### Q.NO. | VALUE POINTS | MARKS
--- | --- | ---
1 | P₂Q₄ | 1
2 | H₂Te < H₂Se < H₂S < H₂O | 1
3 | To make the surface available again for more reaction to occur / To remove the product formed from the surface of the catalyst. | 1
4 | 2 – Phenylethanol | 1
5 | Neopentane / C(CH₃)₄ | 1
6 | a. | 1
 CH₃CH=CH₂ → CH₃CH(OH)CH₃ → CH₃COCH₃
 H²O | [O] | CrO₃
 b. | Br₂/Red P | 1
 CH₃CH₂COOH → CH₃CH(Br)COOH → CH₃CH(OH)COOH
 i) aq KOH or NaOH | (or any other suitable method)
 b. Wolff-Kishner reduction:
 CH₃CH₂COOH | (i) CrO₂Cl₂, CS₂ | 1
 CH₃CH(Br)COOH | (ii) H₃O⁺ | Benzoic acid
 b. Wolff-Kishner reduction:
 CH₃CH₂COOH | (i) NH₂NH₂ | 1
 H₂O | (ii) KOH/ethylene glycol, heat |
### Properties that depend on the number of solute particles irrespective of their nature relative to the total number of particles present in the solution.

**Osmotic Pressure**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Properties that depend on the number of solute particles irrespective of their nature relative to the total number of particles present in the solution. Osmotic Pressure</td>
<td>1</td>
</tr>
</tbody>
</table>
| 8 | a. cis/ trans-diaminedichloridoplatinum(II)  
b. [Co(NH₃)₄(H₂O)Cl] (NO₃)₂ | 1 |
| 9 | a. Zinc to silver  
b. Concentration of Zn²⁺ ions will increase and Ag⁺ ions will decrease. | 1 |
| 10 | a. Cr³⁺  
b. Mn³⁺  
c. Ti⁴⁺  
d. Mn³⁺ | ½ |
| 11 | A= πr²  
= 3.14 x 0.5 x 0.5 cm²  
= 0.785 cm²  
/= 45.5 cm  
ρ = R x A/ /= 45.5 cm  
ρ = 4.55 x 10³Ω x 0.785 cm²/ 45.5 cm  
ρ = 78.5 Ω cm  

 conductivity , κ = 1/ ρ  
= 1/78.5 S cm⁻¹ = 0.0127 S cm⁻¹  
molar conductivity Λm = κ x 1000/C  
= 0.0127 S cm⁻¹ x 1000/0.05 mol/cm³  
= 254.77 S cm² mol⁻¹  

 or  
A= πr²  
= 3.14 x 0.5 x 0.5 cm²  
= 0.785 cm²  
/= 45.5 cm  
G* = /=A= 45.5 cm/ 0.785 cm²  
= 57.96 cm⁻¹  
K= G*/R  
= 57.96 cm⁻¹/ 4.55 x 10³ Ω = 1.27 x 10⁻² S cm⁻¹  
Λm = κ x 1000/C  
= [1.27 x 10⁻² S cm⁻¹ ]x 1000 / 0.05 mol/cm³ | ½ |
a. The particles of the dispersed phase have no affinity for the dispersion medium/solvent repelling (hating) colloidal sols. Example: metal and their sulphides

b. The reactant and the catalyst are in the same phase.

\[ \text{HCl}(l) + \text{CH}_3\text{COOCH}_3(l) + \text{H}_2\text{O}(l) \rightarrow \text{CH}_3\text{COOH}(aq) + \text{CH}_3\text{OH}(aq) \]

c. oil is dispersed in water/Oil is dispersed phase and water is dispersion medium. Ex- milk

(or any other correct example)

OR

<table>
<thead>
<tr>
<th>12</th>
<th>Physisorption</th>
<th>Chemisorption</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Because of van der Waals forces</td>
<td>Caused by chemical bond formation</td>
</tr>
<tr>
<td>2</td>
<td>Reversible</td>
<td>Irreversible</td>
</tr>
<tr>
<td>3</td>
<td>Enthalpy of adsorption is low (20-40 kJ/mol)</td>
<td>Enthalpy of adsorption is high (80-240 kJ/mol)</td>
</tr>
</tbody>
</table>

(Or any other correct difference)

Given : \( T_b \) of glucose solution = 100.20°C

\[ \Delta T_b = K_b \cdot m \]

\( m = 0.20/0.512 \)

\( m = 0.390 \text{ mol/kg} \)

\[ \Delta T_f = K_f \cdot m \]

\( \Delta T_f = 1.86 \text{ K kg/mol } \times 0.390 \text{ mol/kg} \)

\( \Delta T_f = 0.725 \text{ K} \)

Freezing point of solution = 273.15K – 0.725 = 272.425K

a. Metal is converted into a volatile compound which on strong heating decomposes to give pure metal.
b. It selectively prevents one of the sulphide ores from coming to the froth.
c. Coke

For bcc structure

\[ a = 4r / \sqrt{3} \quad \text{or} \quad r = \sqrt{3}a / 4 \]

\( r = \sqrt{3} \times 400 \text{ pm} / 4 \)
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>= 1.732 x 400 pm/4</td>
<td>= 173.2 pm</td>
<td>½</td>
</tr>
<tr>
<td>b.</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>(i) Impurity defect</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>(ii) Cationic vacancies are created.</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>a. Due to steric hindrance and +I effect caused by two alkyl groups in propanone.</td>
<td>½+ ½</td>
</tr>
<tr>
<td></td>
<td>b. Due to electron withdrawing nature of –NO₂ group which increases the acidic strength and decreases the pKₐ value.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>c. (CH₃)₂CH-CHO has one α-H atom whereas α-H atom is absent in (CH₃)₃C-CHO.</td>
<td>1</td>
</tr>
</tbody>
</table>
| 17 | a. Ethylene Glycol and Terephthalic acid  
HOH₂C-CH₂OH ,  p-HOOC-C₆H₄-COOH | ½ + ½ |
|   | b. Tetrafluoroethene , CF₂=CF₂ | ½ + ½ |
|   | c. Hexamethylenediamine and adipic acid  
H₂N(CH₂)₆NH₂ , HOOC(CH₂)₄ COOH | ½ + ½ |
| 18 | a. It is the magnitude of difference in energy between the two sets of d orbital i.e. t₂g and e_g  
t²_g e_g¹ | 1 |
|   | b. In [Ni(H₂O)₆]²⁺, Ni⁺⁺(3d⁸) has two unpaired electrons which do not pair up in the presence of weak field ligand H₂O. | 1 |
| 19 | a. (CH₃)₃C-OH undergoes dehydration. | ½ + ½ |
|   | b. Methyl group is introduced at ortho and para positions. | ½+ ½ |
|   | c. Phenol is converted to benzene. | ½+ ½ |
20. a. ![Chemical structure](image1)
   b. ![Chemical structure](image2)
   c. ![Chemical structure](image3)

21. a. In CuCl₂, Cu is in +2 oxidation state which is more stable due to high hydration enthalpy as compared to Cu₂Cl₂ in which Cu is in +1 oxidation state.
   b. Due to lanthanoid contraction.
   c. Because HCl is oxidised to chlorine.

22. a. Neurologically active drugs / chemical compounds used for treatment of stress / anxiety and mild or even severe mental diseases.
   b. Anionic detergents are sodium salts of sulphonated long chain alcohols or hydrocarbons / alkylbenzene sulphonate or detergents whose anionic part is involved in cleansing action.
   c. Disinfectants kill or prevent growth of microbes and are applied on inanimate / non living objects.

23. (i) Concerned, caring, socially alert, leadership (or any other 2 values).
   (ii) Starch
   (iii) α-Helix and β-pleated sheets
   (iv) Vitamin B / B₁ / B₂ / B₆ / C (any two)

24. \[ k = \frac{2.303 \log [A]₀}{t [A]} \]
   \[ = \frac{2.303 \log 100}{40} \]
   \[ = \frac{2.303 \log 4}{25} \]
   \[ = 2.303 \times 0.6021 \]
   \[ = 0.0347 \text{ min}^{-1} \]
   \[ t_{1/2} = \frac{0.693}{k} \]
<table>
<thead>
<tr>
<th>Quadrature</th>
<th>t$_{1/2}$ = 0.693 = 19.98 min = 20 min 0.0347 min$^{-1}$</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b. (i) First order reaction</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(ii) Zero order reaction</td>
<td>1</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>(a) Rate = k [NO]$^x$ [O$_2$]$^y$ 7.2 X 10$^{-2}$ = k[0.3]$^x$ [0.2]$^y$ -------Eqn (1) 6.0 X 10$^{-3}$ = k[0.1]$^x$ [0.1]$^y$ -------Eqn (2) 2.88 X 10$^{-1}$ = k[0.3]$^x$ [0.4]$^y$ -------Eqn (3) 2.40 X 10$^{-2}$ = k[0.4]$^x$ [0.1]$^y$ -------Eqn (4) Dividing eqn 4 by eqn 2 2.40 X 10$^{-2}$ = k[0.4]$^x$ [0.1]$^y$ 6.0 X 10$^{-3}$ = k[0.1]$^x$ [0.1]$^y$ x=1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Dividing eqn 3 by eqn 1 2.88 X 10$^{-1}$ = k[0.3]$^x$ [0.4]$^y$ 7.2 X 10$^{-2}$ = k[0.3]$^x$ [0.2]$^y$ y = 2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>order w.r.t. NO = 1, order w.r.t O$_2$ is 2</td>
<td>$\frac{1}{2}$, $\frac{1}{2}$</td>
</tr>
<tr>
<td></td>
<td>(b) Rate law Rate = k [NO]$^1$ [O$_2$]$^2$, over all order of the reaction is 3.</td>
<td>$\frac{1}{2}$ + $\frac{1}{2}$</td>
</tr>
<tr>
<td></td>
<td>c. Rate constant k = rate = 7.2 X 10$^{-2}$ [NO]$^1$ [O$_2$]$^2$ 0.3 X(0.2)$^2$ k= 6.0 mol$^{-2}$ L$^2$ min$^{-1}$</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>a. (i) Thermal stability of hydrides decreases down the group/ Bond dissociation enthalpy decreases down the group. (ii) Because Cl$_2$ in presence of moisture liberates nascent oxygen. (iii) Interatomic interactions are weak</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>b.(i)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(ii)</td>
<td>1,1</td>
</tr>
</tbody>
</table>
25. a) Size of Nitrogen is smaller than Chlorine.
b) \(2F_2 + 2H_2O \rightarrow 4HF + O_2\) / HF and \(O_2\) are produced
c) \(PH_3\) / Phosphine
d) \(XeF_2\)
e) \([Fe(H_2O)_6]^{2+} + NO \rightarrow [Fe(H_2O)_5(NO)]^{2+} + H_2O\)

26. (A) (B) (C) (D) (E) 1×5=5
b. \( C_6H_5NH_2 < C_6H_5CH_2NH_2 < CH_3NH_2 < (CH_3)\_2NH \)

c. Add \( NaNO_2 + HCl \) to both the compounds at 273K followed by addition of phenol. Aniline gives orange dye

(or any other correct test)
Marking scheme – 2017

CHEMISTRY (043)/ CLASS XII

FOREIGN 2017 - Set - 56/2/2

<table>
<thead>
<tr>
<th>Q.NO</th>
<th>VALUE POINTS</th>
<th>MARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2-Methylbut-3-en-2-ol</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Neopentane, C(CH₃)₄</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>H₂Te &gt; H₂Se &gt; H₂S &gt; H₂O</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>P₃O₂</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>To make the surface available again for more reaction to occur / To remove the product formed from the surface of the catalyst.</td>
<td>1</td>
</tr>
</tbody>
</table>
| 6    | a. Pentaamminesulphatocobalt(III) chloride  
b. [Pt(NH₃)₂Cl(NO₂)] | 1     |
| 7    | a. Zinc to silver  
b. Concentration of Zn²⁺ ions will increase and Ag⁺ ions will decrease. | 1     |
| 8    | a. Cr³⁺  
b. Mn³⁺  
c. Ti⁴⁺  
d. Mn³⁺ | ½  
½  
½  
½ |
| 9    | a. CH₃CH=CH₂ → CH₃CH(OH)CH₃ → CH₃COCH₃  
[O]  
H⁺  
CH₃CH=CH₂ + H₂O → CH₃CH(OH)CH₃ → CH₃COCH₃  
H⁺  
CrO₃  
b. CH₃CH₂COOH → CH₃CH(Br)COOH → CH₃CH (OH)COOH  
Br₂/Red P  
(i) aq KOH or NaOH  
(ii)H⁺  
(or any other suitable method) | 1     |

OR

9 a. Etard reaction:

Toluene + CrO₂Cl₂ → Chromium complex → Benzaldehyde

1
### Wolff-Kishner Reduction

The relative lowering of vapour pressure of a solution is equal to the mole fraction of the solute.

The vapour pressure of a solution of a non-volatile solute is equal to the vapour pressure of the pure solvent at that temperature multiplied by its mole fraction.

Negative deviation due to formation of Hydrogen bond between chloroform and acetone.

#### Examples

- **a. Phenol & Formaldehyde**
  
  & HCHO

- **b. Vinyl chloride**, CH₂=CHCl

- **c. 1,3-Butadiene & styrene**
  
  CH₂=CH-CH=CH₂ and

#### Energy Differences

a. It is the magnitude of difference in energy between the two sets of d orbital i.e. t₂g and e₉

\[ t² \geq e⁹ \]

b. In \([\text{Ni(CN)}₄]^{2⁻}\), CN⁻ is a strong field ligand and pairing takes place whereas in \([\text{NiCl}_4]^{2⁻}\), due to the presence of Cl⁻, a weak field ligand no pairing occurs / diagrammatic representation.
13. a. \((\text{CH}_3)_3\text{C-OH}\) undergoes dehydration.

\[
\begin{align*}
\text{CH}_3 - \text{C} - \text{OH} & \xrightarrow{573\text{K}} \text{CH}_3 - \text{C} = \text{CH}_2 \\
\end{align*}
\]

b. Methyl group is introduced at ortho and para positions.

c. Phenol is converted to benzene.

\[
\begin{align*}
\text{OCH}_3 & \xrightarrow{\text{Anhyd. AlCl}_3} \text{OCH}_3 \\
\text{OH} & \xrightarrow{\text{Zn}} \\
\end{align*}
\]

14. a. \(\text{Eu}^{2+} (4f^7)\) is a strong reducing agent because \(\text{Eu}^{3+}\) is more stable than \(\text{Eu}^{2+}\).

b. Dichromate ion changes to chromate ion / OH

\[
\text{Cr}_2\text{O}_7^{2-} \rightarrow \text{CrO}_4^{2-}
\]

c. Due to the irregular variation in ionisation enthalpies (sum of 1\(^{st}\) and 2\(^{nd}\) ionisation enthalpies), heat of sublimation and enthalpy of hydration due to irregular electronic configurations from left to right in a period which changes the ionisation potential.

15. a. Antiseptics are the chemicals which either kill or prevent growth of microbes on living tissues.

b. Cationic detergents are quarternary ammonium salts of amines with acetates, chlorides or bromides as anions / detergents whose cationic part is involved in cleansing action.

c. Antibiotics which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria.

16. \(A = \pi r^2\)

\[
\begin{align*}
&= 3.14 \times 0.5 \times 0.5 \text{ cm}^2 \\
&= 0.785 \text{ cm}^2 \\
&\mid l = 45.5 \text{ cm} \\
&\rho = \frac{R \times A}{l} \\
&\rho = 4.55 \times 10^3 \Omega \times 0.785 \text{ cm}^2 / 45.5 \text{ cm} \\
&\rho = 78.5 \ \Omega \text{ cm} \\
&\text{conductivity}, \ \kappa = \frac{1}{\rho} \\
&= \frac{1}{78.5} \text{ S cm}^{-1} = 0.0127 \text{ S cm}^{-1}
\end{align*}
\]
molar conductivity \( \Lambda_m = \kappa \times 1000/C \)
\[ = 0.0127 \text{ S cm}^{-1} \times 1000/0.05 \text{ mol/cm}^3 \]
\[ = 254.77 \text{ S cm}^2 \text{ mol}^{-1} \]

or

\[ A = \pi r^2 \]
\[ = 3.14 \times 0.5 \times 0.5 \text{ cm}^2 \]
\[ = 0.785 \text{ cm}^2 \]

\[ l = 45.5 \text{ cm} \]

\[ G^* = l/A = 45.5 \text{ cm}/0.785 \text{ cm}^2 \]
\[ = 57.96 \text{ cm}^{-1} \]

\[ K = G^* / R \]
\[ = 57.96 \text{ cm}^{-1} / 4.55 \times 10^3 \Omega = 1.27 \times 10^{-2} \text{ S cm}^{-1} \]

\[ \Lambda_m = \kappa \times 1000/C \]
\[ = [1.27 \times 10^{-2} \text{ S cm}^{-1}] \times 1000 / 0.05 \text{ mol/cm}^3 \]
\[ = 254.77 \text{ S cm}^2 \text{ mol}^{-1} \]

17

a. The particles of the dispersed phase have no affinity for the dispersion medium/solvent repelling (hating) colloidal sols. Example: metal and their sulphides

b. The reactant and the catalyst are in the same phase.

\[ \text{HCl(l)} \]
\[ \text{CH}_3\text{COOCH}_3(l) + \text{H}_2\text{O(l)} \rightarrow \text{CH}_3\text{COOH(aq)} + \text{CH}_3\text{OH(aq)} \]

c. Oil is dispersed in water/Oil is dispersed phase and water is dispersion medium.

Ex- milk

(or any other correct example)

17

<table>
<thead>
<tr>
<th><strong>Physisorption</strong></th>
<th><strong>Chemisorption</strong></th>
</tr>
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<tbody>
<tr>
<td>1. Because of van der Waals forces</td>
<td>Caused by chemical bond formation</td>
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<td>3. Enthalpy of adsorption is low (20-40 kJ/mol)</td>
<td>Enthalpy of adsorption is high (80-240) kJ/mol</td>
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</table>

(Or any other correct difference)

18

Given: \( T_b \) of glucose solution = 100.20°C

\[ \Delta T_b = K_b.m \]
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>m= 0.20/ 0.512</td>
<td>m= 0.390 mol/kg</td>
<td>1</td>
</tr>
<tr>
<td>ΔT_f = K_f . m</td>
<td>ΔT_f= 1.86 K kg/mol x 0.390 mol/kg</td>
<td>½</td>
</tr>
<tr>
<td>ΔT_f = 0.725 K</td>
<td>Freezing point of solution = 273.15K – 0.725</td>
<td>½</td>
</tr>
<tr>
<td></td>
<td>= 272.425K</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>a) Zone Refining – Impurities are more soluble in the melt than in the solid metal.</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>b) Collectors enhance non-wettability of the mineral particles. Ex: Pine oil/ fatty acids</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>c) Carbon monoxide (CO)</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>a. For bcc structure</td>
<td>½</td>
</tr>
<tr>
<td></td>
<td>a = 4r /√3 or r = √3a/4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>r = √3 x 400 pm /4</td>
<td>½</td>
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<tr>
<td></td>
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<td></td>
</tr>
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<td></td>
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<td>1</td>
</tr>
<tr>
<td>21</td>
<td>a. C.</td>
<td>1,1,1</td>
</tr>
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<td>22</td>
<td>a. Due to steric hindrance and +I effect caused by two alkyl groups in propanone.</td>
<td>½+ ½</td>
</tr>
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<td></td>
<td>c. (CH₃)₂CH-CHO has one α-H atom whereas α- H atom is absent in (CH₃)₃C-CHO.</td>
<td>1</td>
</tr>
<tr>
<td>23</td>
<td>(i) Concerned, caring, socially alert, leadership (or any other 2 values)</td>
<td>½ + ½</td>
</tr>
<tr>
<td></td>
<td>(ii) starch</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(iii) $\alpha$-Helix and $\beta$-pleated sheets</td>
<td>(iv) Vitamin $B_1$, $B_2$, $B_6$, $C$ (any two)</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>24</td>
<td>a. (i) Thermal stability of hydrides decreases down the group. Bond dissociation enthalpy decreases down the group. (ii) Because $\text{Cl}_2$ in presence of moisture liberates nascent oxygen. (iii) Interatomic interactions are weak</td>
<td>$\frac{1}{2} + \frac{1}{2}$ $\frac{1}{2} + \frac{1}{2}$</td>
</tr>
<tr>
<td></td>
<td>b. (i)</td>
<td>(ii)</td>
</tr>
<tr>
<td></td>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td>1,1</td>
</tr>
<tr>
<td>24</td>
<td>a) Size of nitrogen is smaller than chlorine. b) $2\text{F}_2 + 2\text{H}_2\text{O} \rightarrow 4\text{HF} + \text{O}_2$ / $\text{HF}$ and $\text{O}_2$ are produced c) $\text{PH}_3$ / Phosphine d) $\text{XeF}_2$ e) $[\text{Fe(}\text{H}_2\text{O})_6]^{2+} + \text{NO} \rightarrow [\text{Fe(}\text{H}_2\text{O})_6(\text{NO})]^{2+} + \text{H}_2\text{O}$</td>
<td>1 1 1 1 1</td>
</tr>
<tr>
<td>25</td>
<td><img src="image3.png" alt="Diagram" /> <img src="image4.png" alt="Diagram" /> <img src="image5.png" alt="Diagram" /> <img src="image6.png" alt="Diagram" /> <img src="image7.png" alt="Diagram" /></td>
<td>$1 \times 5 = 5$</td>
</tr>
</tbody>
</table>
25

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>i)</td>
</tr>
<tr>
<td></td>
<td>![Chemical structure of CN]</td>
</tr>
</tbody>
</table>

b. $\text{C}_6\text{H}_5\text{NH}_2 < \text{C}_6\text{H}_5\text{CH}_2\text{NH}_2 < \text{CH}_3\text{NH}_2 < (\text{CH}_3)_2\text{NH}$

c. Add $\text{NaNO}_2 + \text{HCl}$ to both the compounds at 273K followed by addition of phenol. Aniline gives orange dye (or any other correct test)

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</table>

$$k = \frac{2.303 \log [A]_0}{t} - \frac{[A]}{[A]}$$

$$= \frac{2.303 \log 100}{40} - \frac{25}{25}$$

$$= \frac{2.303 \log 4}{40}$$

$$= \frac{2.303 \times 0.6021}{40}$$

$$k = 0.0347 \text{ min}^{-1}$$

$$t_{1/2} = \frac{0.693}{k}$$

$$t_{1/2} = \frac{0.693}{0.0347 \text{ min}^{-1}} = 19.98 \text{ min} = 20 \text{ min}$$

b. (i) first order reaction
(ii) zero order reaction

OR

26 (a)

Rate = $k [\text{NO}]^x [\text{O}_2]^y$

$$7.2 \times 10^{-2} = k[0.3]^x [0.2]^y \text{-------Eqn (1)}$$

$$6.0 \times 10^{-3} = k[0.1]^x [0.1]^y \text{-------Eqn (2)}$$

$$2.88 \times 10^{-1} = k[0.3]^x [0.4]^y \text{-------Eqn (3)}$$

$$2.40 \times 10^{-2} = k[0.4]^x [0.1]^y \text{-------Eqn (4)}$$
Dividing eqn 4 by eqn 2
\[ \frac{2.40 \times 10^{-2}}{6.0 \times 10^{-3}} = k[0.4]^x [0.1]^y \]
x = 1

Dividing eqn 3 by eqn 1
\[ \frac{2.88 \times 10^{-1}}{7.2 \times 10^{-2}} = k[0.3]^x [0.1]^y \]
y = 2

order w.r.t. NO = 1, order w.r.t O₂ is 2
½, ½

(b) Rate law
Rate = k [NO]¹ [O₂]²
The overall order of the reaction is 3.
½ + ½

c. rate constant k = rate
\[ \frac{[NO]¹ [O₂]²}{0.3 \times (0.2)^2} \]
k = 6.0 mol⁻¹ L² min⁻¹

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<tr>
<td>Q.NO</td>
<td>VALUE POINTS</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>H₂Te &gt; H₂Se &gt; H₂S &gt; H₂O</td>
</tr>
<tr>
<td>2</td>
<td>To make the surface available again for more reaction to occur / To remove the product formed from the surface of the catalyst.</td>
</tr>
<tr>
<td>3</td>
<td>2-Phenylpropan-2-ol</td>
</tr>
<tr>
<td>4</td>
<td>Neopentane , C(CH₃)₄</td>
</tr>
<tr>
<td>5</td>
<td>P₃Q₂</td>
</tr>
<tr>
<td>6</td>
<td>a. Zinc to silver</td>
</tr>
<tr>
<td></td>
<td>b. Concentration of Zn²⁺ ions will increase and Ag⁺ ions will decrease.</td>
</tr>
<tr>
<td>7</td>
<td>a. Cr³⁺</td>
</tr>
<tr>
<td></td>
<td>b. Mn³⁺</td>
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<tr>
<td></td>
<td>c. Ti⁴⁺</td>
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<tr>
<td></td>
<td>d. Mn³⁺</td>
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<tr>
<td>8</td>
<td>a.</td>
</tr>
<tr>
<td></td>
<td>CH₃CH=CH₂ → CH₃CH(OH)CH₃ → CH₃COCH₃</td>
</tr>
<tr>
<td></td>
<td>H₂O →</td>
</tr>
<tr>
<td></td>
<td>[O]</td>
</tr>
<tr>
<td></td>
<td>H⁺</td>
</tr>
<tr>
<td></td>
<td>CH₃CH=CH₂ + CrO₃Cl₃ → CS → CH(OC₆H₄HOCl)₃ → CH₃CH(OH)COOH → CHO</td>
</tr>
<tr>
<td></td>
<td>Br₂/Red P →</td>
</tr>
<tr>
<td></td>
<td>i) aq KOH or NaOH</td>
</tr>
<tr>
<td></td>
<td>ii) H⁺</td>
</tr>
<tr>
<td></td>
<td>(or any other suitable method)</td>
</tr>
</tbody>
</table>

OR

| 8    | Etard reaction:                                                           | 1     |
|      | Toluene + CrO₃Cl₃ → Chromium complex → CH₃CH(OH)COOH → CHO                 |       |
|      | H₂O →                                                                     |       |
|      | or                                                                         |       |
b. Wolff-Kishner reduction:

\[
\begin{align*}
\text{C} &= \text{O} \\
\text{NH}_2\text{NH}_2 &\rightarrow \text{C} &= \text{O} \\
\text{KOH/ethylene glycol, heat} &\rightarrow \text{CH}_4 + \text{N}_2
\end{align*}
\]

or

\[
\begin{align*}
\text{C} &= \text{O} \\
\text{NH}_2\text{NH}_2 &\rightarrow \text{C} &= \text{O} \\
\text{KOH/ethylene glycol, heat} &\rightarrow \text{CH}_4 + \text{N}_2
\end{align*}
\]

9. The increase in boiling point of the solvent in a solution when a non-volatile solute is added. Because it depends upon molality / the number of solute particles rather than their nature:

\[\Delta T_b \propto m\]

10. a. Tetraamminechloridonitrito-N-cobalt(III) chloride
   b. \([\text{CoCl}_2(\text{en})_2]\text{Cl}\]

11. a. In \(\text{CuCl}_2\), Cu is in +2 oxidation state which is more stable due to high hydration enthalpy as compared to \(\text{Cu}_2\text{Cl}_2\) in which Cu is in +1 oxidation state
   b. Due to lanthanoid contraction
   c. Because HCl is oxidised to chlorine.

12. a. Drugs that reduce or abolish pain without causing impairment of consciousness, mental confusion or paralysis.
   b. Anionic detergents are sodium salts of sulphonated long chain alcohols or hydrocarbons / alkylbenzene sulphonate or detergents whose anionic part is involved in cleansing action.
   c. Antacids are chemical compounds which are used for the treatment of excess acid produced in the stomach.

13. \[
A = \pi r^2 \\
= 3.14 \times 0.5 \times 0.5 \text{ cm}^2 \\
= 0.785 \text{ cm}^2
\]

\[
l = 45.5 \text{ cm}
\]

\[
\rho = R \times \frac{A}{l} \\
\rho = 4.55 \times 10^3 \Omega \times 0.785 \text{ cm}^2 / 45.5 \text{ cm} \\
\rho = 78.5 \Omega \text{ cm}
\]

conductivity, \(\kappa = 1/\rho\)
\[
molar\ conductivity\ \Lambda m = \kappa \times 1000/C \\
= 0.0127\ S\ cm^{-1}\times 1000/0.05\ mol/cm^3 \\
= 254.77\ S\ cm^2\ mol^{-1}
\]

or

\[
A = \pi r^2 \\
= 3.14 \times 0.5 \times 0.5\ cm^2 \\
= 0.785\ cm^2
\]

\[
l = 45.5\ cm \\
G^* = l/A = 45.5\ cm/0.785\ cm^2 \\
= 57.96\ cm^{-1}
\]

\[
K = G^*/R \\
= 57.96\ cm^{-1}/4.55 \times 10^3\ \Omega = 1.27 \times 10^{-2}\ S\ cm^{-1}
\]

\[
\Lambda m = \kappa \times 1000/C \\
= [1.27 \times 10^{-2}\ S\ cm^{-1}] \times 1000 / 0.05\ mol/cm^3 \\
= 254.77\ S\ cm^2\ mol^{-1}
\]

<table>
<thead>
<tr>
<th>14</th>
<th></th>
<th>1 ( 1/2 ) 2 ( 1/2 ) 3 ( 1/2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>The particles of the dispersed phase have no affinity for the dispersion medium/solvent repelling (hating) colloidal sols. Example: metal and their sulphides</td>
<td>( 1/2 + 1/2 )</td>
</tr>
<tr>
<td>b.</td>
<td>The reactant and the catalyst are in the same phase.</td>
<td>( 1/2 + 1/2 )</td>
</tr>
<tr>
<td>c.</td>
<td>Oil is dispersed in water/Oil is dispersed phase and water is dispersion medium. Ex- milk</td>
<td>( 1/2 + 1/2 )</td>
</tr>
</tbody>
</table>

**OR**

<table>
<thead>
<tr>
<th>14</th>
<th>Physisorption</th>
<th>Chemisorption</th>
<th>1+1+1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Because of van der Waals forces</td>
<td>Caused by chemical bond formation</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Reversible</td>
<td>Irreversible</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Enthalpy of adsorption is low(20-40 kJ/mol)</td>
<td>Enthalpy of adsorption is high(80-240)kJ/mol</td>
<td></td>
</tr>
</tbody>
</table>
16. Given: \( T_b \) of glucose solution = 100.20°C  
\[ \Delta T_b = K_b \cdot m \]  
\( m = \frac{0.20}{0.512} \)  
\( m = 0.390 \text{ mol/kg} \)  
\[ \Delta T_f = K_f \cdot m \]  
\[ \Delta T_f = 1.86 \text{ K kg/mol x 0.390 mol/kg} \]  
\[ \Delta T_f = 0.725 \text{ K} \]  
Freezing point of solution = 273.15K – 0.725  
= 272.425K

17. a. (i) Vapour phase refining/ van Arkel method  
(ii) Zone refining  
(iii) Electrolytic refining  
b. (i) Froth flotation process  
(ii) Magnetic separation  
(iii) Leaching

18. a. For bcc structure  
\[ a = 4r / \sqrt{3} \quad \text{or} \quad r = \sqrt{3} a / 4 \]  
\[ r = \sqrt{3} \times 400 \text{ pm} / 4 \]  
\[ = 1.732 \times 400 \text{ pm}/4 \]  
\[ = 173.2 \text{ pm} \]  
b. (i) Impurity defect  
(ii) Cationic vacancies are created.

19. a. Due to steric hindrance and +I effect caused by two alkyl groups in propanone.  
b. Due to electron withdrawing nature of –NO₂ group which increases the acidic strength and decreases the pKₐ value.  
c. (CH₃)₂CH-CHO has one α-H atom whereas α- H atom is absent in (CH₃)₃C-CHO.

20. a. Chloroprene \( , \ CH₂=\text{C(Cl)}-\text{CH}=\text{CH₂} \)  

b. 1,3- Butadiene & Acrylonitrile  
\( CH₂=\text{CH-CH}=\text{CH₂} \quad \text{&} \quad CH₂=\text{CHCN} \)
<p>| | |</p>
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</table>
| c. 3-Hydroxybutanoic acid & 3-Hydroxypentanoic acid | $\frac{1}{2} + \frac{1}{2}$  
CH$_3$CH(OH)CH$_2$COOH & CH$_3$CH$_2$CH(OH)CH$_2$COOH |
| 21 a) It is the magnitude of difference in energy between the two sets of d orbital i.e. t$_{2g}$ and e$_g$  
$t^{4}_{2g}$ e$_g^0$ | 1  
b) sp$^3$d$^2$, paramagnetic | 1  
$\frac{1}{2} + \frac{1}{2}$ |
| 22 a. Methanol and 2-methyl-2-iodopropane are formed.  
\[
\begin{align*}
\text{CH}_3\text{C}-\text{O}-\text{CH}_3 + \text{HI} & \rightarrow \text{CH}_3\text{OH} + \text{CH}_3\text{C}-\text{I} \\
\end{align*}
\] | 1 |
| b. 2-Methoxy acetophenone and 4-Methoxy acetophenone are formed  
\[
\begin{align*}
\text{OCH}_3 + \text{CH}_3\text{COCl} \xrightarrow{\text{Anhyd. AlCl}} \text{OCH}_3\text{COCH}_3 + \text{OCH}_3\text{COCH}_3 \\
\end{align*}
\] | 1 |
| c. o-Bromophenol and p-Bromophenol are formed.  
\[
\begin{align*}
\text{OHH} & \xrightarrow{\text{Br}_2 \text{ in } \text{CS}_2, 273 \text{ K}} \text{OHH} \text{Br} + \text{OHH} \text{Br} \\
\end{align*}
\] | 1 |
| 23 (i) Concerned, caring, socially alert, leadership (or any other 2 values)  
(ii) starch  
(iii) $\alpha$-Helix and $\beta$-pleated sheets  
(iv) Vitamin B / B$_1$ / B$_2$ / B$_6$ / C (any two) | $\frac{1}{2} + \frac{1}{2}$  
1  
$\frac{1}{2} + \frac{1}{2}$  
$\frac{1}{2} + \frac{1}{2}$ |
| 24 | 1x5=5 |
| (A) | (B) | (C) |
(D) \[
\begin{array}{c}
\text{NH}_2 \\
\text{NO}_2
\end{array}
\]

(E) \[
\begin{array}{c}
\text{NH}_3\text{HSO}_4
\end{array}
\]

OR

24.

a. i) ii) iii)

\[
\begin{array}{c}
\text{CN} \\
\text{Cl}
\end{array}
\]

b. \( \text{C}_6\text{H}_5\text{NH}_2 < \text{C}_6\text{H}_5\text{CH}_2\text{NH}_2 < \text{CH}_3\text{NH}_2 < (\text{CH}_3)_2\text{NH} \)

c. Add NaNO_2 + HCl to both the compounds at 273K followed by addition of phenol. Aniline gives orange dye (or any other correct test)

25.

\[
k = \frac{2.303 \log [A]_0}{t} = \frac{2.303 \log 100}{40} = \frac{2.303 \log 4}{40}
\]

\[
= 2.303 \times 0.6021
\]

\[k = 0.0347 \text{ min}^{-1}\]

\[
t_{1/2} = \frac{0.693}{k}
\]
\[
t_{1/2} = \frac{0.693}{0.0347\ \text{min}^{-1}} = 19.98\ \text{min} = 20\text{min}
\]

b. (i) first order reaction
(ii) zero order reaction

OR

25

(a)
Rate = \( k \ [\text{NO}]^x \ [\text{O}_2]^y \)
\[7.2 \times 10^{-2} = k[0.3]^x [0.2]^y \text{---Eqn (1)}\]
\[6.0 \times 10^{-3} = k[0.1]^x [0.1]^y \text{---Eqn (2)}\]
\[2.88 \times 10^{-1} = k[0.3]^x [0.4]^y \text{---Eqn (3)}\]
\[2.40 \times 10^{-2} = k [0.4]^x [0.1]^y \text{---Eqn (4)}\]
Dividing eqn 4 by eqn 2
\[2.40 \times 10^{-2} = k[0.4]^x [0.1]^y\]
\[6.0 \times 10^{-3} = k[0.1]^x [0.1]^y\]
\[x = 1\]
Dividing eqn 3 by eqn 1
\[2.88 \times 10^{-1} = k[0.3]^x [0.4]^y\]
\[7.2 \times 10^{-2} = k[0.3]^x [0.2]^y\]
\[y = 2\]

order w.r.t. NO = 1, order w.r.t O\(_2\) is 2

(b) Rate law
Rate = \( k \ [\text{NO}]^1 \ [\text{O}_2]^2 \), The overall order of the reaction is 3.

(c) rate constant
\[k = \frac{\text{rate}}{[\text{NO}]^1 [\text{O}_2]^2} = 7.2 \times 10^{-2}\]
\[k = 6.0 \text{ mol}^{-1} \text{ L}^2 \text{ min}^{-1}\]

26.

a. (i) Thermal stability of hydrides decreases down the group/ Bond dissociation enthalpy decreases down the group.
(ii) Because Cl\(_2\) in presence of moisture liberates nascent oxygen.
(iii) Interatomic interactions are weak

b. (i)
OR

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<td>a) Size of nitrogen is smaller than Chlorine.</td>
<td>b) $2F_2 + 2H_2O \rightarrow 4HF + O_2$ / HF and $O_2$ are produced</td>
<td>1</td>
<td></td>
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<tr>
<td></td>
<td>c) PH$_3$ /Phosphine</td>
<td>d) XeF$_2$</td>
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<tr>
<td></td>
<td>e) $[Fe(H_2O)_6]^{2+} + NO \rightarrow [Fe(H_2O)_5(NO)]^{2+} + H_2O$</td>
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