Single correct :

1. The boiling point of C_6H_6, CH_3OH, $C_6H_5NH_2$ and $C_6H_5NO_2$ are 80^0C, 65^0C, 184^0C and 212^0C respectively which will show highest vapour pressure at room temperature :
(A) C_6H_6 (B) CH_3OH (C) $C_6H_5NH_2$ (D) $C_6H_5NO_2$

2. Mole fraction of A vapours above the solution in mixture of A and B ($X_A = 0.4$) will be
[Given : P_A° = 100 mm Hg and P_B° = 200 mm Hg]
(A) 0.4 (B) 0.8 (C) 0.25 (D) none of these

3. At a given temperature, total vapour pressure in Torr of a mixture of volatile components A and B is given by
$$P_{Total} = 120 - 75\ X_B$$
hence, vapour pressure of pure A and B respectively (in Torr) are
(A) 120, 75 (B) 120, 195 (C) 120, 45 (D) 75, 45

4. 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°) = 100 torr, Vapour pr. of pure liquid B (P_B°) = 300 torr]
(A) 200 torr (B) 140 torr (C) 180 torr (D) None of these

5. If Raoult's law is obeyed, the vapour pressure of the solvent in a solution is directly proportional to
(A) Mole fraction of the solvent (B) Mole fraction of the solute
(C) Mole fraction of the solvent and solute (D) The volume of the solution

6. 1 mole of heptane (V. P. = 92 mm of Hg) was mixed with 4 moles of octane (V. P. = 31mm of Hg). The vapour pressure of resulting ideal solution is :
(A) 46.2 mm of Hg (B) 40.0 mm of Hg (C) 43.2 mm of Hg (D) 38.4 mm of Hg

7. Mole fraction of A vapours above solution in mixture of A and B ($X_A = 0.4$) will be :-
(P_A° = 100mm, P_B° = 200mm)
(A) 0.4 (B) 0.8 (C) 0.25 (D) None

8. The vapour pressure of a pure liquid 'A' is 70 torr at 27^0C. It forms an ideal solution with another liquid B. The mole fraction of B is 0.2 and total vapour pressure of the solution is 84 torr at 27^0C. The vapour pressure of pure liquid B at 27^0C is
(A) 14 (B) 56 (C) 140 (D) 70

9. At 88 °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 °C at 1 atm. pressure, benzene - toluence form an ideal solution:
(A) 0.416 (B) 0.588 (C) 0.688 (D) 0.740

10. The exact mathematical expression of Raoult's law is (n = moles of solute ; N = moles of solvent)
(A) $\frac{P^0 - P_s}{P^0} = \frac{n}{N}$ (B) $\frac{P^0 - P_s}{P^0} = \frac{N}{n}$ (C) $\frac{P^0 - P_s}{P_s} = \frac{n}{N}$ (D) $\frac{P^0 - P_s}{P^0} = n \times N$

11. The vapour pressure of a solvent decreased by 10 mm of Hg when a non-volatile solute was added to the solvent. The mole fraction of solute in solution is 0.2, what would be mole fraction of the solvent if decrease in vapour pressure is 20 mm of Hg

(A) 0.2 (B) 0.4 (C) 0.6 (D) 0.8

12. The vapour pressure of a solution having solid as solute and liquid as solvent is :

(A) Directly proportional to mole fraction of the solvent

(B) Inversely proportional to mole fraction of the solvent

(C) Directly proportional to mole fraction of the solute

(D) Inversely propartional to mole fraction of the solute

13. One mole of non volatile solute is dissolved in two moles of water. The vapour pressure of the solution relative to that of water is

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

14. The vapour pressure of pure A is 10 torr and at the same temperature when 1 g of B is dissolved in 20 gm of A, its vapour pressure is reduced to 9.0 torr. If the molecular mass of A is 200 amu, then the molecular mass of B is :

(A) 100 amu (B) 90 amu (C) 75 amu (D) 120 amu

15. The vapour pressure of a pure liquid solvent (X) is decreased to 0.60 atm. from 0.80 atm on addition of a non volatile substance (Y). The mole fraction of (Y) in the solution is:-

(A) 0.20 (B) 0.25 (C) 0.5 (D) 0.75

16. Vapour pressure of CCl_4 at 25°C is 143 mm Hg. 0.5 gm of a non-volatile solute (mol. wt. 65) is dissolved in 100 ml of CCl_4. Fine the vapour perssure of the solution. (Density of CCl_4 = 1.58 gm/cm^3)

(A) 141.93 mm (B) 94.39 mm (C) 199.34 mm (D) 143.99 mm

17. Among the following, that does not form an ideal solution is :

(A) C_6H_6 and $C_6H_5CH_3$ (B) C_2H_5Cl and C_6H_5OH

(C) C_6H_5Cl and C_6H_5Br (D) C_2H_5Br and C_2H_5I

18. Colligative properties of the solution depend upon

(A) Nature of the solution (B) Nature of the solvent

(C) Number of solute particles (D) Number of moles of solvent

19. 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

20. When common salt is dissolved in water

(A) Melting point of the solution increases (B) Boiling point of the solution increases

(C) Boiling point of the solution decreases (D) Both Melting point and Boiling point is decreases

21. What should be the freezing point of aqueous solution containing 17 gm of C_2H_5OH in 1000 gm of water (water K_f = 1.86 deg – kg mol^{-1})

(A) – 0.69°C (B) – 0.34°C (C) 0.0°C (D) 0.34°C

22. The boiling point of an aqueous solution of a non volatile solute is 100.15 °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 and 1.86 K molality^{-1} :

(A) –0.544 °C (B) –0.512 °C (C) –0.272 °C (D) –1.86 °C

23. A 5% solution (by mass) of cane sugar in water has freezing point of 271 K and freezing point of pure water is 273·15K. The freezing point of a 5% solution (by mass) of glucose in water is –

(A) 271 K (B) 273·15 K (C) 269·07 K (D) 277·23 K

24. As a result of osmosis, the volume of the concentrated solution

(A) Gradually decreases (B) Gradually increases

(C) Suddenly increases (D) None

25. If mole fraction of the solvent in solution decreases then :

(A) Vapour pressure of solution increases (B) B. P. decreases

(C) Osmotic pressure increases (D) All are correct

26. 5% solution of sucrose is isotonic with 1% solution of a compound 'A' then the molecular weight of compound 'A' is -

(A) 32.4 (B) 68.4 (C) 121.6 (D) 34.2

27. Osmotic pressure of a sugar solution at 24^0C is 2.5 atmosphere. The concentration of the solution in mole per litre is :

(A) 10.25 (B) 1.025 (C) 1025 (D) 0.1025

28. A solution containing 4 g of a non volatile organic solute per 100 ml was found to have an osmotic pressure equal to 500 cm of mercury at 27^0C. The molecular weight of solute is :

(A) 14.97 (B) 149.7 (C) 1697 (D) 1.497

29. If a 6.84% (wt. / vol.) solution of cane-sugar (mol. wt. 342) is isotonic with 1.52% (wt./vol.) solution of thiocarbamide, then the molecular wight of thiocarbamide is :

(A) 152 (B) 76 (C) 60 (D) 180

30. Which of the following aqueous solution will show maximum vapour pressure at 300 K?

(A) 1 M NaCl (B) 1 M $CaCl_2$ (C) 1 M $AlCl_3$ (D) 1 M $C_{12}H_{22}O_{11}$

31. The correct relationship between the boiling points of very dilute solution oif $AlCl_3$ (T_1K) and $CaCl_2$ (T_2K) having the same molar concentration is

(A) $T_1 = T_2$ (B) $T_1 > T_2$ (C) $T_2 > T_1$ (D) $T_2 \leq T_1$

32. 1.0 molal aqueous solution of an electrolyte A_2B_3 is 60% ionised. The boiling point of the solution at 1 atm is ($K_{b(H_2O)} = 0.52\ K\,kg\,mol^{-1}$)

(A) 274.76 K (B) 377 K (C) 376.4 K (D) 374.76 K

33. The freezing point depression of a 0.1 M a solution of weak acid (HX) is –0.20°C.

What is the value of equilibrium constant for the reaction?

$$HX\ (aq) \rightleftharpoons H^+(aq) + X^-\ (aq)$$

[**Given** : K_f for water = 1.8 kg mol^{-1} K. & Molality = Molarity]

(A) 1.46×10^{-4} (B) 1.35×10^{-3} (C) 1.21×10^{-2} (D) 1.35×10^{-4}

34. The Vant Hoff factor (i) for a dilute solution of $K_3[Fe(CN)_6]$ is (Asuming 100% ionsation) :

(A) 10 (B) 4 (C) 5 (D) 0.25

35. The substance A when dissolved in solvent B shows the molecular mass corresponding to A_3. The vant Hoff's factor will be -

(A) 1 (B) 2 (C) 3 (D) 1/3

36. The lowerring of vapour pressure of 0.1M aqueous solutions of NaCl, $CuSO_4$ and K_2SO_4 are:

(A) All equal (B) In the ratio of 1 : 1 : 1.5

(C) In the ratio of 3 : 2 : 1 (D) In the ratio of 1.5 : 1 : 2.5

37. The value of observed and calcutated molecular wieght of silver nitrate are 92.64 and 170 respectively. The degree of dissociation of silver nitrate is :

(A) 60% (B) 83.5 % (C) 46.7% (D) 60.23%

38. The freezing point of 1 molal NaCl solution assuming NaCl to be 100% dissociated in water is : (K_f = 1.86 K Molality^{-1})

(A) –1.86 °C (B) –3.72 °C (C) +1.86 °C (D) + 3.72 °C

39. The molal elevation constant of water is 0.51. The boiling point of 0.1 molal aqueous NaCl solution is nearly :

(A) 100.05 °C (B) 100.1 °C (C) 100.2° C (D) 101.0° C

40. What is the freezing point of a solution containing 8.1 gm. of HBr in 100gm. water assuming the acid to be 90% ionised (K_f for water=1.86 K molality^{-1}) :-

(A) 0.85°C (B) –3.53°C (C) 0°C (D) –0.35°C

41. If a ground water contains H_2S at concentration of 2 mg/l, determine the pressure of H_2S in head space of a closed tank containing the ground water at 20°C. Given that for H_2S, Henry's constant is equal to 6.8×10^3 bar at 20°C.

(A) 720 Pa (B) 77×10^2 Pa (C) 553 Pa (D) 55×10^2 Pa