

# GPLUS EDUCATION

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CHEMISTRY

## SOLUTIONS

### Single Correct Answer Type

- Equimolar solution in the same solvent have
  - Different boiling and different freezing points
  - Same boiling and same freezing points
  - Same freezing point but different boiling point
  - Same boiling point but different freezing point
- Temperature coefficient is the variation in the :

Distribution coefficient	Concentration of	Concentration of	Distribution coefficient
a) for 1° rise in the temperature	b) solution for 10° rise in the temperature	c) solution for 1° rise in the temperature	d) for 10° rise in the temperature
- What is the molarity of  $H_2SO_4$  solution if 25 mL is exactly neutralised with 32.63 mL of 0.164 M NaOH?
  - 0.107 M
  - 0.126 M
  - 0.214 M
  - 0.428 M
- Which of the following solution in water possesses the lowest vapour pressure?
  - 0.1 (N)  $BaCl_2$
  - 0.1 (M) NaCl
  - 0.1 (M) KCl
  - None of these
- Which of the following is incorrect?
  - 0.1 m sucrose
  - 0.1 m urea
  - 0.1 m ethanol
  - 0.1 m glucose
- Which method cannot be used to find out the molecular weight of non-volatile solute?
  - Victor Meyer's method
  - Osmotic pressure method
  - Cryoscopic method
  - Ebullioscopic method
- At a suitable pressure near the freezing point of ice, there exists :
  - Only ice
  - Ice and water
  - Ice and vapour
  - Ice, water and vapours, all existing side by side
- The vapour pressure of two pure liquid (A) and (B) are 100 torr and 80 torr respectively. The total pressure of solution obtained by mixing 2 mole of (A) and 3 mole of (B) would be :
  - 120 torr
  - 36 torr
  - 88 torr
  - 180 torr
- Which statement is not correct if two immiscible liquids of mol. wt. A and B respectively are mixed in equal amount to have a mixture?
  - $\frac{P'_A}{P'_B} = \frac{m_B}{m_A}$
  - The liquid having high mol. wt. will show lower values of  $P'$
  - $P_M = P_A^0(X_A)_l + P_B^0(X_B)_l$
  - $P_M = P'_A + P'_B$
- Density of a 2.05 M solution of acetic acid in water is 1.02 g/mL. The molality of the solution is
  - 23.077%
  - 230.77%
  - 2.3077%
  - 0.23077%
- The values of observed and calculated molecular weights of calcium nitrate are respectively 65.6 and 164. The degree of dissociation of calcium nitrate will be :
  - 25%
  - 50%
  - 75%
  - 60%
- The molar freezing point constant for water is  $1.86^\circ C/mol$ . If 342 g of cane sugar ( $C_{12}H_{22}O_{11}$ ) is dissolved in 1000 g of water, the solution will freeze at
  - $-1.86^\circ C$
  - $1.86^\circ C$
  - $-3.92^\circ C$
  - $2.42^\circ C$
- An 1% solution of KCl (I), NaCl (II),  $BaCl_2$  (III) and urea (IV) have their osmotic pressure at the same

temperature in the ascending order (molar masses of NaCl, KCl, BaCl<sub>2</sub> and urea are respectively 58.5, 74.5, 208.4 and 60 g mol<sup>-1</sup>). Assume 100% ionisation of the electrolytes at this temperature

- a) I < III < II < IV      b) III < I < II < IV      c) I < II < III < IV      d) III < IV < I < II
14. Which has the highest freezing point at one atmosphere?  
 a) 0.1 M NaCl solution      b) 0.1 M sugar solution      c) 0.1 M BaCl<sub>2</sub> solution      d) 0.1 M FeCl<sub>3</sub> solution
15. The amount of anhydrous Na<sub>2</sub>CO<sub>3</sub> present in 250 mL of 0.25 M solution is  
 a) 6.625 g      b) 66.25 g      c) 662.5 g      d) 6625 g
16. Solution A contains 7 g/L of MgCl<sub>2</sub> and solution B contains 7 g/L of NaCl. At room temperature, the osmotic pressure of  
 a) 50      b) 180      c) 102      d) 25
17. Two liquids X and Y form an ideal solution at 300K, vapour pressure of the solution containing 1 mol of X and 3, mol of Y is 550 mmHg. At the same temperature, if 1 mol of Y is further added to this solution, vapour pressure of the solution increases by 10 mmHg. Vapour pressure (in mmHg) of X and Y in their pure states will be, respectively  
 a) 200 and 300      b) 300 and 400      c) 400 and 600      d) 500 and 600
18. The freezing point of aqueous solution that contains 5% by mass urea, 1.0% by mass KCl and 10% by mass of glucose is : ( $K_f \text{H}_2\text{O} = 1.86 \text{ K molality}^{-1}$ )  
 a) 290.2 K      b) 285.5 K      c) 269.93 K      d) 250 K
19. The vapour pressure of benzene at 90°C is 1020 torr. A solution of 5 g of a solute in 58.5 g benzene has vapour pressure 990 torr. The molecular weight of the solute is :  
 a) 78.2      b) 178.2      c) 206.2      d) 220
20. The elevation in boiling point of a solution of 13.44 g of CuCl<sub>2</sub> in 1 kg of water using the following information will be (molecular weight of CuCl<sub>2</sub> = 134.4 and  $k_b = 0.52 \text{ K m}^{-1}$ )  
 a) 0.16      b) 0.05      c) 0.1      d) 0.2
21. A 0.0020 m aqueous solution of an ionic compound Co(NH<sub>3</sub>)<sub>5</sub>(NO<sub>2</sub>)Cl freezes at -0.00732°C. Number of moles of ions which 1 mol of ionic compound produces on being dissolved in water will be : ( $K_f = +1.86^\circ\text{C/m}$ )  
 a) 1      b) 2      c) 3      d) 4
22. The relative lowering of vapour pressure produced by dissolving 71.5 g of a substance in 1000 g of water is 0.00713. The molecular weight of the substance will be :  
 a) 180      b) 18.0      c) 342      d) 60
23.  $6.02 \times 10^{20}$  molecules of urea are present in 100 mL of its solution. The concentration of urea solution is  
 a) 0.1 M      b) 0.01 M      c) 0.001 M      d) 0.02 M
24. The number of moles of a solute in its solution is 20 and total number of moles are 80. The mole fraction of solute is  
 a) 0.25      b) 0.50      c) 1.00      d) 1.25
25. On shaking 10 mL of 0.1 molar solution of an organic compound in water with 10 mL of CCl<sub>4</sub> till equilibrium is attained, concentration of the organic compound in water would be ( $K = 9$ ) in molar units :  
 a) 0.01      b) 0.09      c) 0.001      d) 0.009
26. Equimolar solutions of two non-electrolytes in the same solvent should have :  
 a) Same b. p but different f. p  
 b) Same f. p. but different b. p.  
 c) Same b. p. and same f. p.  
 d) Different b. p. and different f. p.
27. 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

28. The vapour pressure of water depends upon :
- Surface area of container
  - Volume of container
  - Temperature
  - All of these
29. The degree of dissociation ( $\alpha$ ) of a weak electrolyte,  $A_xB_y$  is related to van't Hoff factor ( $i$ ) by the expression
- $\alpha = \frac{i-1}{(x+y-1)}$
  - $\alpha = \frac{i-1}{x+y+1}$
  - $\alpha = \frac{x+y-1}{i-1}$
  - $\alpha = \frac{x+y+1}{i-1}$
30. The substances whose solubility decreases with increase in temperature :
- $\text{Ca(OH)}_2$
  - $\text{Na}_2\text{CO}_3$
  - $\text{Na}_2\text{SO}_4$
  - All of these
31. 25 mL of a solution of barium hydroxide on titration with 0.1 molar solution of hydrochloric acid gave a titre value of 35 mL. The molarity of barium hydroxide solution was
- ppm
  - Mg/100 cc
  - g/L
  - g/100 cc
32. 1.0 g of a non-electrolyte solute (molar mass  $250 \text{ g mol}^{-1}$ ) was dissolved in 51.2 g of benzene. If the freezing point depression constant of benzene is  $5.12 \text{ K kg mol}^{-1}$ , the lowering in freezing point will be :
- 0.5 K
  - 0.2 K
  - 0.4 K
  - 0.3 K
33. The mole fraction of the solute in one modal aqueous solution is
- 0.018
  - 0.027
  - 0.036
  - 0.048
34. The osmotic pressure of a 5% (wt./vol) solution of cane sugar at  $150^\circ\text{C}$  is
- 3.078 atm
  - 4.078 atm
  - 5.078 atm
  - 2.45 atm
35. Conc  $\text{H}_2\text{SO}_4$  has a density of 1.98 g/mL and is 98%  $\text{H}_2\text{SO}_4$  by weight. Its normality is
- 19.6 N
  - 29.6 N
  - 39.6 N
  - 49.6 N
36. After adding a solute freezing point of solution decreases to  $-0.186$ . Calculate  $\Delta T_b$  if  $k_f = 1.86$  and  $k_b = 0.512$
- 0.512
  - 0.0512
  - 1.86
  - 0.0186
37. The freezing point (in  $^\circ\text{C}$ ) of a solution containing 0.1 g of  $\text{K}_3[\text{Fe(CN)}_6]$  (mol.wt.329) in 100 g of water is : ( $K_f = 1.86 \text{ K kg mol}^{-1}$ )
- $-2.3 \times 10^{-2}$
  - $-5.7 \times 10^{-2}$
  - $-5.7 \times 10^{-3}$
  - $-1.2 \times 10^{-2}$
38. The values of observed and calculated molecular weights of silver nitrate are 92.64 and 170 respectively. The degree of dissociation of silver nitrate is :
- 60%
  - 83.5%
  - 46.7%
  - 60.23%
39. A mixture of ethyl alcohol and propyl alcohol has a vapour pressure of 290 mm at 300 K. 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
- 350
  - 300
  - 700
  - 360
40. At  $40^\circ\text{C}$  the vapour pressure in torr, of methyl alcohol-ethyl alcohol solutions is represented by the equation.  $P = 119 X_A + 135$ ; where  $X_A$  is mole-fraction of methyl alcohol, then the value of  $\lim_{X_A \rightarrow 1} \frac{P_A}{X_A}$  is :
- 254 torr
  - 135 torr
  - 119 torr
  - 140 torr
41. Observe the following abbreviations  
 $\pi_{obs}$  = observed colligative property  
 $\pi_{cal}$  = theoretical colligative property assuming normal behaviour of solute.  
 Van't Hoff factors ( $i$ ) is given by
- $i = \pi_{obs} \times \pi_{cal}$
  - $i = \pi_{obs} + \pi_{cal}$
  - $i = \pi_{obs} - \pi_{cal}$
  - $i = \frac{\pi_{obs}}{\pi_{cal}}$
42. Normality of 2 M  $\text{H}_2\text{SO}_4$  is
- 2 N
  - 4 N
  - $\frac{N}{2}$
  - $\frac{N}{4}$

43. 20 g of binary electrolyte (mol. wt. =100) are dissolved in 500 g of water. The depression in freezing point of the solution is  $0.74^{\circ}\text{C}$  ( $k_f = 1.86 \text{ K m}^{-1}$ ) the degree of ionisation of the electrolyte is  
 a) 0%                                      b) 100%                                      c) 75%                                      d) 50%
44. Molarity of 0.2 N  $\text{H}_2 \text{SO}_4$  is  
 a) 0.2                                      b) 0.4                                      c) 0.6                                      d) 0.1
45. The condition under which Nernst distribution law will not hold true is :  
 a) Temperature is constant  
 b) The molecular state of the solute is the same in both solvents  
 c) The solute does not cause any change in the mutual solubility of the two solvents  
 d) None of the above
46. Which of the following associated with isotonic solutions is not correct?  
 a) They will have the same osmotic pressure  
 b) They will have the same vapour pressure  
 c) They have same weight concentrations  
 d) Osmosis does not take place when the two solutions are separated by a semipermeable membrane
47. The distribution law holds good for :  
 a) Heterogeneous systems b) Homogeneous systems c) Both (a) and (b)                                      d) None of these
48. The energy that favours dissolution of a solute in water is known as :  
 a) Hydration energy  
 b) Lattice energy  
 c) Ionization energy  
 d) Exothermic energy
49. Which is correct about Henry's law?  
 a) There should not be any chemical interaction between the gas and liquid  
 b) The gas in contact with the liquid should behave as an ideal gas  
 c) The pressure applied should be high  
 d) All of the above
50. 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
51. Vapour pressure of chloroform ( $\text{CHCl}_3$ ) and dichloromethane ( $\text{CH}_2\text{Cl}_2$ ) at  $25^{\circ}\text{C}$  are 200 mm Hg and 41.5 mm Hg respectively. Vapour pressure of the solution obtained by mixing 25.5 g of  $\text{CHCl}_3$  and 40 g of  $\text{CH}_2\text{Cl}_2$  at the same temperature will be :  
 (Molecular mass of  $\text{CHCl}_3 = 119.5 \text{ u}$  and molecular mass of  $\text{CH}_2\text{Cl}_2 = 85 \text{ u}$ )  
 a) 173.9 mm Hg  
 b) 615.0 mm Hg  
 c) 347.9 mm Hg  
 d) 90.952 mm Hg
52. A solution is prepared by dissolving 24.5 g of sodium hydroxide in distilled water to give 1L solution. The molarity of NaOH in the solution is  
 (Given, that molar mass of NaOH =  $40.0 \text{ g mol}^{-1}$ )  
 a) 0.2450 M                                      b) 0.6125 M                                      c) 0.9800 M                                      d) 1.6326 M
53. The molal elevation constant for water is  $0.52 \text{ K molality}^{-1}$ . The elevation caused in the boiling point of water by dissolving 0.25 mole of a non-volatile solute in 250 g of water will be :  
 a)  $52^{\circ}\text{C}$                                       b)  $5.2^{\circ}\text{C}$                                       c)  $0.52^{\circ}\text{C}$                                       d)  $0.052^{\circ}\text{C}$
54. The phenomenon in which cells are shrunk down if placed in hypertonic solution is called :  
 a) Plasmolysis                                      b) Haemolysis                                      c) Endosmosis                                      d) None of these



55. Two solutions of glucose have osmotic pressure 1.0 and 3.5 atm. If 1 L of first solution is mixed with  $V$  L of second solution, the osmotic pressure of the resultant solution becomes 2.5 atm. Volume of second solution is  
 a) 1.0 L                      b) 1.5 L                      c) 2.5 L                      d) 3.5 L
56. The difference between the boiling point and freezing point of an aqueous solution containing sucrose (mol wt. =  $342 \text{ gmol}^{-1}$ ) in 100 g of water is  $105.0^\circ\text{C}$ . If  $K_f$  and  $K_b$  of water are 1.86 and  $0.51 \text{ K kg mol}^{-1}$  respectively, the weight of sucrose in the solution is about  
 a) 34.2 g                      b) 342 g                      c) 7.2 g                      d) 72 g
57. At temperature  $327^\circ\text{C}$  and concentration  $C$  osmotic pressure of a solution is  $p$ , the same solutions at concentration  $C/2$  and a temperature  $427^\circ\text{C}$  shows osmotic pressure 2 atm, value of  $p$  will be  
 a)  $\frac{12}{7}$                       b)  $\frac{24}{7}$                       c)  $\frac{6}{5}$                       d)  $\frac{5}{6}$
58. A non-ideal solution was prepared by mixing 30 mL chloroform and 50 mL acetone. The volume of mixture will be  
 a)  $>80 \text{ mL}$                       b)  $<80 \text{ mL}$                       c)  $=80 \text{ mL}$                       d)  $\geq 80 \text{ mL}$
59. The solubility of a gas in liquid at a temperature is directly proportional to its :  
 a) Density                      b) Melting point                      c) Boiling point                      d) Pressure
60. Binary liquid mixtures which exhibit positive deviations from Raoult's law boil at.... temperature than the expected b. p.:  
 a) lower                      b) Higher                      c) Same                      d) Cannot be said
61. Generally those gases are soluble in water to a greater extent which :  
 a) Are easily liquefied  
 b) Are ionized in water  
 c) React with water  
 d) All are correct
62. If the temperature increase from  $0^\circ\text{C}$  to  $50^\circ\text{C}$  at atmospheric pressure, which of the following processes is expected to take place more in case of liquids?  
 a) Freezing                      b) Vaporization                      c) Sublimation                      d) None of these
63. Abnormal colligative properties are observed only when the dissolved non-volatile solute in a given dilute solution  
 a) Is a non-electrolyte                      b) Offers an intense colour  
 c) Associates or dissociates                      d) Offers no colour
64. A solute is soluble in two immiscible liquids which are present in a mixture. The concentration of the solute in the upper layer will be :  
 a) Same as in the lower layer  
 b) Less than in the lower layer  
 c) More than in the lower layer  
 d) In fixed ratio with that in the lower layer
65. Distribution law is a special application of ....and *vice – versa*.  
 a) Raoult's law  
 b) Henry's law  
 c) Dalton's law  
 d) None of these
66. A solution is prepared by dissolving 24.5 g of sodium hydroxide in distilled water to give 1L solution. The molarity of NaOH in the solution is  
 (Given, that molar mass of NaOH =  $40.0 \text{ g mol}^{-1}$ )  
 a) 1000 g of solvent                      b) 1 L of solvent                      c) 1 L of solution                      d) 1000 g of solution
67. In a 0.2 molal aqueous solution of a weak acid  $\text{HX}$ , the degree of ionisation is 0.3 Taking  $k_f$  for water as 1.85, the freezing point of the solution will be nearest to

- a)  $-0.480^{\circ}\text{C}$                       b)  $-0.360^{\circ}\text{C}$                       c)  $-0.260^{\circ}\text{C}$                       d)  $+0.480^{\circ}\text{C}$
68. The vapour pressure (VP) of a dilute solution of non-volatile solute is  $P$  and the VP of pure solvent is  $P_0$ , the lowering of the VP is :  
 a) +ve                                      b) -ve                                      c)  $P/P_0$                                       d)  $P_0/P$
69. Volume of 0.6 M NaOH required to neutralise  $30\text{ cm}^3$  of 0.4 M HCl is  
 a)  $20\text{ cm}^3$                                       b)  $40\text{ cm}^3$                                       c)  $45\text{ cm}^3$                                       d)  $30\text{ cm}^3$
70. In an osmotic pressure measurement experiment, a 5% solution of compound 'X' is found to be isotonic with a 2 % acetic acid solution . The gram molecular mass of 'X' is  
 a) 24                                      b) 60                                      c) 150                                      d) 300
71. Benzene and toluene form nearly ideal solutions. At  $25^{\circ}\text{C}$ , the vapour pressure of benzene is 75 torr and that of toluene is 22 torr. The partial vapour pressure of benzene at  $20^{\circ}\text{C}$  for a solution containing 78 g of benzene and 46 g of toluene in torr is  
 a) 53.5                                      b) 37.5                                      c) 25                                      d) 50
72. Which of the following liquid pairs shows a positive deviation from Raoult's law?  
 a) Water-hydrochloric acid                                      b) Benzene-methanol  
 c) Water-nitric acid                                      d) Acetone-chloroform
73. Following solutions at the same temperature will be isotonic :  
 a) 3.42 g of cane sugar in one litre water and 0.18 g of glucose in one litre water  
 b) 3.42 g of cane sugar in one litre water and 0.18 g of glucose in 0.1 litre water  
 c) 3.42 g of cane sugar in one litre water and 0.585 g of NaCl in one litre water  
 d) 3.42 g of cane sugar in one litre water and 1.17 g of NaCl in one litre water
74. Which of the following liquid pair shows a positive deviation from Raoult's law?  
 a) Water-nitric acid                                      b) Acetone-chloroform  
 c) Water-hydrochloric acid                                      d) Benzene-methanol
75. Which of the following is the expression of Raoult's law?  
 ( $p$  =vapour pressure of pure solvent,  $p_s$  =vapour pressure of the solution)  
 a)  $\frac{p - p_s}{p} = \frac{n}{n + N}$                                       b)  $\frac{p_s - p}{p} = \frac{N}{N + n}$                                       c)  $\frac{p - p_s}{p_s} = \frac{N}{N - n}$                                       d)  $\frac{p_s - p}{p_s} = \frac{N - n}{N}$
76. Which of the following mixture does not show positive deviation from the Raoult's law?  
 a) Benzene + acetone                                      b) Acetone + ethanol  
 c) Acetone + chloroform                                      d) Water + ethanol
77. Who gave the phase rule?  
 a) Nernst  
 b) Willard Gibbs  
 c) Ostwald  
 d) Raoult
78. The volume of water to added to  $100\text{ cm}^3$  of 0.5 N  $\text{H}_2\text{SO}_4$  to get decinormal concentration is  
 a)  $400\text{ cm}^3$                                       b)  $450\text{ cm}^3$                                       c)  $500\text{ cm}^3$                                       d)  $100\text{ cm}^3$
79. 40% by weight solution will contain how much mass of the solute in 1L solution, density of the solution is  $1.2\text{ g/mL}$ ?  
 a) 480 g                                      b) 48 g                                      c) 38 g                                      d) 380 g
80. The azeotropic mixture of water (b. pt.  $100^{\circ}\text{C}$ ) and HCl (b.pt.  $85^{\circ}\text{C}$ ) boils at  $108.5^{\circ}\text{C}$ . When this mixture is distilled it is possible to obtain  
 a) Pure HCl                                      b) Pure water  
 c) Pure water as well as HCl                                      d) Neither HCl nor  $\text{H}_2\text{O}$  in their pure states
81. The normality of a 100 mL solution of sodium hydroxide which contains 4 g of NaOH, is  
 a) 0.5                                      b) 1.0                                      c) 1.5                                      d) 2.0
82. The amount of ice that will separate out on cooling a solute containing 50 g of ethylene glycol in 200 g water to  $-9.3^{\circ}\text{C}$  will be

- a) 8.37 g                      b) 161.3 g                      c) 3.87 g                      d) 38.7 g
83. Among the following substances, the lowest vapour pressure is exerted by :  
 a) Water                      b) Mercury                      c) Kerosene                      d) Rectified spirit
84. A solution has an osmotic pressure of 0.821 atm at 300 K. its concentration would be :  
 a) 0.066 M                      b) 0.66 M                      c) 0.033 M                      d) 0.33 M
85. The vant's Hoff factor for 0.1 M  $\text{Ba}(\text{NO}_3)_2$  solution is 2.74. The degree of dissociation is  
 a) 91.3%                      b) 87%                      c) 100%                      d) 74%
86. What is the freezing point of a solution containing 8.1 g HBr in 100 g water assuming the acid to be 90% ionised? ( $k_f$  for water =  $1.86 \text{ K mol}^{-1}$ )  
 a)  $0.85^\circ\text{C}$                       b)  $-3.53^\circ\text{C}$                       c)  $0^\circ\text{C}$                       d)  $-0.35^\circ\text{C}$
87. The relative lowering of vapour pressure of an aqueous solution containing non-volatile solute is 0.0125. The molality of the solution is  
 a) 0.1 M NaCl                      b) 0.1 M  $\text{BaCl}_2$                       c) 0.1 M sucrose                      d) 0.1 M KCl
88. 5 L of a solution contains 25 mg of  $\text{CaCO}_3$ . What is its concentration in ppm? (mol. wt. of  $\text{CaCO}_3$  is 100)  
 a) 25                      b) 1                      c) 5                      d) 2500
89. A 0.025 M solution of monobasic acid had a freezing point of  $-0.060^\circ\text{C}$ . The  $\text{p}K_a$  for the acid is  
 a) 1.2                      b) 2                      c) 2.5                      d) 5.7
90. If 0.15 g of a solute, dissolved in 15 g of solvent, is boiled at a temperature higher by  $0.216^\circ\text{C}$  than that of the pure solvent. The molecular weight of the substance (molal elevation constant for the solvent is  $2.16^\circ\text{C}$ ) is  
 a) 100                      b) 10.1                      c) 10                      d) 1.001
91. 3.65 g of HCl is dissolved in 16.2 g of water. The mole fraction of HCl in the resulting solution is  
 a) 0.1                      b) 0.2                      c) 0.3                      d) 0.4
92. If molecular interaction of two different liquid molecules are stronger than the molecular interactions of the same liquid molecules the mixture is expected to show :  
 a) Positive deviations  
 b) Negative deviations  
 c) No deviations  
 d) Positive as well as negative deviations
93. Equimolal solutions will have the same boiling point, provided they do not show :  
 a) Electrolysis  
 b) Association  
 c) Dissociation  
 d) Association or dissociation
94. 6 g urea is dissolved in 90 g water. The relative lowering of vapour pressure is equal to :  
 a) 0.0196                      b) 0.06                      c) 1.10                      d) 0.0202
95. At  $88^\circ\text{C}$  benzene has a vapour pressure of 900 torr and toluene has a vapour pressure of 360 torr. What is the mole fraction of benzene in the mixture with toluene that will boil at  $88^\circ\text{C}$  at 1 atm pressure, benzene-toluene form an ideal solution?  
 a) 0.416                      b) 0.588                      c) 0.688                      d) 0.740
96. Which of the following aqueous solutions produce the same osmotic pressure?  
 (i) 0.1 M NaCl solution  
 (ii) 0.1 M glucose solution  
 (iii) 0.6 g urea in 100 mL solution  
 (iv) 1.0 g of a non-electrolyte solute (X) in 50 mL solution (molar mass of X = 200)  
 a) (i), (ii), (iii)                      b) (ii), (iii), (iv)                      c) (i), (ii), (iv)                      d) (i), (iii), (iv)
97. When 20 g of naphthoic acid ( $\text{C}_{11}\text{H}_8\text{O}_2$ ) is dissolved in 50 g of benzene ( $k_f = 1.72 \text{ K kg mol}^{-1}$ ), a freezing point depression of 2 K is observed. The van't Hoff factor ( $i$ ) is  
 a) 0.5                      b) 1                      c) 2                      d) 3

98. The depression in f.p. is directly proportional to :  
 a) Normality                      b) Molality                      c) Molarity                      d) None of these
99. Which of the following solutions has the highest normality?  
 a) 6 g of NaOH/100 mL    b) 0.5 M H<sub>2</sub>SO<sub>4</sub>                      c) N phosphoric acid                      d) 8 g of KOH/L
100. The vapour pressure will be lowest of  
 a) Hypertonic solution                      b) Hypotonic solution  
 c) Isotonic solution                      d) None of the above
101. An aqueous solution of methanol in water has vapour pressure  
 a) Less than that of water                      b) More than that of water  
 c) Equal to that of water                      d) Equal to that of methanol
102. The condition for the validity of Henry's law are :  
 a) The pressure should not be too high  
 b) The temperature should not be too low  
 c) The gas should neither dissociate nor enter into chemical combination with solvent  
 d) All of the above
103. The osmotic pressure of 0.4% urea solution is 1.66 atm. and that of a solution of sugar of 3.42% is 2.46 atm. When both the solutions are mixed then the osmotic pressure of the resultant solution will be  
 a) 1.02 atm                      b) 2.06 atm                      c) 3.04 atm                      d) 0.02 atm
104. Elevation in boiling point was 0.52°C when 6 g of a compound was dissolved in 100 g of water. Molecular weight of X is ( $k_b$  of water is 5.2°C per 100 g water )  
 a) 120                      b) 60                      c) 600                      d) 180
105. When a crystal of the solute is introduced into a super saturated solution of the solute :  
 a) The solute dissolves  
 b) The excess solute crystallizes out  
 c) The solution becomes unsaturated  
 d) The solution remains super saturated
106. Which of the following solutions will have the highest boiling point?  
 a) 0.1 M BaCl<sub>2</sub>                      b) 0.1 M FeCl<sub>3</sub>                      c) 0.1 M NaCl                      d) 0.1 M urea
107. Two solutions have different osmotic pressure. The solution of lower osmotic pressure is called :  
 a) Isotonic solution  
 b) Hypertonic solution  
 c) Hypotonic solution  
 d) None of these
108. Molecular weight of glucose is 180. A solution of glucose which contains 18 g/L, is  
 a) 0.1 molal                      b) 0.2 molal                      c) 0.3 molal                      d) 0.4 molal
109. Azeotropic mixture of HCl and water has  
 a) 48% HCl                      b) 22.2% HCl                      c) 36% HCl                      d) 20.2% HCl
110. Depression in freezing point is 6 K for NaCl solution if  $k_f$  for water is 1.86 K/kg mol, amount of NaCl dissolved in 1 kg water is  
 a) 3.42                      b) 1.62                      c) 3.24                      d) 1.71
111. The amount of urea dissolved in 500 cc of water ( $K_f = 1.86^\circ\text{C}$ ) to produce a depression of 0.186°C in the freezing point is  
 a) 9 g                      b) 6 g                      c) 3 g                      d) 0.3 g
112. The osmotic pressure (At 27°C) of an aqueous solution (200 mL) containing 6 g of a protein is  $2 \times 10^{-3}$  atm. If  $R = 0.080 \text{ L atm mol}^{-1} \text{ K}^{-1}$ , the molecular weight of protein is  
 a)  $7.2 \times 10^5$                       b)  $3.6 \times 10^5$                       c)  $1.8 \times 10^5$                       d)  $1.0 \times 10^5$
113. Assuming that sea water is a 3.50 weight per cent aqueous solution of NaCl. What is the molality of sea water?  
 a) 0.062 m                      b) 0.0062 m                      c) 0.62 m                      d) 6.2 m

114. When 25 g of a non-volatile solute is dissolved in 100 g of water, the vapour pressure is lowered by  $2.25 \times 10^{-1}$  mm. If the vapour pressure of water at 20°C is 17.5 mm, what is the molecular weight of the solute?  
 a) 206                                      b) 302                                      c) 350                                      d) 276
115. Van't hoff factor of  $Ca(NO_3)_2$  is  
 a) Benzoic acid is an organic solute  
 b) Benzoic acid has higher molar mass than benzene  
 c) Benzoic acid gets associated in benzene  
 d) Benzoic acid gets dissociated in benzene
116. Dilute 1 L one molar  $H_2SO_4$  solution by 5 L water, the normality of that solution is  
 a) 0.33 N                                      b) 33.0 N                                      c) 0.11 N                                      d) 11.0 N
117. Molarity of a solution prepared by dissolving 75.5 g of pure KOH in 540 mL solution is  
 a) 1.50 M                                      b) 2.50 M                                      c) 3.50 M                                      d) 5.01 M
118. What is the total number of moles of  $H_2SO_4$  needed to prepare 5.0 L of a 2.0 M solution of  $H_2SO_4$  ?  
 a) 2.5                                      b) 5.0                                      c) 10                                      d) 20
119. The relative lowering of vapour pressure of a dilute aqueous solution containing non-volatile solute is 0.0125. The molality of the solution is about  
 a) 0.70                                      b) 0.50                                      c) 0.90                                      d) 0.80
120. The osmotic pressure of a solution can be accurately measured in the shortest possible time by :  
 a) Berkeley and Hartley method  
 b) Morse and Frazer method  
 c) Pfeffer method  
 d) None of the above
121. In a solution of 7.8 g benzene ( $C_6H_6$ ) and 46.0 g toluene ( $C_6H_5CH_3$ ), the mole-fraction of benzene is  
 a)  $\frac{1}{2}$                                       b)  $\frac{1}{3}$                                       c)  $\frac{1}{5}$                                       d)  $\frac{1}{6}$
122. A thermometer which can be used only for accurate measurement of small differences in temperature is known as a:  
 a) Beckmann thermometer  
 b) Contact thermometer  
 c) Clinical thermometer  
 d) Platinum resistance thermometer
123. A 0.001 molal solution of  $[Pt(NH_3)_4Cl_4]$  in water has a freezing point depression of 0.0054°C. If  $K_f$  for water is 1.80, the correct formulation of the above molecule is :  
 a)  $[Pt(NH_3)_4Cl_3]Cl$                       b)  $[Pt(NH_3)_4Cl_2]Cl_2$                       c)  $[Pt(NH_3)_4Cl]Cl_3$                       d)  $[Pt(NH_3)_4Cl_4]$
124. The molal elevation constant for water is 0.52. What will be the boiling point of 2 molar sucrose solution at 1 atm pressure? (Assume b.p. of pure water is 100°C)  
 a) 101.04°C                                      b) 100.26°C                                      c) 100.52°C                                      d) 99.74°C
125. At certain temperature a 5.12% solution of cane sugar is isotonic with a 0.9% solution of an unknown solute. The molar mass of solute is  
 a) 60                                      b) 46.17                                      c) 120                                      d) 90
126. Molarity of 0.2 N  $H_2SO_4$  is  
 a) 0.1                                      b) 0.2                                      c) 0.3                                      d) 0.4
127. 3.0 molal NaOH solution has a density of 1.110 g/mL. The molarity of the solution is  
 a) 3.9732                                      b) 2.9732                                      c) 1.9732                                      d) 0.9732
128. How many gram of NaOH will be required to prepare 500 g solution containing 10% $\frac{w}{w}$  NaOH solution?  
 a) 100 g                                      b) 50 g                                      c) 0.5 g                                      d) 5.0 g
129. The molal elevation/depression constant depends upon :  
 a) Nature of solvent  
 b) Nature of solute

- c) Temperature  
d)  $\Delta H$  solution
130. The vapour pressure of benzene at a certain temperature is 640 mm of Hg. A non-volatile and non-electrolyte solid weighing 2.175 g is added to 39.08 g of benzene. If the vapour pressure of the solution is 600 mm of Hg, what is the molecular weight of solid substance?  
a) 49.50                      b) 59.60                      c) 69.60                      d) 79.82
131. A solute when distributed between two immiscible phases remains associated in phase II and dissociated in phase I. If  $\alpha$  is the degree of dissociation and  $n$  is the number of molecules associated then :  
a)  $K = \frac{c_I}{c_{II}}$                       b)  $K = \frac{c_I}{\sqrt[n]{c_{II}(1-\alpha)}}$                       c)  $K = \frac{c_I}{c_{II}(1-\alpha)}$                       d)  $K = \frac{c_I(1-\alpha)}{\sqrt[n]{c_{II}}}$
132. Saturated solution of NaCl on heating becomes :  
a) Super saturated                      b) Unsaturated                      c) Remains saturated                      d) None of these
133. At 25°C, the total pressure of an ideal solution obtained by mixing 3 moles of 'A' and 2 moles of 'B', is 184 torr. What is the vapour pressure (in torr) of pure 'B' at the same temperature? (Vapour pressure of pure 'A' at 25°C is 200 torr)  
a) 180                      b) 160                      c) 16                      d) 100
134. At 40°C the vapour pressures of pure liquids, benzene and toluene, are 75 torr and 22 torr respectively. At the same temperature, the partial vapour pressure of benzene in a mixture of 78 g benzene and 46 g toluene in torr assuming the ideal solution should be :  
a) 50                      b) 25                      c) 375                      d) 53.5
135. Solutions A, B, C and D are respectively 0.1 M glucose, 0.05 M NaCl, 0.05 M BaCl<sub>2</sub> and 0.1 M AlCl<sub>3</sub>. Which one of the following pairs is isotonic?  
a) A and B                      b) B and C                      c) A and D                      d) A and C
136.  $p_A$  and  $p_B$  are the vapour pressure of pure liquid components A and B respectively of an ideal binary solution. If  $x_A$  represents the mole fraction of component A, the total pressure of the solution will be :  
a)  $p_B + x_A(p_B - p_A)$                       b)  $p_B + x_A(p_A - p_B)$                       c)  $p_A + x_A(p_B - p_A)$                       d)  $p_A + x_A(p_A - p_B)$
137. The vapour pressure of water at 23°C is 19.8 mm. 0.1 mole of glucose is dissolved in 178.2 g of water. What is the vapour pressure (in mm) of the resultant solution?  
a) 19.0                      b) 19.602                      c) 19.402                      d) 19.202
138. A solution of sucrose (Molar mass = 342 g/mol) is prepared by dissolving 68.4 g of it per litre of solution, what is its osmotic pressure ( $R=0.082 \text{ L atmK}^{-1} \text{ mol}^{-1}$ ) at 273 K?  
a) 0.01 M Na<sub>2</sub>SO<sub>4</sub>                      b) 0.01 M KNO<sub>3</sub>                      c) 0.015 M urea                      d) 0.015 M glucose
139. Lowering in vapour pressure is the highest for:  
a) 0.2 m urea  
b) 0.1 m glucose  
c) 0.1 m MgSO<sub>4</sub>  
d) 0.1 m BaCl<sub>2</sub>
140. The  $K$  for I<sub>2</sub> between CS<sub>2</sub> and H<sub>2</sub>O is 588 in favour of CS<sub>2</sub>. One litre of aqueous solution containing 1 g of I<sub>2</sub> is shaken with 50 mL of CS<sub>2</sub>. What will be the amount of I<sub>2</sub> in aqueous layer?  
a) 0.035 g                      b) 0.010 g                      c) 0.05 g                      d) 0.04 g
141. The relative lowering of vapour pressure of a dilute aqueous solution containing non-volatile solute is 0.0125. The molality of the solution is about  
a) 0.70                      b) 0.50                      c) 0.90                      d) 0.80
142. A solution of 4.5 g of a pure non-electrolyte in 100 g of water was found to freeze at 0.465°C. The molecular weight of the solute closest to ( $k_f = 1.86$ )  
a) 135.0                      b) 172.0                      c) 90.0                      d) 180.0
143. A solution of urea (mol. mass 56) boils at 100.18°C at atmospheric pressure. If  $K_f$  and  $K_b$  for water are 1.86 and 0.512 K molality<sup>-1</sup> respectively, the above solution will freeze at :  
a) - 6.54°C                      b) 6.54°C                      c) - 0.654°C                      d) 0.654°C



144. Vapour pressure of pure  $A = 100$  torr, moles = 2; vapour pressure of pure  $B = 80$  torr, moles = 3. Total vapour pressure of the mixture is  
 a) 440 torr                      b) 460 torr                      c) 180 torr                      d) 88 torr
145. The boiling point of  $C_6H_6$ ,  $CH_3OH$ ,  $C_6H_5NH_2$  and  $C_6H_5NO_2$  are  $80^\circ C$ ,  $65^\circ C$ ,  $184^\circ C$  and  $212^\circ C$  respectively. Which will show highest vapour pressure at room temperature?  
 a)  $C_6H_6$                       b)  $CH_3OH$                       c)  $C_6H_5NH_2$                       d)  $C_6H_5NO_2$
146. In a pair of immiscible liquids, a common solute dissolves in both and the equilibrium is reached. The concentration of solute in upper layer is :  
 a) Same as in lower layer  
 b) Lower than the lower layer  
 c) Higher than the lower layer  
 d) In fixed ratio with that in the lower layer
147. Blood cells retain their normal shapes in solutions which are :  
 a) Isotonic to blood  
 b) Hypotonic to blood  
 c) Hypertonic to blood  
 d) Equinormal to blood
148. A solution has a 1 : 4 mole ratio of pentane to hexane. The vapour pressures of pure hydrocarbons at  $20^\circ C$  are 440 mm Hg for pentane and 120 mm Hg for hexane. The mole fraction of pentane in vapour phase would be :  
 a) 0.786                      b) 0.549                      c) 0.478                      d) 0.200
149. The empirical formula of a non-electrolyte is  $CH_2O$ . A solution containing 6g of the compound exerts the same osmotic pressure as that of 0.05 M glucose solution at the same temperature. The molecular formula of the compound is  
 a)  $C_2H_4O_2$                       b)  $C_3H_6O_3$                       c)  $C_5H_{10}O_5$                       d)  $C_4H_5O_4$
150. A 5.2 molal aqueous solution of methyl alcohol,  $CH_3OH$ , is supplied. What is the mole fraction of methyl alcohol in the solution?  
 a) 1.100                      b) 0.190                      c) 0.086                      d) 0.050
151. The weight of  $H_2C_2O_4 \cdot 2H_2O$  required to pressure 500 mL of 0.2 N solution is  
 a) 63 g                      b) 6.3 g                      c) 0.63 g                      d) 126 g
152. The elevation of boiling point method is used for the determination of molecular weight of:  
 a) Non-volatile and soluble solute  
 b) Non-volatile and insoluble solute  
 c) Volatile and soluble solute  
 d) Volatile and insoluble solute
153.  $50 \text{ cm}^3$  of 0.2 N HCl is titrated against 0.1 N NaOH solution. The titration is discontinued after adding  $50 \text{ cm}^3$  of NaOH. The remaining titration is completed by adding 0.5 N KOH. The volume of KOH required for completing the titration is  
 a)  $12 \text{ cm}^3$                       b)  $10 \text{ cm}^3$                       c)  $25 \text{ cm}^3$                       d)  $10.5 \text{ cm}^3$
154. Dissolution of a solute is an exothermic process if :  
 a) Hydration energy > lattice energy  
 b) Hydration energy < lattice energy  
 c) Hydration energy = lattice energy  
 d) None of the above
155. Which of the following shows maximum depression in freezing point?  
 a)  $K_2SO_4$                       b) NaCl                      c) Urea                      d) glucose
156. Water will boil at  $101.5^\circ C$  at which of the following pressure?  
 a) 76 cm of Hg                      b) 76 mm of Hg                      c) > 76 cm of Hg                      d) < 76 cm of Hg
157. The vapour pressure of pure liquid  $A$  is 0.80 atm. When a non-volatile  $B$  is added to  $A$  its vapour pressure

- drops to 0.60 atm. The mole fraction of  $B$  in the solution is
- a) 0.125                      b) 0.25                      c) 0.5                      d) 0.75
158. One gram of silver gets distributed between  $10 \text{ cm}^3$  of molten zinc and  $100 \text{ cm}^3$  of molten lead at  $8000^\circ\text{C}$ . The percentage of silver still left in the lead layer is approximately
- a) 2                      b) 5                      c) 3                      d) 1
159. How many moles of  $Al_2(SO_4)_3$  would be in 50 g of the substance?
- a) 0.083 mol                      b) 0.952 mol                      c) 0.481 mol                      d) 0.140 mol
160. The distribution law was given by :
- a) Henry                      b) Nernst                      c) van't Hoff                      d) Ostwald
161. The vapour pressure of a solution is proportional to :
- a) Mole fraction of solute  
b)  $1/(\text{mole fraction of solute})$   
c) Mole fraction of solvent  
d) None of the above
162. At low concentrations, the statements that equimolar solutions under a given set of experimental conditions have equal osmotic pressure is true for
- a) Solutions of non-electrolytes only                      b) Solutions of electrolytes only  
c) All solutions                      d) None of the above
163. When a solute is added in two immiscible solvents, it distributes itself between two liquids so that its concentration in first liquid is  $c_1$  and that in the second liquid is  $c_2$ . If the solute forms a stable trimer in the first liquid, the distribution law suggests that :
- a)  $3c_1 = c_2$   
b)  $c_1/\sqrt[3]{c_2} = \text{constant}$   
c)  $c_1/3 = c_2$   
d)  $c_2/\sqrt[3]{c_1} = \text{constant}$
164. Solution  $A$  contains 7 g/L of  $MgCl_2$  and solution  $B$  contains 7 g/L of NaCl. At room temperature, the osmotic pressure of
- a) Solution  $A$  is greater than  $B$   
b) Both have same osmotic pressure  
c) Solution  $B$  is greater than  $A$   
d) Cannot be determine
165. The normality of mixture obtained by mixing 100 mL of 0.2 M  $H_2SO_4$  + 100 mL of 0.2 M NaOH is
- a) 0.2                      b) 0.01                      c) 0.1                      d) 0.3
166. Two liquids  $X$  and  $Y$  form an ideal solution. The mixture has a vapour pressure of 400 mm at 300 K when mixed in the molar ratio of 1:1 and a vapour pressure of 350 mm when mixed in the molar ratio of 1:2 at the same temperature. The vapour pressures of the two pure liquids  $X$  and  $Y$  respectively are
- a) 250 mm, 550 mm                      b) 350 mm, 450 mm                      c) 350 mm, 700 mm                      d) 550 mm, 250 mm
167. Iodine was added to a system of water and  $CS_2$ . The concentration of  $I_2$  in water and  $CS_2$  were found to be  $C_1/C_2$  respectively. The ratio of  $C_1/C_2$  will change if :
- a) More  $I_2$  is added  
b) More  $CS_2$  is added  
c) More water is added  
d) Temperature is changed
168. Which of the following solutions will have the highest boiling point ?
- a) Camphor                      b) Naphthalene                      c) Benzene                      d) Water
169. Pressure cooker reduces cooking time for food because
- a) Boiling point of water involved in cooking is increased  
b) Heat is more evenly distributed in the cooking space

- c) The higher pressure inside the cooker crushes the food material  
 d) Cooking involves chemical changes helped by a rise in temperature
170. The molal boiling point constant of water is  $0.53^{\circ}\text{C}$ . When 2 mole of glucose are dissolved in 4000 g of water, the solution will boil at :  
 a)  $100.53^{\circ}\text{C}$                       b)  $101.06^{\circ}\text{C}$                       c)  $100.265^{\circ}\text{C}$                       d)  $99.47^{\circ}\text{C}$
171. Mole fraction of solute in an aqueous solution which boils at  $100.104$ .  $K_b$  for  $\text{H}_2\text{O} = 0.52 \text{ K molality}^{-1}$ :  
 a)  $3.6 \times 10^{-3}$                       b) 0.004                      c)  $5.6 \times 10^{-3}$                       d) 0.996
172. Colligative properties of a solution depends upon  
 a) Nature of both solvent and solute                      b) Nature of solute only  
 c) Number of solvent particles                      d) The number of solute particles
173.  $X$  is dissolved in water. Maximum boiling point is observed when  $X$  is ....(0.1 M each)  
 a)  $\text{CaSO}_4$                       b)  $\text{BaCl}_2$                       c)  $\text{NaCl}$                       d) Urea
174. Lowering of vapour pressure is highest for  
 a) 0.1 M  $\text{BaCl}_2$                       b) 0.1 M glucose                      c) 0.1 M  $\text{MgSO}_4$                       d) Urea
175. The statement "the relative lowering of the vapour pressure is equal to the ratio of moles of the solute to the total number of the moles in the solution" refers to  
 a) Hess's law                      b) Dalton's law                      c) Raoult's law                      d) Charles' law
176. A solution of two liquids boils at a temperature more than the boiling point of either them. Hence, the binary solution shows  
 a) Negative deviation from Raoult's law  
 b) Positive deviation from Raoult's law  
 c) No deviation from Raoult's law  
 d) Positive or negative deviation from Raoult's law depending upon the composition
177. Which of the following is true when components forming an ideal solution are mixed?  
 a)  $\Delta H_m = \Delta V_m = 0$                       b)  $\Delta H_m < \Delta V_m$                       c)  $\Delta H_m = \Delta V_m = 1$                       d)  $\Delta H_m > \Delta V_m$
178. The relative lowering of vapour pressure of an aqueous solution containing non-volatile solute is 0.0125. The molality of the solution is  
 a) Vapour pressure                      b) Osmotic pressure                      c) Boiling point                      d) Freezing point
179. The normality of 10% (weight/volume) acetic acid is  
 a) 1 N                      b) 1.3 N                      c) 1.7 N                      d) 1.9 N
180. Two solutions of substance (non-electrolyte) are mixed in the following manner.  
 480 mL of 1.5 M first solution + 520 mL of 1.2 M second solution.  
 What is the molarity of the final mixture ?  
 a) 2.70M                      b) 1.344 M                      c) 1.50 M                      d) 1.20M
181. The difference between the boiling point and freezing point of an aqueous solution containing sucrose (mol wt. =  $342 \text{ gmol}^{-1}$ ) in 100 g of water is  $105.0^{\circ}\text{C}$ . If  $K_f$  and  $K_b$  of water are 1.86 and  $0.51 \text{ K kg mol}^{-1}$  respectively, the weight of sucrose in the solution is about  
 a) 1 M solution of glucose                      b) 0.05 M solution of glucose  
 c) 6% solution of glucose                      d) 25% solution of glucose
182. The mass of glucose that should be dissolved in 50 g of water in order to produce the same lowering of vapour pressure as is produced by dissolving 1 g of urea in the same quantity of water is  
 a) 1 g                      b) 3 g                      c) 6 g                      d) 18 g
183. The ratio of vapour pressure over solution phase on mixing two immiscible liquids is equal to :  
 a) Ratio of their weights in mixture  
 b) Ratio of their mol. weights  
 c) Ratio of their moles in liquid phase  
 d) Ration of their moles in vapour phase
184. Density of a 2.05 M solution of acetic acid in water is  $1.02 \text{ g/mL}$ . The molality of the solution is  
 a)  $1.14 \text{ mol kg}^{-1}$                       b)  $3.28 \text{ mol kg}^{-1}$                       c)  $2.28 \text{ mol kg}^{-1}$                       d)  $0.44 \text{ mol kg}^{-1}$

185. Two solutions of  $\text{KNO}_3$  and  $\text{CH}_3\text{COOH}$  are prepared separately. Molarity of both is 0.1 M and osmotic pressures are  $p_1$  and  $p_2$  respectively. The correct relationship between the osmotic pressures is
- a)  $p_1 = p_2$                       b)  $p_1 > p_2$                       c)  $p_2 > p_1$                       d)  $\frac{p_1}{p_1 + p_2} + \frac{p_2}{p_1 + p_2}$
186. An aqueous solution of 6.3 g oxalic acid dihydrate is made up to 250 mL. The volume of 0.1 N sodium hydroxide required to completely neutralise 10 mL of this solution is
- a) 40 mL                      b) 20 mL                      c) 10 mL                      d) 4 mL
187. The vapour pressure of water at  $20^\circ\text{C}$  is 17.5 mmHg.  
If 18 g of glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) is added to 178.2 g of water at  $20^\circ\text{C}$ , the vapour pressure of the resulting solution will be
- a) 17.675 mmHg                      b) 15.750 mmHg                      c) 16.500 mmHg                      d) 17.325 mmHg
188. An azeotropic mixture of two liquids has boiling point lower than either of them, when it
- a) Shows a negative deviation from Raoult's law                      b) Shows no deviation from Raoult's law  
c) Shows positive deviation from Raoult's law                      d) Is saturated
189. The unit of molality is
- a)  $\text{mol L}^{-1}$                       b)  $\text{mol kg}^{-1}$                       c)  $\text{mol}^{-1} \text{L}^{-1}$                       d) mol L
190. The lubricating action of an oil is more if it possess :
- a) High vapour pressure  
b) Low vapour pressure  
c) High surface tension  
d) High density
191. In which ratio of volume 0.4 M HCl and 0.9 M HCl are to be mixed such that the concentration of the resultant solution becomes 0.7 M ?
- a) Air                      b) Brass                      c) Amalgam                      d) Benzene in water
192. Boiling point of water is defined as the temperature at which :
- a) Vapour pressure of water is equal to one atmospheric pressure  
b) Bubbles are formed  
c) Steam comes out  
d) None of the above
193. A solution of 5 g of iodine in  $\text{CS}_2$  was shaken with the same volume of water. The amount of iodine in water is : (Given  $K$  in favour of  $\text{CS}_2 = 420$ )
- a) 0.119 g                      b) 0.0119 g                      c) 0.00119 g                      d) 1.19 g
194. To neutralise completely 20 mL of 0.1 M aqueous solution of phosphorous acid ( $\text{H}_3\text{PO}_3$ ), the volume of 0.1 M aqueous KOH solution required is
- a) 10 mL                      b) 20 mL                      c) 40 mL                      d) 60 mL
195. At high altitude the boiling of water occurs at low temp. because :
- a) Atmospheric pressure is low  
b) Temperature is low  
c) Atmospheric pressure is high  
d) None of the above
196. The movement of solvent molecules through a semipermeable membrane is called
- a) Electrolysis                      b) Electrophoresis                      c) Osmosis                      d) Cataphoresis
197. The freezing point of water is depressed by  $0.37^\circ\text{C}$  in a 0.01 mol NaCl solution. The freezing point of 0.02 molal solution of urea is depressed by
- a)  $0.37^\circ\text{C}$                       b)  $0.74^\circ\text{C}$                       c)  $0.185^\circ\text{C}$                       d)  $0^\circ\text{C}$
198. If 5.85 g NaCl (molecular weight 58.5) is dissolved in water and the solution is made up to 0.5 L, the molarity of the solution will be
- a) 0.1                      b) 0.2                      c) 0.3                      d) 0.4
199. Vapour pressure of  $\text{CCl}_4$  at  $25^\circ\text{C}$  is 143 mm of Hg and 0.5 g of a non-volatile solute (mol. wt=65) is

- dissolved in 100 mL  $\text{CCl}_4$ . Find the vapour pressure of the solution. (Density of  $\text{CCl}_4 = 1.58 \text{ g/cm}^3$ )
- a) 94.39 mm                      b) 141.93 mm                      c) 134.44 mm                      d) 199.34 mm
200. The vapour pressure of water at  $20^\circ\text{C}$  is 17.54 mm. When 20 g of a non-ionic, substance is dissolved in 100 g of water, the vapour pressure is lowered by 0.30 mm. What is the molecular mass of the substance?
- a) 200.8                      b) 206.88                      c) 210.5                      d) 215.2
201. The freezing point (in  $^\circ\text{C}$ ) of solution containing 0.1 g of  $\text{K}_3[\text{Fe}(\text{CN})_6]$  (mol. wt 329) in 100 g of water ( $K_f = 1.86 \text{ K kg mol}^{-1}$ ) is
- a)  $-2.3 \times 10^{-2}$                       b)  $-5.7 \times 10^{-2}$                       c)  $-5.7 \times 10^{-3}$                       d)  $-1.2 \times 10^{-2}$
202. 10 g of iodine is allowed to distribute between  $\text{H}_2\text{O}$  and  $\text{CCl}_4$ . If the partition coefficient is 85 in favour of  $\text{CCl}_4$ , the ratio between volumes of  $\text{H}_2\text{O}$  and  $\text{CCl}_4$  such that 5 g of iodine will be present in aqueous layer is :
- a) 1 : 85                      b) 85 : 1                      c) 170 : 1                      d) 1 : 170
203. Osmotic pressure is 0.0821 atm at temperature of 300 K. Find concentration in mole per litre
- a) 0.33                      b)  $0.22 \times 10^{-2}$                       c)  $0.33 \times 10^{-2}$                       d)  $0.44 \times 10^{-2}$
204. A solution contains  $1.2046 \times 10^{24}$  hydrochloric acid molecules in  $1 \text{ dm}^3$  of the solution. The strength of the solution is
- a) 6 N                      b) 2 N                      c) 4 N                      d) 8 N
205. The osmotic pressure of 0.2 molar solution of urea at  $27^\circ\text{C}$  ( $R=0.082 \text{ L atm mol}^{-1}\text{K}^{-1}$ ) is
- a) 4.92 atm                      b) 1 atm                      c) 0.2 atm                      d) 27 atm
206. Colligative properties are used for the determination of
- a) Molar mass                      b) Equivalent weight  
c) Arrangement of molecules                      d) Melting and boiling points
207. Which of the following is not a colligative property?
- a) Optical activity                      b) Osmotic pressure  
c) Depression of freezing point                      d) Elevation of boiling point
208. If liquids *A* and *B* form an ideal solution, the
- a) Enthalpy of mixing is zero  
b) Entropy of mixing is zero  
c) Free energy of mixing is zero  
d) Free energy as well as the entropy of mixing are each zero
209. *Y* g of non-volatile organic substance of molecular mass *M* is dissolved in 250 g benzene. Molal elevation constant of benzene of  $K_b$ . Elevation in its boiling point is given by :
- a)  $\frac{M}{K_b Y}$                       b)  $\frac{4K_b Y}{M}$                       c)  $\frac{K_b Y}{4M}$                       d)  $\frac{K_b Y}{M}$
210. At  $80^\circ\text{C}$ , 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  $80^\circ\text{C}$  and 1 atm pressure, the amount of '*A*' in the mixture is (1 atm = 760 mm Hg)
- a) 52 mole per cent                      b) 34 mole per cent                      c) 48 mole per cent                      d) 50 mole per cent
211. The solubility of iodine in water is 0.8 g/L. If the partition coefficient of iodine between  $\text{CCl}_4$  and water (in favour of  $\text{CCl}_4$ ) is 82, the solubility of iodine in  $\text{CCl}_4$  is :
- a) 102.5 g/L                      b) 65.6 g/L                      c) 0.009 g/L                      d) 81.2 g/L
212.  $K_f$  for water is  $1.86 \text{ K kg mol}^{-1}$ . If your automobile radiator holds 1.0 kg of water, how many grams of ethylene glycol ( $\text{C}_2\text{H}_6\text{O}_2$ ) must you add to get the freezing point of the solution lowered to  $-2.8^\circ\text{C}$ ?
- a) 93 g                      b) 39 g                      c) 27 g                      d) 72 g
213. How much of 0.1 M  $\text{H}_2\text{SO}_4$  solution is required to neutralise 50 mL of 0.2 M NaOH solution?
- a) 50 mL                      b) 5.0 mL                      c) 0.50 mL                      d) 100 mL
214. From the colligative properties of solution which one is the best method for the determination of molecular weight of proteins and polymers :
- a) Osmotic pressure



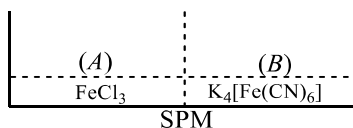




245. The vapour pressure will be lowest of  
 a) 0.1 M sugar solution  
 b) 0.1 M KCl solution  
 c) 0.1 M  $\text{Cu}(\text{NO}_3)_2$  solution  
 d) 0.1 M  $\text{AgNO}_3$  solution
246. Which one is a colligative property?  
 a) Boiling point  
 b) Vapour pressure  
 c) Osmotic pressure  
 d) Freezing point
247. What is the molality of ethyl alcohol (mol. wt. = 46) in aqueous solution which freezes at  $-10^\circ\text{C}$ ? ( $K_f$  for water =  $1.86 \text{ K molality}^{-1}$ )  
 a) 3.540  
 b) 4.567  
 c) 5.376  
 d) 6.315
248. Which of the following solution highest boiling point?  
 a) 0.1 M urea  
 b) 0.1 M sucrose  
 c) 0.1 M  $\text{NaNO}_3$   
 d) 0.1 M  $\text{Al}(\text{NO}_3)_3$
249.  $10 \text{ cm}^3$  of 0.1 N monobasic acid requires  $15 \text{ cm}^3$  of sodium hydroxide solution whose normality is  
 a) 1.5 N  
 b) 0.15 N  
 c) 0.066 N  
 d) 0.66 N
250. An example of a solution having liquid in gas is:  
 a) Moist air  
 b) Dry air  
 c) Au-Hg  
 d)  $\text{C}_2\text{H}_5\text{OH} + \text{H}_2\text{O}$
251. Calculate the molal depression constant of a solvent which has freezing point  $16.6^\circ\text{C}$  and latent heat of fusion  $180.75 \text{ Jg}^{-1}$ .  
 a) 2.68  
 b) 3.86  
 c) 4.68  
 d) 2.86
252. When two liquids A and B are mixed then their boiling points becomes greater than both of them. What is the nature of this solution?  
 a) Ideal solution  
 b) Normal solution  
 c) Negative deviation with non-ideal solution  
 d) Positive deviation with non-ideal solution
253. The amount of anhydrous  $\text{Na}_2\text{CO}_3$  present in 250 mL of 0.25 M solution is  
 a) 6.0 g  
 b) 6.625 g  
 c) 66.25 g  
 d) 6.225 g
254. If  $\alpha$  is the degree of dissociation of  $\text{Na}_2\text{SO}_4$  the van't Hoff factor ( $i$ ) used for calculating the molecular mass is  
 a)  $1 - 2\alpha$   
 b)  $1 + 2\alpha$   
 c)  $1 - \alpha$   
 d)  $1 + \alpha$
255. The density (in  $\text{g mL}^{-1}$ ) of a 3.60 M sulphuric acid solution that is 29%  $\text{H}_2\text{SO}_4$  (molar mass =  $98 \text{ g mol}^{-1}$ ) by mass will be  
 a) 1.64  
 b) 1.88  
 c) 1.22  
 d) 1.45
256. Molal elevation constant of a liquid is :  
 a) The elevation in b.p. which would be produced by dissolving one mole of solute in 100 g of solvent  
 b) The elevation of b.p. which would be produced by dissolving 1 mole solute in 10 g of solvent.  
 c) Elevation in b.p. which would be produced by dissolving 1 mole of solute in 1000 g of solvent  
 d) None of the above
257. The solubility of  $\text{I}_2$  in water increases in the presence of :  
 a) Alcohol  
 b) KI  
 c)  $\text{CCl}_4$   
 d) NaOH
258. A super saturated solution is a metastable state of solution in which solute concentration.  
 a) Is equal to the solubility of that substance in water  
 b) Exceeds than its solubility  
 c) Less than its solubility  
 d) Continuously change
259. When  $W_B$  g solute (molecular mass  $M_B$ ) dissolves in  $W_A$  g solvent, the molality  $M$  of the solution is  
 a)  $\frac{W_B}{M_B} \times \frac{1000}{W_A}$   
 b)  $\frac{W_A}{M_B} \times \frac{1000}{W_B}$   
 c)  $\frac{W_B}{W_A} \times \frac{M_A}{1000}$   
 d)  $\frac{W_A}{W_B} \times \frac{M_B}{1000}$
260. Which one of the following aqueous solutions will exhibit highest boiling point?  
 a) 0.01 M  $\text{Na}_2\text{SO}_4$   
 b) 0.01 M  $\text{KNO}_3$   
 c) 0.015 M urea  
 d) 0.015 M glucose

261. Van't Hoff factor more than unity indicates that the solute in solution has  
 a) Dissociated                      b) Associated                      c) Both (a) and (b)                      d) Cannot say anything
262. For dilute solution Raoult's law states that  
 a) The relative lowering of vapour pressure is equal to mole fraction of solute  
 b) The lowering of vapour pressure is equal to the mole fraction of solute  
 c) The vapour pressure of the solution is equal to mole fraction of the solvent  
 d) The relative lowering of vapour pressure is proportional to amount of solute in solution
263. The van't Hoff factor of  $BaCl_2$  at 0.01 M concentration is 1.98. The percentage of dissociation of  $BaCl_2$  at this concentration is  
 a) 49                                      b) 69                                      c) 89                                      d) 98
264. The amount of ice that will separate out on cooling a solution containing 50 g of ethylene glycol in 200 g water to  $-9.3^\circ C$  is : ( $K'_f = 1.86 \text{ K molality}^{-1}$ )  
 a) 38.71 g                                      b) 38.71 mg                                      c) 42 g                                      d) 42 mg
265. Colligative properties of a solution depends upon  
 a) Nature of both solvent and solute  
 b) Nature of solute only  
 c) Nature of solvent only  
 d) The relative number of solute and solvent particles
266. 19.85 mL of 0.1 N NaOH reacts with 20 mL of HCl solution for complete neutralization. The molarity of HCl solution is  
 a) 9.9                                      b) 0.99                                      c) 0.099                                      d) 0.0099
267. Freezing point of an aqueous solution is  $-0.186^\circ C$ . Elevation of boiling point of same solution would be: ( $K_b = 0.512$  and  $K_f = 1.86 \text{ K molality}^{-1}$ )  
 a)  $0.186^\circ C$                                       b)  $0.0512^\circ C$                                       c)  $0.092^\circ C$                                       d)  $0.237^\circ C$
268. A solution of sucrose (Molar mass = 342 g/mol) is prepared by dissolving 68.4 g of it per litre of solution, what is its osmotic pressure ( $R=0.082 \text{ L atmK}^{-1} \text{ mol}^{-1}$ ) at 273 K?  
 a) 3.92 atm                                      b) 4.48 atm                                      c) 5.92 atm                                      d) 29.4 atm
269. When the vapour pressure of solutions of two liquids are less than those expected from ideal solutions, they are said to show :  
 a) Positive deviations from ideal behaviour  
 b) Negative deviations from ideal behaviour  
 c) Positive deviations for lower concentrations and negative deviations for higher concentration  
 d) None of the above
270. Non- volatile solute when dissolved in water :  
 a) Decreases the vapour pressure of water  
 b) Increases the boiling point of water  
 c) Decreases the freezing point of water  
 d) All of the above
271. At  $27^\circ C$ , the osmotic pressure of a solution containing 4.0 g solute (molar mass = 246) per litre at  $27^\circ C$  is : ( $R = 0.0821 \text{ atm}\cdot\text{mol}^{-1} \text{ K}$ )  
 a) 0.1 atm                                      b) 0.4 atm                                      c) 0.2 atm                                      d) 0.8 atm
272. Which solution would exhibit abnormal osmotic pressure?  
 a) Aqueous solution of urea  
 b) Aqueous solution of common salt  
 c) Aqueous solution of glucose  
 d) Aqueous solution of sucrose
273. Van't Hoff factor of aq  $K_2SO_4$  at infinite dillution has value equal to  
 a) 1                                      b) 2                                      c) 3                                      d) Between 2 and 3
274. Which of the following statements is false?

- a) Two sucrose solution of same molality prepared in different solvent will have the same freezing point depression
- b) Osmotic pressure ( $\pi$ ) of a solution is given by  $\pi = MRT$  where  $M$  is molarity of the solution
- c) The correct order of osmotic pressure for 0.01 M aqueous solution of each compound is  $\text{BaCl}_2 > \text{KCl} > \text{CH}_3\text{COOH} > \text{Sucrose}$
- d) Raoult's law states that the vapour pressure of a component over a solution is proportional to its mole fraction
275. The freezing point of equimolal aqueous solution will be highest for
- a)  $\text{C}_6\text{H}_5\text{NH}_2\text{Cl}$                       b)  $\text{La}(\text{NO}_3)_3$                       c)  $\text{C}_6\text{H}_{12}\text{O}_6$                       d)  $\text{Ca}(\text{NO}_3)_2$
276. 0.004 M  $\text{Na}_2\text{SO}_4$  is isotonic with 0.01 M glucose. Degree of dissociation of  $\text{Na}_2\text{SO}_4$  is
- a) 75%                      b) 50%                      c) 25%                      d) 85%
277. x gram of water is mixed in 69 g of ethanol. Mole fraction of ethanol in the resultant solution is 0.6. What is the value of x in grams?
- a) 54                      b) 36                      c) 180                      d) 18
278. The spontaneous movement of solute particles from a more concentrated solution to less concentrated solution is called :
- a) Osmosis                      b) Diffusion                      c) Plasmolysis                      d) Fusion
279. The molarity of the solution obtained by dissolving 2.5g of NaCl in 100 mL of water is
- a) 0.00428 moles                      b) 428 moles                      c) 0.428 moles                      d) 0.0428 moles
280. To form a super saturated solution of salt one must :
- a) Cool slowly                      b) Cool rapidly                      c) Add some salt to cold solution                      d) Use a clear vessel
281. Solubility of deliquescent substances in water is generally :
- a) High                      b) Low                      c) Moderate                      d) Cannot be said
282. For determination of molecular weights, Raoult's law is applicable only to
- a) Dilute solutions of electrolytes                      b) Concentration solution of electrolytes
- c) Dilute solutions of non electrolytes                      d) Concentration solution of non electrolytes
283. 35.4 mL of HCl is required for the neutralisation of a solution containing 0.275 g of sodium hydroxide. The normality of hydrochloric acid is
- a) 0.97 N                      b) 0.142 N                      c) 0.194 N                      d) 0.244 N
284. The relative lowering of vapour pressure of an aqueous solution containing non-volatile solute is 0.0125. The molality of the solution is
- a) 0.70                      b) 0.50                      c) 0.60                      d) 0.80
285. In the case of osmosis, solvent molecules move from :
- a) Higher vapour pressure to lower vapour pressure
- b) Higher concentration to lower concentration
- c) Lower vapour pressure to higher vapour pressure
- d) Higher osmotic pressure to lower osmotic pressure
286. Two solutions (A) containing  $\text{FeCl}_3(aq)$  and (B) containing  $\text{K}_4[\text{Fe}(\text{CN})_6]$  are separated by semipermeable membrane as shown below. If  $\text{FeCl}_3$  on reaction with  $\text{K}_4[\text{Fe}(\text{CN})_6]$ , produces blue colour of  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ , the blue colour will be noticed in :



- a) (A)
- b) (B)
- c) In both (A) and (B)
- d) Neither in (A) nor in (B)

287. A substance is completely trimerised on dissolution in a solvent. The van't Hoff factor ( $i$ ) for such change is :
- a) 1                                      b) 2                                      c) 3                                      d) 1/3
288. The vapour pressure of a pure liquid  $A$  is 40 mm Hg at 310 K. The vapour pressure of this liquid in a solution with liquid  $B$  is 32 mm Hg. What is the mole fraction of  $A$  in the solution if it obeys the Raoult's law?
- a) 0.5                                      b) 0.6                                      c) 0.7                                      d) 0.8
289. The natural semipermeable membrane is :
- a) Gelatinous  $\text{Cu}_2[\text{Fe}(\text{CN})_6]$   
 b) Gelatinous  $\text{Ca}_3[(\text{PO}_4)_2]$   
 c) Plant cell  
 d) Phenol layer
290.  $A$  and  $B$  ideal gases. The molecular weights of  $A$  and  $B$  are in the ratio of 1:4. The pressure of a gas mixture containing equal weight of  $A$  and  $B$  is  $p$  atm. What is the partial pressure (in atm) of  $B$  in the mixture?
- a)  $\frac{p}{5}$                                       b)  $\frac{p}{2}$                                       c)  $\frac{p}{2.5}$                                       d)  $\frac{3p}{4}$
291. Solubility of solutes which dissolve with the liberation of heat decreases with :
- a) Decrease in temperature  
 b) Increase in temperature  
 c) No change in temperature  
 d) None of the above
292. The vapour pressure of a liquid in a closed container depends upon
- a) Amount of liquid                                      b) Surface area of the container  
 c) Temperature                                      d) None of the above
293. The relationship between osmotic pressure at 273 K when 10 g glucose ( $p_1$ ), 10 g urea ( $p_2$ ) and 10 g sucrose ( $p_3$ ) are dissolved in 250 mL of water is
- a)  $p_1 > p_2 > p_3$                                       b)  $p_3 > p_2 > p_1$                                       c)  $p_2 > p_1 > p_3$                                       d)  $p_2 > p_3 > p_1$
294. When a solute distributes itself between two immiscible liquids in contact with each other, a mathematical constant ratio exists between :
- a) The weight of the solute in the two liquids  
 b) The concentration of solute in the two liquids  
 c) The number of mole of the solute in the two liquids  
 d) The number of atoms of the solute in the two liquids
295. Which one is a colligative property?
- a) Raoult's law states that the vapour pressure of a component over a solution is proportional to its mole fraction  
 b) The osmotic pressure ( $\pi$ ) of a solution is given by the equation  $\pi = MRT$ , where,  $M$  is the molarity of the solution  
 c) The correct order of osmotic pressure for 0.01 M aqueous solution of each compound is  $\text{BaCl}_2 > \text{KCl} > \text{CH}_3\text{COOH} > \text{sucrose}$   
 d) Two sucrose solutions of same molality prepared in different solvents will have the same freezing point depression
296. The boiling point of an aqueous solution of a non-volatile solute is  $100.15^\circ\text{C}$ . What is the freezing point of an aqueous solution obtained by diluting the above solution with an equal volume of water? The values of  $K_b$  and  $K_f$  for water are  $0.512^\circ\text{C}$  and  $1.86^\circ\text{C K molality}^{-1}$
- a)  $-0.544^\circ\text{C}$                                       b)  $-0.512^\circ\text{C}$                                       c)  $-0.272^\circ\text{C}$                                       d)  $-0.186^\circ\text{C}$
297. An azeotropic solution of two liquids has boiling point lower than either when it
- a) Shows a negative deviation from Raoult's law                                      b) Shows a positive deviation from Raoult's law  
 c) Shows no deviation from Raoult's law                                      d) Is saturated
298. Beckmann thermometer are used to measure :

- a) Boiling point of the solution  
 b) Freezing point of the solution  
 c) Any temperature  
 d) Elevation in boiling point or depression in freezing point
299. The partial pressure of ethane over a saturated solution containing  $6.56 \times 10^{-2}$  g of ethane is 1 bar. If the solution contains  $5.0 \times 10^{-2}$  g of ethane, the partial pressure of ethane will be :  
 a) 0.762 bar                      b) 1.762 bar                      c) 0.1 bar                      d) 0.2 bar
300. Which is not applicable to distribution law?  
 a) Parke's process  
 b) Solvent extraction  
 c) Pattinson's process  
 d) Partition chromatography
301. 2.5 L of NaCl solution contain 5 moles of the solute. What is the molarity ?  
 a) 5M                      b) 2M                      c) 2.5M                      d) 12.5M
302. What is the freezing point of a solution containing 8.1 g HBr in 100 g water assuming the acid to be 90% ionised ( $k_f$  for water =  $1.86 \text{ kg mol}^{-1}$ )?  
 a)  $-0.35^\circ\text{C}$                       b)  $-1.35^\circ\text{C}$                       c)  $-2.35^\circ\text{C}$                       d)  $-3.53^\circ\text{C}$
303. Which solution will have least vapour pressure?  
 a) 0.1 M BaCl<sub>2</sub>                      b) 0.1 M urea                      c) 0.1 M Na<sub>2</sub>SO<sub>4</sub>                      d) 0.1 M Na<sub>3</sub>PO<sub>4</sub>
304. One component of a solution follows Raoult's law over the entire range  $0 \leq x_1 \leq 1$ . The second component must follow Raoult's law in the range when  $x_2$  is  
 a) Close to zero                      b) Close to 1                      c)  $0 \leq x_2 \leq 0.5$                       d)  $0 \leq x_2 \leq 1$
305. The van't Hoff factor ( $i$ ) for a dilute aqueous solution of Na<sub>2</sub>SO<sub>4</sub> is :  
 a)  $1 + \alpha$                       b)  $1 - \alpha$                       c)  $1 + 2\alpha$                       d)  $1 - 2\alpha$
306. How many grams of dibasic acid (mol. wt. 200) should be present in 100 mL of the aqueous solution to give 0.1 N?  
 a) 10 g                      b) 20 g                      c) 2 g                      d) 1 g
307. At STP, a container has 1 mole of Ar, 2 moles of CO<sub>2</sub>, 3 moles of O<sub>2</sub> and 4 moles of N<sub>2</sub>. Without changing the total pressure if one mole of O<sub>2</sub> is removed, the partial pressure of O<sub>2</sub> is  
 a) Changed by about 16%                      b) Halved  
 c) Changed by 26%                      d) Unchanged
308. On a humid day in summer, the mole fraction of gaseous a H<sub>2</sub>O (water vapour) in the air at 25°C can be as high as 0.0287. Assuming a total pressure of 0.977 atm. What is the partial pressure of dry air?  
 a) 94.9 atm                      b) 0.949 atm                      c) 949 atm                      d) 0.648 atm
309. The normality of 2.3 M H<sub>2</sub>SO<sub>4</sub> solution is  
 a) 4.6 N                      b) 5.6 N                      c) 6.6 N                      d) 7.6 N
310. The process of extracting a solute from its solution by an immiscible solvent can be more fruitful only if :  
 a) A large quantity of the solvent is used at once  
 b) The number of extractions is increased, using small quantities of the solvent  
 c) The process is carried out at a high temperature  
 d) Small quantities of the solution are added to the extracting solvent in several instalments
311. Volume of water needed to mix with 10 mL N HCl to get 0.1 N HCl is  
 a) 900 mL                      b) 9 mL                      c) 90 mL                      d) 100 mL
312. The solubility of a gas increases in a liquid with  
 a) Decrease in temperature                      b) Increases in temperature  
 c) Reduction of gas pressure                      d) Amount of liquid taken
313. 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 formed is an ideal solution



- b) The solution is non-ideal, showing positive deviation from Raoult's law  
 c) The solution is non-ideal, showing negative deviation from Raoult's law  
 d) *n*-heptane shows positive deviation while ethanol show negative deviation from Raoult's law
314. By dissolving 5g substance in 50 g of water, the decrease in freezing point is 1.2°C. The gram molal depression is 1.85°C. The molecular weight of substance is  
 a) 105.4                                      b) 118.2                                      c) 137.2                                      d) 154.2
315. Which is correct representation of phase rule?  
 a)  $F = P + C + 2$   
 b)  $F + P = C + 2$   
 c)  $F + C = P + 2$   
 d) None of these
316. Vapour pressure of dilute aqueous solution of glucose is 750 mm of mercury at 373 K. The mole fraction of solute is  
 a)  $\frac{1}{76}$                                       b)  $\frac{1}{7.6}$                                       c)  $\frac{1}{38}$                                       d)  $\frac{1}{10}$
317. The empirical formula of a nonelectrolyte is  $CH_2O$ . A solution containing 3 g of the compound exerts the same osmotic pressure as that of 0.05 M glucose solution. The molecular formula of the compound is  
 a)  $CH_2O$                                       b)  $C_2H_4O_2$                                       c)  $C_4H_8O_4$                                       d)  $C_3H_6O_3$
318. Distribution law is applicable when :  
 a) Temperature remains constant  
 b) Dilute solutions are employed  
 c) The two solvents are mutually insoluble  
 d) All are correct
319. 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
320. What is the amount of urea dissolved per litre if its aqueous solution is isotonic with 10% cane sugar solution? (mol.wt.of urea =60)  
 a) 200 g/L                                      b) 19.2 g/L                                      c) 17.54 g/L                                      d) 16.7 g/L
321. The solubility order for the following gases is :  
 a)  $NH_3 > CO_2 > O_2 > H_2$   
 b)  $H_2 > O_2 > NH_3 > CO_2$   
 c)  $CO_2 > NH_3 > O_2 > N_2$   
 d)  $O_2 > H_2 > NH_3 > CO_2$
322. If the various terms in the below given expressions have usual meanings, the van't Hoff factor (*i*) cannot be calculated by which one of the expressions?  
 a)  $\pi V = \sqrt{inRT}$                                       b)  $\Delta T_f = ik_f \cdot m$   
 c)  $\Delta T_b = ik_b \cdot m$                                       d)  $\frac{p^\circ_{\text{solvent}} - p_{\text{solution}}}{p^\circ_{\text{solvent}}} = i \left( \frac{n}{N+n} \right)$
323. One mole of non-volatile solute is dissolved in two mole of water. The vapour pressure of the solution relative to that of water is :  
 a) 2/3                                      b) 1/3                                      c) 1/2                                      d) 3/2
324. A certain substance 'A' tetramerises in water to the extent of 80%. A solution of 2.5 g of A in 100 g of water lowers the freezing point by 0.3°C. The molar mass of A is  
 a) 31                                      b) 62                                      c) 122                                      d) 244
325. If sodium sulphate is considered to be completely dissociated into cations and anions in aqueous solution, the change in freezing point of water ( $\Delta T_f$ ), when 0.01 mole of sodium sulphate is dissolved in 1 kg of water, is ( $k_f = 1.86 \text{ Kkg mol}^{-1}$ )

- a) 0.0372 K                      b) 0.0558 K                      c) 0.0744 L                      d) 0.0186 K
326. The equilibrium in a heterogeneous system can be studied by :  
 a) Distribution law              b) Phase rule                      c) Both (a) and (b)              d) None of these
327. A liquid is in equilibrium with its vapours at its boiling point. On the average the molecules in the two phases have equal :  
 a) Potential energy  
 b) Total energy  
 c) Kinetic energy  
 d) Intermolecular forces
328. In which ratio of volume 0.4 M HCl and 0.9 M HCl are to be mixed such that the concentration of the resultant solution becomes 0.7 M ?  
 a) 4 : 9                              b) 2 : 3                              c) 3 : 2                              d) 1 : 1
329. Formation of a solution from two components can be considered as  
 (1) pure solvent → separated solvent molecules,  $\Delta H_1$   
 (2) pure solute → separated solvent molecules,  $\Delta H_2$   
 (3) separated solvent and solute molecules → solution,  $\Delta H_3$   
 Solution so formed will be ideal if  
 a)  $\Delta H_{soln} = \Delta H_1 - \Delta H_2 - \Delta H_3$                               b)  $\Delta H_{soln} = \Delta H_3 - \Delta H_1 - \Delta H_2$   
 c)  $\Delta H_{soln} = \Delta H_1 + \Delta H_2 + \Delta H_3$                               d)  $\Delta H_{soln} = \Delta H_1 + \Delta H_2 - \Delta H_3$
330. If for a sucrose solution elevation in boiling point is  $0.1^\circ\text{C}$  then what will be boiling point of NaCl solution for the same molal concentration?  
 a) 0.1                              b) 0.2                              c) 0.16                              d) 0.26
331. Which is correct representation for  $K = \frac{c_1}{c_2}$  relation?  
 a) The distribution coefficient  $K$  is in favour of phase I  
 b) The distribution coefficient  $K$  is in favour of phase II  
 c) The distribution coefficient is  $K$   
 d) None of the above
332. The phenomenon in which cells are swelled up and then burst if placed in hypotonic solution is called :  
 a) Plasmolysis                      b) Haemolysis                      c) Exosmosis                      d) None of these
333.  $\text{I}_2$  is added to a system of  $\text{H}_2\text{O}$  and  $\text{CS}_2$ . The concentration of  $\text{I}_2$  in water and  $\text{CS}_2$  is found to be  $c_1$  and  $c_2$  respectively. The ratio of  $c_1/c_2$  will be constant only if :  
 a) The solutions are dilute  
 b) The temperature remains constant  
 c) The solute neither changing the immiscibility of solvents nor itself changing in molecular state  
 d) All of the above
334. Partition coefficient of benzoic acid-ether-water in favour of ether is 2. A solution containing 8 g/litre benzoic acid in ether layer is shaken with 2 litre water. The concentration of acid in water layer is :  
 a) 1                              b) 2                              c) 3                              d) 4
335. Which one is correct?  
 a) Molality changes with temperature.                              b) Molality does not change with temperature.  
 c) Molarity does not change with temperature.                              d) Normality does not change with temperature.
336. The vapour pressure of a solution of a non-volatile electrolyte ( $A$ ) in a solvent ( $B$ ) is 95% of the vapour pressure of the solvent at the same temperature. If  $M_B = 0.3 M_A$ , where  $M_B$  and  $M_A$  are molecular weights of  $B$  and  $A$  respectively, the weight ratio of the solvent and solute are :  
 a) 0.15                              b) 5.7                              c) 0.2                              d) 4.0
337. Van't Hoff factor( $i$ ):  
 a) Is less than one in case of dissociation  
 b) Is more than one in case of association

c)  $i = \frac{\text{normal molecular mass}}{\text{observed molecular mass}}$   
 d)  $i = \frac{\text{observed molecular mass}}{\text{normal molecular mass}}$

338. What is the freezing point of a solution containing 8.1 g HBr in 100 g water assuming the acid to be 90% ionised?

( $k_f$  for wt. =  $1.86 \text{ K mol}^{-1}$ )

- a)  $0.85^\circ\text{C}$                       b)  $-3.53^\circ\text{C}$                       c)  $0^\circ\text{C}$                       d)  $-0.35^\circ\text{C}$

339. 1 kg of NaOH solution contains 4 g of NaOH. The approximate concentration of the solution is

- a) About 0.1 N                      b) Decinormal                      c) 0.1 molal                      d) 0.1 molar

340. 2 N HCl solution will have same molar concentration as a

- a) 4.0 N  $\text{H}_2\text{SO}_4$                       b) 0.5 N  $\text{H}_2\text{SO}_4$                       c) 1 N  $\text{H}_2\text{SO}_4$                       d) 2 N  $\text{H}_2\text{SO}_4$

341. Two bottles A and B contains 1M and 1 m aqueous solution of sulphuric acid respectively

- a) A is more concentrated than B  
 b) B is more concentrated than A  
 c) Concentration of A is equal to concentration of B  
 d) It is not possible to compare the concentrations

342. Which of the following can be measured by the Ostwald-Walker dynamic method?

- a) Relative lowering of vapour pressure                      b) Lowering of vapour pressure  
 c) Vapour pressure of the solvent                      d) All of the above

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

- I. 0.1 m urea  
 II. 0.04 m  $\text{Al}_2(\text{SO}_4)_3$   
 III. 0.05 m  $\text{CaCl}_2$   
 IV. 0.005 m NaCl

The correct statement regarding the above solution is

- a) Freezing point will be lowest for solution I                      b) Freezing point will be highest for solution IV  
 c) Boiling point will be highest for solution IV                      d) Vapour pressure will be highest for solution II

344. The van't Hoff factor  $i$  for a compound which undergoes dissociation in one solvent and association in other solvent is respectively :

- a) Greater than one and greater than one  
 b) Less than one and greater than one  
 c) Less than one and less than one  
 d) Greater than one and less than one

345. The  $\frac{1}{X_A}$  plots of  $\frac{1}{Y_A}$  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 intercepts respectively:

- a)  $P_A^0/P_B^0$  and  $\frac{(P_A^0 - P_B^0)}{P_B^0}$   
 b)  $P_A^0/P_B^0$  and  $\frac{(P_B^0 - P_A^0)}{P_B^0}$   
 c)  $P_B^0/P_A^0$  and  $\frac{(P_A^0 - P_B^0)}{P_B^0}$   
 d)  $P_B^0/P_A^0$  and  $\frac{(P_B^0 - P_A^0)}{P_B^0}$

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

- a) 1.92                      b) 0.98                      c) 1.08                      d) 0.92

347. What is the molarity of  $\text{H}_2\text{SO}_4$  solution that has a density 1.84 g/cc at  $35^\circ\text{C}$  and contains 98% solute by weight?

- a) 4.18 M                      b) 1.84 M                      c) 8.41 M                      d) 18.4 M

348. A solution containing 4 g of polyvinyl chloride in 1 litre of dioxane was found to have an osmotic pressure of  $6 \times 10^{-4}$  atm at 300 K. The molecular mass of the polymer is :  
 a)  $3 \times 10^3$                       b)  $1.6 \times 10^5$                       c)  $5 \times 10^4$                       d)  $6.4 \times 10^2$
349. Binary liquid solutions which exhibit negative deviations from Raoult's law boil at temperature ....than the expected value :  
 a) Lower                              b) Higher                              c) Same                              d) Cannot be said
350. Ethylene glycol is used as an antifreeze in a cold climate. Mass of ethylene glycol which should be added to 4 kg of water to prevent it from freezing at  $-6^\circ\text{C}$  will be ( $K_f$  for water =  $1.86 \text{ K kg mol}^{-1}$ , and molar mass of ethylene glycol =  $62 \text{ g mol}^{-1}$ )  
 a) 804.32 g                      b) 204.30 g                      c) 400.00 g                      d) 304.60 g
351. What happens when an egg is kept in saturated solution of NaCl after removing its hard shell in dilHCl?  
 a) Egg will swell                      b) Egg will shrink  
 c) Egg will remain same                      d) Egg will first shrink and then swell
352. At  $40^\circ\text{C}$ , the vapour pressure (in torr) of methyl alcohol (A) and ethyl alcohol (B) solution is represented by :  
 $P = 120 X_A + 138$ ; where  $X_A$  is mole fraction of methyl alcohol. The value of lime  
 $X_A \rightarrow 0, \frac{P_B^0}{X_B}$  and lime  $X_B \rightarrow 0, \frac{P_A^0}{X_A}$  are :  
 a) 138, 258                      b) 258, 138                      c) 120, 138                      d) 138, 125
353. What will be the molality of a solution having 18 g of glucose (mol. wt. = 180) dissolved in 500 g of water?  
 a) 1 m                              b) 0.5 m                              c) 0.2 m                              d) 2 m
354. According to distribution law, the distribution of solute in two phases is given by the expression,  
 $K = \frac{\text{concentration of solute in phase I}}{\text{concentration of solute in phase II}}$ ,  
 the numerical Value of constant  $K$  depends upon :  
 a) The temperature of the system  
 b) The nature of solute distributed  
 c) The nature of two immiscible solvents used  
 d) All of the above
355. On mixing, heptane and octane form an ideal solution. At 373 K, the vapour pressures of the two liquid components (heptanes and octane) are 105 kPa and 45kPa respectively. Vapour pressure of the solution obtained by mixing 25 g of heptanes and 35 g of octane will be (molar mass of heptanes =  $100 \text{ g mol}^{-1}$  and of octane =  $114 \text{ g mol}^{-1}$ ).  
 a) 72.0 kPa                      b) 36.1 kPa                      c) 96.2 kPa                      d) 144.5 kPa
356. Volume of 0.1 M  $K_2Cr_2O_7$  required to oxidise 35 mL of 0.5 M  $FeSO_4$  solution is  
 a) 29.2 mL                      b) 17.5 mL                      c) 175 mL                      d) 145 mL
357. 25 mL of a solution of barium hydroxide on titration with 0.1 molar solution of hydrochloric acid gave a titre value of 35 mL. The molarity of barium hydroxide solution was  
 a) 0.07                              b) 0.14                              c) 0.28                              d) 0.35
358. An ideal solution is that which  
 a) Obey Raoult's law                      b) Shows positive deviation from Raoult's law  
 c) Shows negative deviation from Raoult's law                      d) Has no connection with Raoult's law
359. The freezing point of 1% solution of lead nitrate in water will be  
 a)  $2^\circ\text{C}$                               b)  $1^\circ\text{C}$                               c)  $0^\circ\text{C}$                               d) Below  $0^\circ\text{C}$
360. Which of the following statement is true?  
 a) The relative lowering of vapour pressure of a solution is equal to the mole fraction of the solute present in the solution.  
 b) Passage of solute molecules towards solution side through semipermeable membrane is osmosis.  
 c) The boiling point of solution is always lower than the solvent.  
 d) The boiling point of a liquid is the temperature at which its vapour pressure becomes equal to 260

mm.

361. Which is a colligative property ?  
 a) Osmotic pressure      b) Free energy      c) Heat of vaporisation      d) Change in pressure
362. When attraction between  $A - B$  is more than that of  $A - A$  and  $B - B$ , the solution will show.....deviation from Raoult's law  
 a) Positive      b) Negative      c) No      d) Cannot predicted
363. Which of the following concentration factors is affected by change in temperature?  
 a) Molarity      b) Molality      c) Mole fraction      d) Weight fraction
364. The sum of mole fractions of  $A$ ,  $B$  and  $C$  in an aqueous solution containing 0.2 moles of each  $A$ ,  $B$  and  $C$  is  
 a) 0.6      b) 0.2      c) 1.0      d) 1.2
365. The increase in boiling point of a solution containing 0.6 g urea in 200 g water is  $0.50^\circ\text{C}$ . Find the molal elevation constant.  
 a)  $10 \text{ K kg mol}^{-1}$       b)  $10 \text{ K g mol}^{-1}$       c)  $10 \text{ K kg mol}$       d)  $1.0 \text{ K kg mol}^{-1}$
366. A 5 molar solution of  $\text{H}_2\text{SO}_4$  is diluted from 1 L to 10 L. What is the normality of the solution?  
 a) 0.25 N      b) 1 N      c) 2 N      d) 7 N
367. A solution containing 4 g of polyvinyl chloride polymer in one litre of dioxane was found to have an osmotic pressure of  $4.1 \times 10^{-4}$  atm at  $27^\circ\text{C}$ . The approximate molecular weight of the polymer is  
 a)  $1.5 \times 10^3$       b)  $2.4 \times 10^5$       c)  $1.0 \times 10^4$       d)  $2 \times 10^{12}$
368. The partition coefficient of solute  $X$  in between immiscible liquids  $A$  and  $B$  is 10 in favour of  $A$ . The partition coefficient of  $X$  in favour of  $B$  is :  
 a) 0.1      b) 10      c) 0.01      d) 100
369. At  $80^\circ\text{C}$ , the vapour pressure of pure liquid ' $A$ ' is 520 mm Hg and that of pure liquid ' $B$ ' is 1000 mm Hg. If a mixture of solution ' $A$ ' and ' $B$ ' boils at  $80^\circ\text{C}$  and 1 atm pressure, the amount of ' $A$ ' in the mixture is : (1 atm = 760 mm Hg)  
 a) 50 mol per cent      b) 52 mol per cent      c) 34 mol per cent      d) 48 mol per cent
370. Which of the following is a colligative property?  
 a) Boiling point      b) Freezing point      c) Osmotic pressure      d) Vapour pressure
371. The normality of mixture obtained by mixing 100 mL of 0.2 M  $\text{H}_2\text{SO}_4$  + 100 mL of 0.2 M NaOH is  
 a) The nature of gas      b) The temperature  
 c) The nature of the solvent      d) All of the above
372. Volume of 0.6 M NaOH required to neutralise  $30 \text{ cm}^3$  of 0.4 M HCl is  
 a) 3 : 4      b) 1 : 2      c) 1 : 4      d) 1 : 1
373. If 117 g NaCl is dissolved in 1000 g of water the concentration of the solution is said to be  
 a) 2 molar      b) 2 molal      c) 1 normal      d) 1 molal
374. Which one of the statements given below concerning properties of solutions, describes a colligative effect?  
 a) Vapour pressure of pure water decreases by the addition of nitric acid  
 b) Boiling point of pure water decreases by the addition of ethanol  
 c) Boiling point of pure benzene increases by the addition of toluene  
 d) Vapour pressure of pure benzene decreases by the addition of naphthalene
375. Volume of water needed to mix with 10 mL 10 N  $\text{HNO}_3$  to get 0.1 N  $\text{HNO}_3$  is  
 a) 1000 mL      b) 990 mL      c) 1010 mL      d) 10 mL
376. The vapour pressure of two liquids  $X$  and  $Y$  are 80 and 60 Torr respectively. The total vapour pressure of the ideal solution obtained by mixing 3 moles of  $X$  and 2 moles of  $Y$  would be  
 a) 68 Torr      b) 140 Torr      c) 48 Torr      d) 72 Torr
377. 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 vessel is :  
 a) More than what would be if the glass plate were removed  
 b) Same as what would be if the glass plate were removed

- c) Less than what would be if the glass plate were removed  
d) Cannot be predicted
378. In a mixture  $A$  and  $B$  components show negative deviation as :
- $\Delta V_{\text{mix}} = +ve$
  - $\Delta H_{\text{mix}} = -ve$
  - $A - B$  interaction is weaker than  $A - A$  and  $B - B$  interaction
  - None of the above reason is correct
379. For determination of molar mass of colloids, polymers and protein, which property is used ?
- Diffusion pressure
  - Atmospheric pressure
  - Osmotic pressure
  - Turgor pressure
380. In countries nearer to polar region, the roads are sprinkled with  $\text{CaCl}_2$ . This is
- To minimise the wear and tear of the roads
  - To minimise the snow fall
  - To minimise pollution
  - To minimise the accumulation of dust on the road
381. Camphor is used as solvent to determine mol. wt. of non-volatile solute by Rast method because for camphor :
- It is readily available
  - It is volatile
  - Molal depression constant is high
  - It is solvent for organic substances
382. Iodine was added to a system of water and  $\text{CS}_2$ . The concentrations of iodine in water and  $\text{CS}_2$  were found to be  $c_1$  and  $c_2$  respectively. The ratio  $c_1/c_2$  will not change only if :
- More iodine is added
  - More water is added
  - More  $\text{CS}_2$  is added
  - The temperature is changed
383. When a non-volatile solute is dissolved in a solvent, the relative lowering of vapour pressure is equal to
- Mole fraction of solute
  - Mole fraction of solvent
  - Concentration of the solute in gram per litre
  - Concentration of the solute in gram per 100 mL
384. Distribution law holds good for the distribution of a dissolved substance between :
- Liquid-liquid phases
  - Liquid-liquid and liquid-gas phases
  - Liquid-liquid and liquid-solid phases
  - Liquid-gas, liquid-liquid and liquid-solid phases
385. A solution containing 1.8 g of a compound (empirical formula  $\text{CH}_2\text{O}$ ) in 40 g of water is observed to freeze at  $-0.465^\circ\text{C}$ . The molecular formula of the compound is  
( $K_f$  of water =  $1.86 \text{ kg K mol}^{-1}$ )
- $\text{C}_2\text{H}_4\text{O}_2$
  - $\text{C}_3\text{H}_6\text{O}_3$
  - $\text{C}_4\text{H}_8\text{O}_4$
  - $\text{C}_6\text{H}_{12}\text{O}_6$
386. If a 5.25% (wt./vol.) solution of a non-electrolyte is isotonic with 1.50% (wt./vol.) solution of urea, (mol-wt = 60) is the same solvent then the molecular weight of non-electrolyte is :
- $210.0 \text{ g mol}^{-1}$
  - $90.0 \text{ g mol}^{-1}$
  - $115.0 \text{ g mol}^{-1}$
  - $105 \text{ g mol}^{-1}$
387. Which has the minimum freezing point?
- One molal  $\text{NaCl}$  aqueous solution
  - One molal  $\text{CaCl}_2$  aqueous solution
  - One molal  $\text{KCl}$  aqueous solution
  - One molal urea aqueous solution
388. In a 0.2 molal aqueous solution of a weak acid  $\text{HX}$ , the degree of ionization is 0.3. Taking  $K_f$  for water as 1.85, the freezing point of the solution will be nearest to



- a)  $-360^{\circ}\text{C}$                       b)  $0.260^{\circ}\text{C}$                       c)  $+0.480^{\circ}\text{C}$                       d)  $-0.480^{\circ}\text{C}$
389. 100 cc of 0.6 N  $\text{H}_2\text{SO}_4$  and 200 cc of 0.3 N HCl were mixed together. The normality of the solution will be  
a) 0.2 N                      b) 0.4 N                      c) 0.8 N                      d) 0.6 N
390. The mole fraction of water in 20% aqueous solution of  $\text{H}_2\text{O}_2$  is  
a)  $\frac{20}{80}$                       b)  $\frac{80}{20}$                       c)  $\frac{68}{77}$                       d)  $\frac{77}{68}$
391. Which of the following concentration units is independent of temperature?  
a) Normality                      b) Molarity                      c) Molality                      d) ppm
392. Which of the following compounds correspond to maximum van'thoff factor for dilute solution?  
a) HCl                      b)  $\text{MgSO}_4$                       c)  $\text{K}_2\text{SO}_4$                       d)  $\text{K}_4\text{Fe}(\text{CN})_6$
393. Which of the following is incorrect?  
a) Relative lowering of vapour pressure is independent  
b) Vapour pressure of a solution is lower than the vapour pressure of the solvent  
c) The vapour pressure is a colligative property  
d) The relative lowering of vapour pressure is directly proportional to the mole fraction solute
394. If 20 mL of 0.4 N NaOH solution completely neutralizes 40 mL of a dibasic acid, the molarity of the acid solution is  
a) 0.1 M                      b) 0.3 M                      c) 0.5 M                      d) 0.7 M
395. Which of the following solutions will have the highest boiling point ?  
a) 0.1 M  $\text{FeCl}_3$                       b) 0.1 M  $\text{BaCl}_2$                       c) 0.1 M NaCl                      d) 0.1 M urea
396. The vapour pressure of two liquids P and Q are 80 torr and 60 torr respectively. The total vapour pressure obtained by mixing 3 mole of P and 2 mole of Q would be :  
a) 68 torr                      b) 20 torr                      c) 140 torr                      d) 72 torr
397. Van't hoff factor of  $\text{Ca}(\text{NO}_3)_2$  is  
a) One                      b) Two                      c) Three                      d) four
398. The van't Hoff factor ( $i$ ) for a dilute solution of  $\text{K}_3[\text{Fe}(\text{CN})_6]$  is :  
a) 10                      b) 4                      c) 5                      d) 0.25
399. The Henry's law constant for the solubility of  $\text{N}_2$  gas in water at 298 K is  $1.0 \times 10^5 \text{ atm}$ . The mole fraction of  $\text{N}_2$  in air is 0.8 The number of moles of  $\text{N}_2$  from air dissolved in 10 moles of water of 298 K and 5 atm pressure is  
a)  $4 \times 10^{-4}$                       b)  $4.0 \times 10^{-5}$                       c)  $5.0 \times 10^{-4}$                       d)  $4.0 \times 10^{-6}$
400. As a result of osmosis, the volume of the concentrated solution :  
a) Gradually decreases  
b) Gradually increases  
c) Suddenly increases  
d) None of these
401. The relationship between the values of osmotic pressure of 0.1 M solution of  $\text{KNO}_3(p_1)$  and  $\text{CH}_3\text{COOH}(p_2)$  is  
a)  $\frac{p_1}{p_1+p_2} = \frac{p_2}{p_1+p_2}$                       b)  $p_1 > p_2$                       c)  $p_2 > p_1$                       d)  $p_1 = p_2$
402. The statement "the relative lowering of the vapour pressure is equal to the ratio of moles of the solute to the total number of the moles in the solution" refers to  
a) Decrease the freezing point of water in the winter and increase the boiling point of water in the summer  
b) Only decrease the freezing point of water  
c) Only increase the boiling point of water  
d) Be used for cleaning the radiator in a car
403. 100 mL of water and 50 mL ether mixture is shaken with succinic acid. At equilibrium ether layer contains 0.127 g and water layer contains 1.843 g of succinic acid. The partition coefficient of succinic acid in favour of water is :

- a) 7.26                                      b) 10                                      c) 2                                      d) 4.5
404. In cold countries, ethylene glycol is added to water in the radiators of cars during winters. It results in :
- Lowering in boiling point
  - Reducing viscosity
  - Reducing specific heat
  - Lowering in freezing point
405. A solution contains non-volatile solute of molecular mass  $M_2$ . Which of the following can be used to calculate the molecular mass of solute in terms of osmotic pressure?
- $M_2 = \left(\frac{m_2}{\pi}\right)VRT$
  - $M_2 = \left(\frac{m_2}{V}\right)\frac{RT}{\pi}$
  - $M_2 = \left(\frac{m_2}{V}\right)\pi RT$
  - $M_2 = \left(\frac{m_2}{V}\right)\frac{\pi}{RT}$
- ( $m_2$  = mass of solute  $V$  = volume of solution,  $\pi$  = osmotic pressure)
406. 9.8 g of  $H_2SO_4$  is present in 2 L of a solution. The molarity of the solution is
- 0.05 M                                      b) 0.01 M                                      c) 0.03 M                                      d) 0.02 M
407. The freezing point depression of 0.001 m,  $K_x[Fe(CN)_6]$  is  $7.10 \times 10^{-3}K$ . If for water,  $k_f$  is  $1.86 K Kg mol^{-1}$ , value of  $x$  will be
- 4                                      b) 3                                      c) 2                                      d) 1
408. Which of the following is not correct for ideal solution?
- $\Delta V_{mix} = 0$                                       b)  $\Delta H_{mix} = 0$                                       c)  $\Delta S_{mix} = 0$                                       d) Obeys Raoult's law
409. What is molality of a solution in which (18 g glucose mol. wt. = 180) is dissolved in 500 g of water?
- 1 m                                      b) 0.5 m                                      c) 0.2 m                                      d) 2 m
410. The freezing point depression constant for water is  $-1.86^\circ C m^{-1}$ . If 5.00 g  $Na_2SO_4$  is dissolved in 45.0 g  $H_2O$ , the freezing point is change by  $-3.82^\circ C$ . Calculate the van't Hoff factor for  $Na_2SO_4$ .
- 0.381                                      b) 2.05                                      c) 2.63                                      d) 3.11
411. A solution of sucrose (molar mass=342 g/mol) is prepared by dissolving 68.4 g of it per litre of the solution, what is its osmotic pressure ( $R = 0.082 L atm K^{-1} mol^{-1}$ ) at 273 K?
- 3.92 atm                                      b) 4.48 atm                                      c) 5.92 atm                                      d) 29.4 atm
412. A 5% solution of sugarcane (mol. wt. = 342) is isotonic with 1% solution of  $X$  under similar conditions. The molecular weight of  $X$  is
- 136.2                                      b) 689.4                                      c) 34.2                                      d) 171.2
413. During osmosis, flow of water through a semipermeable membrane is :
- From both sides of semipermeable membrane with unequal flow rates
  - From solution having lower concentration only
  - From solution having higher concentration only
  - From both sides of semipermeable membrane with equal flow rates
414. Osmotic pressure of 0.4% urea solution is 1.60 atm and that of 3.42% cane sugar is 2.46 atm. When the above two solutions are mixed, the osmotic pressure of the resulting solution is
- 0.82 atm                                      b) 2.46 atm                                      c) 1.64 atm                                      d) 4.10 atm
415. The solubility of a solid in a liquid depends on :
- Nature of solute                                      b) Nature of solvent                                      c) Temperature                                      d) All of these
416. On adding 1 g arsenic to 80 g benzene, the freezing point of benzene is lowered by  $0.19^\circ C$ . The formula of arsenic is
- As                                      b)  $As_2$                                       c)  $As_3$                                       d)  $As_4$
417. The molecular weight of NaCl determined by studying freezing point depression of its 0.5% aqueous

- solution is 30. The apparent degree of dissociation of NaCl is  
 a) 0.60                                      b) 0.50                                      c) 0.30                                      d) 0.95
418. An aqueous solution of glucose is 10% in strength. The volume in which 1 g-mole of it is dissolved will be  
 a) 0.18 L                                      b) 1.8 L                                      c) 0.9 L                                      d) 9.0 L
419. Relative lowering of vapour pressure of a dilute solution is 0.2. What is the mole fraction of the non-volatile solute ?  
 a) 0.8                                      b) 0.5                                      c) 0.3                                      d) 0.2
420. The van't hoff factor for 0.1 m  $\text{Ba}(\text{NO}_3)_2$  solution is 2.74. The degree of dissociation is  
 a) 91.3%                                      b) 87%                                      c) 100%                                      d) 74%
421. Which of the following concentration term is/are independent of temperature?  
 a) Molarity                                      b) Molarity and mole fraction  
 c) Mole fraction and molality                                      d) Molality and normality
422. Which of the following solutions will have highest boiling point  
 a) 0.1 M  $\text{FeCl}_3$                                       b) 0.1 M  $\text{BaCl}_2$   
 c) 0.1 M NaCl                                      d) 0.1 M urea ( $\text{NH}_2 \text{CONH}_2$ )
423. An aqueous solution of glucose was prepared by dissolving 18 g of glucose in 90 g of water. The relative lowering in vapour pressure is  
 a) 0.01                                      b) 0.02                                      c) 1                                      d) 20
424. Molarity of a given orthophosphoric acid solution is 3 M. It's normality is  
 a) 9N                                      b) 0.3 N                                      c) 3 N                                      d) 1 N
425. A molar solution of NaCl has a density of  $1.21 \text{ g mL}^{-1}$ . The molarity of this solution is  
 a) 2.35                                      b) 1.143                                      c) 2.95                                      d) 1.356
426. In a 0.2 molal aqueous solution of a weak acid HX, the degree of ionisation is 0.3 Taking  $k_f$  for water as 1.85, the freezing point of the solution will be nearest to  
 a) MeV                                      b) Cal                                      c) Cm/s                                      d) Atm
427. A substance will be deliquescent if its vapour pressure is :  
 a) Equal to the atmospheric pressure  
 b) Equal to that of water vapour in the air  
 c) Greater than that of water vapour in the air  
 d) Lesser than that of water vapour in the air
428. When an ideal binary solution is in equilibrium with its vapour, molar ratio of the two components in the solution and in the vapour phase is :  
 a) Same  
 b) Different  
 c) May or may not be same depending upon volatile nature of the two components  
 d) None of the above
429. On adding a solute to a solvent having vapour pressure 0.80 atm vapour pressure reduces to 0.60 atm. Mole fraction of solute is  
 a) 0.25                                      b) 0.75                                      c) 0.50                                      d) 0.33
430. If 0.1 M solutions of each electrolyte are taken and if all electrolytes are completely dissociated, then whose boiling point will be highest ?  
 a) Glucose                                      b) KCl                                      c)  $\text{BaCl}_2$                                       d)  $\text{K}_2[\text{Fe}(\text{CN})_6]$
431. Molal depression of freezing point of water is  $1.86^\circ\text{C}$  per 1000 g of water. 0.02 mole of urea dissolved in 100 g of water will produce a lowering of temperature of :  
 a)  $0.186^\circ\text{C}$                                       b)  $0.372^\circ\text{C}$                                       c)  $1.86^\circ\text{C}$                                       d)  $3.72^\circ\text{C}$
432. One gram of silver gets distributed between  $10 \text{ cm}^3$  of molten zinc and  $100 \text{ cm}^3$  of molten lead at  $8000^\circ\text{C}$ . The percentage of silver still left in the lead layer is approximately  
 a) Henry                                      b) Van't Hoff                                      c) Nernst's                                      d) Ostwald
433. 0.1 molal aqueous solution of NaBr freezes at  $-0.335^\circ\text{C}$  at atmospheric pressure  $k_f$  for water is  $1.86^\circ\text{C}$ .

- The percentage of dissociation of the salt in solution is  
 a) 90                                      b) 80                                      c) 58                                      d) 98
434. 50 g of an acid is dissolved in one litre aqueous solution. Distribution coefficient in favour of ether is 3. Acid left in aqueous layer when solution is shaken with one litre ether :  
 a) 25 g                                      b) 12.5 g                                      c) 6.25 g                                      d) None of these
435. You are given 100 mL of  $\text{CCl}_4$  to extract iodine from 200 mL of its aqueous solution. For extracting maximum amount of iodine, which one of the following processes would you use?  
 a) Use all 100 mL of  $\text{CCl}_4$  at one time  
 b) Use 50 mL of  $\text{CCl}_4$  twice  
 c) Use 10 mL of  $\text{CCl}_4$  10 times  
 d) Use 25 mL of  $\text{CCl}_4$  4 times
436. A solution of protein (extracted from crabs) was prepared by dissolving 0.75 g in  $125 \text{ cm}^3$  of an aqueous solution. At  $4^\circ\text{C}$  an osmotic pressure rise of 2.6 mm of the solution was observed. Then molecular weight of protein is : (Assume density of solution is  $1.00 \text{ g/cm}^3$ )  
 a)  $9.4 \times 10^5$                                       b)  $5.4 \times 10^5$                                       c)  $5.4 \times 10^{10}$                                       d)  $9.4 \times 10^{10}$
437. Which of the following is incorrect?  
 a) Relative lowering of vapour pressure is independent of the solute and the solvent.  
 b) The relative lowering of vapour pressure is a colligative property.  
 c) Vapour pressure of a solution is lower than the vapour pressure of the solvent.  
 d) The relative lowering of vapour pressure is directly proportional to the original pressure.
438. The average osmotic pressure of human blood is 7.8 bar at  $37^\circ\text{C}$ . What is the concentration of an aqueous NaCl solution that could be used in the blood stream?  
 a) 0.16 mol/L                                      b) 0.31 mol/L                                      c) 0.60 mol/L                                      d) 0.45 mol/L
439. For a dilute solution, Raoult's law states that  
 a) The lowering of vapour pressure is equal to mole fraction of solute  
 b) The relative lowering of vapour pressure is equal to mole fraction of solute  
 c) The relative lowering of vapour pressure is proportional to the amount of solute in solution  
 d) The vapour pressure of the solution is equal to the mole fraction of solvent
440. The modal elevation constant of water is  $0.52^\circ\text{C}$ . The boiling point of 1.0 modal aqueous KCl solution (assuming complete dissociation of KCl), therefore, should be  
 a)  $98.96^\circ\text{C}$                                       b)  $100.52^\circ\text{C}$                                       c)  $101.04^\circ\text{C}$                                       d)  $107.01^\circ\text{C}$
441. Calculate the molarity of 1 L solution of 93%  $\text{H}_2\text{SO}_4$  (weight/volume). The density of the solution is 1.84 g/mL  
 a) 11.05                                      b) 12.05                                      c) 13.05                                      d) 14.05
442. If  $10^{-4} \text{ dm}^3$  of water is introduced into a  $1.0 \text{ dm}^3$  flask at 300 K, how many moles of water are in the vapour phase when equilibrium is established?  
 (Given : Vapour pressure of  $\text{H}_2\text{O}$  at 300 K is 3170 Pa ;  $R = 8.314 \text{ J K}^{-1} \text{ mole}^{-1}$ )  
 a)  $1.27 \times 10^{-3} \text{ mol}$                                       b)  $5.56 \times 10^{-3} \text{ mol}$                                       c)  $1.53 \times 10^{-2} \text{ mol}$                                       d)  $4.46 \times 10^{-2} \text{ mol}$
443. Increasing the temperature of an aqueous solution will cause  
 a) Decrease in molarity                                      b) Decrease in molarity  
 c) Decrease in mole fraction                                      d) Decrease in % w/w
444. How many grams of sulphuric acid is to be dissolved to prepare 200 mL aqueous solution having concentration of  $[\text{H}_3\text{O}^+]$  ions 1 M at  $25^\circ\text{C}$  temperature.  
 $[\text{H} = 1, \text{O} = 16, \text{S} = 32 \text{ g.mol}^{-1}]$   
 a) 4.9g                                      b) 19.6g                                      c) 9.8g                                      d) 0.98g
445. Equal masses of methane and oxygen are mixed in an empty container at  $25^\circ\text{C}$ . The fraction of the total pressure exerted by oxygen is  
 a)  $\frac{2}{3}$                                       b)  $\frac{1}{3} \times \frac{273}{298}$                                       c)  $\frac{1}{3}$                                       d)  $\frac{1}{2}$
446. Which statement is wrong for distribution law?

- a) The two solvents should be mutually immiscible  
 b) The substance should not chemically react with any of the two solvents  
 c) The temperature should not change during experiment  
 d) The concentration of the solute in both the solvents must be kept high
447. Maximum lowering of vapour pressure is observed in the case of  
 a) 0.1 M glucose                      b) 0.1 M BaCl<sub>2</sub>                      c) 0.1 M MgSO<sub>4</sub>                      d) 0.1 NaCl
448. The volume of water to be added to  $\frac{N}{2}$  HCl to prepare 500 cm<sup>3</sup> of  $\frac{N}{10}$  solution is  
 a) 450 cm<sup>3</sup>                      b) 100 cm<sup>3</sup>                      c) 45 cm<sup>3</sup>                      d) 400 cm<sup>3</sup>
449. A solution of sucrose (molar mass 342 g mol<sup>-1</sup>) has been produced by dissolving 68.5 g sucrose in 1000 g water. The freezing point of the solution obtained will be : ( $K_f$  for H<sub>2</sub>O = 1.86 Kkg mol<sup>-1</sup>)  
 a) -0.372°C                      b) -0.520°C                      c) + 0.372°C                      d) -0.570°C
450. The order of osmotic pressure of isomolar solution of BaCl<sub>2</sub>, NaCl and sucrose is  
 a) BaCl<sub>2</sub> > NaCl > sucrose                      b) NaCl > BaCl<sub>2</sub> > sucrose  
 c) Sucrose > NaCl > BaCl<sub>2</sub>                      d) BaCl<sub>2</sub> > sucrose > NaCl
451. Calculate the normality of 250 mL aqueous solution of H<sub>2</sub>SO<sub>4</sub> having pH = 0.00.  
 a) 0.25 N                      b) 0.50 N                      c) 1 N                      d) 2 N
452. If the elevation in boiling point of a solution of 10 g of solute (mol. wt. = 100 g of water is  $\Delta T_b$ , the ebullioscopic constant of water is  
 a) 10                      b) 100 $\Delta T_b$                       c)  $\Delta T_b$                       d)  $\frac{\Delta T_b}{10}$
453. The highest temperature at which vapour pressure of a liquid can be measured is :  
 a) b.p. of liquid  
 b) Critical temperature ( $T_c$ )  
 c) Critical solution temperature  
 d) Inversion temperature
454. What is molarity of K<sup>+</sup> in aqueous solution that contains 17.4 ppm of K<sub>2</sub>SO<sub>4</sub> (174 g mol<sup>-1</sup>)?  
 a)  $2 \times 10^{-2} M$                       b)  $2 \times 10^{-3} M$                       c)  $4 \times 10^{-4} M$                       d)  $2 \times 10^{-4} M$
455. The freezing point of the 0.05 molal solution of non-electrolyte in water is  
 a) -0.093°C                      b) 1.86°C                      c) 0.93°C                      d) 0.093°C
456. The temperature at which vapour pressure of a solvent in its liquid and solid phase becomes same is called :  
 a) b. p.                      b) f. p.                      c) Krafft point                      d) None of these
457. The vapour pressure of pure liquid is 1.2 atm. When a non-volatile substance B is mixed in A, then its vapour pressure becomes 0.6 atm. The mole fraction of B in the solution is  
 a) 0.15                      b) 0.25                      c) 0.50                      d) 0.75
458. Isotonic solution have the same  
 a) Normality                      b) Density                      c) Molar concentration                      d) None of these
459. Choose the correct statement.  
 When concentration of a salt solution is increased  
 a) Boiling point increases while vapour pressure decreases.  
 b) Boiling point decreases while vapour pressure increases.  
 c) Freezing point decreases while vapour pressure increases.  
 d) Freezing point increases while vapour pressure decreases.
460. When 10 g of a non-volatile solute is dissolved in 100 g of benzene, it raises boiling point by 1°C then molecular mass of the solute is ( $k_b$  for C<sub>6</sub>H<sub>6</sub> = 2.53 kg - mol<sup>-1</sup>)  
 a) 223 g                      b) 233 g                      c) 243 g                      d) 253 g
461. The depression in f. p. of 0.01 m aqueous solution of urea, sodium chloride and sodium sulphate is in the ratio :  
 a) 1 : 1 : 1                      b) 1 : 2 : 3                      c) 1 : 2 : 4                      d) 2 : 2 : 3

462. Azeotropic mixture are
- Constant temperature boiling mixture
  - Those which boils at different temperatures
  - Mixture of two solids
  - None of the above
463. When mercuric iodide is added to the aqueous solution of potassium iodide, the
- Freezing point is raised
  - Freezing point is lowered
  - Freezing point does not change
  - Boiling point does not change
464. Vapour pressure of a solvent containing non-volatile solute is :
- More than the vapour pressure of a solvent
  - Less than the vapour pressure of solvent
  - Equal to the vapour pressure of solvent
  - None of the above
465.  $6.02 \times 10^{20}$  molecules of urea are present in 100 mL of its solution. The concentration of urea solution is (Avogadro constant,  $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$ )
- 0.001 M
  - 0.01 M
  - 0.02 M
  - 0.1 M
466. In two solutions having different osmotic pressure, the solution of higher osmotic pressure is called :
- Isotonic solution
  - Hypertonic solution
  - Hypotonic solution
  - None of these
467. Sodium sulphate is soluble in water, while barium sulphate is sparingly soluble because :
- The hydration energy of sodium sulphate is more than its lattice energy
  - The lattice energy of barium sulphate is less than the hydration energy
  - The lattice energy has no role to play in solubility
  - The hydration energy of sodium sulphate is less than its lattice energy
468. Which has minimum osmotic pressure?
- 200 mL of 2 M NaCl solution
  - 200 mL of 2 M glucose solution
  - 200 mL of 2 M urea solution
  - All have same osmotic pressure
469. Mole fraction ( $X$ ) of any solution is equal to
- $\frac{\text{no. of moles of solute}}{\text{volume of solution in litre}}$
  - $\frac{\text{no. of gram – equivalent of solute}}{\text{volume of solution in litre}}$
  - $\frac{\text{no. of moles of solute}}{\text{mass of solvent in kg}}$
  - $\frac{\text{no. of moles of any constituent}}{\text{total number of moles of all constituents}}$
470. The vapour pressure of benzene at  $80^\circ\text{C}$  is lowered by 10 mm by dissolving 2g of a non-volatile substance in 78 g of benzene. The vapour pressure of pure benzene at  $80^\circ\text{C}$  is 750 mm. The molecular weight of the substance will be :
- 15
  - 150
  - 1500
  - 148
471. The reverse of fusion is freezing and it is :
- Endothermic
  - Exothermic
  - Neither exothermic nor endothermic
  - May be exothermic or endothermic
472. 100 mL of 0.3 HCl is mixed with 200 mL of 0.6 N  $\text{H}_2\text{SO}_4$ . The final normality of the resulting solution will be
- 0.3 N
  - 0.2 N
  - 0.5 N
  - 0.1 N
473. Insulin  $(\text{C}_2\text{H}_{10}\text{O}_5)_n$  is dissolved in a suitable solvent and the osmotic pressure ( $\pi$ ) of solutions of various concentrations  $C$  ( $\text{g}/\text{cm}^3$ ) is measured at  $20^\circ\text{C}$ . the slope of a plot of  $\pi$  against  $C$  is found to be  $4.65 \times 10^{-3}$ . The molecular weight of the insulin is :
- $4.8 \times 10^5$
  - $9 \times 10^5$
  - $3 \times 10^5$
  - $5.17 \times 10^6$
474. The melting point of most of the solid substances increase with an increase of pressure acting on them.



However, ice melts at a temperature lower than its usual melting point, when the pressure increase. This is because :

- a) Ice is less denser than water
  - b) Pressure generates heat
  - c) The bonds break under pressure
  - d) Ice is not a true solid
475. The freezing point of water is depressed by  $0.37^{\circ}\text{C}$  in a  $0.01$  mol NaCl solution. The freezing point of  $0.02$  molal solution of urea is depressed by
- a) Hypotonic
  - b) Isotonic
  - c) Equimolar
  - d) Hypertonic
476. The freezing point depression constant for water is  $1.86\text{ K kgmol}^{-1}$ . If  $45\text{ g}$  of ethylene glycol is mixed with  $600\text{ g}$  of water, the freezing point of the solution is
- a)  $2.2\text{ K}$
  - b)  $270.95\text{ K}$
  - c)  $273\text{ K}$
  - d)  $275.35\text{ K}$
477. A mixture of ethane and ethene occupies  $41\text{ L}$  at  $1\text{ atm}$  and  $500\text{ K}$ . the mixture reacts completely with  $\frac{10}{3}$  mole of  $\text{O}_2$  to produce  $\text{CO}_2$  and  $\text{H}_2\text{O}$ . The mole fraction of ethane and ethene in the mixture are ( $R = 0.082\text{ L atm K}^{-1}\text{ mol}^{-1}$ ) respectively
- a)  $0.50, 0.50$
  - b)  $0.75, 0.25$
  - c)  $0.67, 0.33$
  - d)  $0.25, 0.75$
478. Which of the given solutions has highest osmotic pressure?
- a)  $1\text{ N NaNO}_3$
  - b)  $1\text{ N Ba(NO}_3)_2$
  - c)  $1\text{ N Al(NO}_3)_3$
  - d)  $1\text{ N Th(NO}_3)_4$
479. Molarity is expressed as
- a)  $\text{L/mol}$
  - b)  $\text{Mol/L}$
  - c)  $\text{Mol}/1000\text{ g}$
  - d)  $\text{g/L}$
480. At Abu mountains water boils at  $96^{\circ}\text{C}$ . What amount of NaCl be added in  $1\text{ kg}$  water so that it boils at  $100^{\circ}\text{C}$ .  $K_b$  for  $\text{H}_2\text{O} = 0.52\text{ K molality}^{-1}$
- a)  $225\text{ g}$
  - b)  $450\text{ g}$
  - c)  $200\text{ g}$
  - d)  $125\text{ g}$
481. Which one of the following is not correct for an ideal solution?
- a) It must obey Raoult's law
  - b)  $\Delta H = 0$
  - c)  $\Delta V = 0$
  - d)  $\Delta H = V \neq 0$
482. For an ideal binary liquid solution with  $P_A^0 > P_B^0$  which relation between  $X_A$  (mole fraction of A in liquid phase) and  $Y_A$  (mole fraction of A in vapour phase) is correct,  $X_B$  and  $Y_B$  are mole fraction of B in liquid and vapour phase respectively :
- 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 corelated
483. If  $P_0$  and  $P_s$  are the vapour pressure of solvent and solution respectively and  $N_1$  and  $N_2$  are the mole of solute and solvent then :
- a)  $(P_0 - P_s)/P_0 = N_1/(N_1 + N_2)$
  - b)  $(P_0 - P_s)/P_s = N_1/N_2$
  - c)  $P_s = P_0 \cdot N_2/(N_1 + N_2)$
  - d) All of the above
484. Distribution law cannot be applied for the system in which  $\text{I}_2$  is distributed between :
- a)  $\text{H}_2\text{O}$  and  $\text{CS}_2$
  - b)  $\text{H}_2\text{O}$  and  $\text{CCl}_4$
  - c)  $\text{H}_2\text{O}$  and ether
  - d)  $\text{H}_2\text{O}$  and ethanol
485. The process of getting fresh water from sea water is known as :
- a) Osmosis
  - b) Filtration
  - c) Diffusion

- d) Reverse osmosis
486. A solution containing 10 g per  $\text{dm}^3$  of urea (mol. mass = 60) is isotonic with a 5% (wt. by vol.) solution of a non-volatile solute. The molecular mass (in  $\text{g mol}^{-1}$ ) of non-volatile solute is :  
 a) 350                                      b) 200                                      c) 250                                      d) 300
487. Osmotic pressure of a solution at a given temperature  
 a) Increases with concentration                                      b) Decreases with concentration  
 c) Remains same                                      d) Initially increases and then decreases
488. The osmotic pressure of a solution at  $0^\circ\text{C}$  is 2 atm. What will be its osmotic pressure at  $273^\circ\text{C}$  under similar conditions?  
 a) 0.5 atm                                      b)  $2 \times 273$  atm                                      c) 4 atm                                      d)  $273/2$  atm
489. The ionic strength of solution containing 0.1 mol/kg of KCl and 0.2 mol/kg of  $\text{Cu SO}_4$  is  
 a) 0.3                                      b) 0.6                                      c) 0.9                                      d) 0.2
490. Aqueous solution of 0.004 M  $\text{Na}_2\text{SO}_4$  and 0.01 M glucose are isotonic. The degree of dissociation of  $\text{Na}_2\text{SO}_4$  is :  
 a) 25%                                      b) 60%                                      c) 75%                                      d) 85%
491. How many grams of a sucrose (mol wt. = 342) should be dissolved in 100 g water in order to produce a solution with a  $105.0^\circ\text{C}$  difference between the freezing point and boiling temperature? ( $k_f = 1.86 \text{ C/m}$ ,  $k_b = 0.151^\circ\text{C}$ )  
 a) 34.2 g                                      b) 72 g                                      c) 342 g                                      d) 460 g
492. When a substance is distributed between two immiscible solvents and remains in the same state in the solvent I, while, dissociates in the solvent II. If the concentration of solute are  $c_I$  and  $c_{II}$  in phase I and II respectively then :  
 a)  $\frac{c_I}{c_{II}(1 - \alpha)} = K$   
 b)  $\frac{c_I(1 - \alpha)}{c_{II}} = K$   
 c)  $\frac{c_I(1 - \beta)}{c_{II}} = K$   
 d)  $\frac{c_I}{\sqrt{c_{II}(1 - \alpha)}} = K$
493. When 50 g of lactic acid was mixed with a mixture of equal volume of water and chloroform, the concentration of lactic acid in water was found to be  $49.03 \text{ g litre}^{-1}$  and in chloroform  $0.97 \text{ g litre}^{-1}$ . The distribution coefficient of lactic acid in favour of water is:  
 a) 50.55                                      b) 55.55                                      c) 60.55                                      d) 45.55
494. The molarity of pure water is  
 a) 55.6                                      b) 5.56                                      c) 6.55                                      d) 65.5
495. At  $25^\circ\text{C}$ , the highest osmotic pressure is exhibited by 0.1 M solution of  
 a) Decinormal aluminium sulphate  
 b) Decinormal barium chloride  
 c) Decinormal sodium chloride  
 d) A solution obtained by mixing equal volumes of (b) and (c) and filtering
496. At  $25^\circ\text{C}$  a 5% aqueous solution of glucose (molecular weight =  $180 \text{ g mol}^{-1}$ ) is isotonic with 2% aqueous solution containing an unknown solute. What is the molecular weight of the unknown solute.  
 a) 60                                      b) 80                                      c) 72                                      d) 63
497. The atmospheric pressure is sum of the  
 a) Pressure of the biomolecules  
 b) Vapour pressure of atmospheric constituents  
 c) Vapour pressure of chemicals and vapour pressure of volatiles  
 d) Pressure created on to atmospheric molecules

498. The energy that opposes the dissolution of a solute in a solvent is called :
- Solvent energy
  - Hydration energy
  - Lattice energy
  - Ionization energy
499. In a mixture of *A* and *B*, components show negative deviation when
- A—B* interaction is stronger than *A—A* and *B—B* interaction
  - A—B* interaction is weaker than *A—A* and *B—B* interaction
  - $\Delta V_{mix} > 0, \Delta S_{mix} > 0$
  - $\Delta V_{mix} = 0, \Delta S_{mix} > 0$
500. On the basis of intermolecular forces predict the correct order of decreasing boiling points of the compounds:
- $\text{CH}_3\text{OH} > \text{H}_2 > \text{CH}_4$
  - $\text{CH}_3\text{OH} > \text{CH}_4 > \text{H}_2$
  - $\text{CH}_4 > \text{CH}_3\text{OH} > \text{H}_2$
  - $\text{H}_2 > \text{CH}_4 > \text{CH}_3\text{OH}$
501. What is the molality of pure water?
- 1
  - 18
  - 55.5
  - None of these
502. Vapour pressure of pure '*A*' is 70 mm of Hg at 25°C. It from an ideal solution with '*B*' in which mole fraction of *A* is 0.8. If the vapour pressure of the solution is 84 mm of Hg at 25°C, the vapour pressure of pure '*B*' at 25°C is
- 28 mm
  - 56 mm
  - 70 mm
  - 140 mm
503. The molality of a urea solution in which 0.0100 g of urea,  $[(\text{NH}_2)_2\text{CO}]$  is added to 0.3000  $\text{dm}^3$  of water at STP is
- 0.555m
  - $5.55 \times 10^{-4}\text{m}$
  - 33.3m
  - $3.33 \times 10^{-2}\text{m}$
504. The elevation in boiling point for one molal solution of a solute in a solvent is called :
- Cryoscopic constant
  - Boiling point constant
  - Molal ebullioscopic constant
  - None of the above
505. Normality of 2 M sulphuric acid is
- 2N
  - 4N
  - $\frac{N}{2}$
  - $\frac{N}{4}$
506. The freezing point of one modal NaCl solution assuming NaCl to be 100 % dissociated in water is (modal depression constant=1.86)
- 2.72°C
  - 3.72°C
  - 2.72°C
  - 3.72°C
507. The distribution coefficient of  $\text{I}_2$  in between  $\text{CCl}_4$  and  $\text{H}_2\text{O}$  is 85 in favour of  $\text{CCl}_4$  at 25°C. If solubility of  $\text{I}_2$  in  $\text{H}_2\text{O}$  at 25°C is 0.33 g litre<sup>-1</sup>, the solubility of  $\text{I}_2$  in  $\text{CCl}_4$  is .....g litre<sup>-1</sup>.
- 28.05
  - 30.05
  - 40.05
  - 26.05
508. Acetic acid on dissolution in benzene will show :
- Two times of its normal molecular weight
  - Its normal molecular weight
  - Half of its normal molecular weight
  - None of the above
509. Among the following mixtures, dipole-dipole as the major interaction is present in :
- Benzene and ethanol
  - KCl and water
  - Acetonitrile and acetone
  - Benzene and  $\text{CCl}_4$
510. 5% (wt./vol.) aqueous NaCl solution and 5% (wt./vol.) aqueous KCl solution are :
- Isotonic
  - Isomolar
  - Equinormal
  - None of these
511. The molarity of a solution made by mixing 50 mL of conc  $\text{H}_2\text{SO}_4$  (36 N) with 50 mL of water is

- a) 9 m                      b) 10 m                      c) 11 m                      d) 12 m
512. According to phase rule, if  $P = 3$ ,  $C = 1$ , then  $F$  must be equal to :  
a) 2                      b) 1                      c) Zero                      d) 4
513. At  $95^\circ\text{C}$ , an aqueous solution of iodine containing 0.0156 g/litre is in equilibrium with a  $\text{CCl}_4$  solution containing 4.412 g/litre. If the solubility of  $\text{I}_2$  in water at  $95^\circ\text{C}$  is 0.34 g/litre, then its solubility in  $\text{CCl}_4$  is :  
a)  $\frac{4.412 \times 0.0156}{0.34}$   
b)  $\frac{0.0156 \times 0.34}{4.412}$   
c)  $\frac{4.412 \times 0.34}{0.0156}$   
d)  $\frac{0.0156}{4.412 \times 0.34}$
514. A 5.25% solution of a substance is isotonic with a 1.5% solution of urea (molar mass =  $60 \text{ g mol}^{-1}$ ) in the same solvent. If the densities of both the solutions are assumed to be equal to  $1.0 \text{ g cm}^{-3}$ , molar mass of the substance will be  
a)  $90.0 \text{ g mol}^{-1}$                       b)  $115.0 \text{ g mol}^{-1}$                       c)  $105.0 \text{ g mol}^{-1}$                       d)  $210.0 \text{ g mol}^{-1}$
515. Which pair shows a contraction in volume on mixing along with evolution of heat?  
a)  $\text{CHCl}_3 + \text{C}_6\text{H}_6$                       b)  $\text{H}_2\text{O} + \text{HCl}$                       c)  $\text{H}_2\text{O} + \text{HNO}_3$                       d) All of these

