

HIGHER SECONDARY SECOND YEAR PUBLIC EXAMINATION

MARCH - 2023

CHEMISTRY – ANSWER KEY

PART-I

Note : i) Answer all the questions.

[15x1=15]

ii) Choose the most appropriate answer from the given four alternatives and write the option code and the corresponding answer

TYPE-A

TYPE-B

1. (c) Antacid
2. (c) Activation energy
3. (b) Al
4. (c) $[\text{Cu}(\text{NH}_3)_4]^{2+}$
5. (d) Gel-butter
6. (d) HCl
7. (a) sp^2
8. (d) +3
9. (c) Both assertion and reason are false
10. (c) Rn
11. (b) 0
12. (a) NaCl
13. (a) Uracil
14. (b) Ethane-1,2-diol
15. (a) Schiff's base

- (a) NaCl
- (a) Uracil
- (c) Antacid
- (d) +3
- (b) Ethane-1,2-diol
- (a) sp^2
- (b) Al
- (a) Schiff's base
- (b) 0
- (c) $[\text{Cu}(\text{NH}_3)_4]^{2+}$
- (c) Activation energy
- (d) HCl
- (c) Both assertion and reason are false
- (c) Rn
- (d) Gel-butter

PART-II

Answer any six of the following questions. Question no.24 is compulsory. [6 x 2 = 12]

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

- Sulphide ores can be concentrated by froth floatation method.
 - Galena (PbS),
 - Zinc blende (ZnS)

17. Write the uses of Silicones.

- Silicones are used for low temperature lubrication and in vacuum pumps, high temperature oil baths etc...
- They are used for making water proofing clothes
- They are used as insulting material in electrical motor and other appliances
- They are mixed with paints and enamels to make them resistant towards high temperature, sunlight, dampness and chemicals.

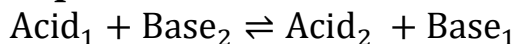
18. Define the term central atom in coordination compounds

- The central atom/ion is the one that occupies the central position in a coordination entity and binds other atoms or groups of atoms (ligands) to itself, through a coordinate covalent bond.

19. Calculate the number of atoms in an fcc unit cell.

$$\text{Number of atoms in fcc unit cell} = \frac{N_c}{8} + \frac{N_f}{2} = \frac{8}{8} + \frac{6}{2} = 1 + 3 = 4$$

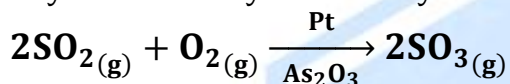
20. What is conjugate acid – base pairs?



- 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).
- Chemical species that differ only by a proton are called conjugate acid – base pairs.

21. Write a note on catalytic poison

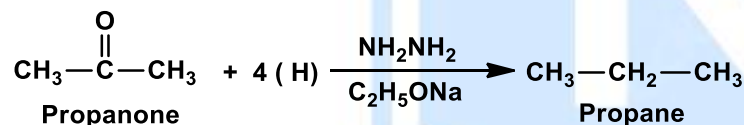
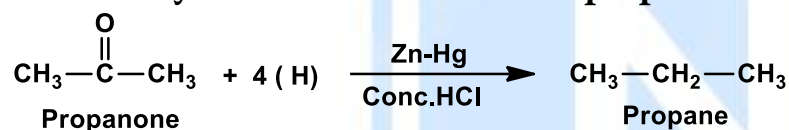
- Certain substances when added to a catalysed reaction either decreases or completely destroys the activity of a catalyst is known as catalytic poisons.



❖ Catalyst - Pt

❖ Catalytic poison – As_2O_3 .

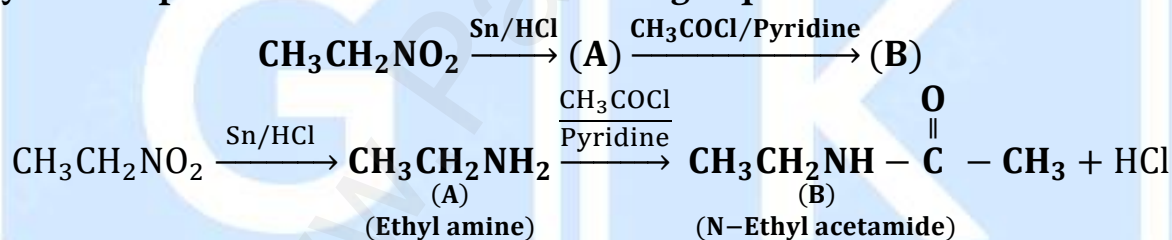
22. How will you convert acetone into propane



23. What are hormones? Give examples.

- Hormone is an organic substance that is secreted by one tissue. It limits the blood stream and induces a physiological response in other tissues.
- It is an intercellular signaling molecule.
- Example: Insulin, estrogen

24. Identify the compounds A and B in the following sequence of reaction.



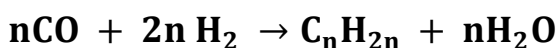
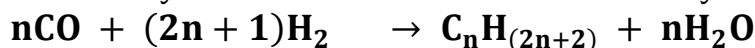
Compound	Formula	Name
A	$\text{CH}_3\text{CH}_2\text{NH}_2$	Ethyl amine
B	$\text{CH}_3\text{CH}_2\text{NH} - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_3$	N-Ethyl acetamide

PART-III

Answer any six of the following questions. Question no.33 is compulsory. [6 x 3 = 18]

25. Explain the FischerTropsch synthesis

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



26. Compare lanthanides and actinides.

Lanthanoids	Actinoids
Differentiating electron enters in 4f orbital	Differentiating electron enters in 5f orbital
Binding energy of 4f orbitals are higher	Binding energy of 5f orbitals are lower
They show less tendency to form complexes	They show greater tendency to form complexes
Most of the lanthanoids are colourless	Most of the actinoids are coloured
They are not form oxocations.	They are form oxocations.
Besides +3 oxidation states lanthanides show +2 and +4 oxidation state.	Besides +3 oxidation states actinides show +4, +5, +6 and +7 oxidation state.

27. In the complex, $[\text{Pt}(\text{NO}_2)(\text{H}_2\text{O})(\text{NH}_3)_2]$ identify the following

i. Central metal atom/ion ii. Coordination number

iii. Oxidation state of metal ion

- Central metal atom/ion = Pt^{+2}
- Coordination number = 4
- Oxidation state of metal ion = +2

28. What is Helmholtz double layer?

- The surface of colloidal particle adsorbs one type of ion due to preferential adsorption.
- This layer attracts the oppositely charged ions in the medium and hence at the boundary separating the two electrical double layers are setup. This is called as Helmholtz electrical double layer.

29. State Faraday's Laws of electrolysis.

Faraday's First Law

- The mass of the substance (m) liberated at an electrode during electrolysis is directly proportional to the quantity of charge (Q) passed through the cell.

$$m \propto Q \quad m = Z It$$

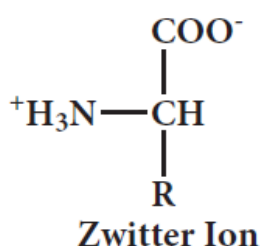
Faraday's Second Law

- When the same quantity of charge is passed through the solutions of different electrolytes, the amount of substances liberated at the respective electrodes are directly proportional to their electrochemical equivalents.

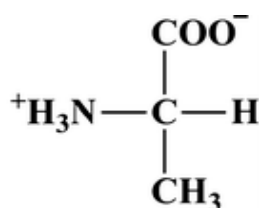
$$m_{\text{Ni}} \propto Z_{\text{Ni}} m_{\text{Cu}} \propto Z_{\text{Cu}} m_{\text{Co}} \propto Z_{\text{Co}} \quad \frac{m_{\text{Ni}}}{Z_{\text{Ni}}} = \frac{m_{\text{Cu}}}{Z_{\text{Cu}}} = \frac{m_{\text{Co}}}{Z_{\text{Co}}}$$

30. Give the structure of Zwitter ion.

- In aqueous solution the proton from carboxyl group can be transferred to the amino group of an amino acid leaving these groups with opposite charges.
- Despite having both positive and negative charges this molecule is neutral and has amphoteric behaviour. These ions are called zwitter ions.

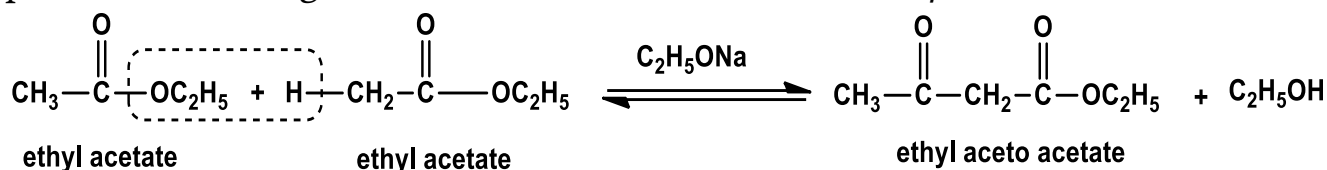


OR



31. How will you convert ethyl acetate to ethyl acetoacetate?

Esters containing at least one α -hydrogen atom undergo self condensation in the presence of a strong base such as sodium ethoxide to form β -keto ester.



32. What are food preservatives? Give two examples.

- Preservatives are capable of inhibiting retarding or arresting the process of fermentation acidification or other decomposition of food by growth of microorganisms.

Examples: Acetic acid, Sodium metasilphite, Benzoic acid, sorbic acid

33. Show that in case of first order reaction, the time required for completion of 99 % twice the times the time required for completion of 90% of the reaction.

$$t_{99\%} = \frac{2.303}{k_1} \log \frac{100}{100 - 99} = \frac{2.303}{k_1} \log 100$$

$$t_{90\%} = \frac{2.303}{k_1} \log \frac{100}{100 - 90} = \frac{2.303}{k_1} \log 10$$

$$\frac{t_{99\%}}{t_{90\%}} = \frac{\log 100}{\log 10} = \frac{2.0}{1.0} = 2$$

$$t_{99\%} = 2 t_{90\%}$$

PART-IV

Answer all the questions.

[5 x 5 = 25]

34. a) (i) Explain zone refining process with an example

- The principle is **Fractional crystallisation**.
- When an impure metal is melted and allowed to solidify, the impurities will prefer to remain in the molten region. Impurities are more soluble in the melt than in the solid state metal.
- The impure metal is taken in the form of a rod.
- One end of the rod is heated using a mobile induction heater, melting the metal on that portion of the rod.
- When the heater is slowly moved to the other end pure metal crystallises while impurities will move on to the adjacent molten zone formed due to the movement of the heater.
- As the heater moves further away, the molten zone containing impurities also moves along with it.
- This process is repeated several times by moving the heater in the same direction again and again to achieve the desired purity level.
- This process is carried out in an **inert gas atmosphere** to prevent the **oxidation** of metals.
- Germanium, Silicon and Gallium** which are used as semiconductor are refined by this process.

(OR)

b) (i) Give the oxidation state of halogen in the following. a) OF_2 b) I_2O_4

a) OF_2

- Fluorine shows only -1 oxidation state.

$$\text{F} = -1$$

b) I_2O_4

$$2x + 4(-2) = 0$$

$$2x - 8 = 0$$

$$2x = 8$$

$$x = 4$$

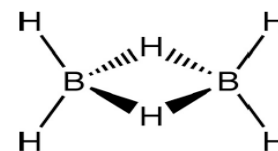
Oxidation state of Iodine is +4

(ii) Complete the following reactions



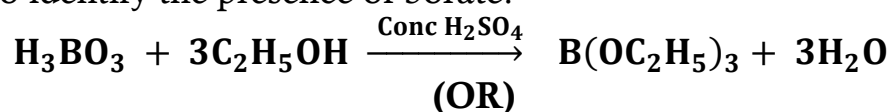
35. a) (i) Explain the Structure of diborane

- In diborane two BH_2 units are linked by two bridged hydrogens.
- It has eight B-H bonds.
- Diborane has only 12 valance electrons and are not sufficient to form normal covalent bonds.
- The four terminal B-H bonds are normal covalent bonds (2c-2e bond).
- The remaining four electrons to be used for the bridged bonds (3c-2e bond).
- In diborane, the boron is sp^3 hybridised.
- Three of the four sp^3 hybridised orbitals contains single electron and the fourth orbital is empty.
- Two of the half-filled hybridised orbitals of each boron overlap with the two hydrogens to form four terminal 2c-2e bonds, leaving one empty and one half filled hybridised orbitals on each boron.
- 3c-2e bonds, B-H-B bond formation involves overlapping the half-filled hybridised orbital of one boron, the empty hybridised orbital of the other boron and the half filled 1s orbital of hydrogen.



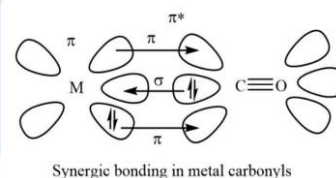
(ii) Write the Ethyl borate test

- When boric acid or borate salt is heated with ethyl alcohol in presence of conc. sulphuric acid, an ester, trialkylborate is formed.
- The vapour of this ester burns with a green edged flame and this reaction is used to identify the presence of borate.



b) (i) **Discuss the nature of bonding in metal carbonyls.**

- The bond between metal atom and the carbonyl ligand consists of two components.
- An electron pair donation from the carbon atom of carbonyl ligand into a vacant d-orbital of central metal atom. This electron pair donation forms M $\xleftarrow{\sigma\text{-bond}}$ CO sigma bond.
- This sigma bond formation increases the electron density in metal d orbitals and makes the metal electron rich.
- In order to compensate for this increased electron density, a filled metal d-orbital interacts with the empty π^* orbital on the carbonyl ligand and transfers the added electron density back to the ligand. This second component is called π -back bonding.
- In metal carbonyls, electron density moves from ligand to metal through sigma bonding and from metal to ligand through pi bonding, this synergic effect accounts for strong M \leftarrow CO bond in metal carbonyls.



36. a) (i) **Explain Schottky defect and Frenkel defect**

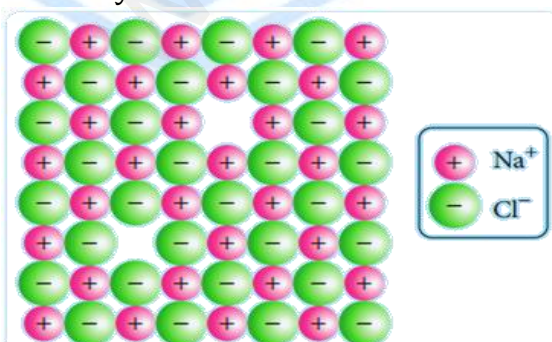
Schottky defect

Schottky defect arises due to the missing of equal number of cations and anions from the crystal lattice. Stoichiometry of the crystal is not changed.

Ionic solids in which the cation and anion are of almost of similar size show schottky defect.

Example: **NaCl**.

Presence of large number of schottky defects in a crystal lowers its density.



Frenkel defect

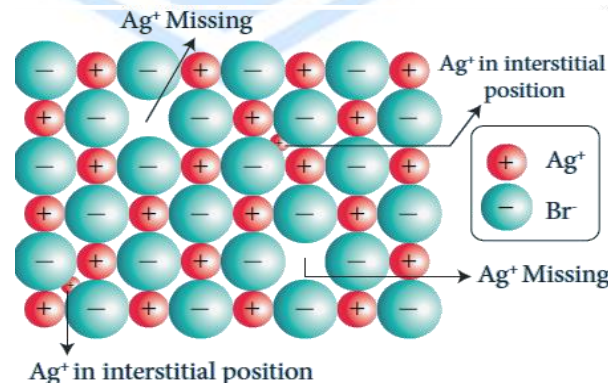
Frenkel defect arises due to the dislocation of ions from its crystal lattice.

The ion which is missing from the lattice point occupies an interstitial position.

This defect occurs when cation and anion differ in size.

Example: **AgBr**

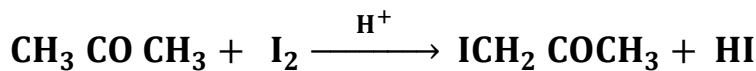
defect does not affect the density of the crystal



(OR)

b) (i) Give two examples for zero order reaction

- Photochemical reaction between H_2 and Cl_2 $H_{2(g)} + Cl_{2(g)} \xrightarrow{h\nu} 2HCl_{(g)}$
- Decomposition of N_2O on hot platinum surface $N_{2O(g)} \rightarrow 2N_{2(g)} + \frac{1}{2}O_{2(g)}$
- Iodination of acetone in acid medium is zero order with respect to iodine.



(ii) How collids are used in tanning of leather and in rubber industry?

Tanning of leather

- Skin and hides are protein containing positively charged particles which are coagulated by adding tannin to give hardened leather for further application. Chromium salts are used for the purpose.
- Chrome tanning can produce soft and polishable leather.

Rubber industry

- Latex is the emulsion of natural rubber with negative particles. By heating rubber with sulphur, vulcanized rubbers are produced for tyres, tubes, etc.

37. a) (i) Derive an expression for Ostwald's dilution law.

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

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

- The dissociation of acetic acid $CH_3COOH \rightleftharpoons CH_3COO^- + H^+$

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

	CH_3COOH	H^+	CH_3COO^-
Initial number of Moles	1	-	-
Degree of dissociation	α	-	-
Number of moles at equilibrium	$1 - \alpha$	α	α
Equilibrium Concentration	$C(1 - \alpha)$	$C\alpha$	$C\alpha$

$$K_a = \frac{C\alpha \times C\alpha}{C(1 - \alpha)}$$

Value of α is small and hence in the denominator $(1 - \alpha) \cong 1$.

$$K_a = \alpha^2 C \Rightarrow \alpha = \sqrt{\frac{K_a}{C}}$$

Concentration of H^+ (H_3O^+) can be calculation using the K_a value

$$[H^+] = \alpha C \quad (\text{at molar concentration } [H^+] \text{ is equal to } \alpha C)$$

$$[H^+] = \sqrt{\frac{K_a}{C}} \times C \quad \therefore \alpha = \sqrt{\frac{K_a}{C}} \quad [H^+] = \sqrt{K_a \cdot C}$$

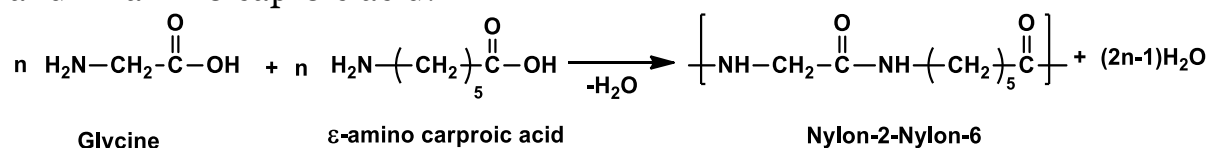
(OR)

b) (i) Aniline does not undergo Friedel craft's reaction.

- Aniline is a Lewis base. It donates its lone pair of electron on N atom to $AlCl_3$ (Lewis acid) and forms salt which becomes strongly deactivating for electrophilic substitution reaction.
- So Aniline does not undergo Friedel - Craft's reaction.

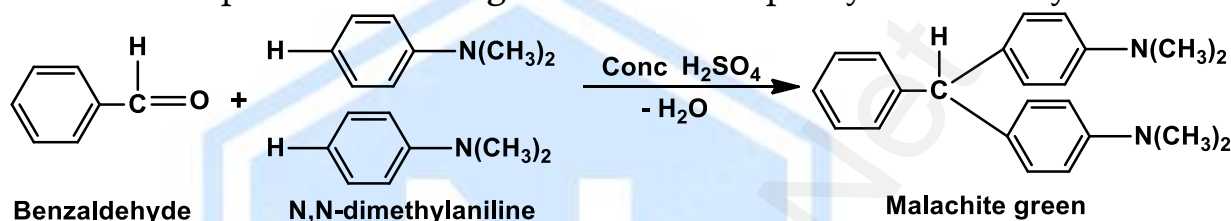
(ii) How nylon-2-nylon-6 is prepared?

It is obtained by the condensation polymersiation of the monomers, glycine and ϵ - amino caproic acid.



38. a) (i) How malachite green is prepared from benzaldehyde?

Benzaldehyde condenses with tertiary aromatic amines like N, N – dimethyl aniline in the presence of strong acids to form triphenyl methane dye.



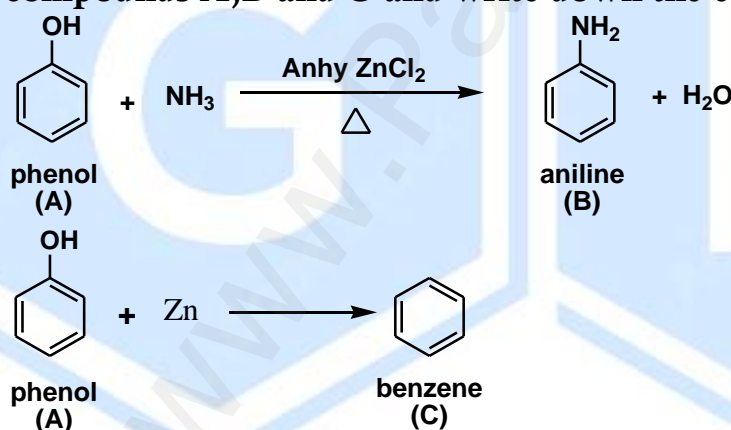
(ii) Write short note on Thorpe nitrile condensation reaction?

Self condensation of two molecules of alkyl nitrile (containing α -H atom) in the presence of sodium to form iminonitrile.



(OR)

- b) (i) Compound (A) of molecular formula $\text{C}_6\text{H}_6\text{O}$ gives purple colouration with neutral FeCl_3 . compound (A) reacts with ammonia to give compound (B) and its also reacts with Zn dust to give compound (C). Identify the compounds A,B and C and write down the equations.



Compound	Molecular Formula	Name
A	$\text{C}_6\text{H}_5\text{OH}$	Phenol
B	$\text{C}_6\text{H}_5\text{NH}_2$	Aniline
C	C_6H_6	Benzene

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