QUARTERLY EXAMINATION - 2023
CHEMISTRY

CLASS : **XII**

TIME : 3.00 Hr.

Register No [ ]

MAX. MARKS : 70

PART - I

I) Choose the Correct Answer.   15 X 1 = 15

1. Considering Ellingham diagram, which of the following metals can be used to reduce alumina?
   a) Fe   b) Cu   c) Mg   d) zn

2. Match the items in column - I with the items of column- II and assign the correct code

Column - I	Column- II		A	B	C	D
A) Cyanide process -	1. Ultrapure Ge	(a)	2	3	1	4
B) Froth floatation process-	2. Dressing of Zns	(b)	4	2	1	3
C) Electrolytic reduction-	3. Extraction of Au	(c)	1	2	3	4
D) Zone refining -	4. Extraction of Al	(d)	3	4	1	2

3. The geometry at which Carbon atom in diamond are bonded to each other is
   a) Teterahedral   b) hexagonal   c) Octahedral   d) none of these

4. The formula for Hyponitrous acid is
   a) HOONO   b) HNO_2 c) $H_2N_2O_2$ d) HNO_4

5. The most common oxidation state of actinoids is
   a) +2   b) +3   c) +4   d) +6

6. Assertion : due to Frenkel defect, density of the crystalline solid decreases
   Reason : In Frenkel defect cation and anion leaves the crystal.
   a) Both assertion and reason are true and reason is correct explanation of assertion
   b) Both assertion and reason are true but reason is not the correct explanation of assertion
   c) Assertion is true but reason is false   d) Both assertion and reason are false

7. The crystal with a metal deficiencey defect is
   a) Nacl   b) Feo   c) Zno   d) Kcl

8. If 75% of a first order reaction was completed in 40 minutes, 50 % of the same reaction under the same conditions would be completed in
   a) 20 minutes   b) 30 minutes   c) 35 minutes   d) 75 minutes

9. The addition of a catalyst during a chemical reaction alters which of the following quantities?
   a) Enthalpy   b) Activation energy   c) Internal energy   d) Entropy

10. The P^H of an aqueous solution is Zero the solution is
    a) neutral   b) slightyly acidic   c) Strongly acidic   d) basic

11. If the solubility product of Lead iodide is 3.2×10^{-8}, its solubility will be
    a) 2×10^{-3} M   b) 4×10^{-4} M   c) 1.6×10^{-5} M   d) 1.8×10^{-5} M

12. In Victor mayer test the secondary alcohol gives the colour is
    a) Red   b) Yellow   c) Green   d) Blue

13. Which of the following compound can be used as antifreeze in automobile radiators?
    a) Ethylene glycol   b) Methanol   c) Ethanol   d) Phenol

14. Which one of the following reaction is an example of disproportionation reaction?
    a) Aldol condensation   b) Cannizaro reaction
    c) Benzoin Condensation   d) None of these

15. Which one of the following reducees tollens reagent
    a) Formic acid   b) Acetic acid   c) Benzophenone   d) None of these

12th - Chemistry -Nmk- page-1

PART - II

II) Answer any 6 Questions (Q.No.24 is Compulsory)   **6X2=12**

16. Which type of ores can be concentranted by froth floatation method? Give two example for such ores.
17. Write the anamolous Property of the first element of 'P' - block.
18. Why fluorine is more reactive than other halogens?
19. Define packing efficiency of crystals.
20. What is half life of a reaction ?
21. Identify the conjugate acid - base pair of the following reaction

   (i) $HS^-_{(aq)} + HF \rightleftharpoons F^-_{(aq)} + H_2S_{(aq)}$ (ii) $HPO_4^{2-} + SO_3^{2-} \rightleftharpoons PO_4^{3-} + HSO_3^-$

22. Give short note on Dows Process.
23. What is Urotrophine? Write the uses of urotrophine.
24. Which is more stable Fe^{3+} (or) Fe^{3+} ? Explain.

PART - III

III) Answer any 6 Questions (Q.No.33 is Compulsory)   **6X3=18**

25. What are the difference between minerals and Ore.
26. Write the uses of Helium.
27. Complete the equations. (i) $HCOOH + H_2SO_4 \longrightarrow$?   (ii) $H_2B_4O_7 \xrightarrow{\text{red hot}}$?
28. Why transition elements forms complex compounds?
29. Write the difference between metal excess defect and metal deficiency defect.
30. Define rate law and rate constant.
31. Write the Rosenmund reduction reaction?
32. Write the dehydrating reaction of Glycerol
33. Write the expression for the solubility product of $Ca_3(PO_4)_2$.

PART - IV

IV) Answer all the questions :   **5X5=25**

34. a) Explain Froth floatation method with diagram.   (5)

                                 (OR)

   b) i) Write the Oxidation state of halogens for the following compounds. 1) OF_2 2) I_2O_4 (2)
       ii) Write the short note on bleaching action of chlorine.   (3)

35. a) i) Explain Structure of diborane.   (3)
       ii) Write a short note on Fisher tropsch Synthesis.   (2)

                                   (OR)

   b) Compare Lanthanoids and Actinoids.   (5)

36. a) i) To Calculate the number of atoms present in sc,bcc, fcc unit cell   (3)
       ii) Define unit cell. Write the seven type of unit cell.   (2)

                                     (OR)

   b) Derive integrated rate equations for Zero order reaction.   (5)

37. a) i) Write Arrhenius equation and explain the terms involved .   (2)
       ii) The rate constant for a first order reaction is $1.54 \times 10^{-3} S^{-1}$ Calculate its half life time. (3)

                                     (OR)

   b) Derive the expression for Ostwald's dilution law.   (5)

38. a) i) Write the coupling reaction of phenol   (2)
       ii) Explain three methods of preparation of ether.   (3)

                                     (OR)

   b) Write the mechanism of Aldol condensation.   (5)

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QUARTERLY EXAMINATION -2023

CHEMISTRY

CLASS : XII   MAX MARKS : 70

PART-A   பகுதி-அ

I. CHOOSE THE CORRECT ANSWER.   I. சரியான விடையைத் தேர்ந்தெடுத்து எழுதுக.

1. c). Mg   1. இ) Mg

2. No option correct: 2. A B C D
   A   B   C   D   3 2 4 1
   3   2   4   1

3. a) Tetrahedral   3. அ) நாற்முகி

4. c) $H_2N_2O_2$ 4. இ) $H_2N_2O_2$

5. b) +3   5. அ) +3

6. d) Both assertion and   6. ஈ) கூற்று மற்றும் காரணம்
   reason are false.   இரண்டும் தவறு

7. b) FeO   7. அ) FeO

8. a) 20 minutes   8. அ) 20 நிமிடங்கள்

9. b) Activation energy   9. அ) கிளர்வு ஆற்றல்

10. c) strongly acidic   10. இ) அதிக அமிலத்தன்மைக்
                                    கொண்டது.

11. a) 2×10^{-3} M   11. அ) 2×10^{-3} M

12. d) Blue   12. ஈ) நீலம்

13. a) Ethylene glycol   13. அ எத்திலீன் கிளைகால்

14. b) Cannizaro reaction   14. அ) கானிசாரோ வினை

15. a) Formic acid.   15. அ) .. பார்மிக் அமிலம்

Answer: 8.

$t_{75\%} = 2 t_{50\%}$.   13. IUPAC NAME:

$t_{50\%} = \dfrac{t_{75\%}}{2a^2}$ ethan-1,2-diol

                                 Common NAME : Ethylene glycol.

$t_{50\%} = \dfrac{40}{?} = 80$

PART-II

11. [Q.NO 24 is compulsory]

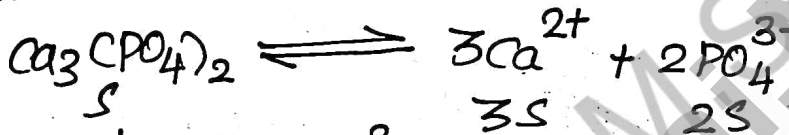24. Which is more stable Fe^{3+} (or) Fe^{2+}? Explain

Fe^{3+} ion is more stable due to its half filled $3d^5$ configuration. but Fe^{2+} ion has $3d^6$ configuration.

PART-III

[Q.NO 33 is compulsory]

33. Write the expression for the solubility product of $Ca_3(PO_4)_2$.

Soln:

$$Ca_3(PO_4)_2 \rightleftharpoons 3Ca^{2+} + 2PO_4^{3-}$$
$$S \qquad\qquad 3S \qquad 2S$$

$$K_{sp} = (3S)^3 (2S)^2$$

$$K_{sp} = 27S^3 \, 4S^2$$

$$K_{sp} = 108\, S^5$$

M.Poovarasan M.Sc B.Ed
PG Asst in Chemistry
Dharmapuri District

வினா எண். 24 க்கு கட்டாயம் விடையளிக்கவும்.

24. Fe^{3+} மற்றும் Fe^{2+} ல் எது அதிக நிலைப்புத்தன்மை உடையது ஏன்?

* Fe^{3+} வெளியிட்ட எலக்ட்ரான் அமைப்பு $3d^5$.
* Fe^{2+} வெளியிட்ட எலக்ட்ரான் அமைப்பு $3d^6$.

Fe^{3+} சரிபாதியாக நிரம்பிய எலக்ட்ரான் அமைப்பை பெற்றுள்ளதால் நிலைப்புத்தன்மை உடையதாக வழுகிறது.

வினா எண். 33 க்கு கட்டாயம் விடையளிக்கவும்.

33. $Ca_3(PO_4)_2$ ன் கரைதிறன் பெருக்கத்திற்கான சமன்பாட்டை எழுதுக.

$$Ca_3(PO_4)_2 \rightarrow 3Ca^{2+} + 2PO_4^{3-}$$
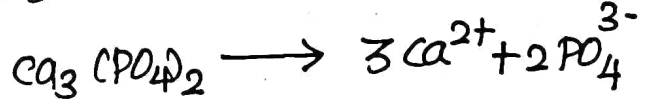
$$K_{sp} = [Ca^{2+}]^3 [PO_4^{3-}]^2$$

$$K_{sp} = (3S)^3 (2S)^2$$

$$K_{sp} = 27S^3 \, 4S^2$$

$$K_{sp} = 108\, S^5$$

CHEMISTRY.

Quarterly Exam Question.

key Answer.

Part -1.

1. Considering Ellingham diagram, which of the following metals can be used to reduce alumina?

    c). Mg.

2. Match the items in column-I with the items column-II and assign the correct code

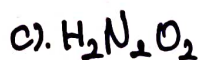| Column - I	Column - II
A). Cyanide process	1. Ultrapure Ge
B). Froth floatation process	2. Dressing of Zns.
C). Electrolytic reduction	3. Extraction of Au.
D). Zone refining	4. Extraction of Al.

    Correct answer is;

A	B	C	D
3	2	4	1

3. The geometry at which carbon atom in diamond are bonded to each other is

    a). Tetrahedral.

4. The formula for Hyponitrous acid is

    c). $H_2N_2O_2$

5. The most common oxidation state of actinoids is

    b). +3

6. Assertion : due to Frenkel defect, density of the crystalline solid decreases.

  Reason   : In Frenkel defect cation and anion leaves the crystal.

    d). Both assertion and reason are false.

7. The crystal with a metal deficiency defect is

    b). FeO

8. If 75% of a first order reaction was completed in 40 minutes, 50% of the same reaction under the same conditions would be completed in

    a). 20 minutes.

9. The addition of a catalyst during a chemical reaction alters which of the following quantities?

    b). Activation energy.

10. The P^H of an aqueous solution is zero the solution is

    c). Strongly acidic.

11. If the solubility product of lead iodide is 3.2×10^{-8}, its solubility will be

    a). 2×10^{-3} M.

12. In Victor mayer test the secondary alcohol gives the colour is

    d). Blue.

13. Which of the following compound can be used as antifreeze in automobile radiators?

    a). Ethylene glycol.

14. Which one of the following reaction is an example of disproportionation reaction?

    b). bannizaro reaction.

15. Which one of the following reduces tollens reagent?

    a). Formic acid.

Part-2.

16. Which type of ores can be concentrated by froth floatation method? Give two example for such ores.

     ⓐ Sulphide ores can be concentrated by froth floatation method.

Example: Galena (PbS) , Zinc Blende (ZnS).

17. Write the anamolous property of the first element of 'P'-block.

     ⓐ Small size of the first member.

     ② High Ionisation enthalpy and high electronegativity.

     ③ Absence of d orbitals in their valence shell.

18. Why fluorine is more reactive than other halogens?

     ⓐ Fluorine is more reactive among the other halogens.

     ② This is due to low value F-F bond dissocation energy.

19. Define packing efficiency of crystal.

     ⓐ Packing fraction (or) efficiency.

$$- \frac{\text{Volume occupied by atoms / spheres}}{\text{Total volume of the unit cell}} \times 100 .$$

20. What is half life of a reaction?

&.The half life of a reaction is defined as the time required for the reactant concentration to reach one half its initial value.

&.For a first order reaction, the half life is a constant. i.e: it does not depend on the initial concentration.

$$k = \frac{2 \cdot 303}{t} \log \frac{[A_0]}{[A]}$$

$$\left(t = t_{1/2} \; ; \; [A] = \frac{[A_0]}{2} \right).$$

$$k = \frac{2 \cdot 303}{t_{1/2}} \log \frac{[A_0]}{[A_0]/2}$$

$$k = \frac{2 \cdot 303}{t_{1/2}} \log 2$$

$$= \frac{2 \cdot 303 \times 0 \cdot 3010}{t_{1/2}}$$

$$k = \frac{0.6932}{t_{1/2}}$$

$$t_{1/2} = \frac{0.6932}{k}.$$

21. Identify the conjugate acid - base pair:

i). $HS^-_{(aq)} + HF \rightleftharpoons F^-_{(aq)} + H_2S_{(aq)}$.
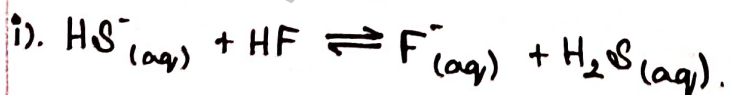
HF - $acid_1$ F^- - $base_1$

H_2S - $acid_2$ HS^- - $base_2$.

ii). $HPO_4^{2-} + SO_3^{2-} \rightleftharpoons PO_4^{3-} + HSO_3^-$
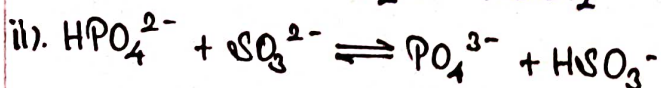
HPO_4^{2-} - $acid_1$ PO_4^{3-} - $base_1$

HSO_3^- - $acid_2$ SO_3^{2-} - $base_2$

22. **Dows process :**

&. When chlorobenzene is hydrolysed with 6-8% NaOH at 300 bar and 633k in a closed vessel, sodium phenoxide is formed which on treatment with dilute HCl gives phenol.
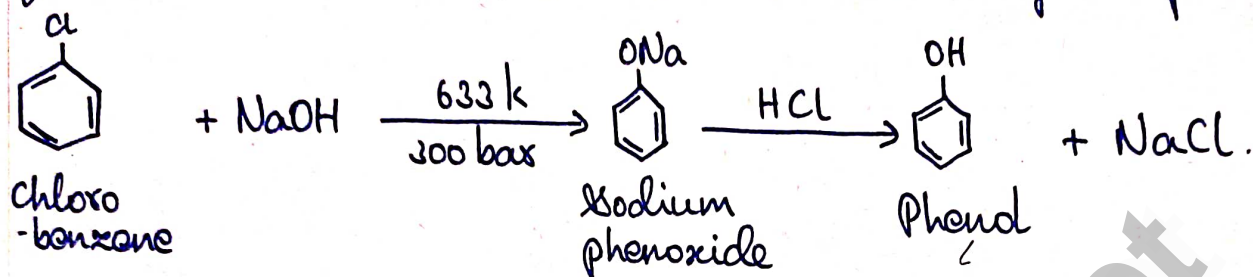
23. **Urotrophine ? Uses of urotrophine :**

&. Formaldehyde reacts with ammonia to form hexa methylene tetramine, which is known as urotrophine.

$$6HCHO + 4NH_3 \longrightarrow (CH_2)_6N_4 + 6H_2O$$

Uses :

&. Urotrophine is used as a medicine to treat urinary infection.

&. Nitration of urotrophine under controlled condition gives an explosive RDX. It is also called cyclonite.

24. **Which is more stable ? Fe^{2+} or Fe^{3+}.**

&. Fe^{3+} = $[Ar]\ 3d^5$. It consists 5 unpaired electrons.

&. Half filled and stable.

&. Fe^{2+} = $[Ar]\ 3d^6$. It consists 4 unpaired electrons.

&. Partially filled d sub shell.

&. Hence Fe^{3+} is more stable than Fe^{2+}.

Part-2.

25. Difference between :

Minerals	Ores.
A naturally occuring substance obtained by mining which contains the metal in free state or in the form of compounds like oxides, sulphide	Minerals that contains a high percentage of metal, from which it can be extracted conveniently and economically.
It contains low percentage of metals.	
All minerals are not ores.	All ores are minerals.
Eg: Hematite magnetite.	Eg: China clay.

26. Uses of helium:

    2. Helium and oxygen mixture is used by divers in place of air oxygen mixture.

    2. This prevents painful dangerous condition called bends.

    2. It is used to provide inert atmosphere in electric arc welding of metals.

    2. It has lowest boiling point.

    2. It is used in cryogenics.

    2. It is used for filling air balloons.

27. Complete the equations:

i). $HCOOH + H_2SO_4 \longrightarrow CO + H_2SO_4 \cdot H_2O$.

ii). $H_2B_4O_7 \xrightarrow{\text{red hot}} 2B_2O_3 + H_2O$.

28. Transition elements:

     The metallic elements that have incompletely filled d or f sub shell in the neutral or cationic state.

Example: Metals, iron and copper.

29. Difference between:

Metal excess defect	Metal deficiency defect.
It arises due to the presence of more number of metal ions compared to anions.	It arises due to the presence of less number of cations than anions.
Electrical neutrality of the crystal can be maintained by the presence of anionic vacancies equal to the excess metal ions.	To maintain electrical neutrality, twice the number of other Fe^{2+} ions are oxidised to Fe^{3+} ions.
Eg: NaCl, kCl.	Eg: FeO

30. Define rate law and rate constant:

Rate law:

  ① It is the expression which relates the rate, rate constant and concentration of reactants of a reaction.
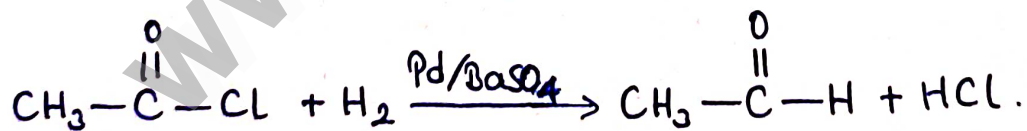
$$xA + yB \longrightarrow Product.$$
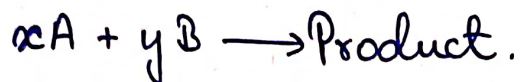
$$Rate = k[A]^m[B]^n$$

Rate constant:

  ① It is the proportanility constant equal to the rate of reaction when concentration of each reactant is unity

$$[A] = [B] = 1, \quad Rate\ constant\ k = Rate.$$

21. Rosemund reduction:

  ① Aldehydes can be prepared by the hydrogenation of acid chloride, in the presence of palladium supported by barium sulphate.

$$CH_3-\overset{\overset{O}{\|}}{C}-Cl + H_2 \xrightarrow{Pd/BaSO_4} CH_3-\overset{\overset{O}{\|}}{C}-H + HCl.$$

  Acetyl chloride   Acetaldehyde.

22. Dehydration of glycerol:

&When glycerol is heated with dehydrating agents

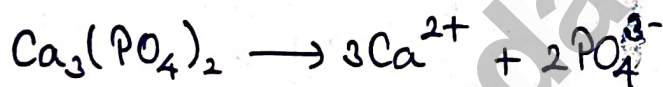such as Conc. H_2SO_4, $KHSO_4$, etc.

&It forms acrolein.

$$
\begin{array}{ccc}
\begin{array}{l}
CH_2-OH \\
| \\
CH-OH \\
| \\
CH_2-OH
\end{array}
&
\xrightarrow[\Delta]{KHSO_4}
&
\begin{array}{l}
CH_2 \\
|| \\
CH \\
| \\
CHO
\end{array}
\end{array}
$$
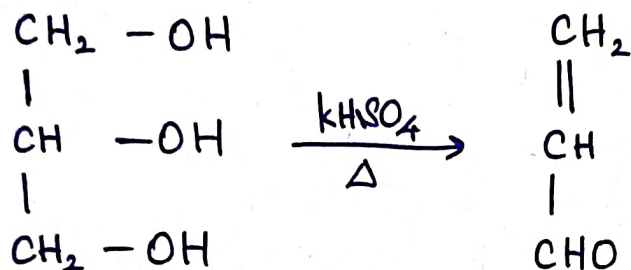
propane -1.2,3 triol.   prop-2-enal (acrolein).

23. Expression for solubility product of $Ca_3(PO_4)_2$.

Sol:

$$Ca_3(PO_4)_2 \longrightarrow 3Ca^{2+} + 2PO_4^{3-}$$

$$k_{sp} = [X^{n+}]^m [Y^{m-}]^n$$

$$k_{sp} = [Ca^{2+}]^3 [PO_4^{3-}]^2$$

$$= (3s)^3 (2s)^2$$

$$= 27s^3 \times 4s^2$$

$$k_{sp} = 108\, s^5.$$

$$\boxed{\therefore k_{sp} = 108\, s^5}$$

Part-4.

34. a). Froth floatation:
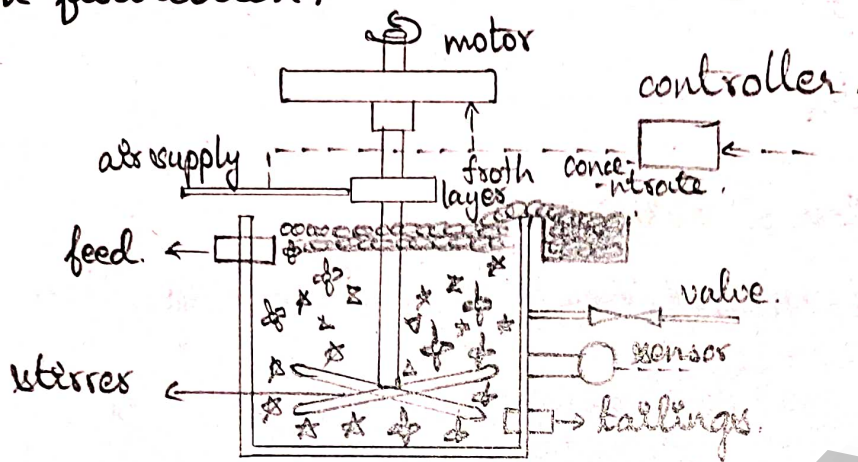
⊙. This method is commonly used to concentrate sulphide ores such as galena (PbS), zinc blende (ZnS), etc...

⊙. In this method, the metallic ore particles which are preferentially wetted by oil can be separated from gangue.

⊙. In this method the crushed ore is suspended in water and mixed with frothing agent such pine and eucalyptus oil.

⊙. A small quantity of sodium ethyl xanthate which acts as a collector is also added.

⊙. A froth is generated by blowing air through this mixture.

⊙. As a result, ore particles, wetted by the oil, rise to the surface along with the froth.

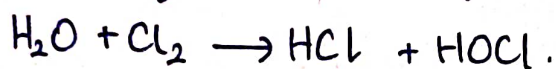⊙. The gangue particles that are preferentially wetted by water settle at the bottom.

Example: Sodium Cyanide (NaCN).

b). i). Oxidation state of halogens :

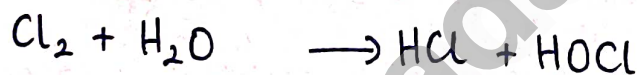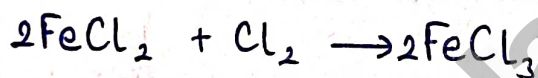   1). OF_2 -   -1.

    2). I_2O_4 -   +4.
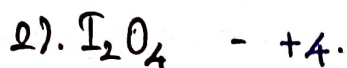
ii). Bleacing action of chlorine:

    a. Chlorine is a strong oxidising and bleaching agent because of nascent oxygen.

$$H_2O + Cl_2 \longrightarrow HCl + HOCl.$$

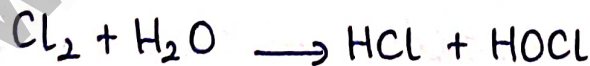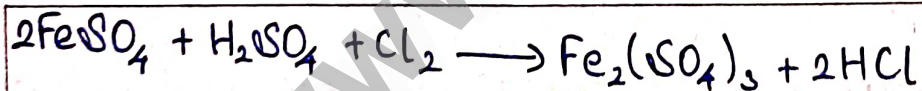   a. The bleaching of chlorine is permanent.

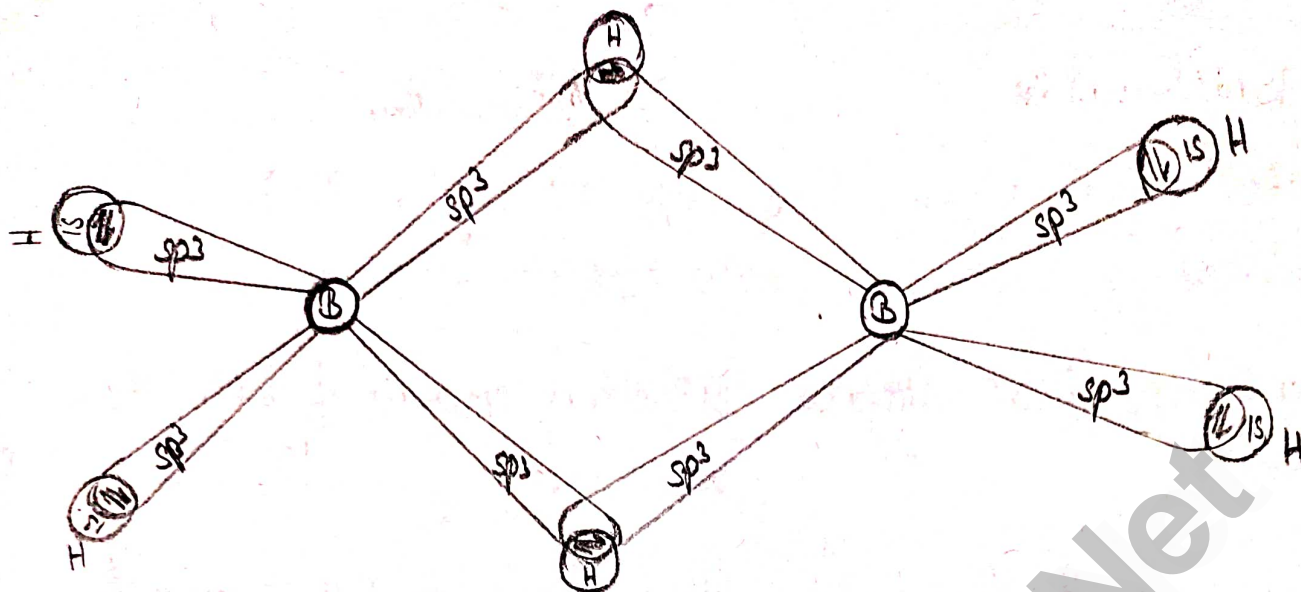   a. It oxidises ferrous salts to ferric, sulphites to sulphates and hydrogen sulphide to sulphur.

$$2FeCl_2 + Cl_2 \longrightarrow 2FeCl_3$$

$$Cl_2 + H_2O \longrightarrow HCl + HOCl$$

$$2FeSO_4 + H_2SO_4 + HOCl \longrightarrow Fe_2(SO_4)_3 + HCl + H_2O.$$

Overall reaction:

$$\boxed{2FeSO_4 + H_2SO_4 + Cl_2 \longrightarrow Fe_2(SO_4)_3 + 2HCl}$$

$$Cl_2 + H_2O \longrightarrow HCl + HOCl$$

$$Na_2SO_3 + HOCl \longrightarrow Na_2SO_4 + HCl$$

Overall reaction:

$$\boxed{Na_2SO_3 + H_2O + Cl_2 \longrightarrow Na_2SO_4 + 2HCl}$$

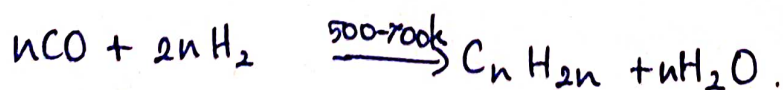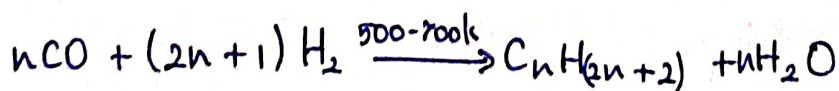$$Cl_2 + H_2S \longrightarrow 2HCl + S.$$
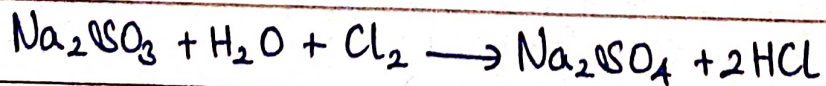
35. a). i). Structure of diborane:

      ❂ Two BH_2 units are linked by two bridged hydrogen.

      ❂ It has eight B-H bonds.

      ❂ It has only 12 valence electrons and not sufficient to form normal covalent bonds.

      ❂ The four terminal B-H bonds are normal covalent

      ❂ 2C - 2e bond.

      ❂ The boron is sp^3 hybridised.

ii). Fisher Tropsch synthesis:

      ❂ The reaction of carbon monoxide with hydrogen at a pressure of less than 50 atm using metal catalyst at 500-700k yields saturated and unsaturated hydrocarbons.

$$nCO + (2n+1) H_2 \xrightarrow{\text{500-700k}} C_n H_{(2n+2)} + nH_2O$$

$$nCO + 2nH_2 \xrightarrow{\text{500-700k}} C_n H_{2n} + nH_2O.$$

b). Compare :

Lanthanoids	Actinoids.
Differentiating electrons enters in 4f orbital.	Differentiating electrons enters in 5f orbital.
Binding energy of 4f orbitals are higher.	Binding energy of 5f orbital are lower.
They show less tendancy to form complexes.	They show greater tendancy to form complexes.
Most of the lanthanoids are colourless.	Most of the actinoids are coloured. Eg : U^{3+} (red) , U^{4+} (green).
They do not form oxo cations.	They do form oxo-cations. Eg: UO_2^{2+}, NpO_2^{2+} etc.
Besides +3 oxidation states lanthanoids show +2 and +4 oxidation state in few cases.	Besides +3 oxidation states actinoids show higher oxidation states such as +4, +5, +6 & +7.

26. a). i). Calculate the number of atoms present in .... unit cell.

SC :

$$SC = \left(\frac{N_c}{8}\right)$$

$$SC = \frac{8}{8} = 1.$$

Bcc :

$$bcc = \left(\frac{N_c}{8}\right) + \left(\frac{N_b}{1}\right)$$

$$= \left(\frac{8}{8} + \frac{1}{1}\right)$$

$$bcc = (1+1) = 2$$

Fcc :

$$Fcc = \left(\frac{N_c}{8}\right) + \left(\frac{N_f}{2}\right)$$

$$= \left(\frac{8}{8}\right) + \left(\frac{6}{2}\right)$$

$$FCC = (1+3) = 4$$

$$\therefore \quad SC = 1$$
$$Bcc = 2$$
$$FCC = 4.$$

ii). Define unit cell? Write the seven type of unit cell.

⊛. A basic repeating structural unit of a crystalline solid is called as a unit cell.

⊛ Seven types of unit cells are:

1. Cubic.　　　　　　5. Orthorhombic
2. Rhombohedral　　　6. Monoclinic.
3. Hexagonal.　　　　7. Triclinic.
4. Tetragonal

b). Zero order reaction;

    ⊙ A reaction in which the rate is independent of the concentration of the reactant over a wide range of concentration.

$$A \longrightarrow product.$$

Rate $= k [A^0]$

$$\frac{-d[A]}{dt} = k(1) \qquad ([A^0] = 1).$$

$$-d[A] = k(dt).$$

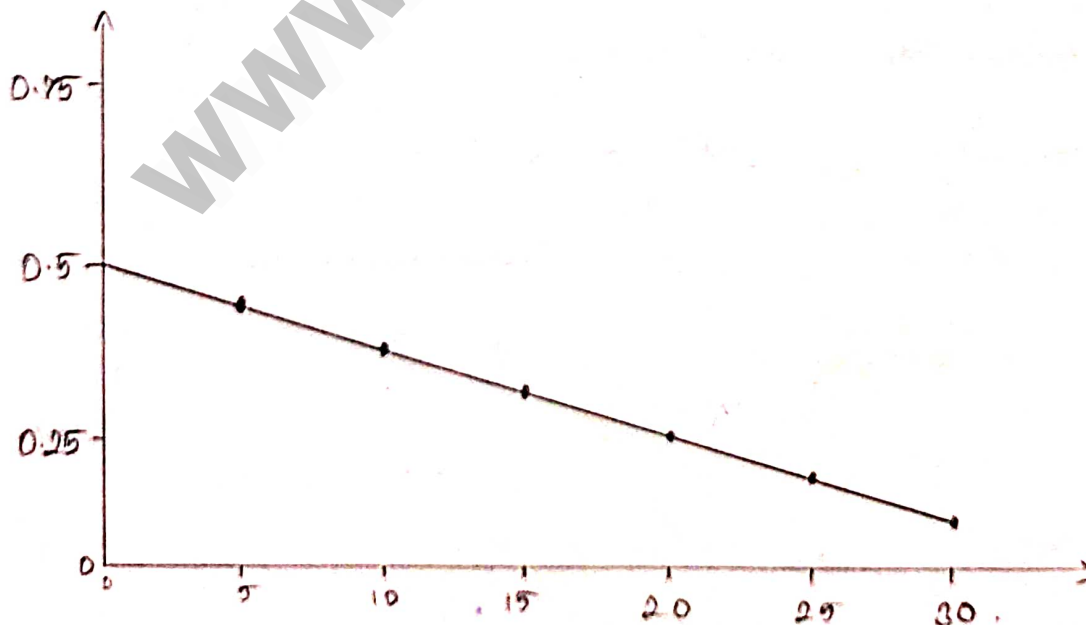Integrate both side:

$$-\int_{[A_0]}^{[A]} d[A] = k \int_0^t dt$$

$$-\left([A]\right)_{[A_0]}^{[A]} = k(t)_0^t$$

$$[A_0] - [A] = kt$$

$$k = \frac{[A_0] - [A]}{t}$$

$$[A] = -kt + [A_0]$$

$$y = c + mx.$$

37. a). i). Arrhenius equation:

$$k = Ae^{-(E_a/RT)}$$

A - frequency factor.

R - gas constant.

E_a = Activation energy.

T - Temperature.

ii). Rate constant for a first order reaction is $1.54 \times 10^{-3} \, s^{-1}$. Calculate its half life time.

Sol:

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

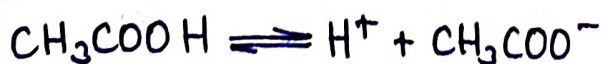Given: $k = 1.54 \times 10^{-3} \, s^{-1}$; $t_{1/2} = ?$

$$t_{1/2} = \frac{0.693}{1.54 \times 10^{-3}}$$

$$t_{1/2} = 450 \, s.$$

b). Ostwald definition:

    ● It states that, when dilution increases, the degree of dissociation of weak electrolyte also increases.

$$\alpha = \frac{\text{No. of moles dissociated}}{\text{Total no. of moles.}}$$

$$CH_3COOH \rightleftharpoons H^+ + CH_3COO^-$$

$$k_a = \frac{[H^+][CH_3COO^-]}{[CH_3COOH]}$$

b). Ostwald's dilution law (derivation):

	CH_3COOH	H^+	CH_3COO^-
Initial no. of moles.	1	-	-
Degree of dissociation	α	-	-
No. of moles at equilibrium	$1-\alpha$	α	α
Equilibrium concentration	$(1-\alpha)C$	αC	αC

$$k_a = \frac{\alpha C \alpha C}{(1-\alpha)C} \implies \frac{\alpha^2 C}{1-\alpha}.$$

(For weak electrolyte $\alpha << 1$)

$$(\because (1-\alpha) \approx 1).$$

$$k_a = \alpha^2 C$$

$$\alpha^2 = \frac{k_a}{C}$$

$$\boxed{\alpha = \sqrt{k_a/C}}$$

$$[H^+] = \alpha C$$

$$[H^+] = \sqrt{\frac{k_a}{C}} \times C$$

$$= \sqrt{\frac{k_a C^2}{C}}$$

$$[H^+] = \sqrt{k_a C}$$

Similarly for a weak base:

$$k_b = \alpha^2 C \quad ; \quad \left(\because \alpha = \sqrt{\frac{k_b}{C}}\right)$$
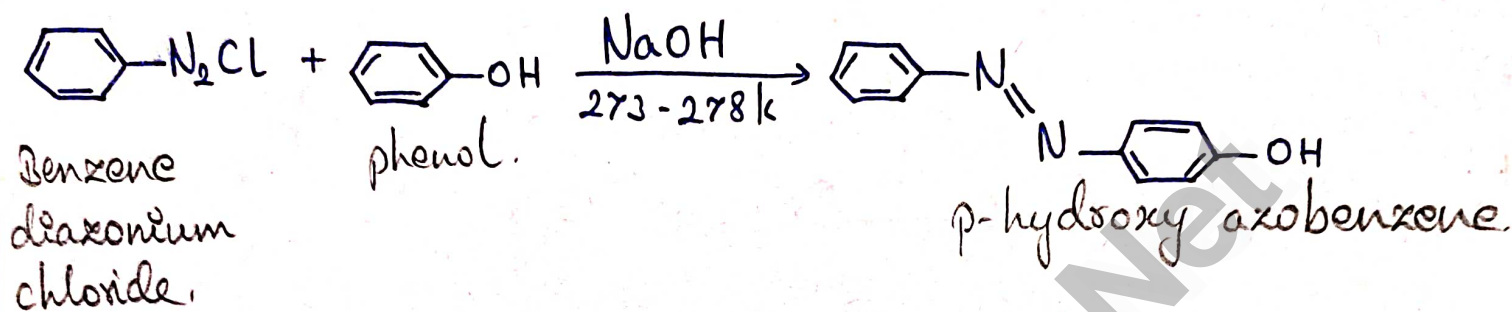
$$[OH^-] = \alpha C$$

$$= \sqrt{k_b/C} \times C$$

$$= \sqrt{\frac{k_b C^2}{C}}$$

$$[OH^-] = \sqrt{k_b C}$$

28. a).i)Coupling reaction of phenol:

  ①.Phenol couples with benzene diazonium chloride in an alkaline solution to form p-hydroxy azobenzene.
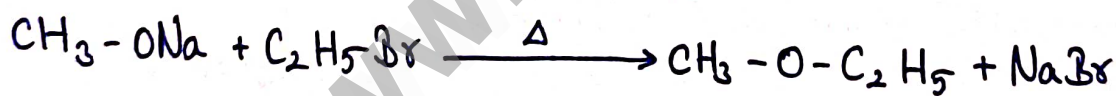

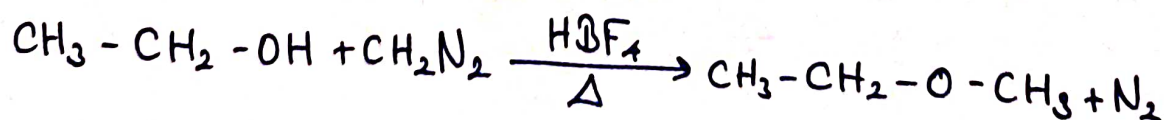Benzene diazonium chloride. phenol.   p-hydroxy azobenzene.

ii). Preparation of ethers:

1. Intermolecular dehydration of alcohol:

$$2CH_3-CH_2-OH \xrightarrow[413k]{conc. H_2SO_4} CH_3-CH_2-O-CH_2-CH_3 + H_2O.$$

2. Williamson ether synthesis:

$$CH_3-ONa + C_2H_5-Br \xrightarrow{\Delta} CH_3-O-C_2H_5 + NaBr$$

a. Methylation of alcohol:

$$CH_3-CH_2-OH + CH_2N_2 \xrightarrow[\Delta]{HBF_4} CH_3-CH_2-O-CH_3 + N_2$$
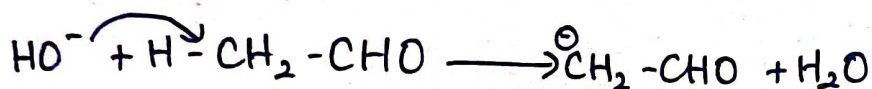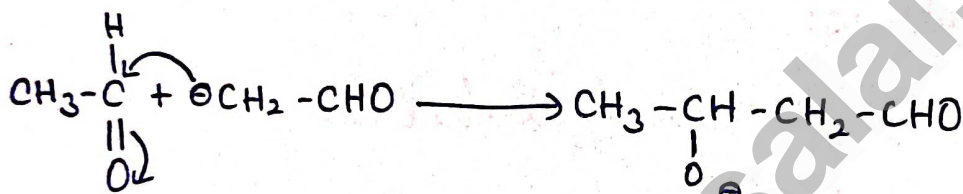
b). Mechanism of Aldol condensation:

&. In presence of dilute NaOH or KOH, two molecules of an aldehydes or ketone having α-hydrogen atoms add together to give β-hydroxy aldehyde (or) β-hydroxy ketone.

Mechanism:

Step: 1

$$HO^- + H\overset{\frown}{-}CH_2-CHO \longrightarrow \overset{\ominus}{C}H_2-CHO + H_2O$$

Step-2

$$CH_3-\underset{\underset{O\downarrow}{\overset{\|}{}}}{\overset{\overset{H}{|}}{C}} + \ominus CH_2-CHO \longrightarrow CH_3-\underset{\underset{\ominus}{\overset{|}{O}}}{\overset{|}{C}H}-CH_2-CHO$$

Step: 3

$$CH_3-\underset{\overset{|}{O_-}}{\overset{|}{C}H}-CH_2-CHO \xrightarrow{H-OH} CH_3-\underset{\overset{|}{O}\overset{}{H}}{\overset{|}{C}H}-CH_2-CHO + OH^-$$

3-Hydroxy Butanal.

$$CH_3-\underset{\overset{|}{OH}}{\overset{|}{C}H}-\underset{\overset{|}{H}}{\overset{|}{C}H}-CHO \xrightarrow[\triangle]{H^+} CH_3-CH=CH-CHO + H_2O.$$

Crotonaldehyde
(But-2-enal).

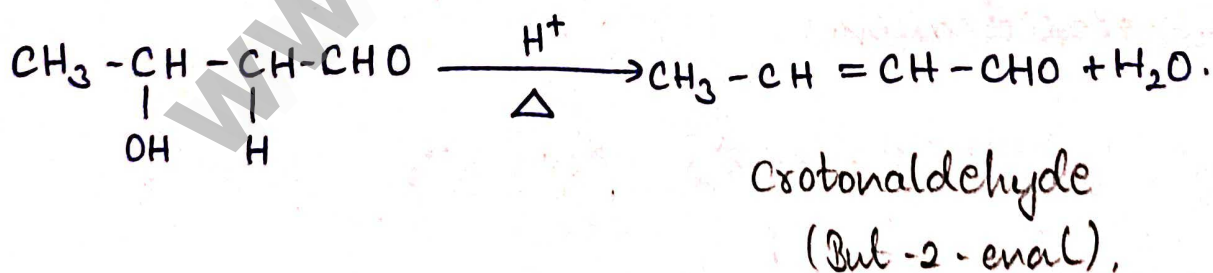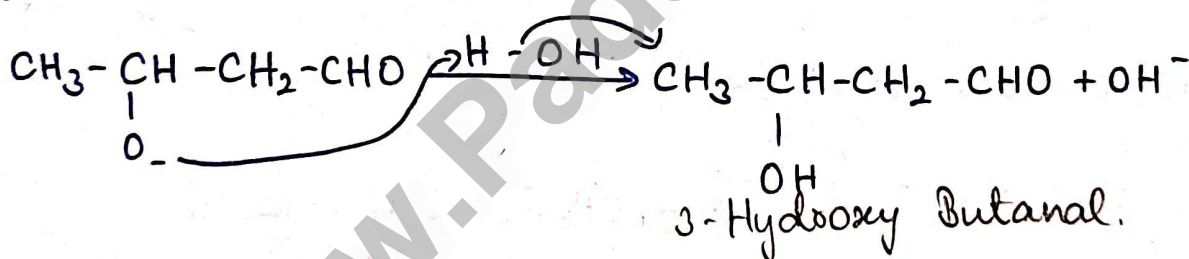M.Poovarasan M.Sc B.Ed
PG Asst in Chemistry
dharmapuri District