CHEMISTRY

PHYSICAL, INORGANIC, AND ORGANIC CHEMISTRY

SOLUTIONS

Solved Examples

1. If we have $6\,\%\,W/W$ urea solution with density $1.060g/mL$, then calculate its strength in g/L?

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2. If 20 ml of $0.5MNa_2.\,SO_4$ is mixed with $50ml$ of $0.2MH_2SO_4$ & 30 ml of $0.4MAl_2(SO_4)_3$ solution. Calculate $\left[Na^+\right]$, $\left[H^+\right]$. $\left[SO_{4^{2-}}\right]$, $\left[Al^{3+}\right]$. [Assuming $100\,\%$ dissociation]

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3. Calculate molality of $1.2MH_2SO_4$ solution? If its $p = 1.4g/mL$

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4. If we have 10 molal urea solution, Calculate mole fraction of urea in this solution $\&$ also calculated $\%\, W/W$ of urea $(MW = 60)$.

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5. Calculate molarity of $CaCO_3$(aq.) solution which has concentration of $CaCO_3 = 200$ppm.

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6. The Henry's law constant for the solubility of N_2 gas in water at $298K$ 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 298K and 5 atm pressure is

A. $4 \times^{-4}$

B. 4.0×10^{-5}

C. 5.0×10^{-4}

D. 4.0×10^{-6}

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7. The vapor pressure of water at $80^\circ C$ is 355 torr. A $100ml$ vessel contained water-saturated oxygen $80^\circ C$, the total gas pressure being 760 torr. The contents of the vessel were pumped into a $50.0m$ vessel at the same temperature. What were the partial pressure of oxygen and of

water vapor, with was the total pressure in the final equilibrated state? Neglect the volume of any water which condense.

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8. (a) A liquid mixture of benzene and toluene is composed of 1 mol of benzene and 1 mol of tolune if the pressure over the mixture at $300K$ is reduced, at what pressure does the first bubble form?

(b) What is the composition of the first bubble formed.

(c) If the pressure is reduced further, at what pressure does the last trace of liquid disapper?

(d) What is the composition of the last drop of liquid?

(e) What will be the pressure, composition of the liquid and the composition of vapour, when 1 mol the mixture has been vaporized? Given $P_{T^0} = 40mmHg$, $P_{B^0} = 100mmHg$

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9. An equimolar mix of benzene $\&$ toluene is prepared the total V.P. of this mix as a fraction of mole fraction of benzene is found to be $P_T = 200 + 400X_{ben}$.

(a) Calculate composition of vapours of this mix. [Assume that the no. of moles going into vapour phase is negligible in comparsion to no. of moles present in liq. phase].

(b) If the vapour above liq in part A are collected $\&$ are condensed into a new liquid calculate composition of vapours of this new liq.

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10. Calculate wt of urea which must be dissolved in $400gm$ of water so final solutions has $V.P.2\%$ less than $V.P.$ of pure water:

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11. $10gm$ of a solute is dissolved in $80gm$ of acctone V.P. of this sol $= 271mmofHg$. If V.P. of acctone is $283mmofHg$. Calculate molar mass

of solute.

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12. $V.P.$ of solute containing $6gm$ of non volatile solute in $180gm$ of water is $20\text{Torr}/mm$ of Hg. If 1 mole water is further added in to the $V.P.$ increase by 0.02. Torr calculate $V.P.$ of pure water $\&$ molecular of non volatile solute.

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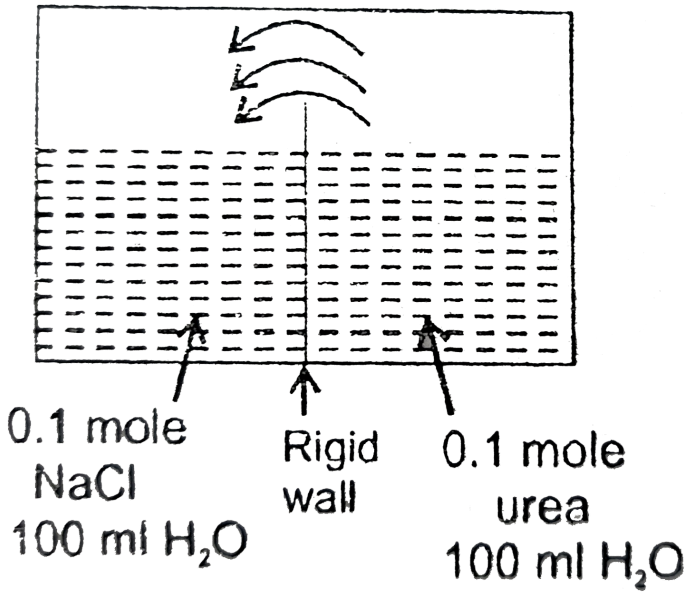

13.

What is the final volume of both container.

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14. If $0.1M$ solutions of $K_4\left[Fe(CN)_6\right]$ is prepared at $300K$ then its density $= 1.2gm/mL$. If solute is $50\,\%$ dissociated calculate ΔP of solutions if P of pure water $= 25mmofHg.\,(K = 39, Fe = 56)$

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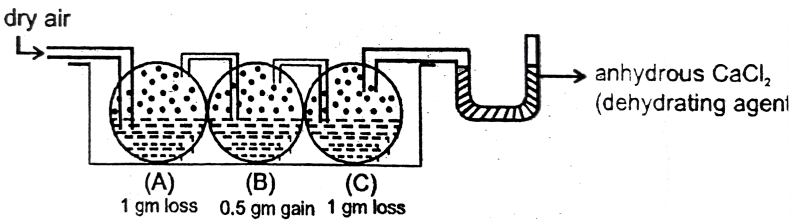
15.



If same volume solution of different solute is used then what is order of

(a) vapour pressure (b) moles solute (c) molar mass of solute.

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16. A solution of $122gm$ of benzoic acid is $1000gm$ of benzene shows a $b.\ p.$ elevation of 1.4°. Assuming that solute is dimerized to the extent of 80 percent $(80^\circ C)$ calculate normal $b.\ p.$ of benzene given molar enthalpy of vap. Of benzine $= 7.8Kcal/mol.$

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17. $1Lit.$ Of aq. Solution of urea having density $= 1.060gm/mL$ is found to have $\Delta T_b = 0.5^\circ C$, if temp. of this solution increase to $101.5^\circ C$ then

calculate amount of water which must have gone is vapour state upto this pt. given $K_b = 0.5 K kgmol^{-1}$ for water

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18. Van't Hoff factors of aqueous solutions of X, Y, Z are $1.8, 0.8 \text{and} 2.5$. 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. $v.\ p. : Y < X < Z$

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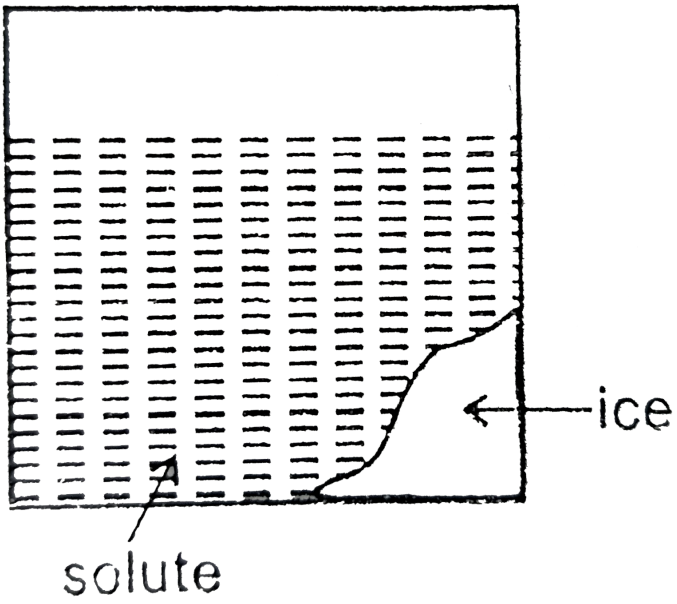
19. $1000 gm H_2O$ have 0.1 mole urea and its freezing point is-$0.2^\circ C$ and low now it is freezed upto $-2^\circ C$ then how much amount of ice will form.



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20. If boiling point of an aqueous solution is $100.1^{\circ}C$. What is its freezing point? Given latent heat of fusion and vaporization of water are $80calg^{-1}$ and $540calg^{-1}$ respectively.

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21. A 0.001 molal solution of a complex represented as $Pt(NH_3)_4Cl_4$ in water had freezing point depression of $0.0054^\circ C$. Given K_f for $H_2O = 1.86Km^{-1}$. Assuming $100\,\%$ ionization of the complex, write the ionization nature and formula or complex.

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22. 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

A. 2

B. 3

C. 3.2

D. 4.2

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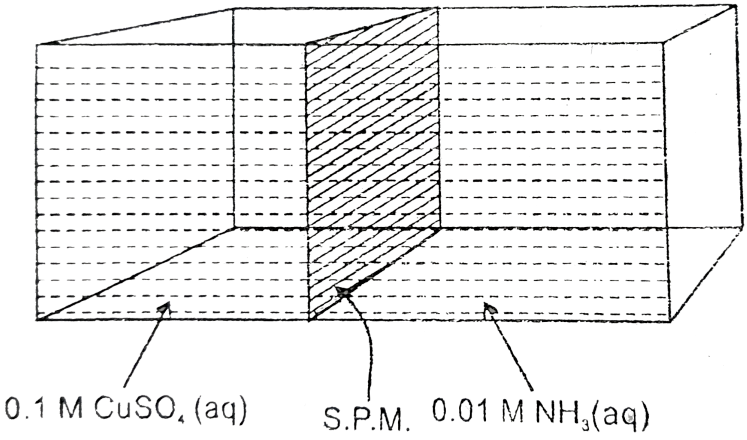
23. In which solution side complex $\left[Cu(MH_3)_4\right]^{2+}$ will form and deep blue colour will obtain.



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24. If V_1mL of C_1 solution $+V_2mL$ of C_2 solution are mixed together then calculate final concentration of solution and final osmotic pressure. If initial osmotic pressure of two solutions are π_1 and π_2 respectively?

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25. Calculate osmotic pressure of $0.1M$ urea aqueous solution at $300K$.

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26. If $10gm$ of an unknown substance (non-electrolytic) is dissolved to make $500mL$ of solution, then osmotic pressure at $300K$ is observed to be 1.23 atm find molecular weight?

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27. If $6gm$ of urea, $18gm$ glucose $\&$ $34.2gm$ surcose is dissolved to make $500mL$ of a solution at $300K$ calculate osmotic pressure?

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28. If $200mL$ of $0.1M$ urea solution is mixed with $300mL$ of $0.2M$ glucose solution at $300K$. Calculate osmotic pressure?

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29. If urea (aq) solution at $500K$ has $O.P. = 2.05$ atm. & glucose solution at $300K$ has $OP = 1.23$ atm. If $200mL$ of I^{st} solution $\&400ml$ of 2^{nd} solution are mixed at $400K$ then calculate $O.P.$ of resulting solution at $400K$ (assume molarity is not dependent on temp.)

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30. $\underset{(A)}{\frac{0.1M\text{urea}}{}}, \underset{(B)}{\frac{0.1MNaCl}{}}, \underset{(C)}{\frac{0.1MBaCl_2}{}}$

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31. Calculate osmotic pressure of a solutions having $0.1MNaCl\&0.2MNa_2SO_4$ and $0.5MHA$.

(Given : Weak acid is $20\,\%$ dissociated at $300K$).

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32. If $0.04MNa_2SO_4$ solutions at $300K$ is found to be isotonic with $0.05MNaCl$ $(100\,\%$ dissociation) solutions. Calculate degree of dissociation of sodium sulphide.

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33. If $6gm$ of CH_3COOH is dissoved in benzene to make 1 litre at $300K$. Osmotic pressure of solution is found to be 1.64 atm. If it is known that CH_3COOH in benzene forms a dimer. Calculate degree of association of acetic acid in benzene?

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34. If $200ml$ of $0.2MBaCl_2$ solution is mixed with $500ml$ of $0.1MNa_2SO_4$ solution. Calculate osmotic pressure of resulting solutions?

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35. If $200ml$ of $0.2MHgCl_2$ solution is added to $800ml$ of $0.5MKl$ ($100\,\%$ dissociated) solution. Assuming that the following complex formation taken place to $100\,\%$ extent.

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36. Ba^{2+} ions, CN^- &Co^{2+} ions form a water soluble complex with Ba^{2+} ions as free cations for a $0.01M$ solution of this complex, osmotic pressure $= 0.984$ atm & degree of dissociation $= 75\,\%$. Then find ccordination number of Co^{2+} ion in this complex ($T = 300K, R = 0.082L\text{mol}^{-1}K^{-1}$)

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37. A sample of charcoal weighing $6g$ was brought into contact with a gas contained in a vessel of one litre capacity at $27^\circ C$. The pressure of the gas was found to fall from 700 to 400 mm. Calculate the volume of the

gas (reduced to STP) that is adsorbent under the condition of the experiment $\left(\text{density of charcoal sample is} 1.5 g cm^3\right)$.

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38. When SO_2 is bubbled into H_2S gas, colloidal sol is formed. What type of colloidal sol is it ?

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39. A reddish positive charged sol is obtained by adding small quantity of $FeCl_3$ solution to freshly prepared and well washed $Fe(OH)_3$ precipitate. How does it take place?

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40. Suppose we have a cube of $1.00 cm$ length. It is cut in all three directions, so as to produce eight cubes, each $0.50 cm$ on edge length.

Then suppose these 0.50 cm cubes are each subdivided into eight cubes 0.25 cm on edge length, and so on. How many of these successive subdivisions are required before the cubes are reduced in size to colloidal dimensions of $100nm$.

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41. Under what conditions is Tyndal effect observed ?

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42. In the layer of the atmosphere, there is a great deal of dust. When the weather is fine, it is possible to see the magnificent red colour of the setting sun. what have these observation to do with colloids?

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43. Classify the following sols according to theirs charges:

(a) gold sol (b) ferric hydroxide sol (c) gelatine (d) blood

(e) sulphur (f) arsenious sulphide (g) titanium oxide.

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44. SnO_2 forms positively charged colloidal sol in acidic medium and negatively charged colloidal sol in basic medium. Explain ?

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45. The particles of a particular colloidal solution of arsenic trisulphide (As_2S_3) are negatively charged. Which 0.0005 M solution would be most effective in coagulating this colloidal solution. KCl, $MgCl_2$, $AlCl_3$ or Na_3PO_4 ? Explain.

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46. Which of the following is (are) lyophobic colloids ?

A. Gold sol

B. As_2S_3 sol

C. Starch sol

D. $Fe(OH)_3$ sol

Answer: A::B::D

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47. The presence of colloidal particles of dust in air imparts blue colour to the sky. This is de to

A. Absorption of the light

B. Scattering of the light

C. Reflection of the light

D. None of these

Answer: B

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48. The volume of nitrogen gas Um (measured at STP) required to cover a sample of silica get with a mono-molecular layer is $129cm^3g^{-1}$ of gel. Calculate the surface area per gram of the gel if each nitrogen molecule occupies $16.2 \times 10^{-20}m^2$.

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49. Which of the following has minimum gold number ?

A. Potato starch

B. Gum arabic

C. Gelatin

D. Albumin

Answer: C

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50. Which of the following are correctly matched ?

A. Butter-gel

B. Milk-emulsion

C. Fog-aerosol

D. Dust-solid sol

Answer: A::B::C

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51. Explain the adsorption of nitrogen on iron.

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52. How do size of particles of adsorbent, pressure of gas and prevailling temperature influence the extent of adsorption of a gas on a solid ?

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53. How is adsorption of a gas is related to its critical temperature ?

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54. Physical adsorption is essentially quite appreciable :

A. at room temperature

B. at higher temperature

C. at lower temperature

D. none if these

Answer: C

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55. What type of colloidal sols are formed in the following ?

(i) Through cooled water, vapours of sulphur are passed.

(ii) White of an egg is mixed with water.

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56. What happens when persistent dialysis of colloidal solution is carried out?

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57. Gelatin is generally added to ice creams. Why?

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58. Which colloidal sol is administered to a patient suffereing from arscenic poisoning?

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59. Name two industrial processes in which heterogeneous catalysts are employed?

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60. Why are substance such as platinum and palladium often used for carrying out electrolysis of aqueous solutions?

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61. Why is it necessary to remove CO when ammonia is obtained by Haber's process ?

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62. Why is it essential to wash a precipitate with water before estimating it quantitatively ?

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63. What are the factors which influence the adsorption of a gas on a solide ?

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64. Which will be adsorbed more readily on the surface of charcoal and why– NH_3 or CO_2?

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65. What do you understand by "isoelectric point" of a colloid ?

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66. Gold number of haemoglobin is 0.03. Hence 100 ml of gold sol will require haemoglobin so that gold is not coagulated by 10 ml of 10% NaCl solution

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(MSPs)

1. A $6.90M$ solution of KOH contains 30% by weight of KOH. Calculate the density of the solution.

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2. $10ml$ of sulphuric acid solution $(sp.\ gr.\ = 1.84)$ contains $98\,\%$ weight of pure acid. Calculate the volume of $2.5MNaOH$ solution required to just neutralise the acid.

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3. A sample of H_2SO_4 (density $1.8gmL^{-1}$) is labelled as $74.66\,\%$ by weight. What is molarity of acid? (Give answer in rounded digits)

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4. The density of a $3MNa_2S_2O_3$ (sodium thiosulphate) solution is $1.25gmL^{-1}$. Calculate:

a. % by weight of $Na_2S_2O_3$

b. Mole fraction of $Na_2S_2O_3$

c. Molalities of $Na^{\oplus}$ and $S_2O_3^{2-}$ ions.

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5. Calculate Molality of aqueous urea solution which has $X_{\text{urea}} = 0.2$

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6. If $200mL$ of $0.1M$ urea solution is mixed with $300mL$ of $0.2M$ glucose solution at $300K$. Calculate osmotic pressure?

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7. A $500gm$ liquid consist of $15gm$ ethane at any temp. T, at a pressure $= 2$ atm. Find Pressure of gas required to dissolve $30gm$ gas in $300gm$ liquid.

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Board Level Exercise

1. Distinguish between molarity and molality.

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2. Why is ether not miscible in water?

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3. State Raoult's law for a binary solution containing volatile components.

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4. What are the values of $P_{\text{total}}, \Delta H, \Delta V$ for negative deviation from ideality? Give one example.

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5. What are maximum boiling azeotropes? Give one example.

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6. What is Henry law?

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7. What is expected value of van't Hoff factor for $K_3\left[Fe(CN)_6\right]$ in the dilute solution?

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8. In the determination of molar mass of A^+B^- using a colligative property, what may be value of van't Hoff factor if the solute is $50\,\%$ dissociated?

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9. Define molal elevation constant or ebullioscopic constant?

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10. Which has the highest freezing point:

A. $1M$ glucose

B. $1MNaCl$

C. $1MCaCl_2$

D. $1MAIF_3$?

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11. A $10\ \%$ solution of urea is isotonic with $20\ \%$ solution of $'x'$ at same temperature. Calculate molecular weight of x.

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12. Why a person suffering from high blood pressure is advised to take minimum quantity of common salt?

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13. What type of non-idealities are exhibited by cyclohexane-ethanol and acetone-chloroform mixture? Give reasons for your answer.

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14. Calculate the molality of K_2CO_3 solution which is formed by dissolving $2.5g$ of it in one litre of solution. Density of solution is $0.85gml^{-1}$. (At. wt. of $K = 39, C = 12, O = 16$)

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15. An electrolyte AB is $50\,\%$ ionised in aqueous solution. Calculate the freezing point of 1 molal aqueous solution.

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16. $5g$ of compound A was dissolved in $100g$ of water at $303K$. The vapour pressure of the solution was found to be 4.16 kilopascal. If the vapour pressure of pure water is $4.24kPa$ at this temperature, what is the molecular mass of A?

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17. When fruits and vegetables are dried and placed in water, they slowly swell and return to original form, Why? Does an increase in temperature accelerate the process? Explain.

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18. The normal freezing point of nitrobenzene $(C_6H_5NO_2)$ is $278.82K$. $A0.25$ molal solution of a certain solute in nitrobenzene causes a freezing point depression of 2 degrees. Calculate the value of K_f for nitrobenzene.

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19. Urea forms an ideal solution. Determine the vapour pressure of an aqueous solution containing 10 per cent by mass of urea at $40^\circ C = 55.3mmHg$).

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20. State Raoult's law, If ΔT is the elevation in boiling point of a solvent and m is no. of moles of solute per kilogram of solvent. What is the relationship between ΔT and m?

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21. An aqueous solution of $3.12g$ of $BaCl_2$ in $250g$ of water is found to boil at $100.0832^\circ C$. Calculate the degree of dissociation of $BaCl_2$. Given that the value of $K_b(H_2O) = 0.52K/m$.

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22. $18g$ of glucose (molar mass $180g\text{mol}^{-1}$) is present in $500CM^3$ of its aqueous solution. What is the molarity of the solution? What additional data is required if the molality of the solution is also required to be calculated?

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23. Define Osmotic pressure and Arrange the following solutions in increasing order of osmotic pressure?

A. $34.2gL^{-1}$ of sucrose

B. $60gL^{-1}$ of urea

C. $90gL^{-1}$ of glucose

D. $58.5gL^{-1}$ of $NaCl$.

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24. The vapour pressure of water is $12.3kPa$ at $300K$. Calculate vapour pressure of 1 molal solution of a solute in it.

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25. (a) What are non-ideal solutions?

(b) What role does the molecular interaction play in deciding the vapour pressure of solutions (i) alcohol and acetone (ii) chloroform and acetone?

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26. Explain giving examples the term 'colligative molality'. Why do we sometimes get abnormal molecular masses of the substances using colligative properties of the solution? The freezing point depression of 0.1 molal solution of benzoic acid in benzene is $0.526K$. For benzene K_f is $5.12Kkgmol^{-1}$. Calculate the value of van't Hoff factor for benzoic acid in benzene. What conclusion can you draw about the molecular state of benzoic acid in benzene?

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27. $2.82g$ of glucose (molar mass $= 180$) is dissolved in $30g$ of water. Calculate the (i) Molality of the solution (ii) mole fractions of (a) glucose (b) water.

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28. An aqueous solution freezes at 272.4 K while pure water freezes at 273 K. Given $K_f = 1.86Kkgmol^{-1}, K_b = 0.512Kkgmol^{-1}$ and vapour

pressure of water at 298 K = 23.756 mm Hg. Determine the following.

Lowering in vapour pressure at 298 K is

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EXERCISE-1(PART-1)

1. Calculate the normality of $NaOH$ when $2g$ is present in $800mL$ solution.

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2. The density of a $3MNa_2S_2O_3$ (sodium thiosulphate) solution is $1.25gmL^{-1}$. Calculate:

a. % by weight of $Na_2S_2O_3$

b. Mole fraction of $Na_2S_2O_3$

c. Molalities of $Na^{\oplus}$ and $S_2O_3^{2-}$ ions.

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3. Calculate the molality and molarity of a solution made by mixing equal volumes of $30\,\%$ by weight of H_2SO_4 (density $= 1.20g/ml$) and $70\,\%$ by weight of H_2SO_4 (density $= 1.60g/mL$)

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4. What are the characteristics of the supersatuated solution.

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5. What do you mean by Hygroscopic compound.

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6. Why are some solution processes exothermic whereas others are endothermic?

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7. The vapour pressure of water at $80^\circ C$ is 355 torr. A $100ml$ vessel contained water-saturated oxygen at $80^\circ C$, the total gas pressure being 760 torr. The contents of the vessel were pumped into a $50.0ml$. Vessel at the same temperature. What were the partial pressures of oxygen and of water vapour, what was the total pressure in the final equilibrated state? Neglect the volume of any water which might condense.

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8. 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

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9. A mixture of an organic liquid A and water distilled under one atmospheric pressure at $99.2^{\circ}C$. How many grams of steam will be condensed to obtain $1.0g$ of liquid A in the distillate? (Vapour pressure of water $99.2^{\circ}C$ is $739mmHg$. Molecular weight of $A = 123$)

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10. Boiling point of a mixture of water and nitrobenzene is $99^{\circ}C$, the vapour pressure of water is $733mm$ of Hg and the atmospheric pressure is $760nn$ if Hg. The molecular weight of nitrobenzene is 123. Find the ratio weights of the components of the distillate.

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11. Two liquids A and B form ideal solution. At $300K$, the vapour pressure of a solution containing 1 mole of A and 3 moles of B is $550mm$ of Hg. At the same temperature, if one more mole of B is added to this solution,

the vapour pressure of the solution increases by $10mm$ of Hg. Determine the vapour pressure of a and B in their pure states.

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12. Two liquids, A and B form an ideal solution. At the specified temperature, the vapour pressure of pure A is $20mmHg$ while that of pure B is $75mmHg$. If the vapour over the mixture consists of 50 mol percent A, what is the mole percent A in the liquid?

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13. Two solutions of A and B are available. The first is known to contain 1 mole of A and 3 moles of B and its total vapour pressure is 1.0 atm. The second is known to contain 2 moles of A and 2 moles of B, its vapour pressure is greater than 1 atm, but if is found that this total vapour pressure may be reduced to 1 atm by the addition of 6 moles of C. The vapour pressure of pure C is 0.80 atm. Assuming ideal solutions and that

all these data refered to $25^{\circ}C$, calculate the vapour pressure of pure A and B.

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14. At $80^{\circ}C$ 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 $80^{\circ}C$ and 1 atm pressure, the amount of 'A' in the mixture is (1 atm $= 760mmHg$)

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15. Vapour pressure of C_6H_6 and C_7H_8 mixture at $50^{\circ}C$ is given by $P(mmHg) = 179X_B + 92$, where X_R is the mole fraction of C_6H_6. A solution is prepared by mixing 936g benzene and 736g toluene and if the vapours over this solution are removed and condensed into liquid and again brought to the temperature of $50^{\circ}C$. what would be mole fraction of C_6H_6 in the vapour state?

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

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17. Total vapour pressure of mixture of 1 mole of volatile component A $\left(P_A^\circ = 100mmHg\right)$ and 3 mole of volatile component $B\left(P_B^\circ = 80mmHg\right)$ is $90mmHg$. For such case :

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18. The partial pressure of ethane over a solution containing $6.56 \times 10^{-2}g$ of ethane is 1 bar. If the solution contains $5.00 \times 10^{-2}g$ of ethane, then the partial pressure of the ethane gas will be

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19. If N_2 gas is bubbled through water at $293K$, how many millimoles of N_2 gas would dissolve in$1L$ of water. Assume thatN_2 exerts a partial pressure of 0.987 bar. Given that Henry law constant for N_2 at $293K$ is 76.48 kbar.

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20. $17.4\,\%$ (wt./vol.) $K_2(SO_4)$ solution at $27^\circ C$ isotonic to $5.85\,\%$ (wt./vol.) $NaCl$ solution at $27^\circ C$. IF $NaCl$ is $100\,\%$ ionised, what is $\%$ ionisation of K_2SO_4 in aq. solution?

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21. Calculate the percentage degree of dissociation of an electrolyte XY_2 (Normal molar mass $= 164$) in water if the observed molar mass by measuring elevation in boiling point is 65.6:

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22. Twenty grams of a solute are added to $100g$ of water at $25^{\circ}C$. The vapour pressure of pure water is $23.76mmHg$, the vapour pressure of the solution is 22.41 Torr.

(a) Calculate the molar mass of the solute.

(b) What mass of this solute is required in $100g$ of water of reduce the vapour pressure ot one-half the value for pure water?

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23. The degree of dissociation of $Ca(NO_3)_2$ in a dilute aqueous solution containing $7g$ of salt per $100g$ of water at $100^{\circ}C$ is $70\,\%$. Calculate the vapour pressure of solution.

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24. Dry air was passed through bulbs containing a solution of 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 which pumice moistened 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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25. (a) A solution containing $0.5g$ of naphithalene in $50gCCl_4$ yield a boiling point elevation of $0.4K$, while a solution of $0.6g$ of an unknown solute in the same mass of the solvent gives a boiling point elevation of $0.65K$. Find the molar mass of the unknown solute.

(b) The boiling point of a solution of $0.1g$ of a substance in $16g$ of ether was found to be $0.100^\circ C$ higher that of pure ether. What is the molecular mass of the substance. K_b (ether) $= 2.16Kkg\text{mol}^{-1}$

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26. The amount of benzene that wil separate out (in grams) if a solution containing $7.32g$ of triphenylmethane in $1000g$ of benzene is cooled to a

temperature which is $0.2^{\circ}C$ below the freezing point of benzene?

$\left(K_f = 5.12K - Kg/\text{mol}\right)$

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27. The boiling point of a solution of $5g$ of sulphur in $100g$ of carbon disulphide is $0.474^{\circ}C$ above that of pure solvent. Determine the molecular formula of sulphur in this solvent. The boiling point of pure carbon disulphide is $47^{\circ}C$ and its heat of vaporisation is 84 calories per gram.

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

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29. $A0.01$ molal solution of ammonia freezes at $-0.02^{\circ}C$. Calculate the van't Hoff factor, i and the percentage dissociation of ammonia in water. $\left(K_{f\,(H_2O)}\right) = 1.86$ deg molal^{-1}.

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30. Predict the osmotic pressure order for the following:

(I) $0.1N$ urea

(II) $0.1NNaCl$

(III) $0.1NNa_2SO_4$

(IV) $0.1NNa_3PO_4$

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31. A solution containing $3.00gm$ of calcium nitrate in $100c.\,c.$ of solution had an osmotic pressure of 11.2 atmosphere at $12^{\circ}C$. Calculate the

degree of ionisation of calcium nitrate at this dilution and temperature.

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32. At $20^{\circ}C$, the osmotic pressure of urea solution is $400mm$. The solution is diluted and the temperature is raised to $35^{\circ}C$, when the osmotic pressureis found to be $105.3mm$. Determine extent of dilution.

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33. If osmotic pressure of $1M$ aqueous solution of H_2SO_4 at $500K$ is 90.2 atm. Calculate K_{a2} of H_2SO_4. Give your answer after multiplying 1000 with K_{a2}. (Assuming ideal solution).

(Given: K_{a1} of H_2SO_4 is ∞, $R = 0.082lt - atm/mol - K$).

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EXERCISE-1(PART-2)

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. 10

D. 1

Answer: B

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

A. evaporate $50mL$ water

B. evaporate $50mL$ solution

C. add 0.1 mol KCl

D. add 0.01 mol KCl

Answer: A::B::D

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3. Which of the following concentration factors can be calculated if the mole fraction and density of aqueous solution of HCl are known?

A. Molality

B. Molarity

C. Percent by mass

D. Normality

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

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

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

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

C. The only true solutions are formed when water dissolves a non-polar solute

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

Answer: B

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5. An ionic compound that attracts atmospheric water so strongly that a hydrate is formed is said to be :

A. Dilute

B. Hygroscopic

C. Immiscible

D. Miscible

Answer: B

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6. A liquid is kept in a closed vessel . If a glass plate (negligible mass)with a small hole is kept on top of the liquid surface, then the vapour pressure of the liquid in the vesel 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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7. The vapour pressure of water depends upon :

A. Surface area of container

B. Volume of container

C. Temperature

D. All

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

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8. 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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9. At the higher altitudes the boiling point of water lowers because

A. temperature of higher altitudes is low

B. atmospheric pressure is low

C. the proportion of heavy water increases

D. atmospheric pressure becmomes more.

Answer: B

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10. Two liquids X and Y are perfectly immisoible. If X and Y have molecular masses in ratio $1:2$, the total vapour pressure of a mixture of X and Y prepared in weight ratio $2:3$ should be $(P_{X^0} = 400$ torr, $P_{Y^0} = 200$torr)

A. 600 torr

B. 400 torr

C. 800 torr

D. 1000 torr

Answer: A

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11. When a liquid that is immiscible with water was steam distilled at $952^\circ C$ at a total pressure of 748 torr, the distillate contained $1.25g$ of the

liquid per gram of water. The vapour pressure of water is 648 torr at $95.2^{\circ}C$. What is the molar mass of liquid?

A. $7.975g/\text{mol}$

B. $166g/\text{mol}$

C. $145.8g/\text{mol}$

D. None of these

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

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12. For a binary ideal lqiuid solutions,the total pressure of the solution is given as

A. $P_{\text{total}} = P_A^{\circ} + \left(P_A^{\circ} - P_B^{\circ}\right)X_B$

B. $P_{\text{total}} = P_B^{\circ} + \left(P_A^{\circ} - P_B^{\circ}\right)X_A$

C. $P_{\text{total}} = P_B^{\circ} + \left(P_B^{\circ} - P_A^{\circ}\right)X_A$

D. $P_{\text{total}} = P_B^\circ + \left(P_B^\circ - P_A^\circ\right) X_B$

Answer: B

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13. Given at $350K p_A^\circ = 300\text{torr}$ and $p_B^\circ = 800\text{torr}$ the composition of the mixture having a normal boiling point of $350K$ 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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14. Two liquids A and B have P_A° and P_B° in the ratio of $1:3$ and the ratio of number of moles of A and B in liquid phase are $1:3$ then mole fraction of A in vapour phase in equilibrium with the solution is equal to :

A. 0.1

B. 0.2

C. 0.5

D. 1.0

Answer: A

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15. An ideal solution contains two volatile liquids $A(P^\circ = 100$ torr) and $B(P^\circ = 200$ torr). If mixture contain 1 mole of A and 4 mole of B then total vapour pressure of the distillate is :

A. 150

B. 180

C. 188.88

D. 198.88

Answer: C

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16. The vapour pressure of two pure liquids A and B, that form an ideal solution are 100 and 900 torr repectively at temperature T. This liquid solution of A and B is composed of 1 mole of A and 1 mole of B. What will be the pressure, when 1 mole of mixture has been vaporized ?

A. 800 torr

B. 500 torr

C. 300 torr

D. None of these

Answer: C

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17. 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. $\overset{\text{Limit}}{X}_{\text{chloroform}} \to 0(p^{\circ}_{\text{acetone}} - p_{s\text{actual}}) = 0$

C. $\overset{\text{Limit}}{X}_{\text{chloroform}} \to 0\left(p^{\circ}_{\text{chloroform}} - p_{s\,(\text{actual})}\right) = 0$

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

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

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

A. solution exhibits ideal behaviour

B. solution shows positive deviations

C. solution shows negative deviations

D. solution will show postive deviations for lower concentration and negative deviations for higher concentrations.

Answer: C

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19. 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. $C_6H_6 - C_6 - C_6H_5CH_3$

D. nC_6H_{14} and $C_6H_5CH_3$

Answer: A

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20. 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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21. A maximum or minima obtained in the temperature, composition curve of a mixture of two liquids indicates:

A. an azeotropic mixture

B. and eutectic formation

C. that the liquids immiscible with one another

D. that the liquids are partially miscible at the maximum or minimum

Answer: A

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22. A solution of sulphuric acid in water exhibits:

A. Negative deviations from Raoult's law

B. Positive deviations from Raoult's law

C. Ideal properties

D. The applicability of Henry's law

Answer: A

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23. 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 increases in pressure and decrease in temperature

D. decreases with increases in pressure and increase in temperature

Answer: C

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24. 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. $1500 M$

D. $2400 M$

Answer: B

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25. 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. I,IV,V

B. I,V

C. I,II,III

D. IV,V

Answer: D

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26. Select correct statements :

A. Gases which have high value of Van der Waals constant $'a'$ are easily liquefied

B. Easily liquenfiable gases are water soluble

C. Ions forming gases in a solvent are solutble in that solvent

D. Under same condition, NH_3 has low solubility that that of CO_2

Answer: A::C

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27. One mole of a solute A is dissolved in a given volume of solvent. The association of the solute take place as follows: $nA \Leftrightarrow A_n$

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

A. $i = 1 - \alpha$

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

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

D. $i = 1$

Answer: C

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

A. $0.05MK_4\left[Fe(CN)_5\right]$ and $0.10MFeSO_4$

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

C. $0.20MNaCl$ and $0.10MBaCl_2$

D. $0.05MFESO_4(NH_4)_2SO_4.\ 6H_2O$ and $0.02MKCl.\ MgCl_2.6H_2O$

Answer: B::D

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

A. M_{normal}

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

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

D. equal to M_{normal}

Answer: B

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30. If P° and P_s are vapour pressure of solvent and its solution, respectively, χ_1 and χ_2 are mole fractions of solvent and solute, respectively, then

A. $P = P_0 N_2$

B. $P = P_0 N_1$

C. $P_0 = P N_1$

D. $P = P_0 (N_1 / N_2)$

Answer: B

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31. 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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32. $PtCl_4.6H_2O$ can exist as a hydrated complex. $1m$ aqueous solution has the depression in freezing point of 3.72°. Assume $100\,\%$ ionization and $K_f(H_2O) = 1.86^\circ mol^{-1}kg$, then the complex is

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

B. $\left[Pt(H_2O)_4Cl_3Cl_2.2H_2O\right.$

C. $\left[Pt(H_2O)_3\right]Cl.3H_2O$

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

Answer: C

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33. How many moles of sucrose should be dissolved in $500gms$ of water so as to get a solution which has a difference of $104^\circ C$ between boiling point and freezing point. $\left(K_f = 1.86KKgmol^{-1}.\ K_b = 0.52KKgmol^{-1}\right)$

A. 1.68

B. 3.36

C. 8.40

D. 0.840

Answer: D

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34. which of the following has been arranged in order of decreasing freezing point?

A. $0.05MKNO_3 > 0.04MCaCl_2 > 0.140M$ sugar $> 0.075MCuSO_4$

B. $0.04MBaCl_2 > 0.140M$ sucrose $> 0.075MCuSO_4 > 0.05MKNO_3$

C. $0.075MCuSO_4 > 0.140M$ sucrose $> 0.04MBaCl_2 > 0.05MKNO_3$

D. $0.075MCuSO_4 > 0.05MNaNO_3 > 0.140M$ sucrose $> 0.04MBaCl_2$

Answer: A

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35. A complex of iron and cyanide ions is $100\,\%$ ionised ar 1m (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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36. 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: B

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37. Sea water is found to contain $5.85\,\%\,NaCI$ and$9.50\,\%\,MgCI_2$ by weight of solution. Calculate its normal boiling point assuming $80\,\%$ ionisation for $NaCI$ and $50\,\%$ ionisation of $MgCI\left[K_b(H_2O) = 0.51kgmol^{-1}K\right]$

A. $T_b = 101.9^\circ c$

B. $T_b = 104.9^\circ C$

C. $T_b = 108.5^\circ C$

D. $T_b = 110.3^\circ C$

Answer: A

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38. Select correct statements :

A. Osmosis, like all colligative properties, results from an increase 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 statements

D. fNone is correct statement

Answer: C

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39. Consider following cases:

I: $2MCH_3COOH$ solution is benzene at $27^\circ C$ where there is dimer formation to the extent of $100\ \%$

II: $0.5MKci$ aq. Solution at $27^\circ C$, which ionises $100\ \%$

Which is/are true statements(s):

A. both are isotonic

B. I is hypertonic

C. II is hypotonic

D. none is correct

Answer: A

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40. 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. 1.85 atm

D. 1.3 atm.

Answer: C

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EXERCISE-1(PART-3)

1. 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, Sttement-2 is True.

Answer: C

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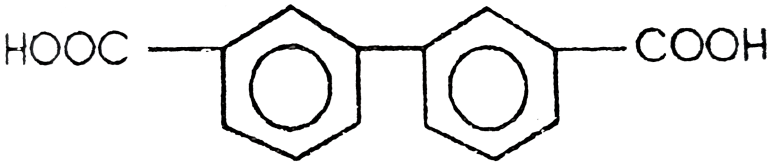
2. Statement-1 : The molar mass obtained for benzoic acid in benzene acid in benzene is found to be nearly 244.

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, Sttement-2 is True.

Answer: C

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3. 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, Sttement-2 is True.

Answer: A

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EXERCISE-2(PART-1)

1. What volume of $98\,\%$ sulphuric acid should be mixed with water to obtain $200mL$ of $15\,\%$ solution of sulphuric acid by weight ? Given density of $H_2O = 1.00gcm^{-3}$, sulphuric acid $(98\,\%) = 1.88gcm^{-3}$ and sulphuric acied $(15\,\%) = 1.12gcm^{-3}$.

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2. If at a particular temperature, the density of $18MH_2SO_4$ is $1.8gcm^{-3}$, calculate (a) molality, (b) $\%$ concentrating by weight of solute and solvent (c) mole fraction of water and H_2SO_4.

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3. Why is benzene soluble in toluene but not in water ?

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4. 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?

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5. The vapour pressure of fluorobenzene at $t^\circ C$ is given by the equation

$$\log p(mmHg) = 7.0 - \frac{1250}{t + 220}$$

Calculate the boiling point of the liquid in $.^\circ C$ if the external (applied) pressure is $2.26\,\%$ more than required for normal boiling point. (log $2 = 0.3$)

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6. An organic liquid, A is immiscible with water. When boiled together with water, the boiling point is $90^\circ C$ which the partial vapour pressure of water is $256mmHg$. The superincumbent (atmospheric) pressure is $736mmHg$. The weight ratio of the liqid water collected $2.5:1$. What is the molecular weight of the liquid.

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7. The vapour pressure of chlorobenzene and water at different temperature are

$t/^\circ C$	90	100	110
$P^\circ(\phi CI)/mmHg$	204	289	402
$P^\circ(H_2O)/mmHg$	526	760	1075

(A)At what pressure will ϕCl steam-disillation at $90^\circ C$?

(B)At what temperature will ϕCl steam-dissillation under a total pressure of $800mmHg$?

(C) How many grams of steam are required for distillation of $10.2g$ of ϕCl (i)at $90^\circ C$ and (ii) under 800 torr total pressure?

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8. A and B form ideal solution, at $50^\circ C$, P_{A^0} is half P_B^0. A solution containing 0.2 mole of A and 0.8 mole of B has a normal boiling point of $50^\circ C$. Calculate P_A^0 and P_A^0 at $50^\circ C$.

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9. An aqueous solution containing liquid $A(M.Wt. = 128) 64\%$ by weight has a vapour pressure of $145mm$. Find the vapour pressure A. If that of water is $155mm$ at the same temperature.

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10. (a) A liquid mixture of benzene and toluene is composed of 1 mol of benzene and 1 mol of toluene. If the pressure over the mixture at $300K$ is reduced, at what pressure does the first bubble form?

(b) What is the composition of the first bubble formed.

(c) If the pressure is reduced further, at what pressure does the last trace of liquid disapper?

(d) What is the composition of the last drop of liquid?

(e) What will be the pressure, composition of the liquid and the composition of vapour. when 1 mol of the mixture has been vaporized?

Given $P_T^0 = 100mmHg$

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

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

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13. The air is a mixture of a number of gases. The major components are oxygen and nitrogen with approximate proportion of $20\,\% : 79\,\%$ by volume at $298K$. The water is in equilibrium with air at a pressure of $10atm$ At $298K$ if Henry's law constants for oxygen and nitrogen at $298K$

are $3.30 \times 10^7 mm$ and $6.51 \times 10^7 mm$, respectively, calculate the composition of these gases in water.

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14. At $300K$, $40mL$ of $O_3(g)$ dissolves in $100g$ of water at $1.0atm$. What mass of ozone dissolved in $400g$ of water at a pressure of $4.0atm$ at $300K$?

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

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16. $2g$ of a non-volatile hydrocarbon solute dissolved in $100g$ of a hypothetical organic solvent (molar mass $= 50$) was found to lower the

vapour pressure from 75.00 to $74.50mm$ of Hg at $20^{\circ}C$. Given that the hydrocarbon contains $96\,\%$ of C, what is the molecular formula of the hydrocarbon ?

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

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18. (a) A solution is prepared by dissolving $10g$ of non-volatile solute in $180g$ of H_2O. If the relative lowering of vapour pressure is 0.005, find the molar mass of the solute.

(b) How many grams of sucrose $(C_{12}H_{22}O_{11})$must be dissolved in $90g$ of water to produce a solution over which the relative humidity is $80\,\%$? Assume the solution is ideal.

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19. $1g$ 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 ? $\left(K_f = 1.86 \frac{K-kg}{\text{mol}}\right)$

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20. A 0.001 molal solution of a complex represented as $Pt(NH_3)_4Cl_4$ in water had freezing point depression of $0.0054^\circ C$. Given K_f for $H_2O = 1.86Km^{-1}$. Assuming $100\,\%$ ionization of the complex, write the ionization nature and formula or complex.

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21. A solution containing $24g$ of a non-electrolyte per kg of water starts to freeze at $-0.75^{\circ}C$. The molar mass of the solute is $60g\text{mol}^{-1}$. Calculate the molal depression constnat for water. If the solution is cooled to $-1^{\circ}C$. How much of ice would separate ?

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22. If V_1mL of C_1 solution $+V_2mL$ of C_2 solution are mixed together then calculate final concentration of solution and final osmotic pressure. If initial osmotic pressure of two solutions are π_1 and π_2 respectively?

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23. A solution contains $68.4gms$ of cane sugar $(C_{12}H_{22}O_{11})$ in $1000gms$ of water. Calculate the following for this solution (a) Vapour pressure: (b) Osmotic pressure at $20^{\circ}C$, (c) Freezing point, (d) Boiling point. [density of the solution $=1.024gmcm^{-3}$, vapour pressure of water $=17.54mm$, latent heat of fusion $=80\text{cal}cm^{-1}$]`

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24. $10gm$ of solute A and $20gm$ of solute B both are dissolved in $500ml$. Of water. The solution ha the same osmotic pressure as $6.67gm$ of A of B are dissolved in the same volume of water at the same temperature. What is the ratio of molar masses of A and B.

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25. At $27^\circ C, a1.2\,\%$ solution $(wt.\,/\mathrm{vol.})$ of glucose is isotonic with $4.0g/\mathrm{litre}$ of urea solution. Find the molar mass of urea, if the molar mass of glucose is 180. Also report the osmotic pressure of solution if $100mL$ of each are mixed at $27^\circ C$. ($R = 0.082L$ atm $\mathrm{mol}^{-1}K^{-1}$, Molar mass of glucose $= 180g/\mathrm{mole}$)

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EXERCISE-2(PART-2)

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. $30mL$

B. $333mL$

C. $750mL$

D. $1000mL$

Answer: C

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

A. $48.4M$

B. $0.0207M$

C. $0.0484M$

D. $0.303M$

Answer: D

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3. When KCl dissolves in water (assume endothermic dissolution), then:

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

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

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

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

Answer: C

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4. 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 enrgy released in breaking up solute-solute and solvent solvent interactions.

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

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

Answer: A

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5. A sample of air is saturated with benezed (vapour pressure = 100 mm Hg at 298 K,750 mmHg 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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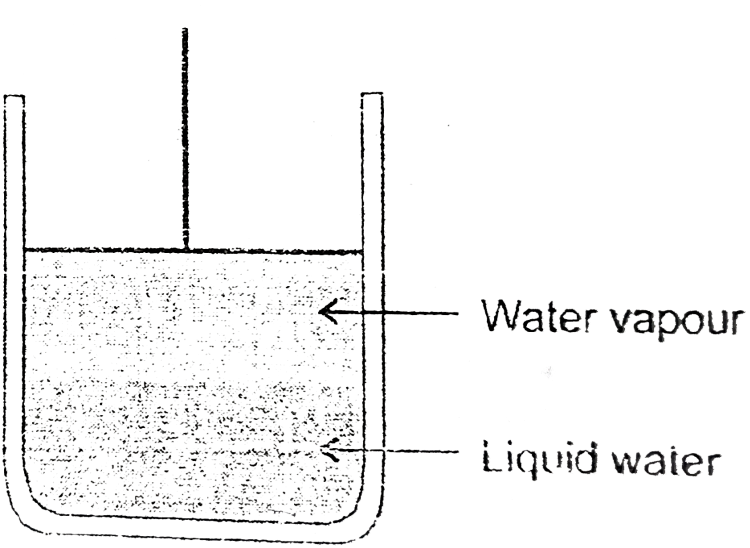
6. The vapour pressure of water at $20^{\circ}C$ is $17.54mmHg$. What will be the vapour pressure of the water in the apparatus shown after the piston is lowered, decreasing the volume of the gas above the liquid to one half of

its initial volume (assume temperature is constant).



A. $8.77 mmHg$

B. $17.54 mmHg$

C. $35.08 mmHg$

D. between 8.77 and $17.54 mmHg$

Answer: B

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7. Water and chlorobenzene are immiscible liquids. Their mixture boils at $89^\circ C$ under a redued pressure of $7.7 \times 10^4 Pa$. The vapour pressure of pure water at $89^\circ C$ is $7 \times 10^4 Pa$. Weight per ccent of chlorobenzene in the distillate is :

A. 50

B. 60

C. 78.3

D. 38.46

Answer: D

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8. If two liquids $A\left(P_A^\circ = 100 \text{ torr}\right)$ and $B\left(P_B^\circ = 200 \text{ torr}\right)$ are completely immiscible with each other, each one will behave independently of the other, are present in a closed vessel. The total vapour pressure of the system will be:

A. less than 100 torr

B. greater than 200 torr

C. between 100 to 200 torr

D. 300 torr

Answer: D

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9. The vapor pressures of benzenen, toluene and a xylene are 75 Torr, 22 Torr and 10 Torr respectively at $20^{\circ}C$ Which of the following is not a possible value of the vapor pressure of an equimolar binarytemary solution of these at $20^{\circ}C$? 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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10. 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 $\lim_{x_A \to 1}(p_A)$ is :

A. $250mm$

B. $140mm$

C. $260mm$

D. $20mm$

Answer: C

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11. The plots of $\frac{1}{X_A} vs. \frac{1}{Y_A}$ (where X_A and Y_A are the mole fraction of liquid A in liquid and vapour phase respectively) is linear with slope and intercept respctively are given as:

A. $\frac{P_A^\circ}{P_B^\circ}$ and $\frac{\left(P_A^\circ - P_B^\circ\right)}{P_B^\circ}$

B. $\frac{P_A^\circ}{P_B^\circ}$ and $\frac{\left(P_B^\circ - P_A^\circ\right)}{P_B^\circ}$

C. $\frac{P_B^\circ}{P_A^\circ}$ and $\frac{\left(P_A^\circ - P_B^\circ\right)}{P_B^\circ}$

D. $\frac{P_B^\circ}{P_A^\circ}$ and $\frac{\left(P_B^\circ - P_A^\circ\right)}{P_B^\circ}$

Answer: B

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12. 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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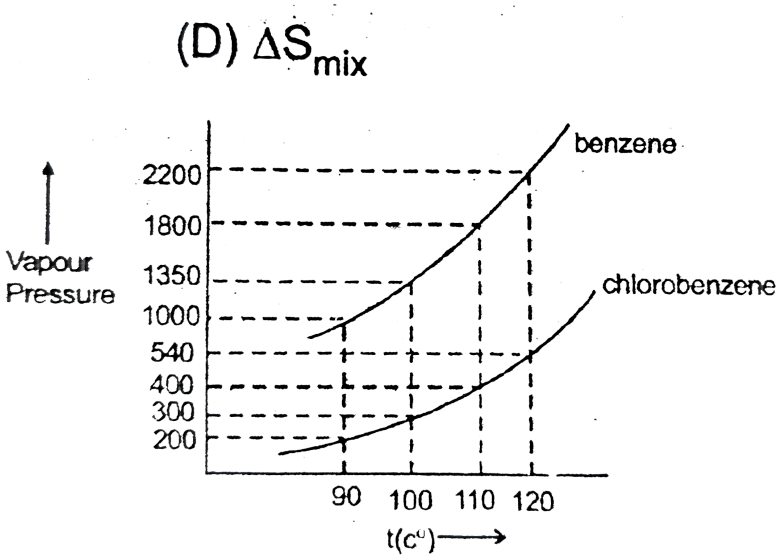
13. Assuming the formation of an ideal solution, determine the boiling point of a mixture containing $1560g$ benzene (molar mass $= 78$) and $1125g$ chlorobenzene (molar mass $= 112.5$) using the following against an external pressure of 1000 Torr.



A. $90^\circ C$

B. $100^\circ C$

C. $110^\circ C$

D. $120^\circ C$

Answer: B

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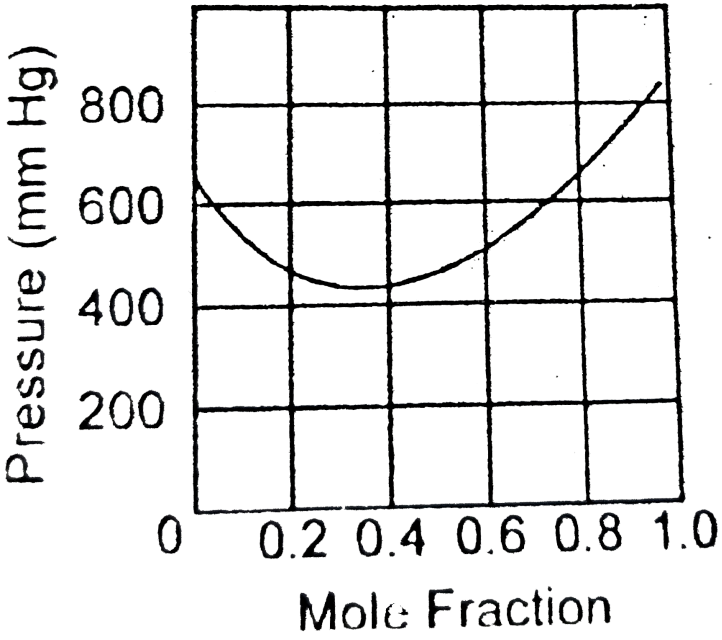
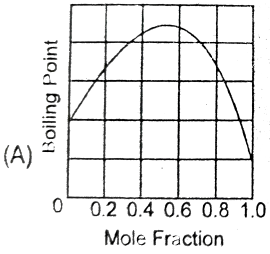
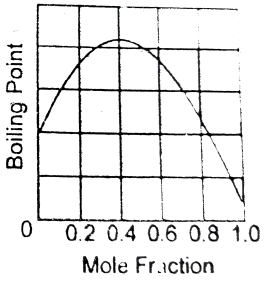
14. Given $P - x$ curve for a non-ideal liquid mixture (Fig.). Identify the correct $T - x$ curve for the same mixture.


Pressure (mm Hg)
800
600
400
200
0
0.2 0.4 0.6 0.8 1.0
Mole Fraction

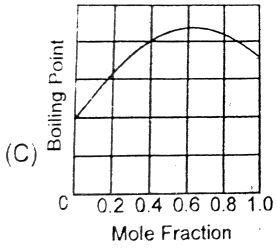
A.


(A)
Boiling Point
0
0.2 0.4 0.6 0.8 1.0
Mole Fraction

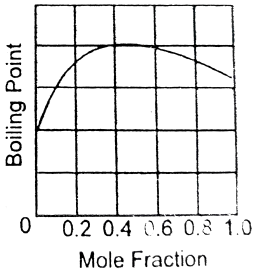
B.


Boiling Point
0
0.2 0.4 0.6 0.8 1.0
Mole Fraction

C.



D.



Answer: B

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15. 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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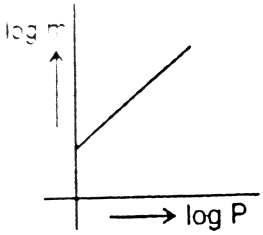
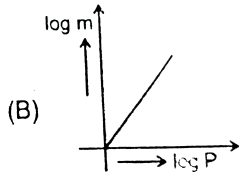
16. Which of the following curves represents the Henry's law ?

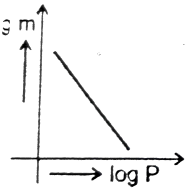
A.



B.

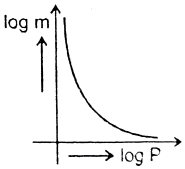


(C)



C.

(D)



D.

Answer: A

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17. According to Henry's law, the solubility of a gas in a given volume of liquid increases with increases in :

A. temperature

B. Pressure

C. Both (A) and (B)

D. None of these

Answer: B

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18. The degree of dissociation of an electrolyte is α and its van't Hoff factor is i. The number of ions obtained by complete dissociation of 1 molecules of the electrolyte is :

A. $\frac{i+\alpha-1}{\alpha}$

B. $i-\alpha-1$

C. $\frac{1-1}{\alpha}$

D. $\frac{1+1+\alpha}{1-\alpha}$

Answer: A

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19. 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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20. The relative decreases in the vapour pressure of an aqueous solution containing $2mol[Cu(NH_3\_(3)Cl]$ 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: C

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21. In the following aqueous solutions

(A) $1m$ surcose (B) $1m$ potassium ferricyanide (C) $1m$ potassium sulphate

maximum value of vapour pressure of solution is that of:

A. A

B. B

C. C

D. equal

Answer: A

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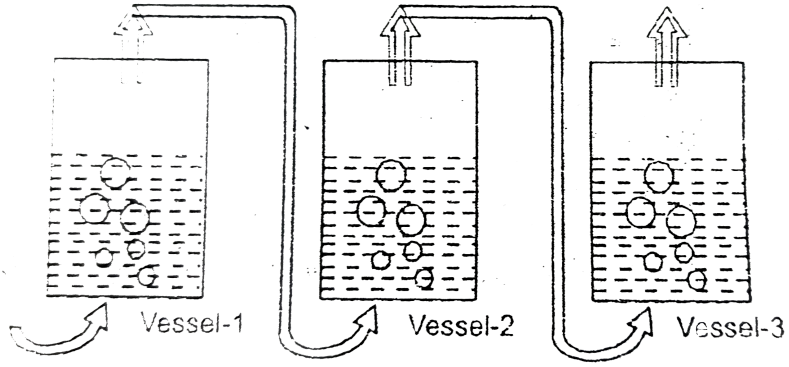
22. Dry air is slowly passed through three solutions of different concentrations, C_1, C_2 and C_3, each containing (non-volatile) $NaCl$ as solute and water as solvent, as shown in the Fig. If the vessel 2 gains weight and the vesel 3 loses weight then:

(D) equal



A. $c_1 > c_2$

B. $c_1 < c_2$

C. $c_1 < c_3$

D. $c_2 > c_3$

Answer: B::D

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23. 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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24. A solute $'S'$ undergoe a reversibel trimerization when dissolved in a certain solvent. The boiling point elevation of its 0.1 molal solution was found to be identical to the boiling point elevation in case of a 0.08 molal

solution of a solute which neither undergoes association nor dissociation. To what percent had the solute $'S'$ undergone trimerization?

A. $30\ \%$

B. $40\ \%$

C. $50\ \%$

D. $60\ \%$

Answer: A

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25. When only a little quantity of $HgCl_2$ is added to excess $Kl(aq)$ 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 remain same

B. Its boiling point is lowered

C. Its vapour pressure become lower

D. Its boiling point is raised

Answer: B

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

A. $290K$

B. $285.5K$

C. $267.42K$

D. $250K$

Answer: C

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

A. 0.37^0 to 0.555^0

B. 0.185^0 to 0.93^0

C. 0.56^0 to 0.93^0

D. 0.37^0 to 093^0

Answer: A

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28. For a solution of $0.849g$ of mercurous chloride in $50g$ of $HgCl_2(l)$ the freezing point depression is $1.24^\circ C$. K_f for $HgCl_2$ is 34.3. What is the state of mercurous chloride in $HgCl_2$? $(Hg - 200, CI - 35.5)$

A. as Hg_2Cl_2 molecules

B. as $HgCl$ molecules

C. as Hg^+ and Cl^- ions

D. as Hg_2^{2+} andCl^- ions

Answer: A

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

A. Vaporisation of a pure solvent

B. Vaporisation of solvent from a solution containing nonvolatile and nonelectrolytic solute in it

C. Vaporisation of solvent from a solution containing nonvolatile but electrolytic solute in it

D. Entropy change will be same in all the above cases

Answer: A

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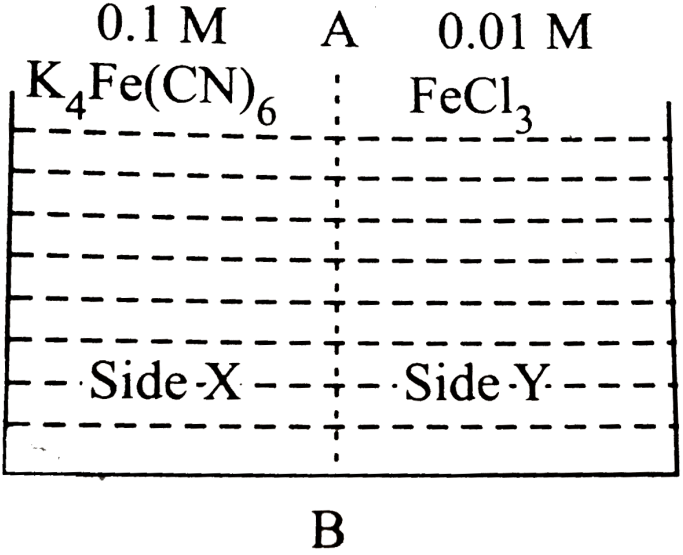
30. $FeCl_3$ on reaction with $K_4[Fe(CN)_6]$ in aqueous solution gives blue colour. These are separated by a semi-permeable membrane AB as shown. Due to osmosis, there is



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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31. 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. $21.8mL$ and $18.2mL$

B. $18.2mL$ and $21.8mL$

C. $20mL$ and $20mL$

D. $17.1mL$ and $22.9mL$

Answer: B

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32. The osmotic pressure of blood is 7.40 atm at $27^{\circ} C$.The number of mol of glucose to be used per litre for an intravenous injection that is to have the same osmotic pressure as blood is

A. 0.3

B. 0.2

C. 0.1

D. 0.4

Answer: A

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33. Which of the following is/are correct for an ideal binary solution of two volatile liquids (eg. Benzene $\&$ toluene)?

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

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

C. The P_T (ie. The total pressure) above the solution will be the sum of the vapor 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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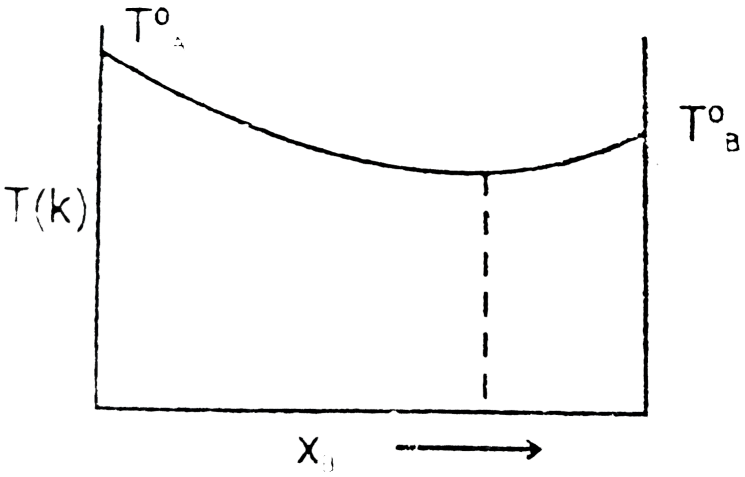
34. The diagram given below represents boiling point composition diagram of solution of component A and B, which is/are incorrect

among the following?



A. The solution shows negative deviation

B. $A-B-$ interactions are stronger than $A-A$ and $B-B$

C. K_H has temperature dependence

D. K_H increases with temperature

Answer: A::B::C

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35. 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-solvent system

B. Higher is the value K_H, lower is soubility of gas for a given partial pressure of gas

C. K_H has temperature dependence

D. K_H increase with temperature.

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

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36. 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. none

Answer: A::B::C

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37. A graph plotted between $\dfrac{P}{d} vs d$ (where p is osmotic pressure of solution of a solute of mol. Wt. m and d is its density temperature T. Pick out the correct statements about the plots :

A. $\left[\dfrac{P}{d}\right]_{d\to 0} = \dfrac{ST}{m}$

B. The intercept of the plot $\dfrac{ST}{m}$

C. The intercept of the plot $= \left[\dfrac{P}{d}\right]_{d\to 0}$

D. $\left[\dfrac{P}{d}\right]_{d\to 0}$ is independent of temperature

Answer: A::B::C

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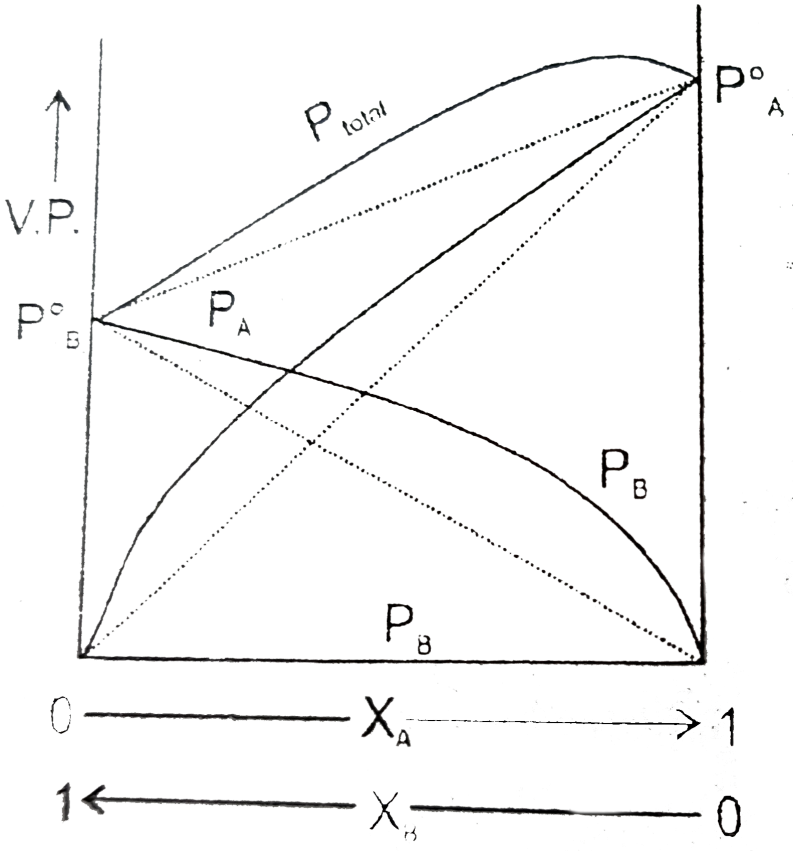
EXERCISE-2(PART-4)

1. Answer the question (given below) which are based on the following diagra.



Consider some facts about the above phase diagram :

Vapour pressure diagram for real solutions of two liquids A and B that

exhibit a positive deviation from Raoult's law. The vapour pressure of both A and B are greater than predicted by Raoult's law. The dashed lines lines represented the plots for ideal solutions.

A: This is observed when $A...B$ attraction are greater than average of $A...B$ and $B...B$ attraction:

B: $\Delta H_{\text{mix}} = +ve, \Delta V_{\text{mix}} = +ve$

C: Boiling point is smaller than expected such that vaporisation is increased

D: Mixture is called azeotropic mixture

Select correct facts

A. A,B,C

B. B,C,D

C. A,C,D

D. A,B,C,D

Answer: B

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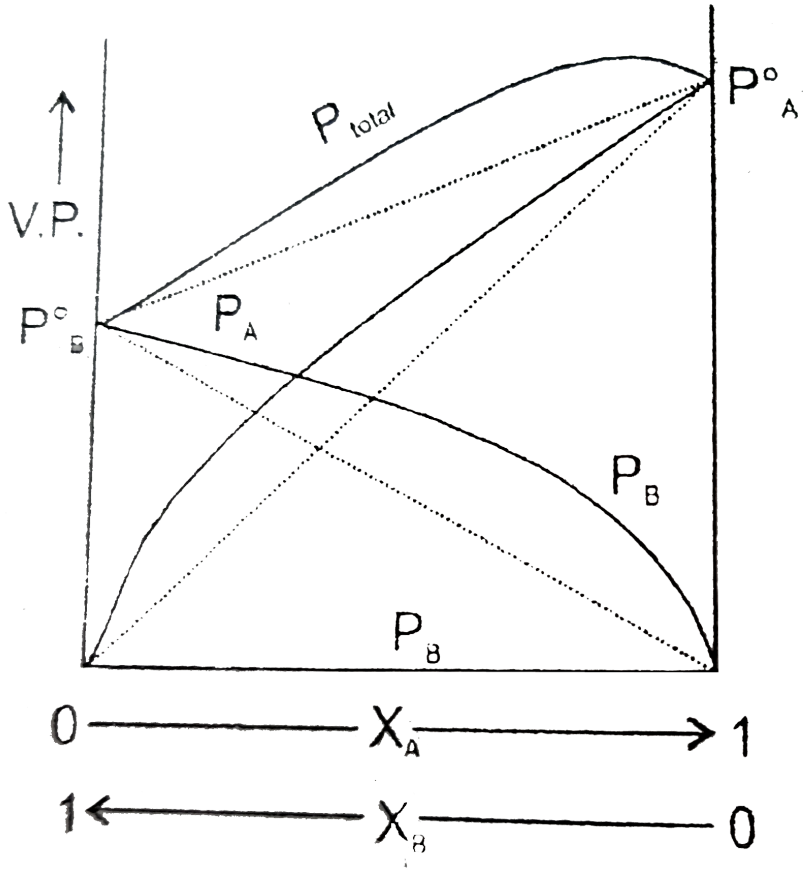
2. Answer the question (given below) which are based on the following



diagra.

Consider some facts about the above phase diagram :

Vapour pressure diagram for real solutions of two liquids A and B that exhibit a positive deviation from Raoult's law. The vapour pressure of both A and B are greater than predicted by Raoult's law. The dashed lines lines represented the plots for ideal solutions.

Total vapour pressure of mixture of 1 mol of volatile component

$A\left(P_A^\circ = 100mmHg\right)$ and 3 mol of volatile component $B\left(P_B^\circ = 60mmHg\right)$ is $75mm$. For such case:

A. There is positive deviation from Raoult's law

B. Boiling point has been lowered

C. Force of attraction between A and B is smaller than that between A and A or between B and B.

D. All the above statements are correct.

Answer: D

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3. Addition of non-volatile solute to a solvent always inceases the colligative properties such as osmotic pressure, ΔP, ΔT_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 $0.1NNaCl$, $0.1N$ urea, $0.1NNa_2SO_4$

and $0.1NNa_3PO_4$ 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. 2,3,4

B. 2,4

C. 1,2,3

D. 3,4

Answer: B

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4. Addition of non-volatile solute to a solvent always inceases the colligative properties such as osmotic pressure, ΔP, ΔT_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 $0.1NNaCl$, $0.1N$ urea, $0.1NNa_2SO_4$ and $0.1NNa_3PO_4$ solution at $27^\circ C$, the correct statement are :

$1g$ mixture of glucose and urea present in $250mL$ 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 $0.5K\text{molality}^{-1}$

(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. 1,2,3

B. 1,2,3,5

C. 2,4,5

D. 1,4,5

Answer: A

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EXERCISE-3(PART-1)

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

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

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

III. Only solute molecules solidify at the freezing point.

IV. Only solvent molecules solidify at the freezing point.

A. I,II

B. II,III

C. I,IV

D. I,II,III.

Answer: C

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2. The van't Hoff factor for $0.1MBa(NO_3)_2$ 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. To $500cm^3$ of water, $3 \times 10^{-3}kg$ of acetic acid is added. If $23\,\%$ of axcetic acid is dissociated wha will be the depression in freezing point? K_f and density of water are $1.86Kkg^{-1}mol^{-1}$ and $0.997gcm^{-3}$ respectively.

A. $0.186K$

B. $0.228K$

C. $0.372K$

D. $0.556K$

Answer: B

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4. 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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5. A $0.004M$ solution of Na_2SO_4 is isotonic with a $0.010M$ solution of glucose at same temperature. The apparent degree of dissociation of Na_2SO_4 is

A. $25\ \%$

B. $50\ \%$

C. $75\ \%$

D. $85\ \%$

Answer: C

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6. $1.22g$ of benzoic acid is dissolved in acetone and benzene separately. Boiling point of mixture with acetone increase by $0.17^\circ C$ and boiling point of mixture with benzene increases by $0.13^\circ C$.

$K_b(\text{acetone}) = 1.7 Kg\text{mol}^{-1}$,

Mass of acetone $= 100g$,

$K_b(\text{benzene}) = 2.6 kKgmol^{-1}$,

Mass of benzene $= 100g$,

Find molecular weight of benzoic acid in acetone and in benzene solution. Justify your answer with structure.

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

A. 0.16

B. 0.05

C. 0.1

D. 0.2

Answer: A

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8. When $20g$ of naphtholic 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'f Hoff factor (i) is

A. 0.5

B. 1

C. 2

D. 3

Answer: A

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9. 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 its examples 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. Thus moel fraction of ethanol in the mixture is 0.9.

Given: Freezing point depression constant of water

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

Freezing point depression constant of ethanol

$\left(K_f^{\text{ethanol}}\right) = 2.0Kkgmol^{-1}$

Boiling point elevation constant of water

$\left(K_b^{\text{water}}\right) = 0.52Kkgmol^{-1}$

Boiling point elevation constant of ethanol

$\left(K_b^{\text{ethanol}}\right) = 1.2Kkgmol^{-1}$

Standard freezing point of water $= 273K$

Standard freezing point of ethanol $= 155.7K$

Standard boiling point of water $= 373K$

Standard boiling point of ethanol $= 351.5K$

vapour pressure of pure water $= 32.8mmHg$

Vapour pressure of pure ethanol $= 40mmHg$

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

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

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

The freezing point of the solution M is :

A. $368.7K$

B. $268.5K$

C. $234.2K$

D. $150.9K$

Answer: D

Watch Video Solution

10. 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

$\left(K_f^{water} = 1.86Kkgmol^{-1}\right)$

Freezing point depression constant to ethanol

$\left(K_f^{ethanol}\right) = 2.0Kkgmol^{-1}\right)$

Boiling point elevation constant of water

$\left(K_b^{water}\right) = 0.52Kkgmol^{-1}\right)$

Boiling point elevation constant of ethanol

$\left(K_b^{ethanol}\right) = 1.2Kkgmol^{-1}\right)$

Standard freezing point of water = $273K$

Standard freezing point of ethanol = $155.7K$

Standard boiling point of water = $373K$

Standard boiling point of ethanol = $351.5K$

Vapour pressure of pure water =$32.8mmHg$

Vapour pressure of pure ethanol =$40mmHg$

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

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

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

Water is added to the solution M such that the mole fraction of water in the solution becomes 0.9. The boiling point of this solution is

A. $39.3mmHg$

B. $36.0mmHg$

C. $29.5mmHg$

D. $28.8mmHg$

Answer: B

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11. 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

$\left(K_f^{water} = 1.86Kkgmol^{-1}\right)$

Freezing point depression constant to ethanol

$\left(K_f^{ethanol}\right) = 2.0Kkgmol^{-1}\right)$

Boiling point elevation constant of water

$\left(K_b^{water}\right) = 0.52Kkgmol^{-1}\right)$

Boiling point elevation constant of ethanol

$\left(K_b^{ethanol}\right) = 1.2Kkgmol^{-1}\right)$

Standard freezing point of water = $273K$

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Vapour pressure of pure water =$32.8mmHg$

Vapour pressure of pure ethanol =$40mmHg$

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

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

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

Water is added to the solution M such that the mole fraction of water in the 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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12. Properties such as boiling point, freezing point and vapour pressure of a pure solvent change when solution molecules ae added to get homogeneous solution. These are called colligative properties. Application 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 of water $\left(K_f^{\text{water}}\right) = 1.86 Kkg\text{mol}^{-1}$

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

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

Boiling point elevation constant of ethanol $\left(K_b^{\text{ethanol}} = 1.2 Kkg\text{mol}^{-1}\right.$

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Stadndard boiling point of ethanol $= 351.5K$

Vapour pressure of pure water $= 32.8 mmHg$

Vapour pressure of pure ethanol $= 40 mmHg$

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

Molecular weight of ethanol $= 46 g \text{mol}^{-1}$

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

the Henry's law constant for the solubility of N_2 gas in water jat $298 K$ is 1.0×10^5 atm. The mole fraction of N_2 in air 0.8. The number of moles of N_2 from air dissoved in 10 moles of water of $298 K$ and 5 atm 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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13. Properties such as boiling point, freezing point and vapour pressure of a pure solvent change when solution molecules ae added to get homogeneous solution. These are called colligative properties. Application 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 of water $\left(K_f^{\text{water}}\right) = 1.86 Kkg\text{mol}^{-1}$

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

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

Boiling point elevation constant of ethanol $\left(K_b^{\text{ethanol}} = 1.2 Kkg\text{mol}^{-1}\right.$

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

Molecular weight of ethanol $= 46g\text{mol}^{-1}$

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

The freezing point (in $.^{\circ}C$) of a solution containing $0.1g$ of $K_3\left[Fe(CN)_6\right]$ (Mol. Wt. 329) in $100g$ of water $\left(K_f = 1.86Kkg\text{mol}^{-1}\right.$ is :

A. -2.3×10^{-2}

B. -5.7×10^{-5}

C. -5.7×10^{-3}

D. -1.2×10^{-2}

Answer: A

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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 its examples 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. Thus moel fraction of ethanol in the mixture is 0.9.

Given: Freezing point depression constant of water

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

Freezing point depression constant of ethanol

$\left(K_f^{\text{ethanol}}\right) = 2.0 K kgmol^{-1}$

Boiling point elevation constant of water

$\left(K_b^{\text{water}}\right) = 0.52 K kgmol^{-1}$

Boiling point elevation constant of ethanol

$\left(K_b^{\text{ethanol}}\right) = 1.2 K kgmol^{-1}$

Standard freezing point of water $= 273K$

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Standard boiling point of water $= 373K$

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vapour pressure of pure water $= 32.8 mmHg$

Vapour pressure of pure ethanol $= 40mmHg$

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

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

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

The vapour pressure of the solution M is:

A. 724

B. 740

C. 736

D. 718

Answer: A

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EXERCISE-3(PART-2)

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

A. $0.001M$

B. $0.001M$

C. $0.02M$

D. $0.1M$.

Answer: B

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

A. $0.01MNa_2SO_4$

B. $0.01MKNO_3$

C. $0.015M$ urea

D. $0.015M$glucose

Answer: A

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3. Equimolar 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 freezing points

Answer: C

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4. Two solutions of a substances (non electrolyte) are mixed in the following manner. 480 ml of $1.5M$ first solution $+520mL$ of $1.2M$ second solution. What is the molarity of the final mixture?

A. $1.20M$

B. $1.50M$

C. $1.344M$

D. $2.70M$

Answer: C

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5. Benzene and toluene form nearly ideal solution. 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 $20^{\circ}C$ for a solution containing 78g 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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6. If α is the degree of dissociation of na_2SO_4 the vant of Hoff's factor (i) used for calculating the molecular mass is-

A. $1 + \alpha$

B. $1 - \alpha$

C. $1 + \alpha$

D. $1 - 2\alpha$.

Answer: C

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7. 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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8. 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. 700

B. 360

C. 350

D. 300

Answer: C

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9. 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 $1.0 g cm^{-3}$, molar mass of the substance will be:

A. $105.0 g \text{mol}^{-1}$

B. $210.0 g \text{mol}^{-1}$

C. $90.0 g \text{mol}^{-1}$

D. $15.0 g \text{mol}^{-1}$

Answer: B

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10. The vapour pressure of water at 20° is $17.5 mm Hg$. If $18g$ of glucose $(C_6H_{12}O_6)$ is added to $178.2g$ of water at $20^\circ C$, 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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11. At $80^\circ C$ 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 $80^\circ C$ 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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12. 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 in non-ideal, showing $-ve$ deviationfrom Raoult's Law.

C. n-heptane shows $+ve$ deviation while ethanol shows $-ve$ deviation from Raoult's Law.

D. The solution formed is an ideal solution.

Answer: A

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13. Two liquids X and Y from an ideal solution at $300K$, Vapour pressure of the Solution containing 1mol of X and 3mol of Y is 550mmHg . At the same temperature, if 1 mol of Y is further added to this solution ,vapour pressur of the solutions increases by 100mmHg 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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14. 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 0.01mole of sodium sulphate is dissoved in 1 kg of water,is $\left(K_f = 1.86 K kgmol^{-1}\right)$

A. $0.0372K$

B. $0.0558K$

C. $0.0744K$

D. $0.0186K$

Answer: B

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15. 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 kPa 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. $72.0kPa$

B. 36.1kPA`

C. $96.2kPa$

D. $144.5kPa$

Answer: A

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16. K_f for water is $1.86Kkgmol^{-1}$. IF your automobile radiator holds $1.0kg$ 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. $72g$

B. $93g$

C. $39g$

D. $27g$

Answer: B

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EXERCISE-3(PART-3)

1. The solubility of $Ba(OH)_2.8H_2O$ in water at $288K$ is $5.6g$ per $100g$ of water. What is the molality hydroxide ions in saturated solution of $Ba(OH)_2.8H_2O$ at $288K$? [At. Mass of $Ba = 137, O = 16, H = 1$)

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2. A decimolar solution of potassium ferrocyanide is $50\,\%$ dissociated at $300K$. Calculate osmotic pressure of the solution. (Given $S = 8.341JK^{-1}mol^{-1}$)

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3. Define an ideal solution.

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4. Explain with a suitable diagram and appropriate examples why some non-ideal solutions show postive deviation from ideal behaviour.

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5. What is meant by abnormal molecular mass of solute? Discuss the factors which bring abnormallty in experimentally determined molecular masses of solutes using colligative properties.

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6. With the help a neat diagram indicate why the solution of a non-volatile solute should freeze at a temperature lower than the freezing

point of the pure solvent.

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7. Draw a suitable diagram to express the relationship for ideal solutions of A and B between vapour pressure and mole fractions of components at constant temperature

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8. Calculate the number of moles of methanol in 5 litres in its $2m$ solution, if the density of the solution $0.981 kgL^{-1}$ (molar mass of methanol $= 32 g\text{mol}^{-1}$)

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9. How is relative lowering of vapour pressure defined for a solution consisting of volatile solvent and non-volatile solute ? How is this

function related to the mole fraction of the solvent and of the solute?

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10. An aqueous solution of sodium chloride freezes below 273 K. Explain the lowering in freezing points of water with the help of a suitable diagram. 1

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11. 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 $5.1Kkgmol^{-1}$. Calculate the atomic mass of A and B.

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12. Why is the elevation in $b.\ p.\ of water d \Leftrightarrow erent \in the follow \in g solutions ? (i)0.1molar$NaCl $solution.\ (ii)$0.1` molar sugar solution

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13. $10ml$ of liquid A was mixed with $10ml$ of liquid B. The volume of the resulting solution was found to be `19.9ml what do you conclude?

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14. Two liquids A and B boil at $130^\circ C$ and $160^\circ C$, respectively. Which of the them has higher vapour pressure at $80^\circ C$.

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15. Of 0.1 molal solutions of glucose and sodium chloride respectively. Which one will have a higher boiling point?

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16. (a) Why is the vapour pressure of a solution of glucose in water lower than that of water ?

(b) A $6.90M$ solution of KOH in water contains $30\,\%$ by mass of KOH. Calculate the density of the KOH solution. [Molar mass of $KOH = 56g\text{mol}^{-1}$]

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17. Define osmotic pressure.

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18. State the condition resulting in reverse osmosis.

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19. (a) The depression in freezing point of water observed for the same molar concentration of acetic acid trichloroacetic acid and trifluoroacetic acid increases in the order as stated above. Explain.

(b) Calculate the depression in freezing point of water when $20.0g$ of $CH_3CH_2CHCICOOH$ is added to $500g$ of water. [Given: $K_a = 1.4 \times 10^{-3}, K_l = 1.86 K kg \text{mol}^{-11}$]

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

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21. The freezing point of a solution containing of $0.2g$ of acetic acid in $20.0g$ of benzene is lowered $0.45^\circ C$. Calculate.

(i) the molar mass of acetic acid from this data

(ii) Van't Hoff factor

[For benzene, $K_f = 5.12 K kg \text{mol}^{-1}$]

What conclusion can you draw from the value of Van't Hoff factor obtained ?

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22. (a) Define the following terms:

(i) Mole fraction (ii) Van't Hoff factor

(b) $100mg$ of a protein is dissolved in enough water to make $10.0mL$ of a solution. If this solution has an osmotic pressure of $13.3mmHg$ at $25^\circ C$, what is the molar mass of protein?

$\left(R = 0.821 L \text{atom mol}^{-1} K^{-1} \text{and} 760 mmHg = 1 \text{ atm.}\right)$

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23. (a) What is meant by: (i) Colligative properties (ii)Molality of a solution (b) What concentration of nitrogen should be present in a glass of water at room temperature? Assume a temperature of $25^{\circ}C$, a total pressure of 1 atmosphere and mole fraction of nitrogen in air of 0.678. [K_H for nitrogen $= 8.42 \times 10^{-7} M/mmHg$]

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24. Non-ideal solutions exhibit either positive or negative deviation from Raoult's law. What are these deviations and why are they caused? Explain with one example for each type.

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25. A solution prepared by dissolving $1.25g$ of oil of winter green (methyl sallicylate) in $99.0g$ of benzene has a boiling point of $80.31^{\circ}C$. Determine the molar mass of this compound. ($B.P.$ of pure benzene $= 80.10^{\circ}C$ and K_b for benzene $= 2.53^{\circ}Ckg\text{mol}.1$)

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26. (a) Differentiate between molarity and molality for a solution. How does a change in temperature influence their values ?

(b) Calculate the freezing point of an aqueous solution containing $10.50g$ of $MgBr_2$ in $200g$ of water. (Molar mass of $MgBr_2 = 184g$) (K_f for waer $= 1.86Kkg\text{mol}^{-1}$)

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27. (a) Define the terms osmosis and osmotic pressure. Is the osmotic pressure of a solution a colligative property? Explain.

(b) Calculate the boiling point of a solution prepared by adding $15.00g$ of $NaCl$ to $250.0g$ of water. (K_b for water $= 0.512Kkg\text{mol}^{-1}$, Molar mass of $NaCl = 58.44g$)

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28. A 1.00 molal aqueous solution of trichloroacetic acid $(\mathbb{C}l_3COOH)$ is heated to its boiling point. The solution has the boiling point of $100.18^\circ C$. Determine the van't Hoff factor for trichloroacetic acid.

(K_b for water $= 0.512 Kkg\text{mol}^{-1}$)

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29. Define the following terms:

(i) Mole fraction (ii) Isotonic sclutions (iii) Van,t Hoff factor (iv) Ideal solution

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30. Calculate the amount of KCl which must be added to $1kg$ of water so that the freezing point is depressed by $2K$. (K_f for water $= 1.86 Kkg\text{mol}^{-1}$).

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Advabced Level Problems (PART-1)

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

A. $3p \pm$

B. $6p \pm$

C. $3000p \pm$

D. $330p \pm$

Answer: A

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2. Available are $1L$ of $0.1MNaCl$ and $2L$ of $0.2MCaCl_2$ solutions. Using only these two solutions what maximum volume of a solution can be prepared having $\left[Cl^-\right] = 0.34M$ exactly. Both electrolytes are strong

A. $2.5L$

B. $2.4L$

C. $2.3L$

D. None of these

Answer: A

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

A. 0.46

B. 0.36

C. 0.20

D. 0.40

Answer: C

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4. 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 increases in pressure and decrease in temperature

D. decreases with increases in pressure and increase in temperature

Answer: C

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5. Colligative properties have many pracitical uses, some of them may be:

I: Melting of snow by slat

II: Desalination of sea water

III: Desalination of sea water

III: Determination of molar mass

IV: Determination of melting point and boiling point of solvent

Actual practical uses are :

A. I,II

B. III,IV

C. I,II,III

D. II,III,IV

Answer: C

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6. Select correct statement(s):

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

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

C. Both (A) and (B)

D. None of the above

Answer: C

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7. 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. $K_{43}[PtCl_5]$

D. $K[PtCl_3]$

Answer: B

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

A. $PtCl_4$ reacts with KCl

B. aq. $ZnCl_2$ reacts with at. NH_3

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

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

Answer: B

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9. 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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10. Consider which can be expressed is degree (temperature) are

A. III,IV

B. I,II

C. I,II,III

D. I,III

Answer: C

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11. Elevation in $b.p.$ of an aqueous urea solution is 0.52°, $\left(K_b = 0.622^{\circ}\,\mathrm{mol}^{-1}kg\right)$ 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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12. Insulin $(C_2H_{10}O_5)_n$ is dissolved in a suitable solvent and the osmotic pressure (π) of solutions of various concentrations $\left(g/cm^3\right)C$ is measured at $20^{\circ}C$. The slope of a plot of π against C is found to be 4.65×10^{-3}. The molecular weight of insulin is:

A. 4.8×10^5

B. 9×10^5

C. 293×10^3

D. 8.314×10^5

Answer: C

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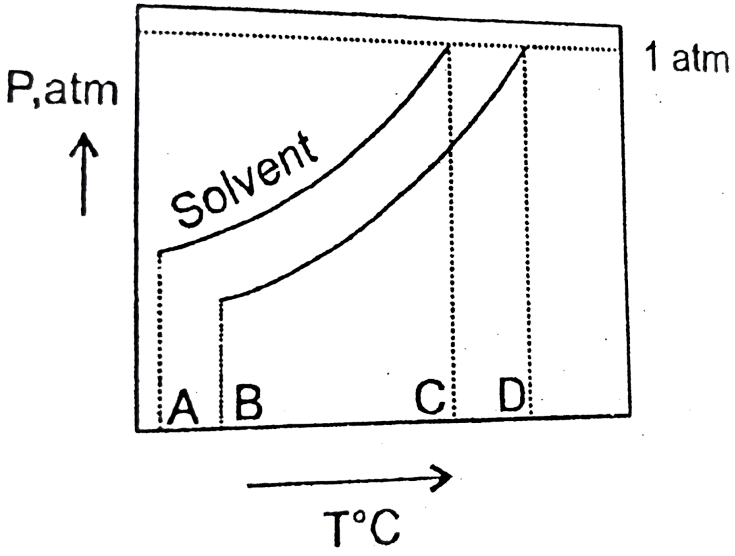
13. What is the normal boiling point of the solution represented by the phase diagram ?



A. A

B. B

C. C

D. D

Answer: D

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14. Select correct statement ?

A. Heats orf vaporisation for a pure solvent and for a solution are similar because similar intermolecular forces between solvent molecules must be overcome in both case.

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 statements

Answer: D

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15. Ratio at $\Delta T_b / K_b$ of $6\,\% AB_2$ and $9\,\% A_2B(AB_2$ and A_(2)B $\perp harenon - e \leq c \to lytes)is1$ "mol"//kg $\in \perp hcases. Hence, a \to micmassesof$A and B` are respectivly :

A. $60, 90$

B. $40, 40$

C. $40, 10$

D. $10, 40$

Answer: C

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16. 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 the above

Answer: B

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

A. $-1.58^\circ C$

B. $-1.86^\circ C$

C. $-3.16^\circ C$

D. $1.86^\circ C$

Answer: B

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18. Mole fraction of a non-electrolyte in aqueous solution is 0.07. If K_f is $1.86^\circ \text{mol}^{-1}kg$, depression if $f.p.$, ΔT_f, is:

A. 0.26°

B. 1.86°

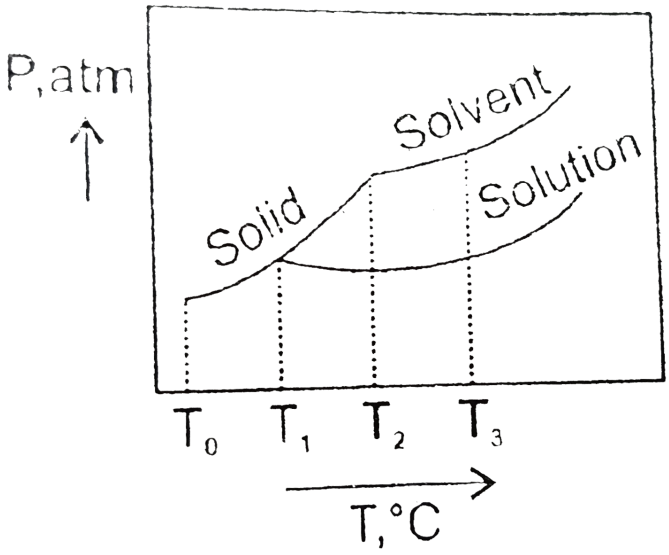
C. 0.13°

D. 7.78°

Answer: D

Watch Video Solution

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



A. T_1

B. T_2

C. T_3

D. T_0

Answer: A

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20. Select correct staement :

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

B. Heats of fusion of solution and solvent are similar since similar forces of 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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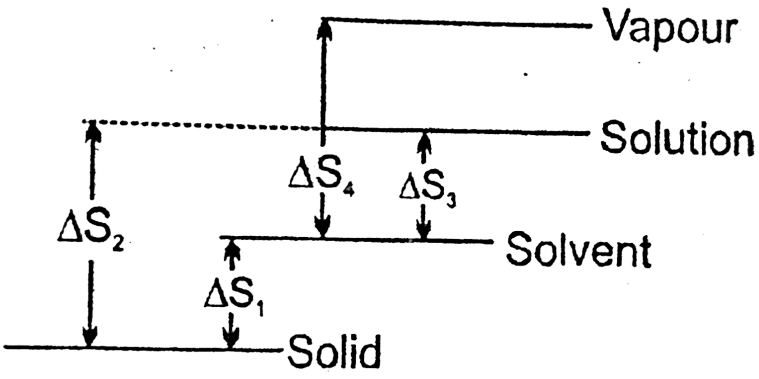
21. Some entropy change are represented infigure. Select correct entropy change.



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

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

C. $\Delta S_1, \Delta S_2, \Delta_3, \Delta S_4$

D. ΔS_2 and ΔS_4

Answer: C

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22. Total vapour pressure of mixture of 1 mol of volatile component $A(P_{A^\circ} = 100mmHg)$ and 3 mol of volatile component $B\left(P_{B^\circ = 60mmHg}\right.$ is $75mm$. 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 maller than that between A and A between B and B

D. All the above statements are correct.

Answer: D

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23. Water and chlorobenzene are immiscible liquids. Their mixture boils at $89^\circ C$ under a redued pressure of $7.7 \times 10^4 Pa$. The vapour pressure of pure water at $89^\circ C$ is $7 \times 10^4 Pa$. Weight per ccent of chlorobenzene in the distillate is :

A. 50

B. 60

C. 70

D. 80

Answer: C

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24. Relative decrease in vapour pressure of an aqueous $NaCl$ is 0.167. Number of moles of $NaCl$ present in $180g$ of H_2O is:

A. 2 mol

B. 1 mol

C. 3 mol

D. 4 mol

Answer: B

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25. 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 mass greater than the solvent

Answer: B

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

A. arrangement of atoms in solute molecule

B. total number of molecular of solute and solvent

C. number of molecules of solute in solution

D. mass of the solute molecules

Answer: C

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27. Which has maximum freezing point?

A. $6g$ urea solution in $100gH_2O$

B. $6g$ acetic acid solution in $100gH_2O$

C. $6g$ sodium chloride in $100gH_2O$

D. All have equal freezing point

Answer: A

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28. Van't Hoff factors of aqueous solutions of X,Y and Z are 2.8,1.8 and 3.5 respectively. Which of the following statement(s) is (are) correct?

a.$BP: X < Y < Z$

b.$FP: Z < X < Y$

c.Osmotic pressure,X=Y=Z

d.$VP: Y < X < Z$

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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29. Select correct statement :

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 equimolal hydrogen chloride solution

C. $1M$ glucose solution and $0.5MNaCl$ solution are isotonic at a given temperature

D. All are coorect statements

Answer: D

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30. The vapour pressure of a pure liquid A is $40mmHg$ at $310K$. The vapour pressure of this liquid in a solution with liquid B is $32mmHg$. The 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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31. The mole fraction of toluene in the vapour phase which is in equilibrium with a solution of benzene $\left(P_B^\circ = 120\text{torr}\right)$ and toluene $\left(P_T^\circ = 80\text{torr}\right)$ having $2.0mol$ of each, is

A. 0.50

B. 0.25

C. 0.60

D. 0.40

Answer: D

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32. The vapour pressure of pure benzene, C_6H_6 at $50^\circ C$ is 268 T or $r.Howmanymo \leq sofnon - volati \leq solutepermolofbenze \neq isre \in gavapourpressureof$ 167T or rat50^(@)C` ?

A. 0.377

B. 0.605

C. 0.623

D. 0.395

Answer: A

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33. 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 positive deviation from Raoult's low

C. shows ideal behaviour

D. is saturated

Answer: B

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34. 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

A. 2

B. 3

C. 3.2

D. 4.2

Answer: B

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

A. $60\ \%$

B. $50\ \%$

C. $100\ \%$

D. $40\ \%$

Answer: C

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36. 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_3COCH_3

B. CS_2 and CH_3COCH_3

C. CH_3CH_2OH and CH_3COCH_3

D. CH_3 and CS_2

Answer: C

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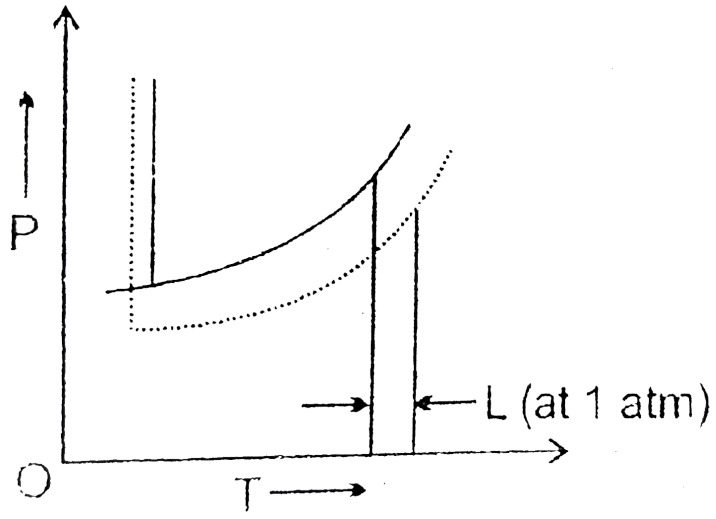
37. The phase diagrams for the pure solvent (solid lines) and the solution (non-volatile solute, dashed line) are recorded below:



The quantity indicated by L in the figue is :

A. ΔP

B. ΔT_f

C. $K_b m$

D. $K_f m$

Answer: C

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38. The total concentration of dissolved particles in side red blood cells is approximately $0.30M$ and the membrane surrounding the cells is semipermeable. What would be the atmosheric pressure in atm inside the cells become if the cells were removed from blood plasma and placed in pure water at $298K$. Also what would happen to red blood cells?

A. 7.34 atm

B. 1.78 atm

C. 2.34 atm

D. 0.74 atm

Answer: A

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39. 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 relative to that of pure solvent

Answer: A

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40. Vapour pressure of CCL_4 at $25^\circ C$ is 143 mmHg 0.05g of a non-volatile solute (mol.wt.=65)is dissolved in $100 ml CCL_4$. find the vapour pressure of the solution (density of $CCL_4 = 158 g/cm^2$)

A. $141.9 mmHg$

B. $94.4 mmHg$

C. $-1.86^\circ C$

D. $0.93^\circ C$

Answer: A

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41. $A0.50$ 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?

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42. The depression of freezing points of 0.05 molal aqueous solution of the following compounds are measured.

1. NaCl2. K_(2)SO_(4)3. C_(6)H_(12)O_(6)4. Al_(2)(SO_(4))_(3)`

Which one of the above compounds will exhibit the maximum depression of freezing point ?

A. 3

B. 2

C. 4

D. 1

Answer: C

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

A. Decimolar $Al_2(SO_4)_3$

B. $Decimolar$BaCl_(2)`

C. $Decimolar$Na_(2)SO_(4)`

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

Answer: A

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44. 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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45. 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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46. 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 dissolution may be

B. Water is a polar molecule

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

D. Liquid water is denser than ice

Answer: C

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47. 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 boiling point but different freezing point

B. Different

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

D. None of the above

Answer: C

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48. The melting points 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 denser than water

B. Pressure generates heat

C. The bonds break undr pressure

D. Ice is not a true solid

Answer: A

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49. For an ideal binary liquid solutions with $P_A^\circ > P_B^\circ$, which relation between X_A (mole fraction of A in liquid phase) and Y_A (mole fraction of A in vapour phase) is correct:

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 and Y_B cannot be correlated

Answer: C

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50. 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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51. 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

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

A. Potential energy

B. Total energy

C. Kinetic energy

D. Intermolecular forces

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53. On the basic intermolecular force predict the correct order of decreasing bolling point of the compound ?

A. $CH_3OH > H_2 > CH_4$

B. $CH_3OH > CH_4 > H_2$

C. $CH_4 > CH_3OH > H_2$

D. $H_2 > CH_4 > CH_3OH$

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54. 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

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

A. Acetone-chloroform

B. Benzene-methanol

C. Watersolute, solid solute

D. Liquid solute, solid solvent

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56. 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)gtP_(2)gtP_(3)~

B. $P_3 > P_1 > P_3$

C. $P_2 > P_1 > P_3$

D. P_(2)gtP_(3)gtP_(1)`

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57. Calculate the amount of ice that will separate out on cooling containing $50g$of ethylene glycol in $200g$ of water to $-9.3^{\circ}C\left(K_f\right.$ for water =$1.86Kmol^{-1}kg$)

A. $38.71g$

B. $38.71mg$

C. $42g$

D. $42mg$

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

A. The volume of mixing is zero

B. The enthalpy of mixing is zero

C. The energy of mixing is zero

D. The enthalpy of mixing is negative

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59. 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 $3K_f$ for $3\text{mol}:^{-1}$ solution

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60. At $35^\circ C$, the vapour pressure of CS_2 is $512 mm Hg$. And of acetone 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 pressure of $600 mm Hg$. Which of the following statements is//are correct ?

A. A mixture of $100 mL$ of acetone and $100 mL$ of CS_2 has a volume of $200 mL$

B. When acetone and CS_2 are mixed at $35^\circ C$, heat must be absorbed in order to produce a solution at $35^\circ C$

C. Process of mixing is exothermic

D. Entropy of mixing is zero

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61. Which of the following concentration factors can be calculated if the mole fraction and density of an aqueous solution of HCl are known ?

A. Molality

B. Molarity

C. Percent by mass

D. Normality

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62. Consider following solutions :

I: $1M$ aqueous glucose solution II: $1M$ aqueous sodium chloride solution

III: $1M$ aqueous ammonium phosphate solution IV: $1M$ benzoic acid in benzene

Select correct statements for the above solutions :

A. All are isotonic solutions

B. III is hypertonic of I,II and IV

C. IV is hypotonic of I,II and III

D. II is hypotonic of III but hypertonic of I and IV

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63. 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

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64. At $40^{\circ}C$, vapour pressure in Torr of methanol nd 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

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65. 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 benzenen decreases by the addition of napththalene

D. Boiling point of pure benzene increases by the addition of toluene

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66. The vapour pressure of a dilute solution of a solute is influenced by :

A. Temperature of solution

B. Mole fraction of solute

C. M.Pt. of solute

D. Degree of dissociation of solute

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67. 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 solidity at the freezing point

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68. Which of the following statements are correct for van't Hoff factor $'i'$ for a solution of weak electrolyte A_xB_y?

A. $o = 1 - a + Xa + Ya$

B. $i > 1$ at normal dilution

C. i increases more rapidly with dilution and attains a limiting alue of

`(x+y

D. The increaes in $'i'$ with dilution is due to increase in molality of solution with dilution

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69. For a dilute solution having molality m of of a given solute in a solvent of mol.wt.M, $b.pt.T_b$ and heat of vaporisation per mole ΔH: $\left[\left(a\frac{T_b}{am}\right]_{m\to 0}\right.$ is equal to :

A. Molal elevation constant of solvent

B. $\frac{RT_b^2M}{\Delta H_{\text{vap}}}, where$M $\in$ kg DeltaH_("vap") and R $\in$ Jmol^(-1)`

C. $\frac{RT_b^2M}{\Delta S_{\text{vap}}}, where$M $\in$ kg, DeltaS_("vap") and R $\in$ Jmol^(-1)`

D. $\frac{RT_{B^2M}}{1000\Delta H_{\text{vap}}}$, where M in g, R and ΔH_{vap} expressed in same unit of heat.

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70. Which facts are true when we use van't Hoff equation $PV = CST$ for osmotic pressure P of dilute solutions ?

A. The quation is identical to that of ideal gas equation

B. The solute particles in solution are analogous to the gas molecules and the solvent is analogous to the empty space between the gas molecules

C. Solute molecules are dipersed in the solvent the way the gas molecules are diperesed in empty space

D. The equation is not identical to that of ideal gas equation

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71. Sodium choride or calcium chloride is used to clear snow from the roads. Why?

A. Antifreeze mixture of $CaCl_2 +$ water $(f.pt. -50^\circ C)$ prefected over $KCl +$ water $(f.pt. -10^\circ C)$

B. The low freezing point of aq. $CaCl_2$ solution is due to its van't Hoff factor $i = 3$.

C. The use of antifreeze for salt solutions causes major problems of corrosion of steel car bodies and reinfcerecement bars in conncreate road strucntures.

D. More is the amount of slat spreaded on road, easier is melting of ice.

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Advabced Level Problems (PART-2)

1. A solution of $2.8g$ of Cdl_2 molar mass $= 364g\text{mol}^{-1}$) in $20g$ water has elevation in boiling point of 0.20^0. What is molecular state of Cdl_2 in aqueous solution ? $\left[K_b(H_2O) = 0.52^0\text{mol}^{-1}kg\right]$

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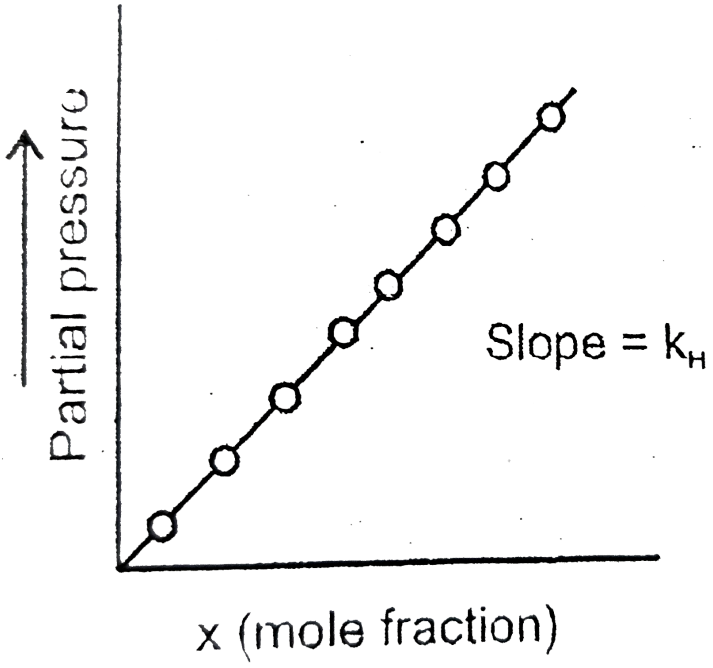
2. Figure explains elevation in boiling point when a non-volatile solute is added to a solvent. Provide a thermodynamic explanation of the elevation in boiling point.



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3. It is found that elevation in boiling point of a given aq. $NaCl$ solution is equal to depression in freezing point of 0.25 molal aq. Na_2CO_3 solution. If $K_f = 1.86^\circ \text{mol}^{-1} kg$, calculate molality of $NaCl$ solution, assume complete ionisation of $NaCl$ and Na_2CO_3 in aqueous solution.

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4. There are two solutions each at $27^\circ C$

Solution A: contains $6g$ urea in $200mL$ solution

Solution B: contains $6g$ acetic acid in $100mL$ solution.

(i) Are they equimolar ? (ii) Are they isotonic ?

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5. How many grams of $NaBr$ must be added to $270g$ of water to lower the vapour pressure by $3.125mmHg$ at which vapour pressure of water is

$50mmHg(Na = 23, Br = 80)$? Assume $100\,\%$ ionisation of $NaBr$.

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6. 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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7. The vapour pressure of pure liquid A at $300K$ is 577 Torr and that of pure liquid B is 390 Torr. These two compounds form ideal liquid and gaseous mixtures. Consider the equilibrium composition of a mixture in which the mole fraction of A in the vapour is 0.35. Calculate the total pressure of the vapour and the composition of the liquid mixture.

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8. Phenol (C_6H_5OH) 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 $-0.93^\circ C.$

$K_l(H_2O) = 1.86^\circ \text{mol}^{-1}kg$

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9. Following are equimolal ($=$ f equimolar) aqueous solutions

(A) $1mglu\cos e$

(B) $1mNaCl$ (C) $1mBaCl_2$

(D) $1mNa_3PO_4$ (E) $1m$ benzoic acid.

assume $100\,\%$ ionisation in B, C, D and $100\,\%$ dimer formation in E arrange them in increasing (1) boiling point, (2) freezing point, (3) osmotic pressure, (4) vapour pressure.\

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10. The freezing point depression of $0.001mK_x$ $\left[Fe(CN)_6\right]$ is $7.10 \times 10^{-3}K$. Determine the value of x. Given, $K_f = 1.86Kkg\text{mol}^{-1}$ for water.

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11. The vapour pressure above a solution of $50g$ acetic acid $(H_2H_3O_2$~ $\in$ 100.0g H_(2)O (P_(H_(2)O^(0)=23.756T or $rat25$^(0)C)$was23.40$T$ or r and $\in$ 100.0g C_(6)H_(6) (P_(C_(6)H_(6)^(0)=72.5T or $rat25$^(0)C) $was70.0T$ or $r.\ As\sum \in g$HC_(2)H_(3)O_(2) $\rightarrow benon - volati \leq, usethesedate \rightarrow discusthe\int ermo \leq c\underline{a}rbond \in g$ HC_(2)H_(3)O_(2)~.

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12. 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. $\left(K_f\right.$ for water $\left. = 1.86km^{-1}\right)$

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13. A certain solution of $1m$ benzoic acid in benzene has a freezing point of $3.1^\circ C$ and a normal boiling point of $82.6^\circ C$. The freezing point of benzene is $5.5^\circ C$. And its boiling point is $80.1^\circ C$. Analyze the state of the solute (benzoic acid) at two temperature and comment .

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14. An aqueous solution containing 288gm of a non-volatile compound having the stochiometric composition $\mathrm{C_XH_{2X}O_X}$ in 90gm water boils at $101.24^\circ\,\mathrm{C}$ at 1.00 atmospheric pressure. What is the molecular formula?

$\mathrm{K_b(H_2O)} = 0.512\ \ \mathrm{K\,mol^{-1}kg}\quad \mathrm{T_b(H_2O)} = 100^\circ\,\mathrm{C}$

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15. The freezing point of an aqueous solution of KCN containing $0.1892 molkg^{-1}$ was $-0.704^\circ C$. On adding 0.45 mole of $Hg(CN)_2$, the

freezing point of the solution was $= 0.620^{\circ} C$. If whole of $Hg(CN)_2$ is used in complex formation according to the equation,

$Hg(CN)_2 + mKCN \rightarrow K_m\left[Hg(CN)_{m+2}\right]$

what is the formula of the complex ? Assume $\left[Hg(CN)_{m+2}\right]^{m-}$ is not ionised and the complex molecule is $100\,\%$ ionised. $\left(K_f(H_2O)\right.$ is $\left.1.86 kgmol^{-1}K.\right)$

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16. Sea water is found to contain $5.85\,\% NaCI$ and$9.50\,\% MgCI_2$ by weight of solution. Calculate its normal boiling point assuming $80\,\%$ ionisation for $NaCI$ and $50\,\%$ ionisation of $MgCI\left[K_b(H_2O) = 0.51 kgmol^{-1}K\right]$

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17. Calculate the boiling point of water at $700 mm$ pressure of Hg. The heat of vaporisation of water is $540 cal'g$.

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18. Vapour pressure of C_6H_6 and C_7H_8 mixture at $50^\circ C$ is given by $P(mmHg) = 179X_B + 92$, where X_R is the mole fraction of C_6H_6. A solution is prepared by mixing 936g benzene and 736g toluene and if the vapours over this solution are removed and condensed into liquid and again brought to the temperature of $50^\circ C$. what would be mole fraction of C_6H_6 in the vapour state?

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19. An aqueous solution of glucose boils at $100.01^\circ C$.The molal elevation constant for water is $0.5kmol^{-1}kg$. The number of molecules of glucose in the solution containing $100g$ of water is

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20. Match the boiling point with K_b for x, y and z, if molecular weight of x, y and z are same.

	$b.\ pt$	k_b
x	100	0.68
y	27	0.53
z	253	0.98

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21. Pure benzenen boils at $180^\circ C$. If latent heat of vaporization of benzenen is 90cal per g, calculate the molecular weight of solute.

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22. $2g$ of benzoic acid dissolved in $25g$ of C_6H_6. Shows a depression in freezing point equal to $1.62K$. Molal depression constant of C_6H_6 is $4.9Kkg\text{mol}^{-1}$. What is the percentage association of acid if it forms double molecules in solution?

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23. Calculate the osmotic pressure $0.2\,\%$ (wt.//vol) of anhydrous $CaCl_2$ solution at $27^\circ C$ assuming $90\,\%$ ionisation of $CaCl_2$. Also report the temperature at which this solution will boil and freeze if K_b and K_f for water are 0.51 and $1.86K$ molality $\hat{}\ (-1)$. If vapour pressure of water at $27^\circ C$ is $24mm$, find out the vapour pressure of his solution. Assume molarity and molality same.

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24. What will be the osmotic pressure of $0.1M$ monobasic acid its pH is 2 at $25^\circ C$?

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25. A complex is represented as $CoCl_3Xnh_3$. Its 0.1 molal solution in water $\Delta T_f = 0.588K$. K_f for H_2O is $1.86K$ molality^{-1}. Assuming

$100\,\%$ ionisation of complex and co $-$ ordination number of Co is six calculate formula of complex.

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26. xg of $NaCl$ ($M = 58.5$) put in a dry flask and water was added with continous strring to produce exactly $1L$ solution having a molality of 2.00 . Find x using the data below: ltbr. Weight $\%\, NaCl$

Weight $\%\, NaCl0101214$ ltbr. Density of solution in g/mL 1.0591 1.0742 1.0895 1.1049`

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27. Two liquids A and B are miscible over the whole range of composition and may be treated as ideal (obeying Raoult's law.) At $350K$ the vapour pressure of pure A is $24.0kPa$ and of pure B is $12.0kPa$. A mixture of $60\,\%$ A and $40\,\%$ B is distilled at this temperature, what is the pressure in a closed distillation apparatus from which air is exclued ? A small

amount of the distillate is collected and and redistilled at $350K$ What is the composition

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28. A solution containing 0.1 mol of naphthalene and 0.9 mol of benzene is cooled out until some benzene freezes out. The solution is then decanted off from the solid and warmed upto $353K$ where its vapour pressure was found to be $670mm$. The freezing point and boiling point of benzene are $278.5K$ and $353K$ respectively, and its enthalpy of fusion is $10.67KJ\text{mol}^{-1}$. Calculate the temperature to which the solution was cooled originally and the amount of benzene that must have frozen out. Assume ideal behaviour.

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29. A very small amount of a non-volatile solute (that does not dissociate) is dissolved in $56.8cm^3$ of benzene (density $0.889gcm^3$). At room temperature, vapour pressure of this solution is $98.88mmHg$ while that

of benzene is $100mmHg$. Find the molality of this solution. If the freezing temperature of this solution is 0.73 degree lower than that of benzene, what is the value of molal the freezing point depression constant of benzene?

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30. The composition of vapour over a binary ideal solution is determined by the composition of the liquid. If X_A and Y_A are the mole fractions of A in the liquid and vapour, respectively, find the value of X_A for which $Y_A - X_A$ has a maximum. What is the value of the pressure at this composition in terms of P_A° and P_B°.

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31. The following is a table of the vapour pressure of pure benzene and chlorobenzene. Determine the boiling point of a mixture containing 40 mole per cent of benzene and 60 mole per cent of chlorobenzene at a

pressure of $1000 mmHg$.

$t_{\circ} C$	90	100	110	120	13
Vapor pressure of benzene$(mmHg)$	1013	1340	1744	2235	29
Vapour pressure of chlorobenzenen$(mmHg)$	208	293	403	542	76

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32. Benzene and toluenen form nearly ideal solutions. At $300K$, $P^{\circ}_{\text{toluene}} = 30 mmHg$ and $P^{\circ}_{\text{benzene}} = 100 mmHg$. A liquid mixture is composed of 3 mol of toluene and 2 mol of benzene.

(a) If the pressure over the mixture at $300K$ is reduced. At what pressure does the first vapor form ?

(b) What is the composition of the first trace of vapor formed ?

(c) If the pressure is reduced further, at what pressure does the last trace of liquid disappear ?

(d) What is the composition of the last trace of liquid ?

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33. In the production of quinoline this compound is isolated from the reaction mixture by steam distillation. Calculate (a) at what temperature the mixture of water and quinoline will boil under a pressure of $740, mmHg$. (b) What is the maximum number of grams of quinoline which can be distilled with $1000g$ water vapour under this pressure.

The temperature dependence of vapour pressure.

The temprature dependence of vapour pressure of water and quionoline is given as follows :

t°C	$P_1°$ (mm Hg)	$P_2°$ (mm Hg)
98.0	707.27	7.62
98.5	720.15	7.80
99.0	733.24	7.97
99.5	746.52	8.15
100.0	760.00	8.35

Molecular weight of quinoline $= 129$

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34. A stream of air is bubbled slowly through liquid benzene in a flask at $20.0^\circ C$ against an ambient pressure of $100.56kPa$. After the passage of

$4.80L$ of air, measured at $20.0^\circ C$ and $100.56kPa$ before it contains benzonb vapor, it is found that $1.705g$ of benzene have been evaporated. Assuming that the air saturated benzene vapor when it leaves the flask. Calculate the equilibrium vapor pressure of the benzene at $20.0^\circ C$.

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35. What is van't Hoff factor in each of the following cases?

(A) Aq. K_(4)[Fe(CN)_(6)]$whichis20\% \in osed(B)$PCl_(5)$whichis50\%$ $dissociated(C)Benzoicacidwhichf$ or ms dim $er \to theextentsof$ 50%` in benzene

(D) Glucose solution

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Others

1. For the coagulation of $200mL$ of As_2S_3 solution $10mL$ of $1MNaCl$ is required. What is the coagulationg value (number of milimoles of solute needed for coagulation of 1 litre of solution) of $NaCl$.

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2. Artificial rain is made by spraying salt over clouds, why ?

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3. Give reason why a finely divided substance is more effective as an adsorbents?

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4. What do you understend by activation of adsorbent? How is it achieved ?

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5. Disuss the effect of pressure and temperature on the adsorption of gases on solides.

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6. What is demulsification ? Name two demulsifiers.

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7. When a graph is plotted between log x/m and log p, it is striaght line with an angle 45° and intercept 0.3010 on y-axis. If initial pressure is 0.3 atm, what will be the amount of gas adsorbed per gm of adsorbent?

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8. Why is ester hydrolysis slow in the beginning and becomes faster after some time?

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9. What is the difference between multimolecular and macromolecular collids ? Give one example of each . How are associated colloids different from these two types of colloids ?

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10. Explain what is observed

(i) when a beam of light is passed through a colloidal sol.

(ii) and electrolyte, NaCI is added to hydrated ferric oxide sol.

(iii) electric curret is passed through a colloidal sol.

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11. Why is adsorption always exothermic ?

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12. What is the main difference between physisorpton and chemisorption ?

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13. What are the factors which influence the adsorption of a gas on a solid ?

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14. What is an adsorption isotherm ?

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15. What do you understend by activation of adsorbent? How is it achieved ?

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16. Which will be adsorbed more readily on the surface of charcoal and why– NH_3 or CO_2?

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17. In an Adsorption experiment a graph between log x/m versus log P was found to be linear with a slope of 45° the intercept of the log x/m was found to be 0.3010. Calculate the amount of gas adsorbed per gm of charcoal under a pressure of 0.6 bar.

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18. $1g$ charcoal is placed in $100mL$ of $0.5MCH_3COOH$ to form an adsorbed mono-layer of acetic acid molecule and thereby the molarity of CH_3COOH reduces to 0.49. Calculate the surface area of charcoal adsorbed by each molecule of acetic acid. Surface are of charocal $= 3.01 \times 10^2 m^2/g$.

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19. What role does adsorption play in heterogeneous catalysis ?

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20. How many grams of gas would be adsobed per gram of a substance at 8 atm by assuming Freundlich adsorption isotherm.

$\frac{x}{m} = kp^{1/n}$

and $k = 10^{-2} atm^{-1/3}$ & $n = 3$

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21. A $1cm \times 1cm$ square paper coated with a suitable adsorbent on both sides. The paper is dipped in a aqueous solution of glucose of volume 20 mL and concentration 20 ppm. Final concentration glucose was dropped to 19 ppm due to adsorption. Find the number of glucose particles per unit area of the paper.

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22. $10mg$ of an adsorbate gets adsorbed on a surface. This cause the release of $3J$ of heat constant pressure and at $27^\circ C$. $[\text{Molar mass of adsorbate} = 100g/mol]$.

(i) Find ΔH_{AD}

(ii) Argue whether the adsorption is physical or chemical?

(iii) If 20 mg of adsorbate is adsorbed a temperature T_0. Then compare T_0 and $27^\circ C$.

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23. Give two examples of hetergeneous catalysis.

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24. Identify the correct order of steps in heterogeneous catalysis.

(i) Adsorption of reactant molecules on the surface of the catalyst.

(ii) Diffusion of reactant to the surface of the catalyst.

(iii) Formation of reactions product on the catalyst surface.

(iv) Diffusion of reactions product from the catalyst surface.

(v) Formation of activated intermediate.

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25. How are the colloidal solutions classified on the the basis of physical states of the dispersed phase and dispersion medium ?

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26. Explain the following terms with suitable examples.

(a) Gel (b) Liquid Aerosol (b) Hydrosol

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27. What is the difference between multimolecular and macromolecular collids ? Give one example of each . How are associated colloids different from these two types of colloids ?

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28. Give one example each of multimolecular and macro-molecular colloids.

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29. Describe a method each for the preparation of sols of sulphur and platinum in water

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30. Explain the following terms :

(i)Peptization (ii)Loyphobic colloids (iii)Dialysis

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31. Why the sun looks red at the time of setting ?

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32. Why is osmotic pressure of a colloidal solution less than that of true solution?

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33. Which one of the following electrolytes is most effective for the coagulation of $Fe(OH)_3 sol$ and why?

$NaCl$, Na_2SO_4, Na_3PO_4

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34. What do you understand by "isoelectric point" of a colloid ?

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35. Rivers form delta on meeting with ocean, why ?

Watch Video Solution

36. Artificial rain is made by spraying salt over clouds, why ?

Watch Video Solution

37. Which colloidal sol is administered to a [atient suffereing from arscenic poisoning?

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38. Name two demulsifier.

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39. What is the difference between sols and emulsions.

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40. What is demulsification ?

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41. Which of the following statements about physical adsorption is correct ?

A. It is usually monolayer

B. It is reversible in nature

C. It involves van der Waals interactions between adsorbent and adsorbate

D. It involves samll enthalpy of adsorption as compared to chemisorption

Answer: B::C::D

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42. Which of the following statements about chemisorption is not applicable?

A. It involves chemical forces between adsorbent and adsorbate

B. It is irreversible in nature

C. It involves high heat of adsorption

D. It does not require activation energy

Answer: D

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43. Which of the following statements regarding adsorption is/are correct?

A. Extent of adsorption of gases on charcoal increases with increase in pressure of the gas

B. Extent of adsorption independent of temperature

C. Extent of chemisorption by a given mass of adsorbent is limted

D. Extent of adsorption is dependent on the nature of adsorbent

Answer: A::C::D

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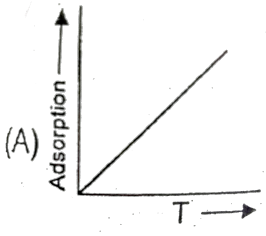
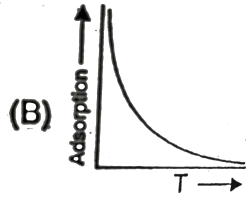
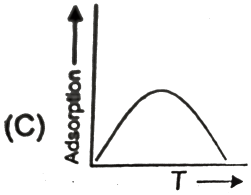
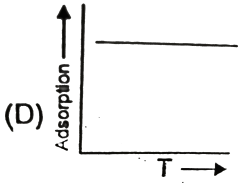
44. Following is the variation of physical adsorption with temperature.

A. 

B. 

C. 

D. 

Answer: B

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45. Adsorption is the phenomenon in which a substance :

A. accumulates on the surface of the other substance

B. goes into the body of the other substance

C. remains close to the other substance

D. none of these

Answer: A

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46. Finely divided catalyst has greater surface area and has greater catalytic activity than the compact solid. If a total surface area of 6291456 cm^2 is required for adsorption in a catalytic gaseous reaction, then how many splits should be made in a cube of exactly 1 cm in length to achieve

required surface area?

[Given : One split of a cube gives eight cubes of same size]

A. 60

B. 80

C. 20

D. 22

Answer: C

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47. Volume of N_2 at 1 atm, 273 K required to form a monolayer on the surface of iron catalyst is $8.15ml/gm$ of the adsorbent. What will be the surface area of the adsorbent per gram if each nitrogen molecule occupies $16 \times 10^{-22}m^2$?

[Take : $N_A = 6 \times 10^{23}$]

A. $16 \times 10^{-16}cm^2$

B. $0.35m^2/g$

C. $39m^2/g$

D. $22400cm^2$

Answer: B

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48. There is desorption of physical adsorption when

A. temperature is increased

B. temperature is decreased

C. pressure is increased

D. concentration is increased

Answer: A

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49. The rate of chemisorption :

A. decreases with increase of pressure

B. increases with increase of pressure

C. is independent of pressure

D. is independent of temperature

Answer: B

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50. Which of the following is not a characteristic of chemisorption?

A. it is irreversible

B. it is specific

C. it is multilayer phenomenon

D. heat of adsorption of about $-400kJ$

Answer: A::B::D

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51. Softening of hard water is done using sodium aluminium silicate (zeolite) . This causes

A. adsorption of Ca^{2+} and Mg^{2+} ions of hard water relpacing Na^{+} ions.

B. adsorption of Ca^{2+} and Mg^{2+} ions of hard water relpacing Al^{3+} ions.

C. both (A) and (B)

D. none of these

Answer: A

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52. Which one is false in the following statement?

A. A catalyst is specific in its action

B. A very small amount of the catalyst alters the rate of a reaction

C. The number of free vacancies on the surface of the catalyst increases on sub-division

D. Ni is used as a catalyst in the manufacture of ammonia

Answer: D

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53. A catalyst increases rate of reaction by

A. Decreasing enthalpy

B. Decreasing internal energy

C. Decreasing activation energy

D. Increasing activation energy

Answer: C

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54. The colloidal solutions of gold prepared by different methods have different colors due to :

A. different diameters of colloidal gold particles

B. variable valency of gold

C. different concentration of gold particles

D. impurities produced by different methods

Answer: A

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55. An example of extrinsic colloid (lyophobic colloids) is :

A. As_2S_3 sol

B. $Fe(OH)_3$ sol

C. Egg albumin

D. Au sol

Answer: A::B::D

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56. Which of the following sols is positively charged?

A. Arsenious sulphide

B. Aluminium hydroxide

C. Ferric hydroxide

D. Silver iodide in silver nitrate solution

Answer: B::C::D

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57. A colloidal solution can be purified by the following method :

A. dialysis

B. peptization

C. filtration

D. oxidation

Answer: A

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58. Peptisation is :

A. conversion of a colloidal into precipitate form

B. conversion of precipitate into colloidal sol

C. conversion of metal into colloidal sol by passage of electric current

D. conversion of colloidal sol into macromolecules

Answer: B

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59. Bleeding is stopped by the application of ferric chloride. This is because

A. the blood starts flowing in opposite direction

B. the blood reacts and forms a solid, which seals the blood vessel

C. the blood is coagulated and thus the blood vessel is sealed

D. the ferric chloride seals the blood vessel

Answer: C

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60. Gold number of a lyophilic sol is such a property that

A. the larger its value, the greater is the peptising power

B. the larger its value, the greater is the protecting power

C. the lower its value, the greater is the protecting power

D. the larger its value, the greater is the peptising power

Answer: C

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61. Protective sols are:

A. Lyophilic colloids - reversible sols

B. lyophobic

C. both (A) and (B)

D. none of (A) and (B)

Answer: A

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62. For the coagulation of $200mL$ of As_2S_3 solution $10mL$ of $1MNaCl$ is required. What is the coagulationg value (number of milimoles of solute needed for coagulation of 1 litre of solution) of $NaCl$.

A. 200

B. 100

C. 50

D. 25

Answer: C

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63. Which of the following ions is most effective in the coagulation of an arsenious suphide solution?

A. K^+

B. Mg^{2+}

C. Al^{3+}

D. C

Answer: C

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64. Which of the following ions is most effective in the coagulation of ferric hydroxide solution?

A. Cl^-

B. Br^-

C. NO_2^-

D. SO_4^{2-}

Answer: D

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65. small liquid droplets dispersed in another liquid is called :

A. Suspension

B. Emulsion

C. Gel

D. True solution

Answer: B

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66. At CMC, the surfactant molecules :

A. Decomposes

B. Become completely soluble

C. Associate

D. Dissociate

Answer: C

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67. Some type of gels like gelatin loose water slowly. The process is known as :

A. Synerisis

B. thixotropy

C. Peptisation

D. Imbibition

Answer: A

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68. Statement-1:All colloidal dispersions give very low osmotic pressure and show very small freezing point depression or boiling point elevation. Statement-2:Tyndall effect is due to scattering of light from the surface of colloidal particles.

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-1

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-2

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: B

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69. Assertion: The Brownian movement is due to the bombardment on colloidal particle by the molecules of dispersion midium which are in the constant motion like molecules in a gas.

Reason: Brownian movement provides a visible proof of the random kinetic motion of molecules in a liquid.

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-2

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-3

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: B

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70. Statement- 1: In the coagulation of negatively charged arsenic sulphide sol, the coagulating power decreases in the order $Al^{3+} > Ba^{2+} > Na^{+}$.

Statement- 2: Generally greater the valency of coagulating ion, the greater is its power of coagulation.

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-3

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-4

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: A

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71. Statement-1:Gold number is the measure of protective powers of different colloids.

Statement-2: The smaller the gold number of lyophilic colloid, the smaller is its protective power.

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-4

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-5

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: C

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72. Assertion: The property of adsorption is shown by solids to a much larger extent than liquids.

Reason: Solids, particularly when finely divided, have a large surface area.

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-5

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-6

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: B

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73. Assertion: A quious gold colloidal solution is red in colour.

Reason: The colour arises due to scattering of light by colloidal gold

particles.

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-6

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-7

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: A

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74. Statement-1:Isoelectric point is pH at which colloidal can move towards either of electrode

Statement-2:At isoelectric point, colloidal solution become electrically neutral

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-7

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-8

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: D

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75. Assertion: A gas with higher critical temperature gets adsorbed to more extent than a gas with lower critical temperature.

Reason: The easily liquefiable gases get adsorbed to more extent which have higher critical temperature.

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-8

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-9

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: B

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76. Statement-1 :When $AgNO_3$ is treated with excess of Kl colloidal particles gets attracted towards anode.

Statement-2 :Colloidal particles adsorb common ions and thus become charged.

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-9

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-10

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: A

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77. Assertion: Colloidal solution exhibit Tyndall effect while true solution particles.

Reason: Because the size of the colloidal particles is large enough to scatter light as compared to size of the true solution particles.

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-10

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-11

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: A

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78. Assertion: Physisorption of molecules occures on surface only.

Reason: in this process, the bonds of the adsorbed molecules are broken.

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-11

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-12

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: C

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79. Assertion: Medicines in the colloidal state are more effective.

Reason: In the colloidal state, the medicine are easily assimilated by the body.

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-12

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-13

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: A

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80. Assertion: Tetraethyl lead minimizes the knocking effect when mixed with petrol.

Reason: Because tetraethyl lead acts as a `-Ve catalyst.

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-13

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-14

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: A

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81. Assertion: In physisorption, adsorption increase with increases in temperature.

Reason: Physisorpation is of exothermic nature.

A. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is correct explanation for STATEMENT-14

B. STATEMENT -1 is true, STATEMENT-2 is true and STATEMENT-2 is not correct explanation for STATEMENT-15

C. STATEMENT-1 is true, STATEMENT-2 is false

D. STATEMENT-1 is false, STATEMENT-2 is true

Answer: D

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82. What happens when gelatin is mixed with gold sol ?

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83. Which of the two, He and Ne, gets adsorbed on the surface of charcoal more readily and why?

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84. Name two industrial processes in which heterogeneous catalysts are employed?

Watch Video Solution

85. Gelatin is generally added to ice creams. Why?

Watch Video Solution

86. How can metallic adsorbent be activated?

Watch Video Solution

87. Account for the following

(i) Curdling of milk (ii) Tail of coments

(iii) Use of potash alum in the purification of water (iv) cleansing action of soap

Watch Video Solution

88. What is fire foam?

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89. Explain what is observed

(a) When an electrolyte NaCl is added to ferric hydroxide sol.

(b) When an emulsion is subjected to centrifugation.

(c) When direct currect is passed through a colloidal sol.

(d) When a beam of light is passes through a colloidal solution.

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90. The pressure of the gas was found to decrease from 720 to 480 mm. When 5g of sample of activated charcoal was kept in a flask of one litre capacity maintained at $27^{\circ}C$. If the density of charcoal is $1.25gm/mL$. The volume of gas adsorbed per gm of charcoal at 480 mm of Hg is :

A. $80.03mL$

B. $32.20mL$

C. $100.08mL$

D. None of these

Answer: C

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91. Coagulation value of the electrolytes $AlCl_3$ and NaCl for As_2S_3 sol are 0.093 and 52 respectively. How many times $AlCl_3$ has greater coagulating power than NaCl?

A. 930

B. 520

C. 560

D. None of these

Answer: C

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92. Graph between $\log x/m$ and $\log p$ is a straight line inclined at an angle of 45°. When pressure is $0.5atm$ and $1nk = 0.693$, the amount of solute adsorbed per gram of adsorbent will be:

A. 1

B. 1.5

C. 0.25

D. 2.5

Answer: A

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93. Which of the following statements is not correct for a lyophobic solution?

A. It can be easily solvated

B. It carries charges

C. The coagulation of this sol is irreversible in nature

D. It is less stable in a solvent

Answer: A

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94. Which of the following statement is correct for a lyophilic solution?

A. It is not easily solvated

B. It is unstable

C. The coagulation of this sol is irreversible in nature

D. It is quite stable in a solvent

Answer: D

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95. Liquid-liquid sol is known as

A. aersol

B. foam

C. emulsion

D. gel

Answer: C

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96. The colloidal system sonsisting of a liquid adsorbate in a solid adsorbent is termed as:

A. aersol

B. foam

C. emulsion

D. gel

Answer: D

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97. Which of the following statement is not correct?

A. A colloidal solution is a heterogeneous two-phase system

B. Silver sol in water is an example of lyophilic solution

C. Metal hydroxides in water are examples of lyophobic solution

D. Liquid-liquid colloidal solution is not a stable system

Answer: B

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98. Size of colloidal particles may range from:

A. 1 to $1000nm$

B. 10 to 100 pm

C. 1 to $100\mu m$

D. 1 to $10mm$

Answer: A

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99. Which of the following represents a multimilecular colloidal particles?

A. Starch

B. A sol of gold

C. Proteins

D. Soaps

Answer: B

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100. Which of the following anions will have minimum flocculation value for the ferric oxide solution?

A. Cl^-

B. Br^-

C. SO_4^{2-}

D. $\left[Fe(CN)_6\right]^{3-}$

Answer: D

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101. Which of the following represents macromolecular colloidal particles?

A. Solution of gold

B. Cellulose

C. Soaps

D. Synthetic detergents

Answer: B

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102. Which of the following statement is not correct?

A. Peptization is the process by which certain substances are converted into the colloidal state.

B. Metal sols of gold, silver and platinum can be prepared by Bredig's arc method.

C. Impurities present in a solution makes it more stable.

D. Dialysis is a process to remove impurities of ions and molecules from a solution.

Answer: C

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103. Select correct statement (s):

A. hydrophilic colloid is a colloid in which there is a strong attraction between the dispersed phase and water

B. hydrophobic colloid is a colloid in which there is a lack of attraction between the dispersed phase and water

C. hydrophobic sols are often formed when a solid crystallises rapidly from a chemical reaction or a supersaturated solution

D. all of the above

Answer: D

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104. A reddish brown sol $\left(\text{containing} Fe^{3+}\right)$ is obtained by:

A. the addition of small amount of $FeCl_3$ solution to freshly prepared $Fe(OH)_3$ precipitate

B. the addition of $Fe(OH)_3$ to freshly prepared $FeCl_3$ solution

C. the addition of NH_4OH to $FeCl_3$ solution dropwise

D. the addition of $NaOH \rightarrow$ FeCl_(3)` solution dropwise

Answer: A

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105. Which is an example of coagulation?

A. Curdling of milk

B. purification of water by addition of alum

C. formation of deltas at the river beds

D. All the three are example of coagulation

Answer: D

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106. Gold of some lyophilic sols are :

I	:	Casein	:	0.01
II	:	Haemoglobin	:	0.03
III	:	Gum arabic	:	0.15
IV	:	Sodium oleate	:	0.40

Which has maximum protective power:

A. I

B. II

C. III

D. IV

Answer: A

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107. Gold number of haemoglobin is 0.03. Hence, $100mL$ of gold sol will require haemoglobin so that gold is not coagulated by $1mL$ of $10\,\%$ NaCl solution:

A. $0.03mg$

B. $30mg$

C. $0.30mg$

D. $3mg$

Answer: C

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108. Which is not a purely surface phenomena:

A. surface tension

B. adsorption

C. absorption

D. none of these

Answer: C

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109. Arsenic (III) sulphide forms a sol with a negative charge. Which of the following ionic substances should be most effective in coagulating the sol?

A. KCl

B. $MgCl_2$

C. $Al_2(SO_4)_3$

D. Na_3PO_4

Answer: C

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110. The stabilisation of a lyophobic colloid due to:

A. perferential adsorption of similar charged particle on colloids surface.

B. the large electro-kinetic potential developed in the colloid.

C. the formation of a covalent bond between two phases.

D. the viscosity of the medium.

Answer: A

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111. Smoke is a dispersion of :

A. gas in gas

B. gas in solid

C. solid in gas

D. liquid in gas

Answer: C

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112. Smoke has generally blue tinge. It is due to:

A. scattering

B. coagukation

C. Brownian motion

D. electro-osmosis

Answer: A

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113. Compared to common colloidal sols milcells have:

A. higher colligative properties

B. lower colligative properties

C. same colligative properties

D. None of these

Answer: B

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114. Which one of the following statements is false for hydrophilic sols?

A. they do not require electrolytes for stability

B. their viscosity is of the order of that of water

C. their surface tension is usually lower than that of dispersion medium.

D. none of these

Answer: B

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115. Which one of the following statement is correct.

A. Brownian movement is more pronounced for smaller particles than for bigger ones

B. Sols of metal sulphides are lyophilic

C. Schulze-Hardy law states, the bigger the size of the ion, the greater is its coagulating power

D. One would expect charcoal to adsorb hydrogen gas more strongly than chlorine

Answer: A

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116. Soaking of water by a sponge is an example of :

A. Simple adsorption

B. Physical adsorption

C. Chemisorption

D. Adsorption

Answer: D

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117. The potential differnce between the fixed particles layer and the diffused layer having opposite charge id called :

A. Water potential

B. Zeta potential

C. Electrode potential

D. None of these

Answer: B

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118. Which one is not the characteristic of chemisorption:

A. Multilayer adsorption

B. Exothermic nature

C. Strong adsorption by adsorption sites

D. Irreversible

Answer: A

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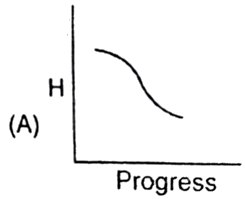
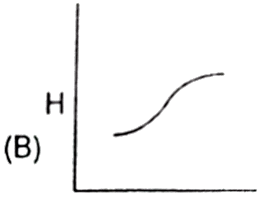
119. Identify the appropriate graph between enthalpy and progress of physical adsorption.

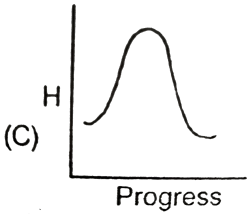
A.



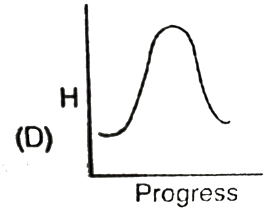
B.



C.



D.



Answer: A

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120. Hydrolysis of ester in catalysed by acid. Rates of hydrolysis of ester were obtained initially and after $50\,\%$ ester has been hydrolused as R_0 and R_{50} then (same temp.)

A. $R_0 = R_{50}$

B. $R_0 < R_{50}$

C. $R_0 > R_{50}$

D. Cannot be determined

Answer: B

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121. The diameter of colloidal particle is of the order

A. $10^{-3}m$

B. $10^{-6}m$

C. $10^{-15}m$

D. $10^{-7}m$

Answer: B::D

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122. Which of the following colloidal solutions contain negatively charged colloidal particles?

A. $Fe(OH)_3$ sol

B. As_2S_3 sol

C. Blood

D. Gold sol

Answer: B::C::D

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123. Which of the following are examples of aerosols?

A. Whipped cream

B. Cloud

C. Fog

D. Soap lather

Answer: B::C

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124. Which of the following statements are true for physisorption ?

A. Extent of adsorption increases with increase in pressure

B. It needs activation energy

C. It can be reversed easily

D. It occurs at high temperature

Answer: A::C

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125. Which of the following are hydrophobic sols?

A. Protein sol

B. Gold sol

C. Gum sol

D. $Fe(OH)_3$ sol

Answer: B::D

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126. If Cl_2 gas is enclosed in presence of powdered charcoal in a closed vessel, the pressure of the gas decreases. It is because :

A. the gas moleciles are adsorbed at the surface

B. the gas molecules concentrate at the surface of the charcoal

C. the gas molecules are adsorbed at the surface

D. the gas molecules are desorbed by the surface

Answer: B::C

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127. When negatively charged colloids like As_2S_3 sol is added to positively charged $Fe(OH)_3$ sol in suitable amounts :

A. Both the sols are precipitated simultaneously

B. This process is called mutual coagulation

C. They becomes positively charged colloids

D. They become negatively charged colloids

Answer: A::B

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128. Which of the following are incorrect statements?

A. Hardy schulz rule is related to coagulation

B. Brownian movement and Tyndall effect are the characteristic of colloids

C. In gel, the liquid is dispersed in liquid

D. Higher the gold number, more is the protective power of lyophillic sols.

Answer: C::D

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129. Which of the following are multimolecular colloids?

A. Sulphur

B. Egg albumin in water (C) Gold sol

C. Gold sol

D. Soap solution

Answer: A::C

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130. The origin of charge on colloidal solution is

A. Self dissociation (in soaps and detergents)

B. Electron capture during Bredig's are method

C. Selective adsorption of ion on their surface

D. It is due to addition of protective colloids

Answer: A::B::C

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131. Which of the following are based on Tyndall effect?

A. Tail of comets

B. Deltas

C. Blue colour of sky

D. Coagulation

Answer: A::C

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132. Comprehension # 1

Many lyophilic sols and few lyophobic sols when coagulated under some special conditions changes into semi rigid mass, enclosing whole amount of liquid within itself, it is called gel and the process is called gelation, Gelatin Agar-agar, gum-Arabic can be converted into gels by cooling them under moderate concentration conditions. Hydrophobic sols like silicic acid. $Al(OH)_3$ are prepared by double decomposition and exchange of solvent method.

Types of Gel :

(i) Elastic gel : Those gel which have elastic properties.

Ex : Gelatin, Strach, Agar-agar etc.

(ii) Non-elastic gel : Those gel which are rigid.

Ex : Silica gel.

Properties of Gel :

1. Syneresis/weeping of gel : The spontaneous liberation of liquid from a gel is called syneresis or weeping of gels. It is reverse of swelling.

Ex : Gelatin, Agar-Agar show syneresis at low concentration while sillicic acid shows it at high concentration.

2. Imbibition or swelling of gel : When gel is kept in a suitable liquid (water) it absorb large volume of liquid. The phenomenon is called imbibition or swelling of gel.

3. Thixotropic : Some gels when shaken to form a sol, on keeping changes into gel are termed as thixotropic gel and phenomenon is called thixotropy.

Ex : Gelatin and silica liquify on shaking changing into corresponding sol and sol on keeping changes back into gel.

Which of the following is used to adsorb water ?

A. Silica gel

B. Calcium acetate

C. Hair gel

D. Cheese

Answer: A

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Ex : Gelatin and silica liquify on shaking changing into corresponding sol and sol on keeping changes back into gel.

The process of imbibing water when elastic gel are placed in water is called :

A. imbibation

B. synerisis

C. coagulation

D. thixotropy

Answer: A

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e.g., gelatin and silica liquify on shaking changing into corresponding sol

and the sol on keeping changes back into gel.

Some types of gels like gelatin and silica liquify on shaking thereby changing into sols. The sols on standing change back into gels. This process is know as :

A. synersis

B. thixotropy

C. double decompostion

D. peptization

Answer: B

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135. The clouds consist of charged particles of water dispersed in air. Some of them are +vely charged, other are -vely charged. When +vely charged clouds come closer they cause lightening and thundering whereas when +ve and -ve charged colloid come closer they cause heavy rain by aggregation of minute particles. It is possible to cause artificial

rain by throwing electrified sand or silver iodic from an aeroplane and thus coagulating the mist hanging in air.

Smoke screen is a cloud of smoke used to hide military, naval police etc. It consists of fine particles of TiO_2.

When excess of $AgNO_3$ is treated with KI solution, AgI forms :

A. $+ve$ charges sol

B. $-vely$ charged sol

C. neutral sol

D. true solution

Answer: A

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Smoke screen is a cloud of smoke used to hide military, naval police etc. It consists of fine particles of TiO_2.

AgI helps in artificial rain because :

A. it helps in ionisation of water

B. it helps in dispersion process

C. it hels in coagulation

D. all of them

Answer: C

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whereas when +ve and -ve charged colloid come closer they cause heavy rain by aggregation of minute particles. It is possible to cause artificial rain by throwing electrified sand or silver iodic from an aeroplane and thus coagulating the mist hanging in air.

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AgI helps in artificial rain because :

A. fine particales of TiO_2 dipersed in air by aeroplanes

B. fine particles of AgI dispersedin air by aeroplanes

C. find particles of Al_2O_3 dispersed in air by aeroplanes

D. None of these

Answer: A

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138. Rate of physisorption increases with :

A. decrease in temperature

B. increase in temperature

C. decrease in pressure

D. decrease in surface area

Answer: A

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139. Adsorpton of gases on solid surface is generally exothermic because :

A. enthalpy is positive

B. entropy decreases

C. entropy increases

D. free energy increases

Answer: B

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140. Lyophilic sols are

A. Irrebersible sols

B. They are prepared from inorganic compound

C. Coagulated by adding electrolytes

D. Self-stabilizing

Answer: D

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141. Among the following, which surfactant will form micelles in aqueous solution at the lowest molar concentration at ambient conditions?

A. $CH_3(CH_2)_{15}N^+(CN_3)_3Br^-$

B. $CH_3(CH_2)_{11}OSO_3^-Na^+$

C. $CH_3(CH_2)_6COO^-Na^+$

D. $CH_3(CH_2)_{11}N^+(CN_3)_3Br^-$

Answer: A

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142. Among the electrolytes $Na_2, SO_4, CaCl_2, Al_2(SO_4)_3$ and NH_4Cl, the most effective coagulating agent for Sb_2S_3 sol is

A. Na_2SO_4

B. $CaCl_2$

C. $Al_2(SO_4)_3$

D. NH_4Cl

Answer: C

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143. Silver (atomic weight $108 g mol^{-1}$) has a density of $10.5 g cm^{-3}$. The number of silver atoms on a surfaces of area $10^{-12} m^2$ can be expressed in scientific notation as $Y \times 10^{-x}$, The value of x is .....

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144. The correct statement (S) pertaining to the adsorption of a gas on a solid surface is (are)

A. Adsorption is always exothermic

B. Physisorption may transform into chemisorption at high temperature

C. Physisorption increases with increasing temperature but chemisorption decreases with increasing temperature.

D. Chemisorption is more exothermic than physisorption, however it is very slow due to higher energy of activation.

Answer: A::B::D

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145. Choose the correct reason (s) for the stability of lyophobic colloidal particles.

A. Preferential adsorption of ions on their surface from the solution

B. Preferential adsorption of solvent on their surface from the solution

C. Attraction between different particles having opposite charges on their surface

D. Potential difference between the fixed layer and the diffused layer of opposite charges around the colloidal particles.

Answer: A::D

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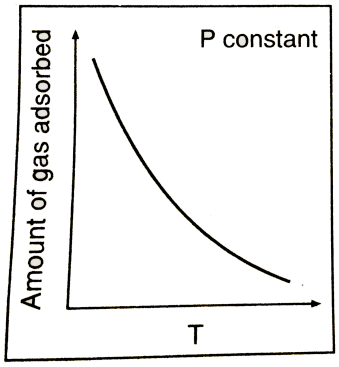
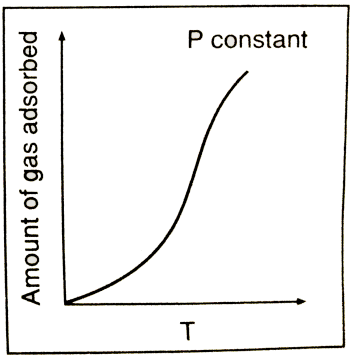
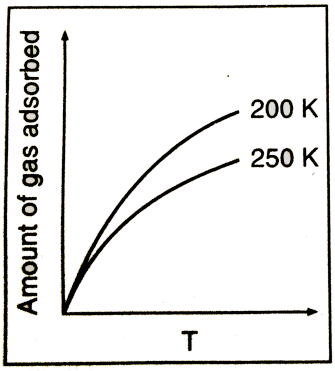
146. The given graph/data I,II,III and IV represent general trends observed for different physisorption and chemisorption processes under mild conditions of temperature and pressure . Which of the following choice(s) about I,II,III, and IV is/are correct ?



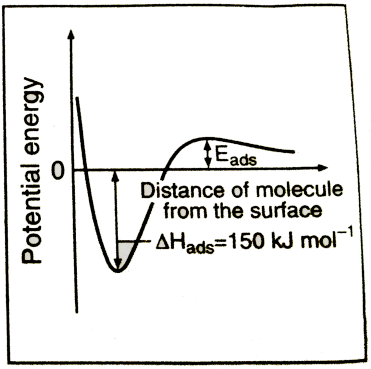
(I)



(II)



(III)



(IV)

A. I is physisorption and II is chemisorption

B. I is physisorption and III is chemisorption

C. IV is chemisorption and II is chemisorption

D. IV is chemisorption and III is chemisorption

Answer: A::C

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147. Methylene blue, from its aqueous solution, is adsorbed on activated charcoal at $25^\circ C$. For process, the correct statement is

A. The adsorption required activation at $25^\circ C$

B. The adsorption is accompanied by a decreases in enthalpy

C. The adsorption increases with increase of temperature

D. The adsorption is irreversible

Answer: B

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148. Which one of the following characteristics is not correct for physical adsorption ?

A. Adsorption on solid is reversible

B. Adsorption increase with increase in temperature

C. Adsorption is spontaneous

D. Both enthalpy and entropy of adsorption are negative.

Answer: B

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149. The dispersed phase in colloidal iron (III) hydroxide and collodial gold is positively and negtively charged respectively with of the following statement is not correct ?

A. Coagulation in both sols can be throught about by electrophoresis

B. Mixing the sols has no effect

C. Sodium sulphate solution causes coangulation in both sols

D. Magnesium chloride solution coagulates, the gold sol more readily than the ion (III) hydroxide sol.

Answer: B

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150. The volume of a colloidal particle V_C as compared to the volume of a solute particle in a true solution V_S could be

A. ~1

B. ~10^{23}

C. ~10^{-3}

D. ~10^{3}

Answer: D

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151. In Langumir's model of adosrption of a gas on a solid surface :

A. the rate of dissociation of adsorbed molecules from the surface does not depend on the surafce covered

B. the adsorption at a single site on the surafce may involve multiple at the same time

C. the mass of gas striking a given area of surface is proportional to the pressure of the gas

D. the mass of gas striking a given area of surfaces is independent of the pressure of the gas

Answer: C

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152. Gold numbers of protective colloids A, B, C and D are $0.50, 0.01, 0.10$ and 0.005 respectively. The correct order of their protective powers is

A. $C < B < D < A$

B. $A < C < B < D$

C. $B < D < A < C$

D. $D < A < C < B$

Answer: B

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153. In context with the industrial preparation of hydrogen from water gas $(CO + H_2)$. Which of the following is the correct statement?

A. CO is removed by adsorption in aqueous Cu_2Cl_2 Solution

B. H_2 is removed through occusion with Pd

C. CO is oxidized to CO_2 with steam in the presence of a catalyst followed by adsorption of CO_2 in alkali

D. CO and H_2 are fractionally separated using differences in their densities

Answer: C

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154. Which of the following statement is incorrect regarding physisorptions?

A. More easily liquefiable gases are adsorbed readily.

B. Under high high pressure it results into multi molecular layer on adsorbent surface

C. Enthalpy of adsorption $(\Delta H_{\text{adsorption}})$ is low and positive

D. It occurs because of van der Waal's forces

Answer: C

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155. According to Freundlich adsorption isotherm, which of the following is correct?

A. $\frac{x}{m} \propto p^0$

B. $\frac{x}{m} \propto p^1$

C. $\frac{x}{m} \propto p^{1/n}$

D. All the above are correct for different ranges of pressure.

Answer: D

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156. The coagulating power of electrolytes having inos $Na^{\oplus}$, Al^{3+} and Ba^{2+} for arsenic sulphide sol increases in the order

A. $Al^{3+} < Ba^{2+} < Na^{+}$

B. $Na^{+} < Ba^{2+} < Al^{3+}$

C. $Ba^{2+} < Na^{+} < Al^{3+}$

D. $Al^{3+} < Na^{+} < Ba^{2+}$

Answer: B

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157. How does chemical adsorption of a gas on the surface of a solid very with temperature ?

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158. How the sol of collodiion is obtained?

Watch Video Solution

159. What is electrophoresis?

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160. Write differences between physisorption and chemisorption.

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161. Collioidal sols can be purified by

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162. How is dialysis carried out? Mention its one application.

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163. Explain what is observed when

(i) an electrolyte is added to ferric hydroxide sol.

(ii) an emulsion is subjected to centrifugation.

(iii) direct currect is passes through a colloidal sol.

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164. Define adsorption and write two important differences between physical adsorption and chemisorption.

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165. Explain the following terms:

(i) Peptization (ii) dialysis (iii) Hardy-Schulze ruel

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166. Explain the following observation:

a. A beam of light passing through a colloidal solution has a visible path.

b. Passing an electric current through a colloidal solution removes

colloidal particles from it.

c. Ferric hydroxide sol coagulates on addition of potassium sulphate.

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167. Explain the following terms giving a suitable example in each case:

(i) Emulsification (ii) Homogeneous catalysis

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168. Define adsorption. Write any two features which distinguish physisorption from chemisorption.

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169. What causes Brownian movement in a colloidal solution?

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170. What are lyophilic and lyophobic sols ? Give one example of each type. Which one of these two types of sols is easily coagulated and why?

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171. Define the term 'Tyndall effect'.

Watch Video Solution

172. Give an example of 'shape-selective catalyst'.

Watch Video Solution

173. What is an emulsion?

Watch Video Solution

174. Define 'electrophoresus'?

Watch Video Solution

175. Explain how the phenomenon of pdsorption finds application in each of the following processes :

(i) Production of vacuum

(ii) Heterogeneous catalysis

(iii) Froth Floatation process

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176. Define each of the following terms:

(i) Micelles (ii) Peptization (iii) Desorption

Watch Video Solution

177. Define 'peptization'

Watch Video Solution

178. Explain the following terms giving a suitable example for each :

(i) Aerosol

(ii) Emulsion

(iii) Micelle

Watch Video Solution

179. What is shape — selective catalysis ?

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180. What is the difference between multimolecular and macromolecular colloids? Give one example of each.

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181. Write the dispersed phase nd dispersion medium in the colloidal systems (i) Smoke (ii) Milk.

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182. What are lyophilic and lyophobic colloidal? Which of these sols can be easily coagulated on the addition of small amount of electrolytes?

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183. For adsorption of a gas on a solid, the plot of log (x/m) vs log P is linear with a slope equal to [n being a whole number]:

A. K

B. log K

C. n

D. $1/n$

Answer: D

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184. surface tension of lyophilic sols is

A. Lower than that of H_2O

B. More than that of H_2O

C. Equal to that of H_2O

D. None of these

Answer: A

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185. On passing light from colloidal solution, the effect due to scattering of light is known as :

A. Electrophrosis

B. Tyndall effect

C. Electromosis

D. Coagulation

Answer: B

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186. The solution in which the light is scattered by the particles is:

A. Suspension

B. Colloidal solution

C. True solution

D. None of these

Answer: B

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187. Blood is purified by :

A. Dialysis

B. Electro-osmosis

C. Coagulaion

D. Filtration

Answer: A

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188. An arsenious sulphide sol carries a negative charge . The maximum precipitating power for this sol is possessed by

A. K_2SO_4

B. $CaCl_2$

C. Na_3PO_4

D. $AlCl_3$

Answer: D

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189. Tyndall effect in shown by :

A. Sol

B. Solution

C. Plasma

D. Precipitation

Answer: A

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190. According to Hardy - Schulze rule, the coagulating power of cation follows the order :

A. $Na^+ > Ba^{2+} > Al^{3+}$

B. $Al^{3+} > Ba^{2+} > Na^+$

C. $Ba^{2+} > Al^{3+} > Na^+$

D. $Al^{3+} > Na^+ > Ba^{2+}$

Answer: B

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191. Mikl is an example of :

A. True solution

B. Gel

C. Suspension

D. Emulsion

Answer: D

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192. Most effective ion to coagulate a negative sol is:

A. PO_4^{3-}

B. Al^{3+}

C. Ba^{2+}

D. K^+

Answer: B

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193. Which of the following electrolytes will be most effective in the coagulation of gold sol :

A. $NaNO_3$

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

C. Na_3PO_4

D. $MgCl_2$

Answer: D

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194. Which of the following is property of colloid?

A. Scattering of light

B. Shows attraction

C. Dialysis

D. Emulsion

Answer: A

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195. The stability of lyophilic is due to which of the following:

A. Charge on their particles

B. Large size of their particles

C. Small size of their particles

D. Solvation by dispersion medium

Answer: D

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196. A colloidal solution is subjected to an electrical field. The particle move towards anode. The coagulation of same sol is studied using $NaCl$, $BaCl_2$ and $AlCl_3$ solutions. Their coagulating power should be

A. $NaCl > BaCl_2 > AlCl_3$

B. $BaCl_2 > AlCl_3 > NaCl_3$

C. $AlCl_3 > BaCl_2 > NaCl$

D. $BaCl_2 > NaCl > AlCl_3$

Answer: C

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197. Which of the following is most effective in coagulating a ferric hydroxide sol ?

A. KCl

B. KNO_2

C. K_2SO_4

D. $K_3\left[Fe(CN)_6\right]$

Answer: D

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198. Which one is a colloid solution?

A. NaCl

B. Urea

C. Cane Sugar

D. Blood

Answer: D

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199. Of which of the following colloidal systems, fog is an example?

A. Liquid dispersed in gas

B. Gas dispersed in gas

C. Solid dispersed in gas

D. Solid dispersed in liquid

Answer: A

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200. Which is the correct statement in case of milk?

A. Milk is an emulsion of fat in water

B. Milk is an emulsion of protein in water

C. Milk is stabilized by protein

D. Milk is stabilized by fat

Answer: A

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201. The charge on As_2S_3 sol is due to the adsorbed :

A. H^+

B. OH^-

C. O^{-2}

D. S^-

Answer: D

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202. Sky looks blue due to

A. Dispersion

B. Reflection

C. Transmission

D. Scattering

Answer: D

Watch Video Solution

203. Gold number is minimum in case of.....

A. Gelatin

B. Egg albumin

C. Gumarabic

D. Starch

Answer: A

Watch Video Solution

204. Tyndall effect will be observed in :

A. Solution

B. Percipitate

C. Sol

D. Vapour

Answer: C

Watch Video Solution

205. The Brownian motion is due to :

A. Temperature flucation within the liquid phase

B. Attraction and repulsion between charge on the colloidal particles

C. Imapact of molecules of the dispersion medium on the colloidal paticles

D. Convective currect

Answer: C

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206. For coagulating As_2S_3 colloidal sol, which of the following will have the lowest coagulation value

A. NaCl

B. KCl

C. $BaCl_2$

D. $AlCl_3$

Answer: D

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207. The size of a colloidal particle is :

A. $> 0.1\mu$

B. $1m\mu$ to 0.1μ

C. $> 0.1\mu$

D. More than $3000m\mu$

Answer: B

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208. Which of the following ielectrolytes is least effective in causing flocculation of ferric hydroxide sol?

A. $K_4[Fe(CN)_6]$

B. K_2CrO_4

C. KBr

D. K_2SO_4

Answer: C

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209. On additon of one ML of 10% NaCI solution of 10ml gold sol in presence of 0.25 gm of starch, the coagulation is just prevented, starch

has gold number :

A. 0.025

B. 0.25

C. 2.5

D. 25

Answer: D

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210. Which one of the following is not a colloidal solution?

A. Smoke

B. Ink

C. Air

D. Blood

Answer: C

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211. which of the following will have the highest coagulating power for As_2S_3 colloid?

A. PO_4^{3-}

B. SO_4^{2-}

C. Na^+

D. Al^{3+}

Answer: D

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212. Positive sol is :

A. Gold

B. Gelatin

C. As_2S_3

D. None

Answer: B

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213. Which one is a lyophobic colloid?

A. Gelatin

B. Starch

C. Sulphur

D. Gum arabic

Answer: C

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214. Smoke is an example of :

A. Gas dispersed in liquid

B. Gas dispersed in solid

C. Solid dispersed in gas

D. Solid dispersed in solid

Answer: C

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215. Tyndall effect in colloidal solution is due to

A. Scattering of light

B. Reflection of light

C. Absorption of light

D. Presence of electrically charged perticles

Answer: A

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216. A colloidal solution of arsenious sulphide is most readily coagulated by the addition of a normal solution?

A. NaCl

B. $CaCl_2$

C. Na_3PO_4

D. $Al_2(SO_4)_3$

Answer: D

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217. A colloid always :

A. Contains two phases

B. Is a true solution

C. Contains three phases

D. Contains only water soluble particles

Answer: A

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218. Colloidal solution of silver is prepared by :

A. Colloidal milk

B. Double decomposition method

C. Bredig's method

D. Peptization

Answer: C

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219. Lyophobic colloids are :

A. Reversible colloids

B. Irreversible colloids

C. Protective colloids

D. Gum proteins

Answer: B

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220. Which of the following ions has maximum flocculation value?

A. $\left[Fe(CN)_6\right]^{4-}$

B. Cl^-

C. SO_4^{2-}

D. PO_4^{-3}

Answer: B

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221. The arsenous sulphide sol has -ve charge. The maximum power of precipitating is of:

A. H_2SO_4

B. Na_3PO_4

C. $CaCl_2$

D. $AlCl_3$

Answer: D

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222. Which of the following is wrong:

A. Enthalpy (numerical value) of physisorption is greater than that of chemisorption

B. Physisorption is not very specific but chomisorption is highly specific

C. Chemisorption takes place at relatively high temperatures

D. In physisorption generally multi-molecular layers are formed on the adsorbent

Answer: A

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223. Which of the following gases, will be adsorbed maximum on a solid surface?

A. CO_2

B. O_2

C. N_2

D. H_2

Answer: A

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224. Which of the following is a mismatch?

A. Lyophilic colloids - reversible sols

B. Associated colloids - micelles

C. Tyndall effect - scattering of light by colloidal particle

D. Electrophoresis - movement of dispersion medium under the influence of electric field

Answer: D

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225. Which of the following ions will be most effective in coagulating the As_2S_3 sol?

A. Fe^{3+}

B. Ba^{2+}

C. Cl^-

D. PO_4^{3-}

Answer: A

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226. When freshly precipitated $Fe(OH)_3$ is shaken with aqueous solution of $FeCl_3$, a colloidal solution is formed. The process is known as :

A. Emulsification

B. Coagulation

C. Petpization

D. Electro-osmosis

Answer: C

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227. (i) At 298 K the volume of NH_3 adsorbed by 1 g of charcoal is higher than that of H_2 under similar conditions.

(ii) The movement of colloidal particles towards the oppositely charged electrodes on passing current is known as Brownian movement.

If T for true and F for false then correct option is :

A. T, T

B. T, F

C. F, T

D. F, F

Answer: B

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228. A negative catalyst will :

A. raise the energy of activation for a given reaction

B. take away the energy of reactants and deactivate them

C. catalyse the backward reaction more than the forward one, thereby shifting equilibrium backward.

D. None of these

Answer: A

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229. When a graph is pplotted between $\log x/m$ and log p, it is straight line with an angle 45° and intercept 0.3010 on y-axis. If initial pressure is 0.3 atm, what will be the amount of gas adsorbed per gm of adsorbent:

A. 0.4

B. 0.6

C. 0.8

D. 0.1

Answer: B

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230. A liquid is found to scatter a beam of light but leaves no residue when passed through the filter paper.

A. a suspension

B. Oil

C. a colloidal sol

D. a true solution

Answer: C

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231. Which of the following kinds of catalysis can be explained by the adsorption theory?

A. heterrogeneous catalysis

B. enzyme catalysis

C. homogeneous catalysis

D. acid base catalysis

Answer: A

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232. Which of the following relations is(are) correct according to Freundlich?

(P)x/m = constant ,

(Q) x/m = constant $\times p^{1/n}(n > 1)$,

(S) x/m = constant $\times p^{n}(n > 1)$

A. All are correct

B. All are wrong

C. (ii) is correct

D. (iii) is correct

Answer: C

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233. The principle involved in the chromatographic operation is :

A. Adsorption

B. Absorption

C. Partition

D. None

Answer: A

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234. The physical adsorption of gases on the solid surface is due to :

A. vander Waals forces

B. convalent bonding

C. hydrogen bonding

D. All of these

Answer: A

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235. Correct eqution of Freundlich isotherm is :

A. $\log\left(\frac{x}{m}\right) = \log K + \frac{1}{n}\log C$

B. $\log\left(\frac{x}{m}\right) = \log m + \frac{1}{m}\log C$

C. $\log\left(\frac{x}{m}\right) = \log C + \frac{1}{K}\log C$

D. $\log\left(\frac{x}{m}\right) = \log C + \frac{1}{n}\log K$

Answer: A

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236. Identify the correct statement regarding enzymes.

A. Enzymes are specific biological catalysts that can normally function at very high tempt. $(T \approx 1000K)$

B. Enzymes are normally heterogeneous catalysis that very specific in action

C. Enzymes are specific biological catalysts that can not be poisoned

D. Enzymes are non-biological catalysts.

Answer: B

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237. The size of colloidal particles is :

A. $1 - 10\text{Å}$

B. $20 - 50\text{Å}$

C. $10 - 100\text{Å}$

D. $1 - 200\text{Å}$

Answer: B::C

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238. Which of the following statement is correct?

A. The efficiency of a heterogeneous catalyst depends upon its surface area.

B. Catalyst operates by providing alternate path for the reaction that involves a lower activation energy

C. Catalyst lowers the energy of activation of the forward direction without affecting the energy of activation of the backward direction.

D. Catalyst does not affect the enthalpy change of the reaction.

Answer: A::B::C

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239. Which of the following statement is (are) true?

A. The concentration of a homogeneous catalyst may appear in the rate expression.

B. A catalyst is always consumed in the reaction

C. A catalyst must always must always be in the same phase as the reactants

D. None of these

Answer: A

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240. The colloidal particles are electrically charged as a indicated by their migration towards cathode or anode under the applied electric field. In a particular colloidal system, all particles carry either positive charge or negative charge.

The electric charge on colloidal particles orginate in several ways. According to preferential adsorption theory, the freshly obtained precipitate particles adsorb ions from the dispersion medium, which are common to their lattice and acquire the charge of adsorbed ions. For example, For example, freshly obtained $Fe(OH)_3$ precipitated is dispersed, by a little $FeCl_3$, into colloidal solution owing to the

adsorption of Fe^{3+} ions in preference. Thus sol particles will be positively charged.

In some cases the colloidal particles are aggregates of cations or anions having ampiphilic character. When the ions posses hydrophobic part (hydrocarbon end) as well as hydrophilic part (polar end group), they undergo association in aqueous solution to form particles having colloidal size. The formation of such particles, called micelles plays a very important role in the solubilization of water insoluble substances, (hydrocarbon, oils, fats, grease etc.). In micelles, the polar end groups are directed towards water and the hydrocarbon ends into the centre. The charge on sol particles of proteins depends on the pH. At low pH, the basic group of protein molecule is ionized (protonated) and at higher pH (alkaline medium), the acidic group is ionized. At isoelectric pH, characteristic to the protein, both basix and acidic groups are equally ionized. The stability of colloidal solution is attributed largely to the electric charge of the dispersed particles. This charge causes them to be coagulated or precipitated. On addition of small amount of electrolytes, the ions carrying oppiste charge are adsorbed by sol particles resulting in the neutralization of their charge. When the sol particles either with no

charge or reduced charge, come closer due to Brownian movement, they coalesce to form bigger particles resulting in their separation from the dispersion medium. This is what is called coagulating or precipitation of the colloidal solution. The coagulating power of the effective ion, which depend on its charge, is expressed in terms of its coagulating value, defined as its minimum concentration (m mol/L) needed to precipitate a given sol.

A gelatin sol at pH less than the isoelectric value is subjected to an electric field. The sol particles migrate toward :

A. Anode

B. Cathode

C. Both anode and cathode

D. Neither anode no cathode

Answer: B

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Which of the following ions would have the minimum coagulating value for sol obtained on peptizing $Sn(OH)_4$ by little NaOH solution?

A. Cl^-

B. SO_4^{2-}

C. K^+

D. Ba^{2+}

Answer: D

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How would you obtain a sol of AgI, the particles of which migrate towards cathode under the electric field?

A. By adding you obtain of KI to $AgNO_3$ solution

B. By adding little excess of $AgNO_3$ to KI solution

C. By mixing equal volumes of $0.010M\,AgNO_3$ and $0.010M$ KI

D. None of these

Answer: B

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When 9.0 ml of arsenious sulphide sol and 1.0 ml of $0.09MBaCl_2$ are mixed, turbidity due to precipitation just appears after 2 hours. The effective ion and its coagulating value are respectively :

A. Cl^-, $10mmol/L$

B. Cl^-, $20mmol/L$

C. Ba^{2+}, $10mmol/L$

D. Ba^{2+}, $20mmol/L$

Answer: C

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In some cases the colloidal particles are aggregates of cations or anions having ampiphilic character. When the ions posses hydrophobic part (hydrocarbon end) as well as hydrophilic part (polar end group), they undergo association in aqueous solution to form particles having colloidal size. The formation of such particles, called micelles plays a very important role in the solubilization of water insoluble substances, (hydrocarbon, oils, fats, grease etc.). In micelles, the polar end groups are directed towards water and the hydrocarbon ends into the centre. The charge on sol particles of proteins depends on the pH. At low pH, the basic group of protein molecule is ionized (protonated) and at higher pH (alkaline medium), the acidic group is ionized. At isoelectric pH, characteristic to the protein, both basix and acidic groups are equally ionized. The stability of colloidal solution is attributed largely to the

electric charge of the dispersed particles. This charge causes them to be coagulated or precipitated. On addition of small amount of electrolytes, the ions carrying oppiste charge are adsorbed by sol particles resulting in the neutralization of their charge. When the sol particles either with no charge or reduced charge, come closer due to Brownian movement, they coalesce to form bigger particles resulting in their separation from the dispersion medium. This is what is called coagulating or precipitation of the colloidal solution. The coagulating power of the effective ion, which depend on its charge, is expressed in terms of its coagulating value, defined as its minimum concentration (m mol/L) needed to precipitate a given sol.

100 ml each of two sols of AgI, one obtained by adding $AgNO_3$ to slight excess of KI and another obtained by adding KI to slight excess of $AgNO_3$, are mixed together. Then :

A. The two sols will stabilize each other

B. The sol particles will acquire more electric charge

C. The sols will coagulate each other mutually

D. A true solution will be obtained

Answer: C

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245. The colloidal particles are electrically charged as a indicated by their migration towards cathode or anode under the applied electric field. In a particular colloidal system, all particles carry either positive charge or negative charge.

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defined as its minimum concentration (m mol/L) needed to precipitate a given sol.

Under the influence of an electric field, the particles in a sol migrate towards cathode. The coagulation of the same sol is studied using NaCl, Na_2SO_4 and Na_3PO_4 solutions. Their coagulating values will be in the order :

A. $NaCl > Na_2SO_4 > Na_3PO_4$

B. $Na_2SO_4 > Na_3PO_4$ gt NaCl`

C. $Na_3PO_4 > Na_2SO_4 > NaCl$

D. $Na_2SO_4 > NaCl > Na_3PO_4$

Answer: A

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246. What is meant by the colloidal state of matter? Explain the following terms:

(i) Multimolecular colloids (ii) electro-dialysis

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247. What are micelles ? Give an example of a micelle system.

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248. The zig-zag motion of colloidal particles is called " _____".

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249. What are micelles? How do they differ from a normal colloidal solution?

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250. The colloidal dispersions of liquids in solid media are called .....

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251. Describe the following terms while starting the properties of colloids:

(i) Browanian movement (ii) Tyndall effect (iii) Electrophoresis

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252. Explain the terms: Physisorption and Chemisorption.

How does adsorption of a gas on a solid surface vary with pressure?

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253. What is observed when a beam of light is passed through a colloidal solution of arsenius sulphide?

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254. What are lyophilic and lyophobic sols? Compare the two in terms of stability and reversiblity.

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255. Explain the terms shape selective catalyst, emulsification and dimulsification with one example each.

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256. Explain the terms 'Brownian movement' and 'peptization'.

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257. Write two differences between multimolecular colloids and macromolecular colloids ?

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258. Explain the difference between a homogeneous and heterogeneous catalyst. Give an example of each.