, Statement -2 is 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:

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4. Statement - The vapour pressure of $0.1M$ sugar solution is more than that of $0.1M$ potassium chloride solution.

Explanation- Lowering of vapour pressure is directly proportional to the number of species present in the solution.

A. Statement-1 is True, Statement-2 is True, Statement -2 is 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:

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5. What is the correct sequence of osmotic pressure of 0.01 M aq. Solution of :

(1) $Al_2(SO_4)_3$ (2) Na_3PO_4

(3) $BaCl_2$ (4) Glucose

A. $\pi_4 > \pi_2 > \pi_3 > \pi_1$

B. $\pi_3 > \pi_4 > \pi_2 > \pi_1$

C. $\pi_3 > \pi_4 > \pi_1 > \pi_2$

D. $\pi_1 > \pi_2 > \pi_3 > \pi_4$

Answer:

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6. The vapour pressure of a 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 up to the atmospheric pressure, when boiling begins. However, increase is small, like $0.1\text{mol}kg^{-1}$ aqueous sucrose solution boils at $100.05^{\circ}C$.

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 rates at which two molecules stick together to form the solid and leave it to return to liquid state are equal when solute is present. Fewer solvent molecules are in contact with surface of solid. However, the rate at which the solvent molecules

leave the surface of solid remains unchanged. That is why temperature is lowered to restore the equilibrium. The freezing point depression in an ideal solution is proportional to molality of the solute.

An aqueous solution of $0.1 \text{mol} kg^{-1}$ concentration of sucrose should have freezing point of $\left(K_f = 1.86\right)$

A. $-0.186^\circ C$

B. 1.86°

C. $0.186^\circ C$

D. $-1.86^\circ C$

Answer:

Watch Video Solution

7. The vapour pressure of a 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 up to the atmospheric pressure, when boiling begins. However, increase is small, like $0.1\text{mol}kg^{-1}$ aqueous sucrose solution boils at $100.05^{\circ}C$.

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freezing point depression in an ideal solution is proportional to molality of the solute.

Whene 250 m,g of eugenol is added to 100 gm of camphor $\left(K_f = 37.9\right)$, it lowered the freezing point by $0.62^\circ C$, the molar mass of eugenol is

A. 1.6×10^2gm/mole

B. 1.6×10^4 gm/mole

C. 1.6×10^3 gm/mole

D. 200 gm/mole

Answer:

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8. The vapour pressure of a 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 up to the atmospheric pressure, when boiling begins. However, increase is small, like $0.1\text{mol}kg^{-1}$ aqueous sucrose solution boils at $100.05^{\circ}C$.

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freezing point depression in an ideal solution is proportional to molality of the solute.

The freezing point iof a 5% by mass CH_3COOH (aq.) solutin is $-1.8^\circ C$. Th vasn't Hoff factor is (K_f of water $= 1.86$)

A. 1.1

B. 1.2

C. 1.3

D. None of the above

Answer:

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9. The vapour pressure of a 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 up to the atmospheric pressure, when boiling begins. However, increase is small, like $0.1\text{mol}kg^{-1}$ aqueous sucrose solution boils at $100.05^{\circ}C$.

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freezing point depression in an ideal solution is proportional to molality of the solute.

The freezing point of benzene solution was $5.4^{\circ}C$. The osmotic pressure at $10^{\circ}C$ is (freezing point of pure benzene $= 5.5^{\circ}C$) (K_f for benzene $= 5.12^{\circ}\, kg\mathrm{mol}^{-1}$, assume molality of molarity of benzerne solution)

A. 0.25 atm

B. 0.45 atm

C. 0.65 atm

D. 0.85 atm

Answer:

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10. Y g of non-volatile or ganic 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. $\frac{4K_bh}{M}$

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

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

Answer:

Watch Video Solution

11. During depression in the 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:

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12. The molecular weight of benzoic acid in benzene as determined by depression in the freezing point method

corresponds to

A. ionization of benzoic acid

B. dimerisation of benzoic acid

C. trimerisation of benzoic acid

D. solvation of benzoic acid

Answer:

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13. Which of the following represents correcty the changes in thermodynamic properties during the formation of 1 mole of an ideal binary solution :

A. 

B. 

C. 

D. 

Answer:

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14. Which statement about the composition of vapour over an ideal $1:1$ molar mixture of benzene and toluene is correct ? Assume the temperature is constant at $25^\circ C$

Vapour pressure data $(25^\circ C)$:

Benzene	$75mmHg$
Toluene	$22mmHg$

A. The vapour will contain higher percentage of benzene

B. The vapour will contain higher percentage of toluene

C. The vapour will contain equal amount of benzene and toluene

D. Not enough information is given to make a prediction

Answer:

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15. When mercuric iodide is added to the aqueous solution of KI, then the :

A. freezing point is raised

B. freezing point is lowered

C. freezing point does not change

D. boiling point does not change

Answer:

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16. Which has the highest 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:

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17. Consider the following vapour pressure-composition graph, SP is equal to :

A. $PQ + RS$

B. $PQ + QR + RS$

C. $SR + SQ$

D. $PQ + QR$

Answer:

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18. For a non-volatile solute

A. vapour pressure of solute is zero

B. vapour pressure of solution = vapour pressure of pure solvent

C. vapour pressure of solution = vapour pressure of solvent in solution

D. all of the above

Answer:

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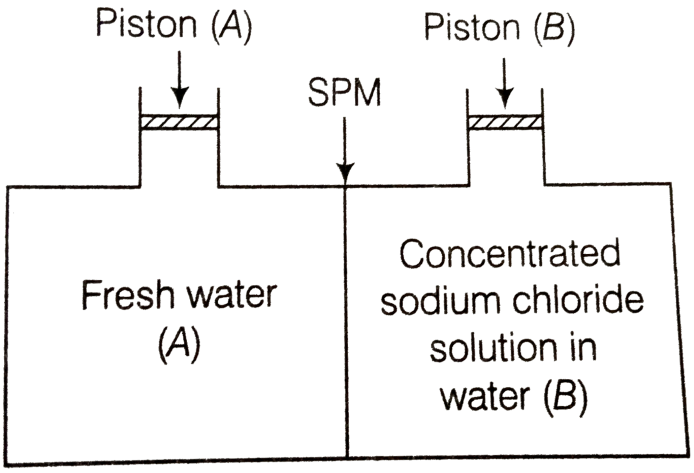
19. Consider the figure and mark the correct option.



A. Water will move from side (A) to side (B) if a pressure lower than osmotic pressure is applied on piston (B)

B. Water will move from side (B) to side (A) if a pressure greater than osmotic pressure is applied on piston (B)

C. Water will move from side (B) to side (A) if a pressure equal to osmotic pressure is applied on piston (B)

D. Water will move from side (A) to side (B) if pressure equal to osmotic pressure is applied on piston (A)

Answer:

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20. At $40^\circ C$, the vapour pressures in torr, of methyl alcohol and ethyl alcohol solutions is represented by the equation. $P = 119X_A + 135$ where X_A is mole fraction of methyl alcohol, then the value of $\lim_{x_A \to 1} \frac{P_A}{X_A}$ is

A. 254 torr

B. 135 torr

C. 119 torr

D. 140 torr

Answer:

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21. What mass of urea be dissolved in $171g$ of water so as to decrease the vapour pressure of water by $5\ \%$?

A. 15 g

B. 20 g

C. 25 g

D. 30 g

Answer:

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22. Increasing amount of solid Hgl_2 is added to $1L$ of an aqueous solution containing $0.1molKI$. Which fo the following graphs do represent the variation of freezing point of the resulting with the amount of Hgi_2 added?

A. 

B. 

C. 

D. 

Answer:

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23. Equimolal solutions KCl and compound X in water show depression in freezing point in the ratio of $4:1$, Assuming KCl to be completely ionized, the compound X in solution must

A. Dissociate to the extent of 50%

B. Hydrolyse to the extent of 80%

C. Dimerize to the extent of 50%

D. Trimerize to the extent of 75%

Answer:

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24. $CNS^{\ominus}$ ions give red colour with Fe^{3+} ions in aqueous solution as:

$$Fe^{3+}(aq) + 3CNS^{\ominus}(aq) \rightarrow \underset{\text{red}}{Fe(CNS)_3}\ (aq)$$

If $0.1M$ $KCNS$ solution is separated from $0.1MFeCl_3$ solution by means of a semi-permeable membrane, red colour will appear on:

a.$FeCl_3$ soluion , b. $KCNS$ solution side ,

c. Both sides , d. Neither side

A. $FeCl_3$ solution

B. $KCNS$ solution side

C. both sides

D. neither side

Answer:

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25. Consider the two solutions:

I: $0.5MNaCl$ aqueous solution at $25^\circ C$,

$NaCl$ is complete ionized.

II:$2.0MC_6H_5COOH$ in benzene at $25^\circ C$,

C_6H_5COOH dimerizes to the full extent.

Which of the following statements(s) is (are) correct?

A. Both the solution display equal osmotic pressure

B. Both solutions have equal vapour pressure

C. Solutions II is hypertonic

D. Solutions II has greater depression of freezing point than the solution I

Answer:

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26. Which pair(s) of liquids on mixing is/are expected to show no net volume change and no heat effect?

A. acetone and ethanol

B. chlorobenzene and bromobenzene

C. chloroform and benzene

D. n-butyl chloride and n-butyl bromide

Answer:

27. Assertion (A): The molecular mass of polymers cannot be calculated using the boiling point or freezing point method.

Reason (R): The boiling point method for determining the molecular masses is used for compounds stable at high temperature.

A. Statement-1 is True, Statement-2 is True, Statement -2 is 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:

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28. Assertion (A): Camphor is used as a solvent in the determination of the molecular mass of naphthalene and anthracene.

Reason (R): camphor has high molal elevation constant.

A. Statement-1 is True, Statement-2 is True, Statement -2 is 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:

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29. The relative decrease in VP of an aqueous glucose dilute solution is found to be 0.018. Hence, the elevation in

boiling point is (it is given $1molal$ aqueous urea solution boils at $100.54^\circ)C$ at $1atm$ pressure)

A. $0.018^\circ C$

B. 0.18°

C. 0.54°

D. 0.03°

Answer:

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30. Which has maximum osmotic pressure at temperature T?

a. $100mL$ of $1M$ urea solution

b. $300mL$ of $1M$ glucose solution

c. Misture of $100mL$ of $1M$ urea solution and $300mL$ of $1M$ glucose solution

d. All are isotonic

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:

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31. A mixture of volatile component A and B has total vapour pressure (in torr)

$P = 254 - 119\chi_A$

where χ_A is the mole fraction of A in mixture. Hence, P_A° and P_B° are (in torr)

A. 254, 119

B. 119, 254

C. 135, 254

D. 154, 119

Answer:

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32. 1 mol benzene $(P^{\circ}\_(\text{benzene}) = 42mm)$ and 2 mol toluence $(P^{\circ}\_(\text{toluene}) = 36mm)$ will have

A. total vapour pressure 38 mm

B. mol fraction of vapours of benzene above liquid mixture is 7/19

C. positive deviation from Raoult's law

D. negative deviation from Raoult's law

Answer:

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33. When non-volatile solute is added to a pure solvent, the:

A. V.P. of solution becomes lower than the V.P. of pure solvent

B. rate of evaporation of solvent is reduced

C. solute does not affect the rate of condensation

D. rate of evaporation of solvent = rate of condensation of the solvent at equilibrium

Answer:

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34. An aqueous solution has freezing point at $-2.55^{\circ}C$. What is its boiling point $\left(K_b^{H_2O} = 0.52Km^{-1},\right.$ $K_f^{H_2O} = 1.86Km^{-1}$?

A. $107.0^{\circ} C$

B. $100.6^{\circ} C$

C. $100.1^{\circ} C$

D. $100.7^{\circ} C$

Answer:

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35. Among the following, the solution which shows the lowest osmotic pressure is:

A. 0.1 M NaCl

B. $0.05 M CaCl_2$

C. $0.04MK_3\left[Fe(CN)_6\right]$

D. $0.03MFeCl_3$

Answer:

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36. A $0.1M$ solution of glucose (molecular weight $180g\text{mol}^{-1}$) and a $0.1M$ solution of urea (molecular weight 60 g mol^{-1}) are placed on the two sides of a semi-permeable membrane to equal heights. In this context, which of the following statements is correct?

a. Glucose will flow across the membrane into the urea solution.

b. Urea will flow across the membrane into the glucose

solution.

c. Water will flow across the membrane from the urea solution into the glucose solution.

d. There will be no net movement across the membrane.

A. Glucose will flow across the membrane into the urea solution

B. Urea will flow across the membrane into the glucose solutionq

C. Water will flow across the membrane from the urea solution into the glucose solution

D. There will be no net movement across the membrane

Answer:

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37. Which of the following statements is incorrect ?

A. The freezing point of water is depressed by the addition of glucose

B. The degree of dissociation of a weak electrolyte decreases as its concentration decreases

C. Energy is released when a substance dissolves in water provided that the hydration energy of the substance is more than its lattice energy

D. If two liquids that form an ideal solution are mixed, the change in entropy is positive

Answer:

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38. Two liquids A and B form an ideal soluton. The vapour pressure of pure A and pure B are $66mmHg$ and $88mmHg$, respectively. Calculate the composition of vapour A in the solution which is equilbrium and whose molar volume is 36%.

A. 0.43

B. 0.7

C. 0.3

D. 0.5

Answer:

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39. $M_n =$ Normal molecular mass of solute

$M_0 =$ Observed molecule mass of solute from colligative property measurement :

Column-I		Column-II	
(A)	$M_o < M_n$	(1)	0.1 M CH_3COOH in benzene
(B)	$M_o \approx M_n / 3$	(2)	0.1 M urea in water
(C)	$M_o > M_n$	(3)	0.05 M barium chloride in water
(D)	$M_o = M_n$	(4)	0.1 M CH_3COOH in water

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40. At $17^\circ C$, the osmotic pressure of sugar solution is 580 torr. The solution is diluted and the temperature is raised

to $57^{\circ}C$, when the osmotic pressure is found to be 165 torr. The extent of dilution is

a.2 times ,b.3 times ,c.4 times ,d.5 times

A. 2 times

B. 3 times

C. 4 times

D. 5 times

Answer:

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41. The vapour pressure of an aqueous solution of glucose is $750mm$ of Hg at $373K$. Calculate molality and mole

fraction of solute.

A. 0.64

B. 0.741

C. 0.68

D. 0.94

Answer:

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42. The boiling point of an aqueous solution of a non-volatile solute is $100.15^{\circ}C$. What is the freezing point of an aqueous solution obtained by diluting the above

solution with an equal volume of water? $[K_b$ and K_f for water are 0.512 and $1.86\ \mathrm{K}molal^{-1}]$

A. $-0.544^{\circ}C$

B. $-0.52^{\circ}C$

C. $-0.272^{\circ}C$

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

Answer:

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43. The relative lowering of vapour pressure of an aqueous solution of a non-volatile solute of molecular weight 60 (which neither dissociates nor associates in the solution) is

0.018. If K_f of water is $1.86^\circ Cm^{-1}$ the depression in freezing point will be :

A. $0.93^\circ C$

B. $3.72^\circ C$

C. $1.86^\circ C$

D. $0.018^\circ C$

Answer:

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44. Calculate the entropy change for vapourisation of water if latent heat of vapourisation for water is 540 cal/g. (K_b for water $= 0.51K.\ kg\text{mole}^{-1}$)

A. 1.45 cal /mole -K

B. 26.3 cal /mole-K

C. 52.6 cal/mole-K

D. 1.87 cal/mole-K

Answer:

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45. We have 200 mL of 6% urea solution at $27^{\circ}C$. Osmotic pressure due to osmosis is ($R = 0.0821 L \text{atom mol}^{-1} K^{-1}$)

A. 24.63 atm

B. 12.315 atm

C. 4.926 atm

D. 6.157 atm

Answer:

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46. Two equimolar solutions have osmotic pressures in the ratio of 2 : 1 at temperatures

A. $327^\circ C, 163.5^\circ C$

B. $327^\circ C, 27^\circ C$

C. $27^\circ C, 327^\circ C$

D. $327^\circ C, 200^\circ C$

Answer:

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47. Human blood gives rise to an osmotic pressure of approximately 7.65 atm at body temperature , 37° C Hence , molarity of an intravenous glucose solution be to have the same osmotic pressure as blood is :

A. 0.30 M

B. 0.20 m

C. 0.10 M

D. 0.50 M

Answer:

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48. Osmotic pressure of insulin solution at 298 K is found to be $0.0072atm$. Hence, height of water Column due to this pressure will be (Given density of Hg = 13.6 gmL^{-1})

A. 0.76 cm

B. 0.70 cm

C. 7.4 cm

D. 76 cm

Answer:

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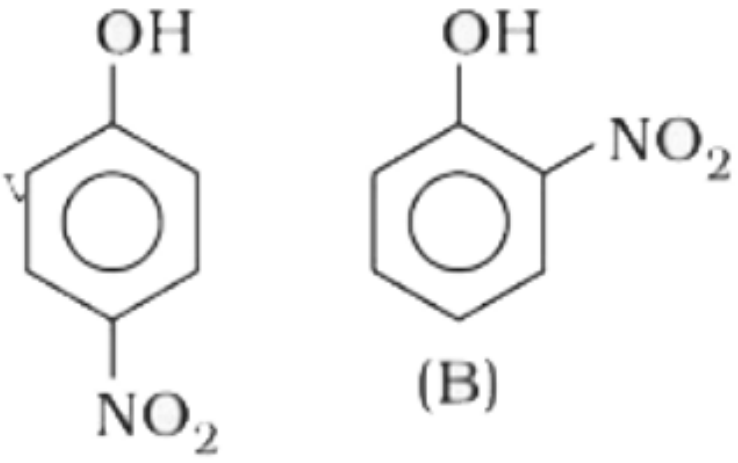
49. Out of the compounds below, the vapour pressure of (B) at a particular temperature is



(B)

A. higher than that of (A)

B. lower than that of (A)

C. higher or lower than (A), depending on the size of the vessel

D. same as that of (A)

Answer:

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50. How much urea must be dissolved in $10^{-2}m^3$ water to yield a pressure is $2.03 \times 10^5 Nm^{-2}$ at 300K?

A. 48.30 g

B. 60.0 g

C. 24.15 g

D. 48.03 g

Answer:

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51. Acetic acid exists in benzene solution in the dimeric form. In an actual experiment, the van't Hoff factor was found to be 0.52. Then, the degree of dissociation of acetic acid is

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52. Calculate the mass of a non-volatile solute (molar mass 40 g mol^{-1}) which should be dissolved in 114g octane to reduce its vapour pressure to 80%.

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53. 1000gm of sucrose solution in water is cooled to $-0.5^{\circ}C$. How much of ice would be separated out at this temperature, if the solution started to freeze at $-0.38^{\circ}C$. Express your answer in gram.

$\left(K_f H_2O = 1.86 K \text{mol}^{-1} kg\right)$

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54. The depression in freezing point of $0.01m$ aqueous $CH_3C\infty H$ solution is 0.02046°, $1m$ urea solution freezes at $-1.86^{\circ}C$. Assuming molality equal to molarity, pH of CH_3COOH solution is

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

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56. 75.2 g of phenol is dissolved in a solvent of K_f=14. If the depression in freezing point is 7 K then find the % of phenol that diamerises.

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57. A storage battery contains a solution of H_2SO_4 38 % by weight. At this concentration, the Vant't Hoff factor is

2.50. At what temperature will the battery contents freeze?

$\left(K_f = 1.86^\circ mol^{-1} kg\right)$

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58. Calculate the apparent degree of ionisation of an electrolyte MX_2 in water, if the observed molar mass of the solute by measuring elevation in boiling point is 65.6 (Normal molar mass of the solute = 164).

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59. 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, then the weight ratio of the solvent and solute is :

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

a. 0.80 , b.0.50 , c.0.70 , d.0.40

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61. A 5 per cent aqueous solution by mass of a non-volatile solute boils at $100.15^{\circ}C$. Calculate the molar mass of the solute. $K_b = 0.52 Kkg\text{mol}^{-1}$.

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62. One gram of serum albumin dissolved in $1000cm^3$ of water gives a solution height of 3.9 mm of Ht of $25^\circ C$. What is the molar mass of serum albumin? Density of the solution can be taken as $1.0gcm^{-3}$.

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63. Density of a 2.05 M solution of acetic acid in water is 1.02 g/mL. The molality of the solution is:

Watch Video Solution

64. The freezing point of $0.08 molal NaHSO_4$ is $-0.345^\circ C$. Calculate the percentage of $HSO_4 + O$ ions that transfers a proton to water. Assume $100\,\%$ ionization of $NaHSO_4$ and K_t for $H_2O = 1.86 K molality^{-1}$.

Watch Video Solution

65. Freezing point of 0.2 M KCN solution is $-0.7^\circ C$. On adding 0.1 mole of $Hg(CN)_2$ to one litre of the 0.2 M KCN solution, the freezing point of the solution becomes $-0.53^\circ C$ due to the reaction $Hg(CN)_2 + mcN^- \rightarrow Hg(CN)_{m+2}^{m-}$. What is the value of m assuming molality = molarity?

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Jee Main Archive

1. Which one of the following aqueous solutions will exhibit highest boiling point ?

A. $0.01MNa_2SO_4$

B. 0.015 M glucose

C. 0.015 M urea

D. $0.01MKNO_3$

Answer:

Watch Video Solution

2. 6.02×10^{21} molecules of urea are present in 100ml of its solution. The concentration of urea solution is

A. 0.001 M

B. 0.1 M

C. 0.02 M

D. 0.01 M

Answer:

Watch Video Solution

3. Which of the following liquid paires shows a positive deviation from Raoult's law /

A. Water-hydrochloric acid

B. Acetone-chloroform

C. Water-nitric acid

D. Benzene-methanol

Answer:

Watch Video Solution

4. Which one of the following statements is false ?

A. Raoult's law states that the vapour pressure of a component over a solution is proportional to its mole fraction

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

C. The correct order of osmotic pressure for 0.01 M aqueous solution of each compound is $BaCl_2 > KCl > CH_3COOH >$ sucrose

D. The osmotic pressure $(\pi) =$ MRT, where M is the molarity of the solution

Answer:

Watch Video Solution

5. if α is the degree of dissociation of Na_2SO_4 , the vant Hoff's factor (i) used for calculating the molecular mass is

A. $1 + \alpha$

B. $1 - \alpha$

C. $1 + 2\alpha$

D. $1 - 2\alpha$

Answer:

Watch Video Solution

6. Benzene and toluene form nearly ideal solutions. At $20^\circ C$ the vapour pressure of benzene is 75 torr and that

of toluene is 22 torr. The partial vapour pressure of benzene at 20°C for a solution containing 78g of benzene and 46g of toluene in torr is:

A. 50

B. 25

C. 37.5

D. 53.5

Answer:

Watch Video Solution

7. Two solution 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. 1.50 M

C. 1.344 M

D. 2.70 M

Answer:

Watch Video Solution

8. Equimolal solutions in the same solvent have

A. Same boiling point but different freezing point

B. Same freezing point but different boiling point

C. Same boiling and same freezing points

D. Different boiling and different freezing points

Answer:

Watch Video Solution

9. Density of a 2.05 M solution of acetic acid in water is 1.02 g/mL. The molality of the solution is:

A. $1.14 \text{mol} kg^{-1}$

B. $3.28 \text{mol} kg^{-1}$

C. $2.28 \text{mol} kg^{-1}$

D. $0.44 \text{mol} kg^{-1}$

Answer:

Watch Video Solution

10. The density (in gmL^{-1}) of a 3.60 M sulphuric acid solution that is 29% H_2SO_4 by mass will be:

A. 1.64

B. 1.88

C. 1.22

D. 1.45

Answer:

Watch Video Solution

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

A. 350

B. 300

C. 700

D. 360

Answer:

Watch Video Solution

12. At $80^{\circ}C$, the vapour pressure of pure liquid A is $520mm$ Hg and that of pure liquid B is $1000mmHg$. If a mixture of solution A and B boils at $80 \circ C$ and $1atm$ pressure, the amount of A in the mixture is $(1atm = 760mmHg)$

a. $50mol\ \%$, b.$52mol\ \%$,c.$34mol\ \%$,d.$48mol\ \%$

A. 52 mol percent

B. 34 mol percent

C. 48 mol percent

D. 50 mol percent

Answer:

Watch Video Solution

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

A. 17.675 mm Hg

B. 15.750 mm Hg

C. 16.500 mm Hg

D. 17.325 mm Hg

Answer:

Watch Video Solution

14. The liquids X and Y form an ideal solution at 300 K, vapour pressure of the solution containing 1 mol of X and 3 mol of Y is 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 mmHg. Vapour pressure (in mmHg) of X and Y in their pure states will be, respectively -

A. 200 and 300

B. 300 and 400

C. 400 and 600

D. 500 and 600

Answer:

Watch Video Solution

15. A binary liquid solution is 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 formed is an ideal solution

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

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

D. n-heptane shows +ve deviation while ethanol shows –ve deviation from Raoult's law.

Answer:

Watch Video Solution

16. 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 : $(K_f = 1.86 \text{ K kg } mol^{-1})$

A. 0.0372K

B. 0.0558K

C. 0.0744 K

D. 0.0186 K

Answer:

Watch Video Solution

Watch Video Solution

17. On mixing, heptane and octane form an ideal solution. At $373K$ the vapour pressure of the two liquid components (heptane and octane) are $105kPa$ and $45kPa$ respectively. Vapour pressure of the solution obtained by mixing 25.0 of heptane and $35g$ of octane will be (molar mass of heptane $= 100gmol^{-1}$ and of octane $= 114gmol^{-1}$):-

A. 72.0 kPa

B. 36.1 kPa

C. 96.2 kPa

D. 144.5 kPa

Answer:

Watch Video Solution

18. Ethylene glycol is used as an antifreeze agent. Calculate the amount of ethylene glycol to be added to 4 kg of water to prevent it from freezing at $-6^{\circ}C$.

$\left(K_f \text{ for } H_2O = 1 \cdot 85K\text{mole}^{-1}kg\right)$

A. 204.30 g

B. 400.00 g

C. 304.60 g

D. 804.32 g

Answer:

Watch Video Solution

19. A 5.2 molal aqueous of methyl alcohol, CH_3OH, is supplied. What is the molefraction of methyl alcohol in the solution ?

A. 0.19

B. 0.086

C. 0.05

D. 0.1

Answer:

Watch Video Solution

20. The degree of dissociation (α) of a weak electrolyte A_xB_y is related to van't Hoff factor (i) by the expression

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

B. $\alpha = \dfrac{i-1}{(x+y+1)}$

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

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

Answer:

Watch Video Solution

21. The density of a solution prepared by dissolving 120 g of urea (mol. Mass = 60 u) in 1000 g of water is 1.15 g/mL. The molarity of this solution is

A. 0.50 M

B. 1.78 M

C. 1.02 M

D. 2.05 M

Answer:

Watch Video Solution

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

A. 72 g

B. 93 g

C. 39 g

D. 27 g

Answer:

Watch Video Solution

23. Consider separate solutions of $0.500MC_2H_5OH(aq)$, $0.100MMg_3(PO_4)(aq)$,$0.250MKBr(aq)$, and $0.125MNa_3PO_4(aq)$ at $25^\circ C$. Which statement is true about these solutions, assuming all salts to be strong electrolytes?

A. $0.500MC_2H_5OH(aq)$ has the highest osmotic pressure

B. They all have the same osmotic pressure

C. $0.100MMg_3(PO_4)_2(aq)$ has the highest osmotic pressure

D. $0.125MNa_3PO_4$ (aq) has the highest osmotic pressure

Answer:

Watch Video Solution

24. The vapour pressure of acetone at $20^\circ C$ is 185 torr. When $1.2g$ of non-volatile substance was dissolved in $100g$

of acetone at $20^{\circ}C$ its vapour pressure was 183 torr. The molar mass $\left(gmol^{-1}\right)$ of the substance is:

A. 32

B. 54

C. 128

D. 488

Answer:

Watch Video Solution

25. 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. 35.0 torr and 0.480

B. 38.0 torr and 0.589

C. 30.5 torr and 0.389

D. 35.8 torr and 0.280

Answer:

Watch Video Solution

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

A. dissociation

B. association

C. partial ionization

D. complex formation

Answer:

Watch Video Solution

27. 18 g glucose $(C_6H_{12}O_6)$ is added to 178.2 g water. The vapour pressure of water (in torr) for this aqueous solution is :

A. 759.00 Torr

B. 7.60 Torr

C. 76.00 Torr

D. 750.40 Torr

Answer:

Watch Video Solution

28. The solubility of N_2 in water at 300K at 300K and 500 torr partial pressure $0.01gL^{-1}$. The solubility (in gL^{-1}) at 750 torr partial pressure is :

A. 0.0075

B. 0.005

C. 0.02

D. 0.015

Answer:

Watch Video Solution

29. An aqueous solution of a salt MX_2 at certain temperature has a van't Hoff factor of 2. The degree of dissociation for this solution of the salt is :

A. 0.5

B. 0.33

C. 0.67

D. 0.8

Answer:

Watch Video Solution

30. The freezing point of benzene decreases by $0.45^{\circ}C$ when 0.2 g of acetic acid is added to 20 g of benzene. If acetic acid associates to form a dimer in benzene, percentage association of acetic acid in benzenne will be:

A. 94.6%

B. 0.646

C. 0.804

D. 0.746

Answer:

Watch Video Solution

31. Among the following mixtures, dipole-dipole as the major interaction, is present in

A. benzene and ethanol

B. acetonitrile and acetone

C. KCl and water

D. benzene and carbon tetrachloride

Answer:

Watch Video Solution

32. 5 g of Na_2SO_4 was dissolved in x g of H_2O . The change in freezing point was found to be $3.82^\circ C$. If Na_2SO_4 is $81.5\ \%$ ionised , the value of x

(k_f for water =1.86$^\circ C$ kg mol^{-1}) is apporximately :

(molar mass of S=32 g mol^{-1} and that of Na=23 g mol^{-1})

A. 15 g

B. 45 g

C. 25 g

D. 65 g

Answer:

Watch Video Solution

33. A solution is prepared by mixing 8.5g of CH_2Cl_2 and 11.95g of $CHCl_3$. If vapour pressure of CH_2Cl_2 and $CHCl_3$ at 298 K are 415 and 200 mm Hg respectively, the

mole fraction of $CHCl_3$ in vapour form is :

$\left(\text{Molar mass of Cl} = 35.5\ \text{g mol}^{-1}\right)$

A. 0.675

B. 0.162

C. 0.486

D. 0.325

Answer:

Watch Video Solution

34. For 1 molal aqueous solution of the following compounds, which one will show the highest freezing

A. $\left[Co(H_2O)_6\right]Cl_3$

B. $\left[Co(H_2O)_5Cl\right]Cl_2.\ H_2O$

C. $\left[Co(H_2O)_5Cl_2\right]Cl.2H_2O$

D. $\left[Co(H_2O)_3Cl_3\right].3H_2O$

Answer:

Watch Video Solution

35. Two 5 molal solutions are prepared by dissolving a non-electroylete, non -volatile solute separately in the solvents X and Y. The molecular weights of the solvents are M_x and M_Y, respectively where $M_X = \frac{4}{3}M_Y$. The relative lowering of vapour pressure of the solution in X is "m" times that of the solution in Y. Given that the number of

moles of solute is very small in comparision to that of solvent, the value of "m" is :

A. $\frac{3}{4}$

B. $\frac{4}{3}$

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

D. $\frac{1}{4}$

Answer:

Watch Video Solution

36. The mass of a non-volatile, non-electrolyte solute $\left(\text{molar mass} = 50 g \text{mol}^{-1}\right)$ needed to be dissolved in 114 g octane to reduce its vapour pressure to 75%, is :

A. 50 g

B. 16.66 g

C. 75 g

D. 150 g

Answer:

View Text Solution

37. Which one of the following statements regarding Henry's law is not correct ?

A. Higher the value of K_H at a given pressure, higher is the solubility of the gas in the liquids

B. The value of K_H increases with increase of temperature K_H and is function of the nature of the gas

C. Different gases have different K_H (Henry's law constant) values at the same temperature

D. The partial pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution

Answer:

Watch Video Solution

38. A solution containing 62 g ethylene glycol in 250 g water is cooled to $-10^{\circ}C$. If K_f for water is 1.86 K mol^{-1}, the amount of water (in g) separated as ice is :

A. 64

B. 32

C. 16

D. 48

Answer:

Watch Video Solution

39. Elevation in the boiling point for 1 molal solution of glucose is 2K. The depression in the freezing point for 2 molal solution of glucose in the same solvent is 2K. The relation between K_b and K_f is

A. $K_b = 2K_f$

B. $K_b = K_f$

C. $K_b = 1.5K_f$

D. $K_b = 0.5K_f$

Answer:

Watch Video Solution

40. The freezing point of a diluted milk sample is found to be $-0.2^{\circ}C$, while it should have been $-0.5^{\circ}C$ for pure milk. How much water has been added to pure milk to make the diluted sample?

A. 3 cups of water to 2 cups of pure milk

B. 2 cups of water to 3 cups of pure milk

C. 1 cups of water to 2 cups of pure milk

D. 1 cups of water to 3 cups of pure milk

Answer:

Watch Video Solution

41. Freezing point of a 4% aqueous solution of X is equal to freezing point of 12% aqueous is reaction of Y .if molecular weight of X is A then molecular weight of Y is :

A. 3A

B. A

C. 4A

D. 2A

Answer:

Watch Video Solution

42. Molecules of benzoic acid (C_6H_5COOH) dimerise in benzene. 'w' g of the acid dissolved in 30g of benzene shows a depression in freezing point equal to 2K. If the percentage association of the acid to form dimer in the solution is 80, then w is : (Given that $K_f = 5KKgmol^{-1}$ Molar mass of benzoic acid $= 122gmol^{-1}$)

A. 2.4g

B. 1.5g

C. 1.0g

D. 1.8g

Answer:

Watch Video Solution

43. Liquids A and B form an ideal solution in the entire composition range. At 350K, the vapor pressure of pure A and pure B are 7×10^3 Pa and 12×10^3 Pa, respectively. The composition of the vapor in equilibrium with a solution containing 40 mole percent of A at this temperature is :

A. $x_A = 0.76, x_B = 0.24$

B. $x_A = 0.4, x_B = 0.6$

C. $x_A = 0.37, x_B = 0.63$

D. $x_A = 0.28, x_B = 0.72$

Answer:

Watch Video Solution

44. K_2HgI_4 is 40% ionised in aqueous solution. The value of its van't Hoff factor (i) is :

A. 1.6

B. 1.8

C. 2

D. 2.2

Answer:

Watch Video Solution

45. At room temperature, a dilute solution of urea is prepared by dissolving 0.60 g of urea in 360 g of water. If

the vapour pressure of pure water at this temperature is 35 mm Hg, lowering of vapour pressure will be: (molar mass of urea $= 60 g \mathrm{mol}^{-1}$)

A. 0.027 mm Hg

B. 0.031 mm Hg

C. 0.017 mm Hg

D. 0.28 mm Hg

Answer:

Watch Video Solution

46. The osmotic pressure of a dilute solution of a compound XY in water is four times that of a solution of

0.01 M $BaCl_2$ in water. Assuming complete dissociation of the given ionic compounds in water, the concentration of XY (in $\mathrm{mol}L^{-1}$) in solution is:

A. 4×10^{-4}

B. 4×10^{-2}

C. 6×10^{-2}

D. 16×10^{-4}

Answer:

Watch Video Solution

47. Liquid 'M' and liquid 'N' form an ideal solution. The vapour pressures of pure liquids 'M' and 'N' are 450 and

700 mmHg, respectively, at the same temperature. Then correct statement is : (x_M = Mole fraction of 'M' in solution, x_N = Mole fraction of 'N' in solution , y_M = Mole fraction of 'M' in vapour phase , y_N = Mole fraction of 'N' in vapour phase)

A. $\frac{x_M}{x_N} = \frac{y^M}{y_N}$

B. $\frac{x_M}{x_N} < \frac{y_M}{y_N}$

C. $(x_m - y_M) < (x_N - y_N)$

D. $\frac{x_M}{x_N} > \frac{Y_M}{Y_N}$

Answer:

Watch Video Solution

48. The vapour pressures of pure liquids A and B are 400 and 600 mm Hg respectively at 298 K. On mixing the two liquids, the sum of their initial volumes is equal to the volume of the final mixture. The mole fraction of liquid B is 0.5 in the mixture. The vapour pressure of the final solution, the mole fractions of components A and B in vapour phase, respectively are :

A. 450 mm Hg, 0.5, 0.5

B. 450 mm Hg, 0.4, 0.6

C. 500 mm Hg, 0.4, 0.6

D. 500 mm Hg, 0.5, 0.5

Answer:

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49. A solution is prepared by dissolving 0.6 g of urea (molar mass $= 60 g \text{mol}^{-1}$) and 1.8 g of glucose (molar mass $= 180 g \text{mol}^{-1}$) in 100 mL of water at $27^{\circ} C$. The osmotic pressure of the solution is:

$\left(R = 0.8206 L \text{atm} K^{-1} \text{mol}^{-1}\right)$

A. 1.64 atm

B. 4.92 atm

C. 8.2 atm

D. 2.46 atm

Answer:

Watch Video Solution

50. 1g of a non-volatile non-electrolyte solute is dissolved in 100g of two different solvents A and B whose ebullioscopic constants are in the ratio of 1 : 5. The ratio of the elevation in their boiling points, $\frac{\Delta T_b(A)}{\Delta T_b(B)}$ is

A. $1:0.2$

B. $1:5$

C. $5:1$

D. $10:1$

Answer:

Watch Video Solution

51. Molal depression constant for a solvent is $4.0 kgmol^{-1}$. The depression in the freezing point of the solvent for $0.03 molkg^{-1}$ solution of K_2SO_4 is : (Assume complete dissociation of the electrolyte)

A. 0.18 K

B. 0.24 K

C. 0.36 K

D. 0.12 K

Answer:

Watch Video Solution

52. For the solution of the gases W, X, Y and Z in water at 298 K , the Henry's law constants (K_H) are 0.5, 2, 35 and 40 kbar, respectively. The correct plot for the given data is :

A. 

B. 

C. 

D. 

Answer:

Watch Video Solution

53. Two open beakers one containing a solvent and the other containing a mixture of that solvent with a non volatile solute are together sealed in a container. Over time:

A. the volume of the solution and the solvent does not change

B. the volume of the solution increases and the volume of the solvent decreases

C. the volume of the solution decreases and the volume of the solvent increases

D. the volume of the solution does not change and the volume of the solvent decreases

Answer:

Watch Video Solution

54. A cylinder containing an ideal gas (0.1 mol of 1.0 dm^3) is in thermal equilibrium with a large volume of 0.5 molal aqueous solution of ethylene glycol at its freezing point. If the stoppers S_1 and S_2 (as shown in the figure) are suddenly withdrawn, the volume of the gas in litres after equilibrium is achieved will be _____.

(Given K_f (water) $= 2.0 Kkg\text{mol}^{-1}$, $R = 0.08 dm^3 atm K^{-1}\text{mol}^{-1}$)

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55. How much amount of NaCl should be added to 600 g fo water $(\varphi = 1.00g/mL)$ to decrease freezing point of water to $-0.2^{\circ}C$? _____. (The freezing point depression constant for water $= 2Kkg\text{mol}^{-1}$)

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56. A graph of vapour pressure and temperature for three different liquids X, Y and Z is shown below:

The following inferences are made:

(A) X has higher intermolecular interactions compared to Y.

(B) X has lower intermolecular interactions compared to Y.

(C) Z has lower intermolecular interactions compared to Y.

The correct inference(s) is are :

A. A and C

B. A

C. B

D. complex formation

Answer:

Watch Video Solution

57. At $35^\circ C$, the vapour pressure of is and that of acetone is . A solution of CS_2 in acetone has a total vapour pressure of . The false statement amongst the following is:

A. Raoult's law is not obeyed by this system

B. CS_2 and acetone are less attracted to each other than to themselves

C. Heat must be absorbed in order to produce the solution at $35^\circ C$

D. A mixture of $100mLCS_2$ and 100 mL acetone has a volume $< 200mL$

Answer:

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Jee Advanced Archive

1. An azeotropic solution of two liquid has boiling point lower than either of them when it

A. Shows negative deviation from Raoult's law

B. Shows no deviation from Raoult's law

C. Shows positive deviation from Raoult's law

D. is saturated

Answer:

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2. For a dilute solution, Raoult's low states that :

A. The lowering of vapour pressure is equal to the mole fraction of solute

B. The relative lowering of vapour pressure is equal to the mole fraction of solute

C. The relative lowering of vapour pressure is proportional to the amount of solute in solution.

D. The vapour pressure of the solution is equal to the mole fraction of solvent

Answer:

Watch Video Solution

3. When mercuric iodide is added to the aqueous solution of KI, then the :

A. freezing point is raised

B. freezing point is lowered

C. freezing point does not change

D. boiling point does not change

Answer:

Watch Video Solution

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

A. Potassium sulphate

B. Sodium chloride

C. Urea

D. Glucose

Answer:

Watch Video Solution

5. The freezing point of equimolal solution will be highest for :

A. $C_6H_5NH_3Cl$ (aniline hydrochloride)

B. $Ca(NO_3)_2$

C. $La(NO_3)_3$

D. $C_6H_{12}O_6$ (glucose)

Answer:

Watch Video Solution

6. 0.2 molal acid HX is 20% ionised in solution, $K_f = 1.86 K \text{molality}^{-1}$. The freezig point of the solution is

A. -0.45

B. -0.90

C. -0.31

D. -0.53

Answer:

Watch Video Solution

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

A. ionization of benzoic acid

B. dimerization of benzoic acid

C. trimerization of benzoic acid

D. solvation of benzoic acid

Answer:

Watch Video Solution

8. In the depression in freezing point experiment, it is found that

A. Vapour pressure of the solution is less than that of pure solvent

B. Vapour pressure of the solution is more than that of pure solvent

C. Only solute molecules solidify at the freezing point

D. Only solvent molecules solidify at the freezing point

Answer:

Watch Video Solution

9. During depression in the 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:

Watch Video Solution

10. The elevation in boiling point of a solution of $13.44g$ of $CuCl_2$ in $1kg$ of water using the following information will

be (molecular weight of $CuCl_2$ is 134.4 and $K_b = 0.52Km^{-1}$)

A. 0.16

B. 0.05

C. 0.1

D. 0.2

Answer:

Watch Video Solution

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

A. 0.2

B. 1

C. 2

D. 3

Answer:

Watch Video Solution

12. When $20g$ of naphthoic acid $(C_{11}H_8O_2)$ is dissolved in $50g$ of benzene $\left(K_f = 1.72Kkgmol^{-1}\right)$, 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:

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13. 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 $= 45 g \text{mol}^{-1}$

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

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. 268.7K

B. 268.5 K

C. 234.2 K

D. 150.9 K

Answer:

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14. Properties such as boiling point, freezing point, and vapour pressure of a pure solvent change when solute molecules are added to get homogeneous solution. These are called colligative properties. Applications of colligative properties are very useful in day-to-day life. One of the examples is the use of the mixture of ethylene glycol and water as an 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

$K_f^{water} = 1.86 K kgmol^{-1}$

Freezing point depression constant of ethanol

$K_f^{ethanol} = 2.0 K kgmol^{-1}$

Boiling point elevation constant of water

$K_b^{water} = 2.52 K kgmol^{-1}$

Boiling point elevation constant of ethanol

$K_b^{ethanol} = 1.2 K kgmol^{-1}$

Standard freezing point of water = $273K$

Standard freezing point of ethanol = $155.7K$

Standard boiling point of water = $373K$

Standard boiling point of ethanol = $315.5K$

Vapour pressure of pure water =$32.8 mmHg$

Vapour pressure of pure ethanol=$40 mmHg$

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

Molecular weight of ethanol =$46 gmol^{-1}$

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

The freezing point of solution M is

A. 39.3 mm Hg

B. 36.0 mm hg

C. 29.5 mm Hg

D. 28.8 mm Hg

Answer:

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

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 $= 40mmHg$

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. 380.4 K

B. 376.2 K

C. 375.5 K

D. 354.7 K

Answer:

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16. The henry's law constant for the solubility of N_2 gas in water at 298 K is 1.0×10^5 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 298 K and 5 atm pressure is

A. 4.0×10^{-4}

B. 4.0×10^{-5}

C. 5.0×10^{-4}

D. 4.0×10^{-6}

Answer:

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17. The freezing point $(.^{\circ} C)$ of a solution containing $0.1g$ of $K_3\left[Fe(CN)_6\right]$ (molecular weight 329) on $100g$ of water $\left(K_f = 1.86Kkgmol^{-1}\right)$

A. -2.3×10^{-2}

B. -5.7×10^{-2}

C. -5.7×10^{-3}

D. -1.2×10^{-2}

Answer:

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18. For a dilute solution containing $2.5g$ of a non-volatile non-electrolyte solute in $100g$ of water, the elevation in boiling point at $1atm$ pressure is $2^{\circ}C$. Assuming concentration of solute is much lower than the concentration of solvent, the vapour pressure (mm of Hg) of the solution is (take $K_b = 0.76Kkgmol^{-1}$)

A. 724

B. 740

C. 736

D. 718

Answer:

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19. For a dilute solution containing $2.5g$ of a non-volatile non-electrolyte solute in $100g$ of water, the elevation in boiling point at $1atm$ pressure is $2^{\circ}C$. Assuming concentration of solute is much lower than the concentration of solvent, the vapour pressure (mm of Hg) of the solution is (take $K_b = 0.76Kkgmol^{-1}$)

A. 724

B. 740

C. 736

D. 718

Answer:

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

A. ΔG is positive

B. ΔS_{system} is positive

C. $\Delta S_{\text{surroundings}} = 0$

D. $\Delta H = 0$

Answer:

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21. MX_2 dissociates into M^{2+} and $X^{\ominus}$ ion in an aqueous solution, with a degree of dissociation (α) of 0.5. The ratio of the observed depression of freezing point of the aqueous solution to the value of the depression of freezing point in absence of ionic dissociation is

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22. A compound H_2X with molar weight of 80 g is dissolved in solvent having density of $0.4 gm L^{-1}$. Assuming no change in volume upon dissolution, the molality of a 3.2 molar solution is :

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23. If the freezing point of a 0.01 molal aqueous solution of a cobalt (III) chloride-ammonia complex (which behaves as a strong electrolyte) is $-0.0558^{\circ}C$, the number of chloride (s) in the coordination sphere of the complex if $\left[K_f \text{ of water } = 1.86 K kg mol^{-1}\right]$

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24. Mixture (s) showing positive deviation from Raoult's law at $35^{\circ}C$ is (are)

A. carbon tetrachloride + methanol

B. carbon disulphide + acetone

C. benzene + toluene

D. phenol + aniline

Answer:

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25. The mole fraction of a solute in a solution is 0.1. At 298 K, molarity of this solution is the same as its molality. Density of this solution at 298 K is $2.0 gcm^{-3}$. The ratio of the molecular weights of the solute and solvent, $\left(\frac{MW_{\text{solite}}}{MW_{\text{solvent}}}\right)$ is .....

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26. Pure water freezes at 273 K and 1 bar. The addition of 34.5 g of ethanol to 500 g of water changes the freezing point of the solution. Use the freezing point depression constant of water as $2\,\mathrm{K\,kg\,mol^{-1}}$. The figures shown below represent plots of vapour pressure (V.P.) versus temperature (T). [molecular weight of ethanol is 46 g mol^{-1}]

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

A. 

B. 

C. 

D. 

Answer:

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27. For a solution formed by mixing liquids L and M, the vapour pressure of L plotted against the mole fraction of M in solution is shown in the following figure. Here χ_L and χ_M represent mole fractions of L and M, respectively, in the solution. The correct statement(s) applicable to this system is(are)

A. The point Z represents vapour pressure of pure liquid M and Raoult's law of obeyed from $x_L = 0$ to $x_L = 1$

B. The point Z represents vapour pressure of pure liquid L and Raoult's law is obeyed when $x_L \rightarrow 1$

C. The point Z represents vapour pressure of pure liquid M and Raoult's law is obeyed when $x_L \rightarrow 0$

D. Attractive intermolecular interactions between L-L in pure liquid L and M-M in pure liquid M are stronger than those between L-M when mixed in solution

Answer:

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28. Liquids A and B form ideal solution over the entire range of composition. At temperature T, equimolar binary

solution of liquids A and B has vapour pressure 45 torr. At the same temperature, a new solution of A and B having mole fractions x_A and x_B, respectively, has vapours pressure of 22.5 torr. The value of x_A/x_B in the new solution is _____.

(Given that the vapour pressure of pure liquid A is 20 torr at temperature T).

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29. The plot given below shows P – T curves (where P is the pressure and T is the temperature) for two solvents X and Y and isomolal solutions of NaCl in these solvents. NaCl completely dissociates in both the solvents.

On addition of equal number of moles of a non-volatile solute S in equal amount (in kg) of these solvents, the elevation of boiling point of solvent X is three times that of solvent Y. Solute S is known to undergo dimerization in these solvents. If the degree of dimerization is 0.7 in solvent Y, the degree of dimerization in solvent X is _____.

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30. On dissolving 0.5 g of non-volatile, non-ionic solute to 39 g of benzene, its vapour pressure decreases from 650 mm of Hg to 640 mm of Hg. The depression of freezing point of benzene (in K) upon addition of the solute is _____.

(Given data: Molar mass & molar freezing point depression is 78 g mol^{-1} & $5.12 K kg mol^{-1}$]

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31. The mole fraction of urea in an aqueous urea solution containing 900 g of water is 0.05. If the density of the solution is $1.2 g cm^{-3}$, the molarity of urea solution is

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Given data: Molar masses of urea and water are $60 g \text{mol}^{-1}$ and $18 g \text{mol}^{-1}$, respectively)

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