Multiple Choice Questions

Solutions and Types of solutions

[MHT-CET 2019]

1. Which of the following sets of components forms homogeneous mixture ?
   a) Silver chloride + Water
   b) Sugar + Benzene
   c) Ethyl alcohol + Water
   d) Phenol + Water

[MHT-CET 2020]

2. Which of the following statements is NOT correct about solution ?
   a) True solution is a heterogenous mixture of two or more substances with fixed composition.
   b) The three states of matter solid, liquid and gas may play the role of either solute or solvent.
   c) The component of solution which constitutes smaller part is called solute.
   d) When water is solvent, the process of solvation is known as hydration.
3. An amalgam of mercury with sodium is an example of
   a) liquid in liquid solution
   b) solid in liquid solution
   c) solid in solid solution
   d) liquid in solid solution
4. Solution of chloroform in nitrogen is an example of
   a) liquid in solid
   b) liquid in gas
   c) gas in liquid
   d) liquid in liquid
5. What type of solution is obtained when benzoic acid is added in benzene ?
   a) Solid in liquid b) Solid in solid c) liquid in solid d) liquid in liquid

[MHT-CET 2021]

6. Hydrogen in palladium is an example of a solution of
   a) gas in solid b) liquid in gas c) gas in liquid d) gas in gas
7. Air is an example of a solution of
   a) gas in solid b) liquid in gas c) gas in liquid d) gas in gas
8. Which of the following solutions behaves nearly as an ideal solution ?
   a) Benzene + toluene
   b) Chloroform + acetone
   c) Phenol + aniline
   d) Ethanol + acetone
9. What type of following solutions is obtained from amalgam of mercury with sodium?
   a) liquid in solid b) solid in gas c) solid in solid d) solid in liquid

[MHT-CET 2022]

10. What type of solution is sea water ?
    a) liquid in solid b) liquid in liquid c) solid in liquid d) solid in solid
11. What type of solution is carbonated water ?
    a) gas in solid b) liquid in liquid c) liquid in gas d) gas in liquid
12. What type of solution is bronze ?
    a) gas in solid b) solid in liquid c) liquid in solid d) solid in solid

Solubility and Henry's law

[MHT-CET 2016]

13. The relation between solubility of a gas in liquid at constant temperature and external pressure is stated by which law ?
    a) Raoult's law
    b) van't Hoff Boyle's law
    c) van't Hoff Charles' law
    d) Henry's law

[MHT-CET 2017]

14. Solubility of which among the following solids in water changes slightly with temperature ?
    a) KNO_3
    b) $NaNO_3$
    c) KBr
    d) NaBr

[MHT-CET 2020]

15. The Henry's law constant for oxygen is 1.3×10^{-3} mol dm^{-3} atm^{-1}. If partial pressure of oxygen is 0.46 atmosphere, what is the concentration of dissolved oxygen at 25°C and 1 atm pressure ?
    a) 2.82×10^{-3} mol dm^{-3}
    b) 5.98×10^{-4} mol dm^{-3}
    c) 3.53×10^{-4} mol dm^{-3}
    d) 5.98 mol dm^{-3}

16. Which among following is true for the value of Henry's law constant K ?
    a) is same for all gases.
    b) is greater for gases with higher solubilities.
    c) increases with increase in temperature.
    d) first increases and then decreases with increase in temperature.

17. Henry's law is a relation between
    a) temperature and pressure
    b) pressure and solubility
    c) pressure and volume
    d) volume and solubility

18. Solubility of a gas in liquid increases with
    a) decrease in pressure and decrease in temperature.
    b) decrease in pressure and increase in temperature.
    c) increase in pressure and increase in temperature.
    d) increase in pressure and decrease in temperature.

[MHT-CET 2021]

19. Calculate solubility of a gas in water at 1 bar, if Henry's law constant for the gas is 7×10^{-4} mol L^{-1} bar^{-1}.
    a) 3.4×10^{-5} mol L^{-1}
    b) 1.42×10^{-5} mol L^{-1}
    c) 5.0×10^{-3} mol L^{-1}
    d) 7.0×10^{-4} mol L^{-1}

20. Which among the following salts has appreciable increase in solubility with increasing temperature ?
    a) NaBr
    b) NaCl
    c) KCl
    d) $NaNO_3$

21. Calculate solubility of a gas in H_2O at 0.75 bar if Henry's law constant for the gas is 7×10^{-4} mol L^{-1} bar^{-1}.
    a) 0.75×10^{-4} mol L^{-1}

22. Henry's law constant for CH_3Br is 0.16 mol L^{-1} bar^{-1} at 298 K. What pressure is required to have solubility of 0.08 mol L^{-1} ?

a) 0.24 bar b) 1.6 bar c) 0.5 bar d) 4.0 bar

23. In which of the following salts the solubility increases appreciably with increase in temperature ?

a) KBr b) NaBr c) NaCl d) KCl

24. What is Henry's law constant if solubility of a gas in water at 298 K and 1 bar pressure is 7×10^{-4} mol L^{-1} ?

a) 2.0×10^{-5} mol L^{-1} bar^{-1} b) 7.0×10^{-4} mol L^{-1} bar^{-1}

c) 3.5×10^{-3} mol L^{-1} bar^{-1} d) 3.1×10^{-5} mol L^{-1} bar^{-1}

25. Henry's law constant for CH_3Br is 0.16 mol L^{-1} bar^{-1} at 298 K. What is solubility of CH_3Br in water at 380 mm Hg ?

a) 0.24 mol L^{-1} b) 0.08 mol L^{-1} c) 0.32 mol L^{-1} d) 0.16 mol L^{-1}

[MHT-CET 2022]

26. Calculate the solubility of gas in water at 260 mm Hg and 25°C, if Henry's law constant of gas is 0.159 mol dm^{-3} atm^{-1} at 25°C.

a) 3.8×10^{-2} mol dm^{-3} b) 2.7×10^{-2} mol dm^{-3}

c) 5.4×10^{-2} mol dm^{-3} d) 1.2×10^{-2} mol dm^{-3}

27. Calculate the pressure of gas if the solubility of gas in water at 25°C is 6.85×10^{-4} mol dm^{-3} (Henry's law constant is 6.85×10^{-4} mol dm^{-3} bar^{-1})

a) 2.0 bar b) 0.5 bar c) 1.5 bar d) 1 bar

28. Calculate the solubility of gas in water at 1.2 atm and 25°C if Henry's law constant is 0.145 mol dm^{-3} atm^{-1} at 25° C.

a) 0.174 mol dm^{-3} b) 0.31 mol dm^{-3} c) 0.45 mol dm^{-3} d) 0.25 mol dm^{-3}

29. What is the unit of Henry's law constant ?

a) mol dm^{-3} b) mol dm^{-3} bar^{-1} c) mol dm^3 bar^{-1} d) mol dm^{-3} bar

30. Which of the following laws represents the quantitative relationship between the solubility of gas in liquid and its pressure ?

a) Henry's law b) Charle's law c) Raoult's law d) Avogadro's law

31. Which of following salt's solubility increases appreciably with increase in temperature?

a) KCl b) NaCl c) KNO_3 d) NaBr

32. Calculate the solubility of a gas in water at 0.8 atm and 25°C.

[Henry's law constant is 6.85×10^{-4} mol dm^{-3} atm^{-1}]

a) 3.94×10^{-4} mol dm^{-3} b) 2.74×10^{-4} mol dm^{-3}

c) 6.85×10^{-4} mol dm^{-3} d) 5.48×10^{-4} mol dm^{-3}

33. Calculate Henry's law constant if the solubility of certain gas in water at 25°C and 1 atm is 6.85×10^{-4} mol dm^{-3}.

a) 4.0×10^{-4} mol dm^{-3} atm^{-1} b) 3.42×10^{-4} mol dm^{-3} atm^{-1}

c) 2.3×10^{-4} mol dm^{-3} atm^{-1} d) 6.85×10^{-4} mol dm^{-3} atm^{-1}

66. What is the relation between the depression in freezing point and molar mass of non-volatile solute ?

a) $M_2 = \frac{1000\ \Delta T_f\ W_2}{K_f\ W_1}$ b) $M_2 = \frac{\Delta T_f\ W_1}{1000\ K_f\ W_2}$

c) $M_2 = \frac{1000\ K_f\ W_1}{\Delta T_f\ W_2}$ d) $M_2 = \frac{1000\ K_f\ W_2}{\Delta T_f\ W_1}$

67. Find the molar mass of solute when 2 gram are dissolved in 60 gram benzene at 30°C and relative lowering of vapour pressure is 0.06. (Molar mass of benzene is 78 g mol^{-1})

a) 43.3 gram mol^{-1} b) 35.2 gram mol^{-1} c) 24.2 gram mol^{-1} d) 17.4 gram mol^{-1}

68. What is vapour pressure of a solution containing 1.8 g glucose in 16.2 g of water if vapour pressure of water is 32 mm Hg ?

a) 22.2 mm Hg b) 26.6 mm Hg c) 24.6 mm Hg d) 31.7 mm Hg

69. Calculate the amount of solute dissolved in 612 gram of water at 30°C if molar mass of solute is 342 g mol^{-1}. (Relative vapour pressure lowering is 0.025 and molar mass of water 18 g mol^{-1}).

a) 240.2 gram b) 270.6 gram c) 290.7 gram d) 142.5 gram

70. Which of the following mathematical expressions is correct regarding Raoult's law for a binary mixture of two volatile liquids if x_2 , x_1 are mole fractions and P_1°, P_2° are vapour pressures of pure liquids ?

a) $P = \left(P_2^0 - P_1^0\right) x_2 + P_1^0$ b) $P = \left(P_2^0 - P_1^0\right) x_1 + P_1^0$

c) $P = \left(P_1^0 - P_2^0\right) x_1 + P_2^0$ d) $P = \left(P_2^0 - P_1^0\right) x_2 + P_2^0$

71. The relative lowering of vapour pressure of the solution is

a) inversely proportional to mole fraction of solvent.

b) directly proportional to mole fraction of solvent.

c) inversely proportional to mole fraction of solute.

d) directly proportional to mole fraction of solute.

72. Which of the following relations about relative lowering in vapour pressure is true ?

a) $\Delta P = \frac{P_1 - P_1^0}{P_1^0}$ b) $\Delta P = \frac{P_1^0 - P_1}{P_1^0}$ c) $\frac{\Delta P}{P_1^0} = \frac{n_1}{n_2}$ d) $\frac{\Delta P}{P_1^0} = \frac{P_1^0 - P_1}{P_1^0}$

73. What is the vapour pressure of solution containing n mole of non-volatile solute in 2n mole water if vapour pressure of pure water is 24 mm Hg ?

a) 12 mm b) 06 mm c) 08 mm d) 18 mm

74. Calculate the molar mass of solute when 1.6 gram non - volatile solute dissolved in 86 gram solvent, lowers the freezing point by 0.34 K. (K_f for solvent is 1.17 K kg mol^{-1})

a) 64.0 g mol^{-1} b) 60.5 g mol^{-1} c) 72.2 g mol^{-1} d) 56.0 g mol^{-1}

75. The vapour pressure of pure water at room temperature is 40 mm Hg. In an aqueous solution of a non-volatile solute, mole fraction of water is 0.9. What is the vapour pressure of solution ?

a) 30 mm Hg b) 40 mm Hg c) 36 mm Hg d) 32 mm Hg

86. A solution of 6 g of solute in 100 g of water boils at 100.52°C. The molal elevation constant of water is 0.52 K kg mol^{-1}. What is molar mass of solute ?
a) 60 g mol^{-1} b) 120 g mol^{-1} c) 90 g mol^{-1} d) 180 g mol^{-1}

87. Which of the following statements is correct for boiling point of a liquid ?
a) Temperature at which a liquid boils at any pressure.
b) Temperature at which solid is in equilibrium with its liquid.
c) Temperature at which vapour pressure equals the applied pressure.
d) Temperature at which applied pressure is greater than vapour pressure of liquid.

88. What is boiling point of a decimolal aqueous solution of glucose if molal elevation constant for water is 0.52°C kg mol^{-1} ?
a) 101.52°C b) 99.95°C c) 99.48°C d) 100.052°C

89. What is the boiling point of 0.5 molal aqueous solution of sucrose if 0.1 molal aqueous solution of glucose boils at 100.16°C ?
a) 100.32°C b) 100.80°C c) 100.16°C d) 100.62°C

90. What is molar mass of solute if 50 gram of it in 150 gram solvent has boiling point elevation of 5.54 K ? (K_b = 2.77 K kg mol^{-1})
a) 180.0 g mol^{-1} b) 166.6 g mol^{-1} c) 60.5 g mol^{-1} d) 90.3 g mol^{-1}

91. What is the value of molal elevation constant of a solvent if 50 g solute (molar mass 111) when dissolved in 150 g of it has elevation in boiling point of 8.3 K ?
a) 7.72 K kg mol^{-1} b) 0.52 K kg mol^{-1} c) 2.76 K kg mol^{-1} d) 1.86 K kg mol^{-1}

[MHT-CET 2022]

92. What is the relation between molality of the solution and molar mass of solute ?
a) $m = \frac{1000\ W_1}{M_2\ W_2}$ b) $m = \frac{M_2\ W_2}{1000\ W_1}$ c) $m = \frac{1000\ W_2}{M_2\ W_1}$ d) $m = \frac{M_2\ W_1}{1000\ W_2}$

93. What is the relation between molar mass of solute and boiling point elevation of solution ?
a) $M_2 = \frac{1000\ K_b\ W_1}{\Delta T_b\ W_2}$ b) $M_2 = \frac{1000\ \Delta T_b\ W_2}{K_b\ W_1}$ c) $M_2 = \frac{1000\ K_b\ W_2}{\Delta T_b\ W_1}$ d) $M_2 = \frac{\Delta T_b\ W_1}{1000\ K_b\ W_2}$

94. Calculate the amount of solute dissolved in 160 gram solvent that boils at 85°C, the molar mass of solute is 120 g mol^{-1}.
(K_b for solvent = 2.7°C kg mol^{-1} and boiling point of solvent = 76°C)
a) 50 gram b) 60 gram c) 64 gram d) 42 gram

95. What is the unit of molality ?
a) mol kg^{-1} K b) mol kg^{-1} c) mol dm^{-3} d) mol kg

96. Find the molar mass of solute when 5 gram non-volatile solute is dissolved in 100 gram solvent that boils at 310 K.
(The boiling point of solvent is 308 K and molal elevation constant is 2.4 K kg mol^{-1})
a) 80 g mol^{-1} b) 60 g mol^{-1} c) 72 g mol^{-1} d) 50 g mol^{-1}

97. Calculate the mass of solute having molar mass 60 g mol^{-1} dissolved in 100 gram solvent if boiling point elevation is 2 K and molal elevation constant for solvent is 2.5 K kg mol^{-1}.
a) 2.4 gram b) 1.2 gram c) 7.2 gram d) 4.8 gram

201. Which among the following is unit of ebullioscopic constant?
a) K dm^3 mol^{-1} b) K kg mol^{-1} c) K dm^{-3} mol d) K kg mol

202. Calculate the freezing point depression of solvent when 20 gram of nonvolatile solute with molar mass 60 g mol^{-1} is dissolved in 1180 gram solvent. (Cryoscopic constant of solvent is 1.18 K kg mol^{-1})?
a) 0.33 K b) 0.41 K c) 2.5 K d) 5.2 K

203. What is the vapour pressure of solution obtained by dissolving urea in water at 20°C if vapour pressure of water is 17 mm Hg and relative lowering of vapour pressure si 0.025 ?
a) 16.58 mm Hg b) 14.56 mm Hg c) 15.51 mm Hg d) 13.10 mm Hg

204. Which among the following solution has minimum freezing point depression assuming complete ionisation?
a) 0.1 m NaCl b) 0.2 m KNO_3 c) 0.1 m Na_2SO_4 d) 0.05 m $CaCl_2$

205. A solution of nonvolatile solute is obtained by dissoving 19 g in 200 g water. Calculate the molar mass of solute if relative lowering of vapour pressure is 0.03.
a) 57.00 g mol^{-1} b) 60.24 g mol^{-1} c) 65.14 g mol^{-1} d) 59.28 g mol^{-1}

[MHT-CET - 2024]

206. Calculate the molar evevation constant of solvent if boiling point elevation of solution of nonvola solute is 0.125 K and molality of solution is 0.25 m.
a) 0.3 K kg mol^{-1} b) 0.4 K kg mol^{-1} c) 0.5 K kg mol^{-1} d) 0.6 K kg mol^{-1}

207. Calculate the molality of solution of non volatile solute having depression in freezing point 0.93K and cryoscopic constant of solvent 1.86 K kg mol^{-1}.
a) 0.3 mol kg^{-1} b) 0.4 mol kg^{-1} c) 0.5 mol kg^{-1} d) 0.6 mol kg^{-1}

208. A solution of non volatile solute is obtained by dissolving 2g in 50 g benzene. Calculate the vapour pressure of solution if vapour pressure of pure benzene is 640 mm Hg at 25°C. [Mol. mass of benzene = 78 g mol^{-1}, mol. mass of solute = 64 g mol^{-1}]
a) 600.21 mm Hg b) 604.52 mm Hg c) 608.64 mm Hg d) 612.83 mm Hg

209. The molar conductivity of 0.02 M KCl solution is 410Ω^{-1} cm^2 mol^{-1} at 25°C. Calculate its conductivity ?
a) 8.2×10^{-3} Ω^{-1} cm^{-1} b) 2.8×10^{-3} Ω^{-1} cm^{-1}
c) 4.1×10^{-3} Ω^{-1} cm^{-1} d) 5.4×10^{-3} Ω^{-1} cm^{-1}

210. The molal elevation boiling point constant for water is 0.513°C kg mol^{-1}. Calculate boiling point of solution if 0.1 mole of sugar is dissolved in 200 g water ?
a) 100.513°C b) 100.256°C c) 100.0513°C d) 100.025°C

211. What mass of solute (molar mass 58 g mol^{-1}) is to be dissolved in 2.5 dm^3 H_2O to generate osmotic pressure of 0.245 atm at 300 K ? (R = 0.0821 dm^3 atm K^{-1} mol^{-1})
a) 1.0 gram b) 0.72 gram c) 1.44 gram d) 1.75 gram

212. The limiting molar conductivities (Λ_0) for NaCl, KBr and KCl are 126, 152 and 150 S cm^2 mol^{-1} respectively. What is the Λ_0 of NaBr ?
a) 128 S cm^2 mol^{-1} b) 302 S cm^2 mol^{-1} c) 278 S cm^2 mol^{-1} d) 176 S cm^2 mol^{-1}

213. A conductivity cell dipped on 0.05 M KCl has resistance 600 ohm. If conductivity is 0.0015 ohm^{-1} cm^{-1}. What is the value of cell constant ?
a) 0.47 cm^{-1} b) 0.90 cm^{-1} c) 1.5 cm^{-1} d) 2.5 cm^{-1}