1. 3  
   
2. 2, 5 - dinitrophenol  
   
3. \( \text{CH}_3\text{-CH}_2\text{-Br} \)  
   Because it is a primary halide / (1\(^{st}\)) halide  
   
4. \( \text{BaCl}_2 \) because it has greater charge / +2 charge  
   
5. \( X_2Y_3 \)  
   
6. Elements which have partially filled d-orbital in its ground states or any one of its oxidation states.  
   1) Variable oxidation states.  
   
2) Form coloured ion  
   Or any other two correct characteristics
7. 1) Diamminedichloroethylenediaminechromium(III) chloride
   2) \([\text{Co(NH}_3\text{)}_5(\text{ONO})]^{2+}\)

8. (i) \(\text{LiAlH}_4/\text{NaBH}_4/\text{H}_2\text{Pt}\)
   (ii) \(\text{KMnO}_4, \text{KOH}\)

9. When vapour pressure of solution is higher than that predicted by Raoult's law / the intermolecular attractive forces between the solute-solvent/(A-B) molecules are weaker than those between the solute-solute and solvent-solvent molecules/ A-A or B-B molecules. 
   Eg. ethanol-acetone/ethanol-cyclohexane/CS\(_2\)-acetone or any other correct example \(\Delta_{\text{mix}}H\) is positive

**OR**

(a) Azeotropes are binary mixtures having the same composition in the liquid and vapour phase and boil at a constant temperature.
(b) Minimum boiling azeotrope
   eg - ethanol + water or any other example

10. (i) \(\text{Ag}^+ (\text{aq}) + e \rightarrow \text{Ag} (\text{s})\)
    Reaction with higher \(E^\circ\) value / \(\Delta G^\circ\) negative
    (ii) Molar conductivity of a solution at infinite dilution or when concentration approaches zero
     Number of ions per unit volume decreases

11. \(\Delta T_f = i K_f m\)
    \(\Delta T_f = i K_f \frac{w_b \times 1000}{M_b \times w_a}\)
\[ 1.62 \, K = i \times 4.9 \, \text{kg mol}^{-1} \times \frac{3.9 \, g}{122 \, \text{g mol}^{-1}} \times \frac{1000}{49 \, g} \]

\[ i = 0.506 \]

Or by any other correct method

As \( i < 1 \), therefore solute gets **associated**.

12. (i) Zinc being low boiling will distil first leaving behind impurities/ or on electrolysis the pure metal gets deposited on cathode from anode.

(ii) Silica acts as flux to remove iron oxide which is an impurity as slag or

\[ \text{FeO} + \text{SiO}_2 \rightarrow \text{FeSiO}_3 \]

(iii) Wrought iron

13. \[ d = \frac{z \times M}{a^3 \, N_A} \]

\[ z = \frac{d \, a^3 \, N_A}{M} \]

\[ z = \frac{2.7 \, g \, \text{cm}^3 \times 6.022 \times \text{mol}^{-1} \times (4.05 \times 10^{-8} \, \text{cm})^3}{M} \]

\[ = 3.999 \approx 4 \]

Face centered cubic cell / fcc

14. (i) 5f orbital electrons have poor shielding effect than 4f.

(ii) due to d-d transition / or the energy of excitation of an electron from lower d-orbital to higher d-orbital lies in the visible region / presence of unpaired electrons in the d-orbital.

(iii) \[ 2 \, \text{MnO}_4^- + 6 \, \text{H}^+ + 5 \, \text{NO}_2^- \rightarrow 2 \, \text{Mn}^{2+} + 3 \, \text{H}_2\text{O} + 5 \, \text{NO}_3^- \]
15. (i) 

![Diagram](image)

(ii) t 2g^3 e g^1

(iii) sp^3, diamagnetic

16. The cell reaction: \( \text{Fe(s)} + 2\text{H}^+ (\text{aq}) \rightarrow \text{Fe}^{2+} (\text{aq}) + \text{H}_2 (\text{g}) \)

\[
E_{\text{cell}}^\circ = E^\circ_c - E^\circ_a = 0.44 \text{V}
\]

\[
E_{\text{cell}} = E_{\text{cell}}^\circ - 0.059 \log \left( \frac{[\text{Fe}^{2+}]}{[\text{H}^+]} \right)
\]

\[
E_{\text{cell}} = 0.44 \text{ V} - 0.059 \log \left( \frac{0.001}{0.01} \right)
\]

\[
= 0.44 \text{ V} - 0.059 \log (10)
\]

\[
= 0.44 \text{ V} - 0.0295 \text{ V}
\]

\[
= \approx 0.410 \text{ V}
\]

17. (i) mutual coagulation

(ii) strong interaction between dispersed phase and dispersion medium or solvated layer

(iii) CO acts as a poison for catalyst

18. (i) Hexamethylene diamine \( \text{NH}_2 (\text{CH}_2)_6 \text{NH}_2 \) and

adipic acid \( \text{HOOC - (CH}_2)_4 - \text{COOH} \)

(ii) 3 hydroxybutanoic acid \( \text{CH}_3 \text{CH(OH)CH}_2 \text{COOH} \) and
3 hydroxypentanoic acid \( \text{CH}_3\text{CH}_2\text{CH(OH)CH}_2\text{COOH} \) ½

(iii) Chloroprene \( \text{H}_4\text{C}=\text{C(Cl)CH}=\text{CH}_2 \) ½

IUPAC names are accepted ½

Note: ½ mark for name/s and ½ mark for structure/s

19. (i) \( \text{CH}_3\text{CH}_2\text{CH}_3 \) 1

(ii) \( \text{C}_6\text{H}_5\text{COONa} + \text{CH}_3 \) ½, ½

(iii) \( \text{CH}_4 \) 1

20. (i) \( \text{C}_6\text{H}_5\text{OH} + \text{NaOH} \rightarrow \text{C}_6\text{H}_5\text{ONa} \xrightarrow{\text{CH}_3\text{X}} \text{C}_6\text{H}_5\text{OCH}_3 \)

Or

\( \text{C}_6\text{H}_5\text{OH} + \text{Na} \rightarrow \text{C}_6\text{H}_5\text{ONa} \xrightarrow{\text{CH}_3\text{X}} \text{C}_6\text{H}_5\text{OCH}_3 \) 1

(ii) \( \text{CH}_3\text{CH(OH)CH}_3 \xrightarrow{\text{CrO}_3 \text{ or Cu/573K}} \text{CH}_3\text{COCH}_3 \xrightarrow{(i) \text{CH}_3\text{MgX}} \xrightarrow{(ii) \text{H}_2\text{O}} (\text{CH}_3)_2\text{C(OH)CH}_3 \) 1

(iii) \( \text{C}_6\text{H}_5\text{NH}_2 + \text{NaNO}_2 + \text{HCl} \rightarrow \text{C}_6\text{H}_5\text{N}_2\text{Cl} \xrightarrow{273K} \text{H}_2\text{O warm} \rightarrow \text{C}_6\text{H}_5\text{OH} \) 1

OR

a)

(i) \( \text{CH}_3\text{CH}_2\text{OH} + \text{H}^+ \rightarrow \text{CH}_3\text{CH}_2\text{O}^+ \text{H}^- \) ½

(ii) \( \text{CH}_3\text{CH}_2\text{OH} + \text{CH}_3\text{CH}_2\text{O}^+ \xrightarrow{\text{H}^-} \text{CH}_3\text{CH}_2\text{OH} + \text{CH}_3\text{CH} + \text{H}_2\text{O} \) 1

(iii) \( \text{CH}_3\text{CH}_2\text{O}^- + \text{CH}_2\text{CH}_2\rightarrow \text{CH}_3\text{CH}_2\text{O}^- \text{CH}_2\text{CH}_3 + \text{H}^+ \) 1

b)

\[
\begin{align*}
\text{COOH} + (\text{CH}_3\text{CO})_2\text{O} & \rightarrow \text{COOH} \text{OCOCCH}_3 + \text{CH}_3\text{COOH} \\
\end{align*}
\]

(Acetyl chloride instead of acetic anhydride may be used)
21. (i) Maltose
(ii) Fibrous proteins: parallel polypeptide chain, insoluble in water, Globular proteins: spherical shape, soluble in water, (or any suitable difference)
(iii) Vitamin D

22. (i) Larger surface area, higher van der Waals' forces, higher the boiling point
(ii) Rotation due to one enantiomer is cancelled by another enantiomer
(iii) \(-\text{NO}_2\) acts as Electron withdrawing group or \(-\text{I}\) effect

23. (i) Concern for students health, Application of knowledge of chemistry to daily life, empathy, care, or any other
(ii) Through posters, nukkad natak in community, social media, play in assembly or any other
(iii) Tranquilizers are drugs used for treatment of stress or mild and severe mental disorders. Eg: equanil (or any other suitable example)
(iv) Aspartame is unstable at cooking temperature.

24. (a) (i) Due to decrease in bond dissociation enthalpy from HF to HI, there is an increase in acidic character observed.
(ii) Oxygen exists as diatomic \(\text{O}_2\) molecule while sulphur as polyatomic \(\text{S}_8\)
(iii) Due to non availability of d orbitals

(b) ![Diagram of molecule with F, Cl, and R atoms]
OR

(i) White Phosphorus because it is less stable due to angular strain

(ii) Nitrogen oxides emitted by supersonic jet planes are responsible for depletion of ozone layer.

\[ \text{NO} + \text{O}_3 \rightarrow \text{NO}_2 + \text{O}_2 \]

(iii) due to small size of F, large inter electronic repulsion / electron-electron repulsion among the lone pairs of fluorine

(iv) Helium

(v) \( \text{XeF}_2 + \text{PF}_5 \rightarrow [\text{XeF}]^+ [\text{PF}_6]^– \)

25.

\[ \text{A} = \begin{array}{c} \text{N} \equiv \text{C} \\ \text{C} \equiv \text{N} \end{array} \quad \text{B} = \begin{array}{c} \text{N} \equiv \text{C} \\ \text{C} \equiv \text{N} \end{array} \quad \text{C} = \begin{array}{c} \text{N} \equiv \text{C} \\ \text{C} \equiv \text{N} \end{array} \quad \text{D} = \begin{array}{c} \text{N} \equiv \text{C} \\ \text{C} \equiv \text{N} \end{array} \quad \text{E} = \begin{array}{c} \text{N} \equiv \text{C} \\ \text{C} \equiv \text{N} \end{array} \]

\[ 1 \times 5 = 5 \]

OR

a. i)

b. \((\text{CH}_3)_2 \text{N} < \text{C}_2\text{H}_5 \text{NH}_2 < \text{C}_2\text{H}_5 \text{OH}\)

b. By Hinsberg test secondary amines \((\text{CH}_3)_2 \text{NH}\) shows ppt formation which is insoluble in KOH tertiary amines \((\text{CH}_3)_3 \text{N}\) do not react with benzene sulphonyl choride
As k is constant in both the readings, hence it is a pseudo first order reaction.

\( \text{Rate} = -\frac{\Delta [R]}{\Delta t} \)

\[= \frac{-[0.15 - 0.30]}{60 - 30} = 0.005 \text{ mol L}^{-1} \text{ s}^{-1} \]

**OR**

a) (i) Rate will increase 4 times of the actual rate of reaction.

(ii) Second order reaction

b) \( t_{1/2} = \frac{0.693}{k} \)

\[30 \text{ min} = \frac{0.693}{k} \]

\[k = 0.0231 \text{ min}^{-1} \]
\[ k = \frac{2.303}{t} \log \left( \frac{A_0}{A} \right) \]

\[ t' = \frac{2.303}{0.0231} \frac{\log 100}{\log 10} \]

\[ t = \frac{2.303}{0.0231} \text{ min} \]

\[ t = 99.7 \text{ min} \]