JEE MAIN : CHAPTER WISE TEST PAPER-1

SUBJECT :- CHEMISTRY **DATE.....**
CLASS :- 12th **NAME.....**
CHAPTER :- SOLUTION **SECTION.....**

(SECTION-A)

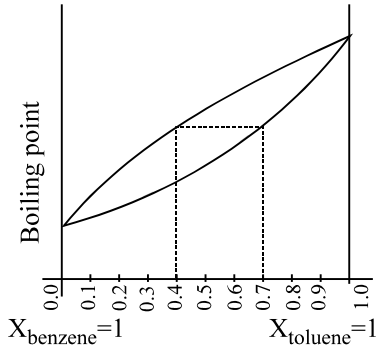
1. Pressure over ideal binary liquid mixture containing 10 moles each of liquid A and B is gradually decreased isothermally. If P_A^o=200 mm Hg and P_B^o=100 mm Hg, find the pressure at which half of the liquid is converted into vapour.
(A) 150 mm Hg (B) 166.5 mm Hg
(C) 133 mm Hg (D) 141.4 mm Hg

2. Elevation of boiling point of 1 molar aqueous glucose solution (density = 1.2 g/ml) is
(A) K_b (B) 1.20 K_b
(C) 1.02 K_b (D) 0.98 K_b

3. For an ideal binary liquid solution with $P_A^\circ > P_B^\circ$, which relation between X_A (mole fraction of A in liquid phase) and Y_A(mole fraction of A in vapour phase) is correct?
(A) $Y_A < Y_B$ (B) $X_A > X_B$
(C) $\frac{Y_A}{Y_B} > \frac{X_A}{X_B}$ (D) $\frac{Y_A}{Y_B} < \frac{X_A}{X_B}$

4. The freezing point depression of a 0.10 M solution of formic acid is – 0.2046°C. What is the equilibrium constant for the reaction at 298 K?
$HCOO^-(aq) + H_2O(l) \rightleftharpoons HCOOH(aq) + OH^-(aq)$
(Given : $K_f(H_2O)$ = 1.86K kg mol^{-1}, Molarity = molality)
(A) 1.1×10^{-3} (B) 9×10^{-12}
(C) 9×10^{-13} (D) 1.1×10^{-11}

5. The following graph represents variation of boiling point with composition of liquid and vapours of binary liquid mixture. The graph is plotted at constant pressure.
Which of the following statement(s) is **incorrect**. Here X & Y stands for mole fraction in liquid and vapour phase respectively



(A) $X_{benzene}$ = 0.5 and $Y_{toluene}$ = 0.2
(B) $X_{toluene}$ = 0.3 and $Y_{benzene}$ = 0.6
(C) $X_{benzene}$ = 0.3 and $Y_{toluene}$ = 0.4
(D) if $X_{benzene}$ = 0.7 than $Y_{toluene}$ < 0.3

6. How many grams of sucrose (mol.wt. = 342) should be dissolved in 100 gm water in order to produce a solution with 105°C difference between the freezing point & boiling point temperatures?
(Unit : k_f = 1.86 K.kg mol^{-1} ; k_b = 0.51 K.kg mol^{-1})
(A) 34 gm (B) 46 gm
(C) 72 gm (D) 342 gm

7. A cylinder fitted with a movable piston contains liquid water in equilibrium with water vapour at 25°C. Which of the following operation results in a decrease in the equilibrium vapour pressure at 25°C?
(A) Moving the piston downward a short distance
(B) Removing a small amount of vapour
(C) Removing a small amount of liquid water
(D) Dissolving some salt in the water.

8. Insulin is dissolved in a suitable solvent & the osmotic pressure (π in atm) of solutions of various concentration **'C' in gm/cc** is measured at 27°C. The slope of the plot π against **'C'** is found to be 5×10^{-3}. The molecular weight of insulin is:
(A) 4.9×10^5 (B) 4.9×10^3
(C) 4.9×10^6 (D) 4.9×10^4

9. At certain temperature (T) for the gas phase reaction
$2H_2O(g) + 2Cl_2(g) \rightleftharpoons 4HCl(g) + O_2(g)$; $K_p = 6 \times 10^8$ atm
If Cl_2, HCl & O_2 are mixed in such a manner that the partial pressure of each is 1 atm and the mixture is brough into contact with excess of liquid water. What would be approximate partial pressure of Cl_2 when equilibrium is attained at temperature (T)?
[Given : Vapour pressure of water is 380 mm Hg at temperature (T)]
(A) 8.1×10^{-7} atm (B) 10^{-4} atm
(C) 3.6×10^{-3} atm (D) 9×10^{-4} atm

10. A sample of acetone undergoes 40% dimerization. Then mole fraction of the dimer in the final mixture is
(A) 0.16 (B) 0.75 (C) 0.4 (D) 0.25

11. The **normal boiling point** of water is 100°C. What will be its **standard boiling point**.
(A) 100°C
(B) much greater than 100°C
(C) less than 100°C
(D) slightly greater than 100°C

12. Which of the following ideal aqueous solutions will show maximum boiling point.
(A) 0.5 M NaCl showing 50% dissociations
(B) 0.3 M $K_2Fe[Fe(CN)_6]$
(C) 1 M Glucose solution
(D) 1 mole of AgCl is mixed with 0.5 *l* of H_2O

13. The average molecular weight of a solute in a solution where 1 gm of it dimerises upto 75% in 100 gm H_2O showing a depression in freezing point of 0.093°C is given by : **(K_f H_2O = 1.86)**

(A) 200 (B) $\frac{200}{(0.25+0.375)}$

(C) 200(0.25 + 0.375) (D) 100

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

(A) $\frac{2}{3}$ (B) $\frac{1}{2}$

(C) $\frac{2}{5}$ (D) $\frac{1}{3}$

15. 200 ml of a very dilute aqueous solution of a protein contains 1.9gm of the protein. If osmotic rise of such a solution at 300K is found to be 38 mm of solution then calculate molar mass of the protein.
(A) 24630 gm/mole (B) 123150 gm/mole
(C) 517230 gm/mole (D) 61575 gm/mole

16. How does the surface tension of a liquid vary with increase in temperature?
(A) Remains same (B) Increases
(C) Decreases (D) No regular pattern

17. A liquid system consists of two immiscible liquids water and n-butyl chloride distills at one atmosphere pressure. If vapour pressure of water at that temperature is 570 mm of Hg, then the ratio of masses of water and n-butyl chloride distilled is :
(A) 3 : 1 (B) 0.58 : 1
(C) 1 : 1 (D) 1 : 3

18. Which of the following mixtures will show positive deviation from Raoult's law?
(A) Methanol and Acetone
(B) Chloroform and Acetone
(C) Nitric acid and Water
(D) Phenol and Aniline

19. A 0.003 M $Al_2(SO_4)_3$ solution is isotonic with 0.01 M solution of glucose. The % dissociation of aluminum sulphate will be :
(A) 75 % (B) 58.33 %
(C) 23.97 % (D) 43.12 %

20. Which of the following solutions can have boiling point less than that of both the individual components?
(A) n-Hexane & n-Heptane
(B) $CHCl_3$ & CH_3COCH_3
(C) HNO_3 & H_2O
(D) C_2H_5OH & H_2O

(SECTION-B)

21. Calculate mass of the final solution obtained on heating a solution comprising of 0.5 moles of urea in 2000 gm of H_2O to a temperature of 101°C if $K_{b(H_2O)}$ = 0.5 K kg/mole.

22. Two liquids A & B form an ideal solution. What is the vapour pressure of solution containing 2 moles of A and 3 moles of B at 300 K?
[Given : At 300 K, Vapour pr. of pure liquid A (P_A^o) = 100 torr
Vapour pr. of pure liquid B (P_B^o) = 300 torr]

23. At 300 K, the vapour pressure of an ideal solution containing 3 mole of A and 2 mole of B is 600 torr. At the same temperature, if 1.5 mole of A & 0.5 mole of C (non-volatile) are added to this solution the vapour pressure of solution increases by 30 torr. What is the value of P_B^o ?

24. How many grams of sucrose (mol.wt. = 342) should be dissolved in 100 gm water in order to produce a solution with 105°C difference between the freezing point & boiling point temperature at 1 atm?
(Unit : k_f = 2 K.kg mol^{-1} ; k_b = 0.5 K.kg mol^{-1})
Fill your answer by multiplying it with 100.

25. Vapour pressure of solution containing 6 gm of a non-volatile solute in 180 gm water is 20 torr. If 1 mole of water is further added, the vapour pressure of solution increases by 0.02 torr. Assume the solution is very dilute. The vapour pressure of pure water at this temperature is

[Answer by multiplying the value of vapour pressure, in torr, by 100]

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

(1) Solution of benzene & toluene

(2) Solution of hexane & heptane

(3) Solution of chloroform & methanol

(4) Solution of methanol & acetone

(5) Solution of chloroform & acetone

(6) Solution of HNO_3 & water

(7) Solution of Aniline & phenol

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

(9) Very dilute aqueous solution of glucose

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

27. 4 ml of a gas at 1 atm pressure and 300 K is dissolved in 1L of solution. Calculate the volume of the gas dissolved at 4 atm pressure and 300 K in $\frac{1}{2}$ L of solution **in ml**.

28. Two substances **A** and **B** form an ideal solution at a temperature of 300K. Given vapour pressures of **A** and **B** liquids are 700 and 800 torr respectively and the solution has the normal boiling point of 300 K. Calculate moles of vapours of **A** in the gaseous mixture at equilibrium if total 10 moles of gases are present at equilibrium. (up to nearest integer)

29. At 10ºC, the osmotic pressure of urea solution is 500 mm. The solution is diluted and the temperature is raised to 25ºC, when the osmotic pressure is found to be 105.3 mm. The extent of dilution (ratio of final to initial volume of solution) is

30. The freezing point of 0.1 molal aq. solution of $K_X[Fe(CN)_6]$ is – 0.744°C. The molal depression constant of water is 1.86 K-Kg mol^{-1} . If the salt behaves as strong electrolyte in water, the value of 'X' is :