S1. Ans. (a)

Value of Henry's law constant $\propto \frac{1}{\text{Solubility of gas}}$

Higher the value of K_H at a given pressure, lower is the solubility of the gas in the liquid.

K_H value of gases (given): A > C > B

∴ Order of solubility of gases in water:

B > C > A

S2. Ans. (d)

π = CRT

Slope = RT

25.73 = 0.083 × T

T = $\frac{25.73}{0.083}$ = 309.47 ≈ 310 K

∴ Temperature in °C = 310 – 273 = 37°C

S3. Ans.(b)

Assertion is true because He has low solubility in blood. (NCERT)

S4. Ans.(a)

i × M↓ ⟹ ΔT_b↓

Electrolyte	i × M
NaCl	2 × 0.05 = 0.1
KCl	2 × 1.0 = 0.2
$MgSO_4$	2 × 0.1 = 0.2
NaCl	2 × 1 = 2

S5. Ans.(d)

$\pi = iCRT$

$P_1 = 1 \times \frac{10}{180} \times R \times T$ (For Glucose)

$P_2 = 1 \times \frac{10}{60} \times R \times T$ (For Urea)

$P_3 = 1 \times \frac{10}{342} \times R \times T$ (For Sucrose)

∴ $P_2 > P_1 > P_3$

S6. Ans.(b)

Given : $n_{C_6H_6} = n_{C_8H_{18}} = 3:2$

So, $X_{C_6H_6} = \frac{3}{5}, X_{C_8H_{18}} = \frac{2}{5}$

$P_5 = P_B^\circ \cdot X_B + P_T^\circ \cdot X_T$

$= 280 \times \frac{3}{5} + 420 \times \frac{2}{5}$

$= 168 + 168$

$= 336\ mm$ of Hg

S7. Ans.(d)

While ethanol-acetone mixture shows positive deviation due to weaker A-B interaction in comparison to A-A or B-B interaction.

Pure ethanol molecules are hydrogen bonded. When acetone is added, its molecules get in between the ethanol molecules and break some of the hydrogen bonds between them.

Thus, the intermolecular attractive interactions are weakens and the solution shows positive deviation from Raoult's law.

S8. Ans.(b)

$\Delta T_f = K_f \times molality(m)$

$\Delta T_f = 5.12 \times 0.078$

⇒ 0.3993

= 0.40 K

S9. Ans.(d)

Assuming dilute solution

$\frac{\Delta P}{P_A^0} = \frac{n_B}{n_A} = \frac{w_B}{m_B} \cdot \frac{m_A}{w_A}$

$\frac{20}{100} = \frac{8}{m_B} \cdot \frac{114}{114}$

$m_B = \frac{8 \times 100}{20} = 40\ g\ mol^{-1}$

S10. Ans.(b)

Solutions that have same osmotic pressure at a given temperature are called isotonic solutions.

S11. Ans.(c)

For ideal solution,

$\Delta_{mix}H = 0$, i.e., no heat should be absorbed or evolved during mixing

$\Delta_{mix}V = 0$

S12. Ans.(a)

Maximum boiling azeotrope will forms by solutions that show negative deviation from Raoult's law.

Water and Nitric acid → forms maximum boiling azeotrope

S13. Ans.(a)

If molality of a dilute solution is doubled, the value of molal depression constant (K_f) will be unchanged because the value of molal depression constant will depend only on number of solute and solvent particle, as it is colligative property.

S14. Ans.(c)

Molarity will depend upon temperature as molarity will depend upon the volume of the solution which change with temperature.

S15. Ans.(c)

$P_t^\circ = 37\ torr$, $P_b^\circ = 119\ torr$

$y_1 = \frac{P_t^\circ X_t}{P_t^\circ X_t + P_b^\circ X_b}$, $X_t = 0.5$

$y_t = \frac{37\times0.5}{(37)(0.5)+(119)(0.5)} = \frac{37}{37+119} = 0.237$

S16. Ans.(b)

In case of an ideal solution $\Delta S_{mix} \neq 0$

$\Delta U_{mix} = 0$ but $\Delta S_{mix} \neq 0$

According to 3rd law of thermodynamics:

$\Delta G = \Delta H - T\Delta S$

$\Delta G_{mix} \neq 0$

S17. Ans.(b)

$Ba(OH)_2$ is a strong electrolyte. It will 100% dissociate in aqueous solution:

$Ba(OH)_2 \rightleftharpoons Ba^{2+} + 2OH^-$

van't Hoff factor becomes 3.

S18. Ans.(b)

Two colligative properties will be used to solve the question.

$\frac{p_0 - p_s}{p_s} = \frac{w_A/M_A}{w_B/M_B}$

$\frac{760-732}{732} = \frac{6.5\times M_B}{100/18}$

M_B = 32 g/mol

Molality (m) = $\frac{Wb\times1000}{m_B\times w_A}$

Molality (m) = $\frac{6.5\times1000}{32\times100} = 2.03$

Molal Elevation Constant

$\Delta T_b = K_b \times m = 0.52 \times 2.03 = 1.05$

$\Delta T_b = T_b - T_b^\circ$

$1.05 = T_b - 100$

$T_b = 100 + 1.05 = 101.05°C$

S19. Ans.(c)

$P_{Benzene} = x\,P^o$

$P_{Toluene} = x\,P^o$

For an ideal 1:1 molar mixture of Benzene and Toluene.

$X_{Benzene} = \frac{1}{2}; X_{Toluene} = \frac{1}{2}$

$P_{Benzene} = \frac{1}{2} \times 12.8\ KPa = 6.4\ K\ Pa$

$P_{Toluene} = \frac{1}{2} \times 3.85\ K\ Pa = 1.925\ KPa$

Thus, the vapour will contain a high percentage of Benzene than Toluene.

S20. Ans.(a)

$X_{solution} = \frac{1}{55.5+1} = \frac{1}{56.5} = 0.0177$

S21. Ans.(c)

$Al_2(SO_4)_3 \rightleftharpoons \underset{i=5}{2Al^{3+}} + 3SO_4^{2-}$

$K_4[Fe(CN)_6] \rightleftharpoons \underset{i=5}{4K^+} + [Fe(CN)_6]^-$

S22. Ans.(a)

$\Delta S_{mix} > 0$

As entropy increases after mixing.

S23. Ans.(d)

X must be going dissociation in water thus increasing vant's Hoff factor (i) as after dissolution the number of solute particles increases.

S24. Ans.(b)

Depression in freezing point depends on vant's Hoff factor which depends on dissociation entities.

So, among 4 options

$Al_2(SO_4)_3$ will have $2Al^{3+} + 3SO_4^{2-} = 5$ entities exhibiting maximum depression in freezing point.

S25. Ans.(c)

$Molarity = \frac{W\times1000}{M\times V_{(mL)}}$

$2 = \frac{W}{63} \times \frac{1000}{250}$

$W = \frac{63}{2}$

Because 70% HNO_3 ;

$Mass\ of\ acid \times \frac{70}{100} = \frac{63}{2}$

$Mass\ of\ acid = 45\ g$