Class : 12

Register Number

COMMON QUARTERLY EXAMINATION 2023-24

Time Allowed : 3.00 Hours] **CHEMISTRY** **[Max. Marks : 70**

PART – A

I. Choose the correct answer. **15x1=15**

1. Which of the following plot gives Ellingham diagram
   a) Δs Vs T b) ΔG° Vs T c) ΔG° Vs $\frac{1}{T}$ d) ΔG° Vs T^2
2. Hybridization of Carbon in diamond is
   a) Sp^3 b) Sp^2 c) d Sp^2 d) d^2 Sp^3
3. Which of the following statements is not correct?
   a) Beryl is a cyclic silicate b) Mg_2SiO_4 is an orthosilicate
   c) $[SiO_4]^{4-}$ is the basic structural unit of silicates d) Feldspar is not aluminosilicate
4. The Molarity of given orthophosphoric acid solution is 2M, its normality is
   a) 6N b) 4N c) 2N d) None of these
5. **Assertion** : Ce^{4+} is used as an oxidizing agent is volumetric amalysis.
   Reason : Ce^{4+} has the tendency of attaining +3 Oxidation state.
   a) Both assertion and reason are true and reason is not 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
6. The Vacant Space in bcc lattice unit cell is
   a) 48% b) 23% c) 32% d) 26%
7. *Co - ordination number of body - centered cubic unit cell is*
   a) 6 b) 12 c) 8 d) 10
8. *The half life period of a radioactive element is 140 days. After 560 days, 1 g of element will be reduced to*
   a) $\left(\frac{1}{2}\right)$ g b) $\left(\frac{1}{4}\right)$ g c) $\left(\frac{1}{8}\right)$ g d) $\left(\frac{1}{16}\right)$ g
9. The decomposition of Phosphine (PH_3) on tungsten at low pressure is a first order reaction. It is because the
   a) rate is proportional to the surface coverage
   b) rate is inversely proportional to the surface coverage
   c) rate is independent of the surface coverage
   d) rate of decomposition is slow.
10. Equal volumes of three acid solutions of P^H,1,2 and 3 are mixed in a vessel. What will be the H^+ ion concentration in the mixture?
    a) 3.7×10^{-2} b) 10^{-6} c) 0.111 d) none of these
11. The P^H of Stomach acid is
    a) 11 b) 7 c) 3 d) 1
12. Carbolic acid is
    a) Phenol b) Picric acid c) benzoic acid d) Phenylacetic acid
13. The Substance which is used as an antifreeze in automobile rediator is
    a) Ethanol b) Ethylene glycol c) Glycerol d) Phenol
14. Which of the following represents the correct order of acidity in the given compounds.
    a) $FCH_2COOH > CH_3COOH > BrCH_2COOH > ClCH_2COOH$
    b) $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_3COOH$
    c) $CH_3COOH > ClCH_2COOH > FCH_2COOH > BrCH_2COOH$
    d) $ClCH_2COOH > CH_3COOH > BrCH_2COOH > ICH_2COOH$

15. In Rosenmund reaction ---------- acts as a catalytic poison.
a) $BaSO_4$ b) $CuSO_4$ c) $MgSO_4$ d) $ZnSO_4$

PART - B

II. Answer any six questions of the following. Question No. 20 is compulsory. **6x2=12**

16. Give the uses of Alum.
17. Show that phosphine act as a reducing agent.
18. What is Lanthanoid contraction?
19. Explain Bragg's equation.
20. Show that in case of first order reaction, the time required for 99.9% completion is nearly ten times the times required for half completion of the reaction.
21. State Oswald dilution law.
22. How will you convert ethylene glycol into 1, 4 dioxane?
23. Give the preparation urotropine.
24. Chloro acetic acid is stronger than acetic acid. Justify.

PART - C

III Answer any six questions of the following. Question No. 32 is compulsory. **6x3=18**

25. What are the differences between minerals and ores?
26. How is inorganic benzene is prepared?
27. Calculate the magnetic moment of Mn^{2+} ion?
28. Distinguish tetrahedral and octahedral voids.
29. Explain pseudo first order reaction with an example.
30. What are Lewis acids and bases? Give two example for each.
31. How will you prepare Tri nitro glycerine?
32. Identify A, B and C.

$$C_6H_5MgBr \xrightarrow{CO_2} A \xrightarrow[H_2O]{H^+} B \xrightarrow[FeBr_3]{Br_2} C$$

33. Write the tests for carboxylic acid group.

PART - D

IV Answer all the questions. **5x5=25**

34. (a) Write a short note on electrochemical principles of metallurgy. (5)

(OR)

(b) i) What happens when Boric acid is heated? (3)
ii) What is Inert pair effect? (2)

35. (a) How is potassium - di - chromate prepared? (5)

(OR)

(b) i) Explain the structure of Ammonia. (3)
ii) Give a reason to support that sulphuric acid is a dehydrating agent. (2)

36. (a) Calculate the percentage efficiency of packing in case of face centered cubic crystal. (5)

(OR)

(b) i) Mention the factors affecting the reaction rate. (2)
ii) Give three examples for zero order reaction. (3)

37. (a) (i) Discuss the Lowry - Bronsted concept of acids and bases. (3)
(ii) Define Buffer index. (2)

(OR)

(b) i) Write the differences between order and molecularity. (3)
ii) Write a note on Frenkel defect. (2)

38. (a) Write the mechanism of Aldol Condensation. (5)

(OR)

(b) i) Explain Kolbe's reaction. (3)
ii) Explain Dows process. (2)

SACRED HEART MATRICULATION HIGHER SECONDARY SCHOOL

COMMON QUARTERLY EXAM – SEPTEMBER 2023-24

STD: **12** **CHEMISTRY ANSWERKEY**

TIME: **180 MINUTES** MAXIMUM MARKS: **70**

PART – A

I. ***Answer all the questions. Choose the correct answer from the given four alternatives and write the option code and the corresponding answer.*** **(15x1=15)**

1. b) ΔG° vs T
2. a) SP^3
3. d) Feldspar is not aluminosilicate
4. a) 6N
5. a) Both assertion and reason are true and reason is the correct explanation of assertion
6. c) 32%
7. c) 8
8. d) (1/16)g
9. c) rate is independent of the surface coverage
10. a) 3.7×10^{-2}
11. d) 1
12. a) Phenol
13. b) Ethylene glycol
14. b) $FCH_2COOH > ClCH_2COOH > BrCH_2COOH > CH_3COOH$
15. a) $BaSO_4$

PART – B

II. ***Answer any six questions. Question No.20 is compulsory.*** **(6x2=12)**

16. Give the uses of Alum.

- It is used for purification of water. It is also used for water proofing and textiles
- It is used in dyeing, paper and leather tanning industries
- It is employed as a styptic agent to arrest bleeding.

17. Show that phosphine act as a reducing agent.

Phosphine shows reducing agent in the reaction with some metal compounds. For example, Phosphine reacts with $AgNO_3$ to reduce and produce precipitates of Ag_3P (silver phosphide).

$$3AgNO_3 + PH_3 \longrightarrow Ag_3P + 3HNO_3$$

18. What is Lanthanoid contraction?

As we move across 4f series, the atomic and ionic radii of lanthanoids show gradual decrease with increse in atomic number. This decrese in ionic size is called **lanthanoid contraction**.

19. Explain Bragg's equation.

The fundamental equation that gives a simple relation between the wavelength of the X-rays, the interplanar distance in the crystal and the angle of reflection is known as **Bragg's equation**.

$$n\lambda = 2d \sin \theta$$

where **n** is the order of reflection, **λ** is the wavelength of X-rays, **d** is the interplanar distance in crystal, **Θ** is the angle of reflection.

20. Show that in case of first order reaction, the time required for 99.9% completion is nearly ten times the time required for half completion of the reaction.

Let

$[A_0] = 100;$

when $t = t_{99.9\%}$; $[A] = (100-99.9) = 0.1$

$$k = \frac{2.303}{t}\log\left(\frac{[A_0]}{[A]}\right)$$

$$t_{99.9\%} = \frac{2.303}{k}\log\left(\frac{100}{0.1}\right)$$

$$t_{99.9\%} = \frac{2.303}{k}\log 1000$$

$$t_{99.9\%} = \frac{2.303}{k}(3)$$

$$t_{99.9\%} = \frac{6.909}{k}$$

$$t_{99.9\%} \simeq 10 \times \frac{0.69}{k}$$

$$t_{99.9\%} \simeq 10\, t_{1/2}$$

21. State Ostwald dilution law.

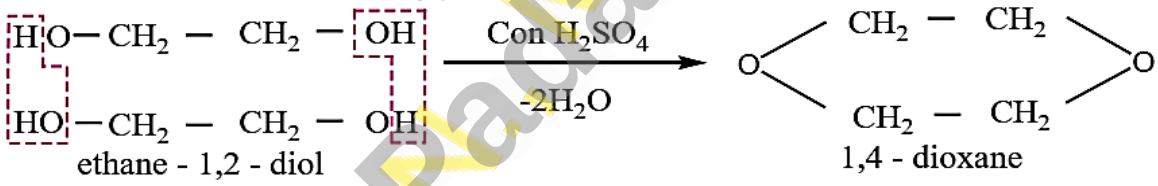
Ostwald's dilution law relates the dissociation constant of the weak acid (Ka) with its degree of dissociation (α) and the concentration (c).

Degree of dissociation (α) is the fraction of the total number of moles of a substance that dissociates at equilibrium.

$$\alpha = \frac{Number\ of\ moles\ dissociated}{total\ number\ of\ moles}$$

22. How will you convert ethylene glycol into 1,4 dioxane?

When distilled with Conc.H_2SO_4, glycol forms dioxane



ethane - 1,2 - diol

1,4 - dioxane

23. Give the preparation Urotropine.

Formaldehyde reacts with ammonia to form hexa methylene tetramine, which is also known as **Urotropine**.

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

Formaldehyde — Hexamethylene tetramine

24. Chloro acetic acid is stronger than acetic acid. Justify.

- Acidity increases with increasing electronegativity of the substituents.
- For Example,

$$FCH_2COOH > ClCH_2COOH > BrCH_2COOH > ICH_2COOH > CH_3COOH$$

- Acidity increases with increasing number of electron – withdrawing substituents on the α-carbon.
- For Example,

$$Cl_3CCOOH > Cl_2CHCOOH > ClCH_2COOH > CH_3COOH$$

- Therefore, chloro acetic acid is stronger than acetic acid.

PART – C

III. ***Answer any six questions. Question No.32 is compulsory.*** **(6x3=18)**

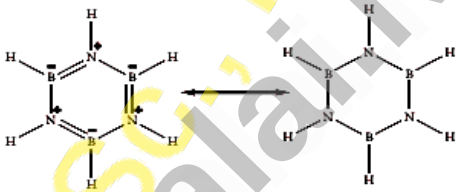
25. What are the differences between minerals and ored?

Minerals	Ores
A naturally occurring substance obtained by mining which contains the metal in free state or in the form of compounds.	Ore contains a high percentage of metal, from which it can be extracted conveniently and economically.
All minerals are not ores	All ores are Minerals
It contains a low percentage of metal	It contains a high percentage of metals
Ex: Mineral of Al is bauxite and china clay	**Ex:** Ore of Al is bauxite

26. How is inorganic benzene is prepared?

Borozole or **Borazine** is known as Inorganic benzene. When treated with excess ammonia at low temperatures diborane gives diboranediammonate. On heating at higher temperatures it gives inorganic benzene (borazole).

$$3B_2H_6 + 6NH_3 \xrightarrow{-153\ K} 3(B_2H_6.2NH_3)\ (or)\ 3[BH_2(NH_3)_2]^+[BH_4]^-$$

$$3B_2H_6+2NH_3 \xrightarrow[\text{Clossed vessel}]{\text{High temp}}$$  $$+12H_2$$

$2B_3N_3H_6$ (Borazole or Borazine - Inorganic benzene)

27. Calculate the magnetic moment of Mn^{2+} ion?

Mn (Z = 25). Electronic configuration [Ar] $3d^5\ 4s^2$

Mn^{2+} – Electronic configuration [Ar] $3d^5$

So, the number of unpaired electrons in Mn^{2+} is 5.

Spin only magnetic moment $\mu_s = \sqrt{n(n+2)}$

$$\mu_s = \sqrt{5(5+2)} = \sqrt{35} = 5.92\ BM$$

28. Distinguish tetrahedral and octahedral voids.

Tetrahedral voids	Octahedral voids
When a sphere of second layer (b) is above the void (x) of the first layer (a), tetrahedral void is formed.	When the voids (y) in the first layer (a) are partially covered by the spheres of layer (b), octahedral void is formed.
If the number of close packed sphere be 'n' then, the number of tetrahedral voids generated is equal to 2n.	If the number of close packed sphere be 'n' then, the number of octahedral voids generated is equal to n.
This constitutes four spheres, three on the lower (a) and one in the upper layer (b)	This constitutes six spheres, three on the lower (a) and three in the upper layer (b)
When the centres of these four spheres are joined, a tetrahedron is formed.	When the centres of these six spheres are joined, a octahedron is formed.
The coordination number is 4.	The coordination number is 6.

29. Explain pseudo first order reaction with an example.

Kinetic study of a higher order reaction is difficult to follow, for example, in a study of a second order reaction involving two different reactants; the simultaneous measurement of change in the concentration of both the reactants is very difficult. To overcome such difficulties, a second

order reaction can be altered to a first order reaction by taking one of the reactant in large excess, such reaction is called pseudo first order reaction. Let us consider the acid hydrolysis of an ester,

$$CH_3COOCH_3\ (aq) + H_2O\ (l) \xrightarrow{H^+} CH_3COOH\ (aq) + CH_3OH\ (aq)$$

$$\text{Rate} = k\ [CH_3COOCH_3]\ [H_2O]$$

If the reaction is carried out with the large excess of water, there is no significant change in the concentration of water during hydrolysis. i.e., concentration of water remains almost a constant. Now, we can define $k\ [H_2O] = k'$; Therefore the above rate equation becomes

$$\text{Rate} = k'\ [CH_3COOCH_3]$$

Thus it follows first order kinetics.

30. What are Lewis acids and bases? Give two example for each.

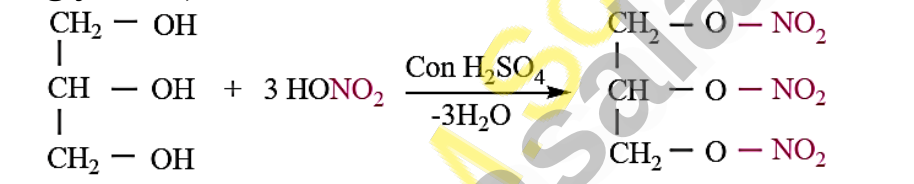
Lewis Acid: A Lewis acid is a positive ion (or) an electron deficient molecule

Example, **BF_3, $AlCl_3$, BeF_2**

Lewis base: A Lewis base is a anion (or) neutral molecule with at least one lone pair of electrons. Example, **NH_3, R-NH_2, F^-, Cl^-**

31. How will you prepare Tri nitro glycerine?

Glycerol reacts with concentrated nitric acid in the presence of concentrated sulphuric acid to form **TNG** (**tri**nitro**g**lycerine).



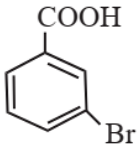
Propan - 1,2,3 - triol
glycerol

1,2,3 - trinitroxy propane

32. Identify A, B and C.

$$C_6H_5MgBr \xrightarrow{CO_2} A \xrightarrow{H^+/H_2O} B \xrightarrow{Br_2/FeBr_3} C$$

$$C_6H_5MgBr \xrightarrow{CO_2} C_6H_5COOMgBr \xrightarrow{H^+/H_2O} C_6H_5COOH \xrightarrow{Br_2/FeBr_3}$$



A- Bromido(phenyl)magnesium, **B-** benzoic acid, **C-** m - bromo benzoic acid

33. Write the tests for carboxylic acid group.

- In aqueous solution carboxylic acid turn blue litmus red.
- Carboxylic acids give brisk effervescence with sodium bicarbonate due to the evolution of carbon-di -oxide.
- When carboxylic acid is warmed with alcohol and Con H_2SO_4 it forms an ester, which is detected by its fruity odour.

PART – D

IV. *Answer all the questions.* **(5x5=25)**

34.(a) Write a short note on electrochemical principles of metallurgy. (5)

- Electrolytic refining is carried out in an electrolytic cell

  Cathode : Thin strips of pure metal **Anode** : Impure metal

  Electrolyte : Acidified aqueous solution of salt of the metal.
- The metal of interest dissolves from the anode, pass into the solution while the same amount of metal ions from the solution will be deposited at the cathode.

- During electrolysis, the less electropositive impurities in the anode, settle down at the bottom and are removed as anode mud.
- Electrolytic refining of silver as an example.

Cathode : Pure silver **Anode** : Impure silver rods

Electrolyte : Acidified aqueous solution of silver nitrate.

- When a current is passed through the electrodes the following reactions will take place

Reaction at anode $Ag(s) \longrightarrow Ag^{+}(aq) + 1e^{-}$

Reaction at cathode $Ag^{+}(aq) + 1e^{-} \longrightarrow Ag(s)$

- During electrolysis, at the anode the silver atoms lose electrons and enter the solution.
- The positively charged silver cations migrate towards the cathode and get discharged by gaining electrons and deposited on the cathode.

(OR)

(b) (i) What happens when Boric acid is heated? (3)

Boric acid when heated at 373 K gives metaboric acid and at 413 K, it gives tetraboric acid. When heated at red hot, it gives boric anhydride which is a glassy mass.

$$4H_3BO_3 \xrightarrow{373\ K} 4HBO_2 + 4H_2O$$
$$4HBO_2 \xrightarrow{413\ K} H_2B_4O_7 + H_2O$$
$$H_2B_4O_7 \xrightarrow{\text{Red hot}} 2B_2O_3 + H_2O$$

(ii) What is Inert pair effect? (2)

In heavier post transition metals, the outer ***s*** electrons (***ns***) have a tendency to remain inert and show reluctance as inert pair effect.

35.(a) How is potassium di chromate prepared? (5)

- **Important Ore:** $K_2Cr_2O_7$ is prepared from chromite–Iron ore, or Chromite ore.
- **Concentration method:** The ore is converted by gravity separation
- Conversion of chromite iron ore into sodium chromate.

$$4\,FeCr_2O_4 + 8\,Na_2CO_3 + 7\,O_2 \xrightarrow{900 - 1000^0C} 8\,Na_2CrO_4 + 2\,Fe_2O_3 + 8\,CO_2\uparrow$$

- Conversion of sodium chromate into sodium dichromate:

$$\underset{\text{sodium chromate (yellow)}}{2Na_2CrO_4} + H_2SO_4 \longrightarrow \underset{\text{sodium dichromate (orange red)}}{Na_2Cr_2O_7} + Na_2SO_4 + H_2O$$

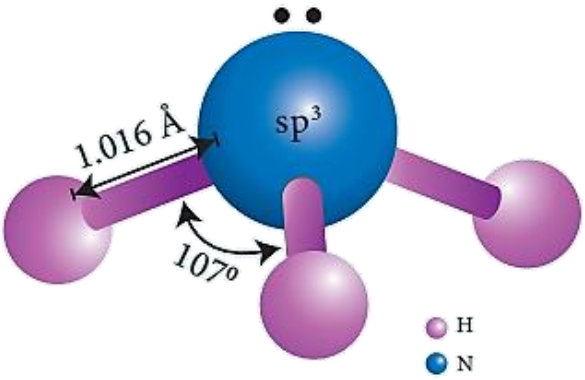
- Conversion of sodium dichromate into potassium dichromate :

$$\underset{\text{sodium dichromate (orange red)}}{Na_2Cr_2O_7} + 2KCl \longrightarrow \underset{\text{potassium dichromate (orange red)}}{K_2Cr_2O_7} + 2NaCl$$

(OR)

(b) (i) Explain the structure of Ammonia. (3)

- Ammonia molecule is pyramidal in shape N-H bond distance is 1.016 Å and H-H bond distance is 1.645 Å with a bond angle 107°.
- The structure of ammonia may be regarded as a tetrahedral with one lone pair of electrons in one tetrahedral position hence it has a pyramidal shape.



(ii) Give a reason to support that sulphuric acid is a dehydrating agent. (2)

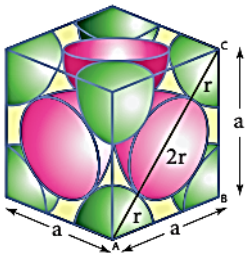
- Sulphuric acid is highly soluble in water. It has strong affinity towards water
- Hence it can be used as a dehydrating agent.
- When dissolved in water it forms mono ($H_2SO_4.H_2O$) and di ($H_2SO_4.2H_2O$) hydrates and the reaction is exothermic. The dehydration property can also be illustrated by its reaction with organic compounds such as sugar, oxalic acid and formic acid.

$$\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2SO_4 \longrightarrow 12C + H_2SO_4.11H_2O$$

$$\underset{\text{Formic acid}}{HCOOH} + H_2SO_4 \longrightarrow CO + H_2SO_4.H_2O$$

$$\underset{\text{Oxalic acid}}{(COOH)_2} + H_2SO_4 \longrightarrow CO + CO_2 + H_2SO_4.H_2O$$

36.(a) Calculate the percentage efficiency of packing in case of face centred cubic crystal. (5)



From the figure

$AC = 4r$

$4r = a\sqrt{2}$

$r = \frac{a\sqrt{2}}{4}$

In ΔABC

$AC^2 = AB^2 + BC^2$

$AC = \sqrt{AB^2 + BC^2}$

$AC = \sqrt{a^2 + a^2} = \sqrt{2a^2} = \sqrt{2}\ a$

Volume of the sphere with radius r is

$$= \frac{4}{3}\pi\left(\frac{\sqrt{2}a}{4}\right)^3 = \frac{4}{3}\pi\left(\frac{2\sqrt{2}a^3}{64}\right)$$

$$= \frac{\sqrt{2}\ \pi a^3}{24}$$

Total number of spheres belongs to a single fcc unit cell is 4

$$\therefore \text{ the volume of all spheres in a fcc unit cell} = 4 \times \left(\frac{\sqrt{2}\ \pi a^3}{24}\right) = \left(\frac{\sqrt{2}\ \pi a^3}{6}\right)$$

$$\text{packing efficiency} = \frac{\left(\frac{\sqrt{2}\ \pi\ a^3}{6}\right)}{\left(a^3\right)} \times 100$$

$$= \frac{\sqrt{2}\ \pi}{6} \times 100$$

$$= \frac{1.414 \times 3.14 \times 100}{6}$$

$$= 74\%$$

(OR)

(b) (i) Mention the factors affecting the reaction rate. (2)

The rate of a reaction is affected by the following factors.

Nature and state of the reactant, Concentration of the reactant, Surface area of the reactant, Temperature of the reaction, Presence of a catalyst

(ii) Give three examples for zero order reaction. (3)

- Photochemical reaction between H_2 and I_2

$$H_2(g) + Cl_2(g) \xrightarrow{h\nu} 2HCl(g)$$

- Decomposition of N2O on hot platinum surface

$$N_2O(g) \rightleftharpoons N_2(g) + \frac{1}{2}O_2(g)$$

- Iodination of acetone in acid medium is zero order with respect to iodine.

$$CH_3COCH_3 + I_2 \xrightarrow{H^+} ICH_2COCH_3 + HI$$

37.(a) (i) Discuss the Lowry-Bronsted concept of acids and bases. (3)

According to their concept, an acid is defined as a substance that has a tendency to donate a proton to another substance and base is a substance that has a tendency to accept a proton

from other substance. In other words, an acid is a proton donor and a base is a proton acceptor.

When hydrogen chloride is dissolved in water, it donates a proton to the later. Thus, HCl behaves as an acid and H_2O is base. The proton transfer from the acid to base can be represented as

$$HCl + H_2O \rightleftharpoons H_3O^+ + Cl^-$$

When ammonia is dissolved in water, it accepts a proton from water. In this case, ammonia (NH_3) acts as a base and H_2O is acid. The reaction is represented as

$$H_2O + NH_3 \rightleftharpoons NH_4^+ + OH^-$$

Let us consider the reverse reaction in the following equilibrium

$$\underset{\text{Proton donar (acid)}}{HCl} + \underset{\text{Proton acceptor (Base)}}{H_2O} \rightleftharpoons \underset{\text{Proton donar (acid)}}{H_3O^+} + \underset{\text{Proton acceptor (Base)}}{Cl^-}$$

H_3O^+ donates a proton to Cl^- to form HCl i.e., the products also behave as acid and base.

In general, Lowry – Bronsted (acid – base) reaction is represented as

$$Acid_1 + Base_2 \rightleftharpoons Acid_2 + Base_1$$

The species that remains after the donation of a proton is a base ($Base_1$) and is called the conjugate base of the Bronsted acid ($Acid_1$). In other words, chemical species that differ only by a proton are called conjugate acid – base pairs.

Conjugate acid - base pair

$$\underset{\text{Proton donar (acid)}}{HCl} + \underset{\text{Proton acceptor (Base)}}{H_2O} \rightleftharpoons \underset{\text{Proton donar (acid)}}{H_3O^+} + \underset{\text{Proton acceptor (Base)}}{Cl^-}$$

Conjugate acid - base pair

HCl and Cl^-, H_2O and H_3O^+ are two conjugate acid – base pairs. i.e., Cl^- is the conjugate base of the acid HCl . (or) HCl is conjugate acid of Cl^-. Similarly H_3O^+ is the conjugate acid of H_2O.

(ii) Define Buffer index. (2)

The buffering ability of a solution can be measured in terms of buffer capacity. Vanslyke introduced a quantity called buffer index, β, as a quantitative measure of the buffer capacity. It is defined as the number of gram equivalents of acid or base added to 1 litre of the buffer solution to change its pH by unity.

$$\beta = \frac{dB}{d(pH)}$$

Here,

dB = number of gram equivalents of acid / base added to one litre of buffer solution.

d(pH) = The change in the pH after the addition of acid / base.

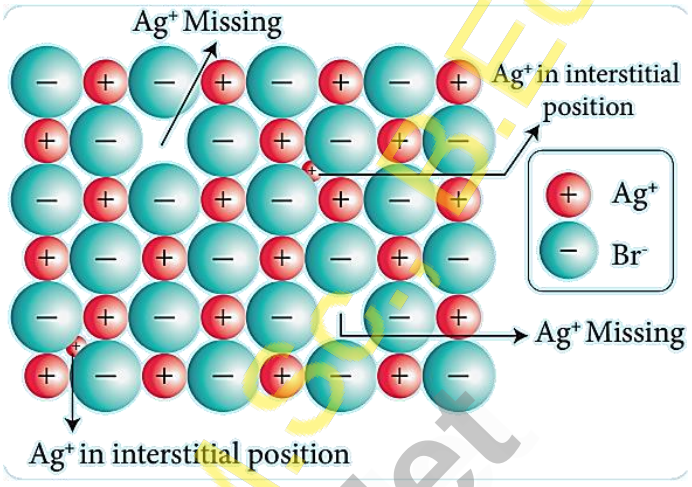
(OR)

(b) (i) Write the differences between order and molecularity. (3)

S.No.	Order of a reaction	Molecularity of a reaction
1	It is the sum of the powers of concentration terms involved in the experimentally determined rate law.	It is the total number of reactant species that are involved in an elementary step.

2	It can be zero (or) fractional (or) integer	It is always a whole number, cannot be zero or a fractional number.
3	It is assigned for a overall reaction.	It is assigned for each elementary step of mechanism.

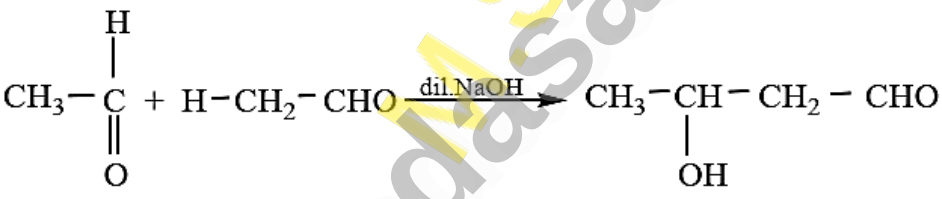
(ii) Write a note on Frenkel defect. (2)



- Frenkel defect arises due to the dislocation of ions from its crystal lattice.
- The ion which is missing from the lattice point occupies an interstitial position.
- This defect is shown by ionic solids in which cation and anion differ in size. Unlike Schottky defect, this defect does not affect the density of the crystal.
- For example AgBr, in this case, small Ag^+ ion leaves its normal site and occupies an interstitial position.

38.(a) Write the Mechanism of Aldol condensation. (5)

The carbon attached to carbonyl carbon is called α - carbon and the hydrogen atom attached to α - carbon is called α - hydrogen.

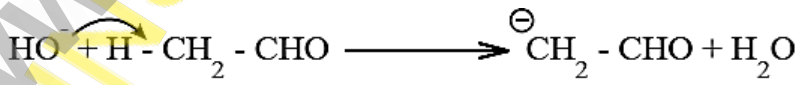


Acetaldehyde — Acetaldol (3 - Hydroxy butanal)

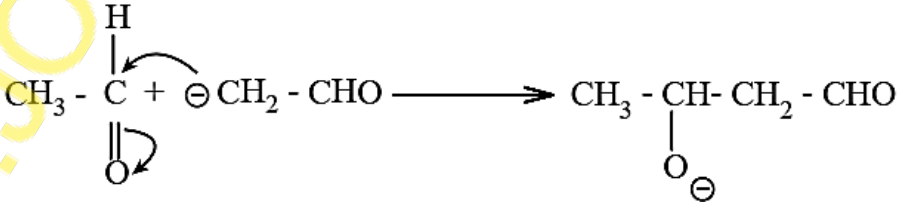
Mechanism

The mechanism of aldol condensation of acetaldehyde takes place in three steps.

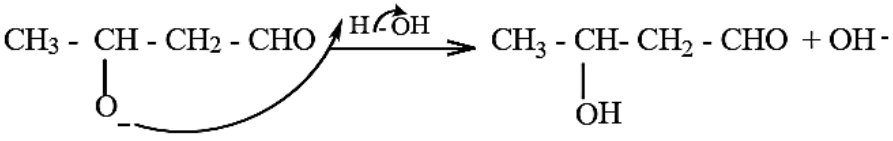
Step 1 : The carbanion is formed as the α - hydrogen atom is removed as a proton by the base.



Step 2 : The carbanion attacks the carbonyl carbon of another unionized aldehyde to form an alkoxide ion.

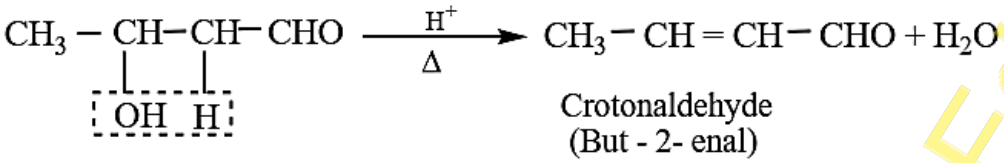


Step 3 : The alkoxide ion formed is protonated by water to form aldol.



3-Hydroxy butanal

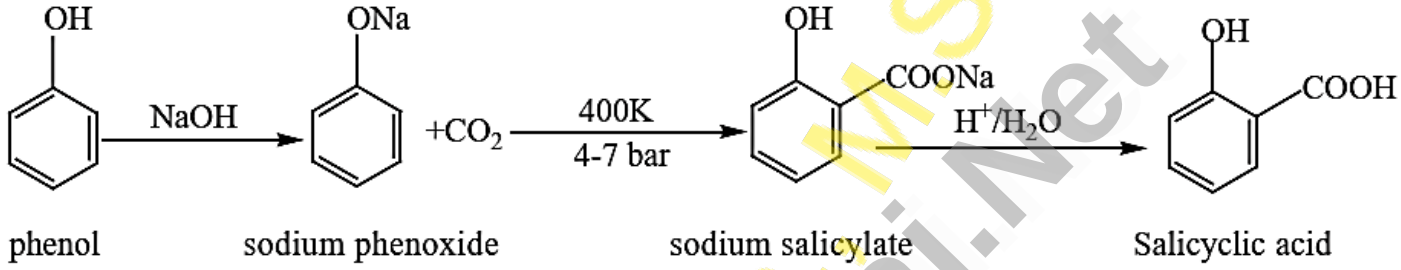
The aldol rapidly undergoes dehydration on heating with acid to form α - β unsaturated aldehyde.



(OR)

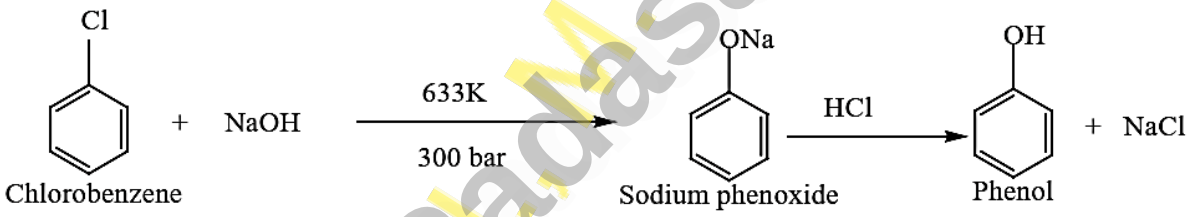
(b) (i) Explain Kolbe's reaction. (3)

In this reaction, phenol is first converted into sodium phenoxide which is more reactive than phenol towards electrophilic substitution reaction with CO_2. Treatment of sodium phenoxide with CO_2 at 400K, 4-7 bar pressure followed by acid hydrolysis gives salicylic acid.



(ii) Explain Dow's process. (2)

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.



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