

12th
STD

PUBLIC EXAM - APRIL 2023

Reg. No.

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Part - III

TIME ALLOWED : 3.00 Hours]

CHEMISTRY (with answers)

[MAXIMUM MARKS : 70

Instructions :

(1) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

(2) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

Note : Draw diagrams and write equations wherever necessary.

PART - I

Note : (i) Answer **all** the questions. $15 \times 1 = 15$

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

- The crystal with metal excess defect is :
(a) NaCl (b) AgBr (c) AgCl (d) FeO
- Which of the following base is **not** present in DNA?
(a) Uracil (b) Adenine
(c) Cytosine (d) Guanine
- Milk of Magnesia is used as _____.
(a) Tranquilizer (b) Analgesic
(c) Antacid (d) Anaesthetic
- The most common oxidation state of Actinoids is :
(a) +4 (b) +2 (c) +6 (d) +3
- Which of the following compound is used as an anti-freeze in automobile radiator?
(a) Methanol (b) Ethane - 1, 2, - diol
(c) Ethanol (d) Glycerol
- Carbon atoms in Fullerene with formula C_{60} have _____ hybridisation.
(a) sp^2 (b) sp^3 (c) sp^3d (d) sp
- The metal extracted by Hall - Heroult process is :
(a) Cu (b) Al (c) Zn (d) Ni

8. The product formed by the reaction of an Aromatic aldehyde with primary amines is :
(a) Schiff's base (b) Carboxylic acid
(c) Ketone (d) Aromatic acid

9. The emf of Standard Hydrogen Electrode (SHE) is _____.
(a) -1.0 (b) 0 (c) 1.1 (d) +1.0

10. A magnetic moment of 1.73 BM will be shown by one among the following :

- (a) $[CoCl_6]^{4-}$ (b) $TiCl_4$
(c) $[Cu(NH_3)_4]^{2+}$ (d) $[Ni(CN)_4]^{2-}$

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

12. Which one of the following will cause common - ion - effect when added to the following dissociation equilibrium reaction?



- (a) CH_3COCl (b) $AgCl$
(c) CH_3Cl (d) HCl

13. **Assertion :** Hex -4- ennitrile on reaction with Di-isobutyl aluminium hydride followed by Hydrolysis gives Hex-4-enal.

Reason : Di-isobutyl aluminium hydride is a selective reducing agent.

- (a) **Assertion** is true but **Reason** is false.
(b) Both **Assertion** and **Reason** are true, but reason is not the correct explanation of **assertion**.
(c) Both **Assertion** and **Reason** are false.
(d) Both **Assertion** and **Reason** are true and reason is the correct explanation of **assertion**.

14. Which of the following is used as the source of gamma rays?

- (a) Xe (b) Ar (c) Rn (d) Kr

15. Which one is correctly matched?
- (a) Foam - mist
 (b) Emulsion - smoke
 (c) Sol - whipped cream
 (d) Gel - butter

PART - II

Note : Answer **any six** questions. Question No. 24 is **Compulsory.** $6 \times 2 = 12$

16. Which type of ores can be concentrated by froth floatation method? Give two examples for such ores.
17. Write the uses of Silicones.
18. Define the term central atom in co-ordination compounds.
19. Calculate the number of atoms in an FCC unit cell.
20. What is conjugate Acid - Base pairs?
21. What are catalytic poisons?
22. How will you convert acetone into propane?
23. What are Hormones? Give example.
24. Identify the compounds A and B in the following sequence of reactions.

$$\text{CH}_3\text{CH}_2\text{NO}_2 \xrightarrow{\text{Sn/HCl}} \text{A} \xrightarrow{\text{CH}_3\text{COCl}} \text{B}$$

PART - III

Note : Answer **any six** questions. Question No. 33 is **Compulsory.** $6 \times 3 = 18$

25. Write a note on Fischer tropsh synthesis.
26. Write any three differences between Lanthanoids and Actinoids.
27. For the complex, $[\text{Pt}(\text{NO}_2)(\text{H}_2\text{O})(\text{NH}_3)_2]\text{Br}$ identify the following.
- (a) Central metal atom / ion
 (b) Co-ordination number
 (c) Oxidation number of central metal ion
28. Write a note on Helmholtz electrical double layer.
29. State Faraday's Laws of Electrolysis.
30. Give the structure of a Zwitter ion.
31. How will you convert Ethylacetate into Ethylacetoacetate?

32. What are food preservatives? Give two examples.
33. Show that in case of first order reaction the time required for the completion of 99% is twice the time required for the completion of 90% of the reaction.

PART - IV

Note : Answer **all** the questions. $5 \times 5 = 25$

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

(OR)

- (b) (i) Find the oxidation state of Halogen in the following compounds.
 (1) OF_2 (2) I_2O_4
 (ii) Complete the following reactions.
 (1) $\text{P}_4 + \text{NaOH} + \text{H}_2\text{O} \longrightarrow$
 (2) $\text{XeF}_6 + \text{H}_2\text{O} \longrightarrow$
 (3) $\text{Cu} + \text{conc. H}_2\text{SO}_4 \longrightarrow$

35. (a) (i) Describe the structure of Diborane.
 (ii) Write ethylborate test.

(OR)

- (b) Describe the nature of bonding in metallic carbonyls.

36. (a) Explain Schottky and Frenkel defects.

(OR)

- (b) (i) Give two examples for zero order reaction.
 (ii) How colloids are used in tanning of leather and in Rubber industry?

37. (a) Derive an expression for Ostwald's Dilution Law.

(OR)

- (b) (i) Why aniline does not undergo Friedel Craft's reaction?
 (ii) How nylon - 2 - nylon - 6 is prepared?

38. (a) (i) How Malachitegreen is prepared from Benzaldehyde?
 (ii) Write short note on Thorpe nitrile Condensation reaction.

(OR)

- (b) Compound (A) of molecular formula C_6H_6O gives purple colouration with neutral $FeCl_3$. Compound (A) reacts with ammonia to give Compound (B) and it also reacts with Zn dust to give Compound (C). Identify the Compounds A, B and C and write down the equations.



ANSWER

PART - I

1. (a) NaCl
2. (a) Uracil
3. (c) Antacid
4. (d) + 3
5. (b) Ethane - 1, 2-diol
6. (a) sp^2
7. (b) Al
8. (a) Schiff's base
9. (b) 0
10. (c) $[Cu(NH_3)_4]^{2+}$
11. (c) Activation energy
12. (d) HCl
13. (d) Both **Assertion** and **Reason** are true and reason is the correct explanation of **assertion**.
14. (c) Rn
15. (d) Gel - butter

PART - II

16. (i) Sulphide ores can be concentrated by froth floatation method.
(ii) **Ex** : Lead sulphide galena (PbS) and zinc blende (ZnS).
17. **Uses of Silicones** :
(i) Silicones are used for low temperature lubrication and in vacuum pumps, high temperature oil baths etc.
(ii) They are used for making water proofing clothes.

- (iii) They are used as insulating material in electrical motor and other appliances.
- (iv) They are mixed with paints and enamels to make them resistant towards high temperature, sunlight, dampness and chemicals.

18. Central atom :

- (i) The central atom or 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.
- (ii) For example, in $K_4[Fe(CN)_6]$, the central metal ion is Fe^{2+} . In the coordination entity $[Fe(CN)_6]^{4-}$, the Fe^{2+} accepts an electron pair from each ligand, CN^- and thereby forming six coordinate covalent bonds with them.
- (iii) It is referred to as a Lewis acid.

19. The atoms in the face centre is being shared by two unit cells each atom in the face centers makes $\left(\frac{1}{2}\right)$ contribution to the unit cell.

∴ Number of atoms in a fcc unit cell

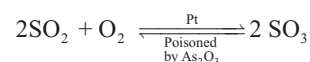
$$= \frac{N_c}{8} + \frac{N_f}{2} = \frac{8}{8} + \frac{6}{2} = 1 + 3 = 4.$$

20. Conjugate Acid - Base Pairs :

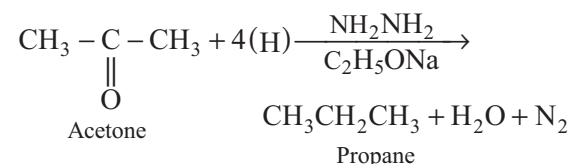
The species that remains after the donation of a proton is a base ($Base_1$) and is called the conjugate base of the Bronsted acid ($Acid_1$). In other words, chemical species that differ only by a proton are called conjugate acid - base pairs.

21. **Catalytic Poisons**: A substance which destroys the activity of the catalyst is called a poison and the process is called catalytic poisoning. Some of the examples are

Eg : The platinum catalyst used in the oxidation of SO_2 in contact process is poisoned by arsenious oxide.

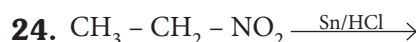


22. Aldehydes and Ketones when heated with hydrazine (NH_2NH_2) and sodium ethoxide, hydrocarbons are formed. Hydrazine acts as a reducing agent and sodium ethoxide as a catalyst.



23. Hormones :

- (i) Hormone is an organic substance (e.g. a peptide or a steroid) that is secreted by one tissue its limit the blood stream and induces a physiological response (e.g. growth and metabolism) in other tissues.
- (ii) It is an intercellular signalling molecule. e.g. insulin, epinephrine.
- (iii) Hormones are classified into Endocrine, Paracrine and Autocrine hormones.



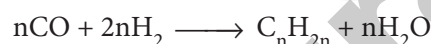
Ethyl amine (A)



N -ethylacetamide (B)

PART - III**25. Fischer Tropsch 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.**

S. No.	Lanthanoids	Actinoids
1.	Differentiating electron enters in 4f orbital	Differentiating electron enters in 5f orbital
2.	Binding energy of 4f orbitals are higher	Binding energy of 5f orbitals are lower
3.	They show less tendency to form complexes	They show greater tendency to form complexes
4.	Most of the lanthanoids are colourless	Most of actinoids, are coloured Ex : U^{3+} (red), U^{4+} (green), UO_2^{2+} (yellow)

27. (a) Central metal atom / ion : **Metal ion is Pt^{2+}**

(b) Co-ordination number : + 4

(c) Oxidation number of central metal ion : + 2

28. 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. 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.

i.e $m \propto Q$

We know that the charge is related to the current

$$\text{by the equation } I = \frac{Q}{t} \Rightarrow Q = It$$

$$\therefore m \propto It$$

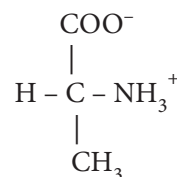
(or)

$$m = Z It$$

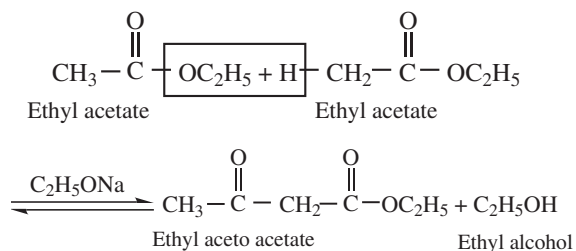
Where is Z is known as the electro chemical equivalent of the substance produced of the electrode.

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.

30.**Structure of a Zwitter ion**

31. Claisen Condensation : 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. (i) Preservatives are capable of inhibiting, retarding or arresting the process of fermentation, acidification or other decomposition of food by growth of microorganisms.
- (ii) Sodium metabisulphite is used as preservatives for fresh vegetables and fruits.
- (iii) Potassium meta bisulphite, Boric acid, Sodium benzoate etc., are some of the examples of food preservatives.

33.

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

$$t_{99\%} = \frac{2.303}{k} \log 100 \quad \dots (1)$$

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

$$t_{90\%} = \frac{2.303}{k} \log 10 \quad \dots (2)$$

$$\frac{(1)}{(2)} \Rightarrow \frac{t_{99\%}}{t_{90\%}} = \frac{\log 100}{\log 10}$$

$$\frac{t_{99\%}}{t_{90\%}} = \frac{2}{1}$$

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

PART - IV

34. (a) Zone Refining process :

- This method is based on the Fractional Crystallisation. The impure metal is melted and allowed to solidify, the impurities prefer to remain in the molten region.
- The impure metal is taken in the form of a rod.
- When the metal rod is heated with a heater the metal melts.
- The heater is slowly moved from one end to the other end.
- The impurity dissolves in the molten zone.
- When the heater moves, the molten zone also moves.
- This process is repeated again and again to get pure metal.
- The process is carried in an inert gas atmosphere to prevent the oxidation of metals.

Example :

Elements such as Germanium (Ge), Silicon (Si) and Galium (Ga) are refined using this process

(OR)

(b) (i) Oxidation state of Halogens:

(1) OF₂

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

$$2x = -2$$

$$x = -1$$

∴ Oxidation state of F in OF₂ = -1

(2) I₂O₄

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

$$2x - 8 = 0$$

$$2x = +8$$

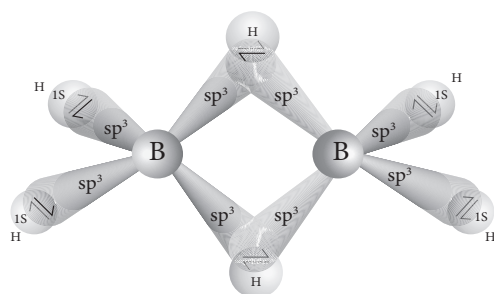
$$x = +4$$

Oxidation state of I in I₂O₄ is +4.

- (ii) (1) $P_4 + 3NaOH + 3H_2O \longrightarrow 3NaH_2PO_2 + PH_3 \uparrow$
- (2) $XeF_6 + 3H_2O \longrightarrow XeO_3 + 6HF$
- (3) $Cu + 2H_2SO_4 \xrightarrow{\text{Hot Conc}} CuSO_4 + SO_2 + 2H_2O$

35. (a) (i) Structure of Diborane :

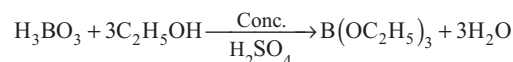
- In diborane two BH₂ units are linked by two bridged hydrogens.
- Therefore, it has eight B-H bonds.
- However, diborane has only 12 valence electrons and are not sufficient to form normal covalent bonds.
- The four terminal B-H bonds are normal covalent bonds (two centre - two electron bond or 2c-2e bond).
- The remaining four electrons have to be used for the bridged bonds. i.e. two three centred B-H-B bonds utilise two electrons each. Hence, these bonds are three centre-two electron bonds (3c-2e). The bridging hydrogen atoms are in a plane as shown in the figure. In diborane, the boron is sp³ hybridised.
- Three of the four sp³ hybridised orbitals contains single electron and the fourth orbital is empty.
- Two of the half filled hybridised orbitals of each boron overlap with the 1s orbitals of two hydrogens to form four terminal 2c-2e bonds, leaving one empty and one half filled hybridised orbitals on each boron.
- The Three centre - two electron 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.



Structure of diborane

(ii) Ethyl Borate Test :

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

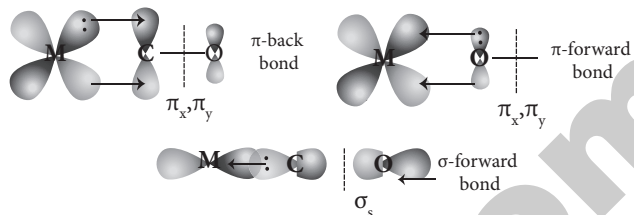


(OR)

(b) Bonding in metal carbonyls :

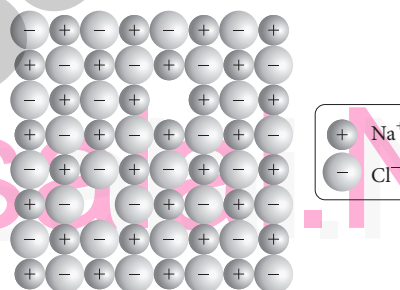
- (i) In metal carbonyls, the bond between metal atom and the carbonyl ligand consists of two components.
- (ii) The first component is an electron pair donation from the carbon atom of carbonyl ligand into a vacant d -orbital of central metal atom.
- (iii) This electron pair donation forms $\text{M} \leftarrow \overset{\sigma_{\text{bond}}}{\text{CO}}$ sigma bond.
- (iv) This sigma bond formation increases the electron density in metal d orbitals and makes the metal electron rich.
- (v) 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.
- (vi) This second component is called π -back bonding. Thus in metal carbonyls, electron density moves from ligand to metal through sigma bonding and from metal to ligand through π bonding, this synergic effect accounts for strong $\text{M} \leftarrow \text{CO}$ bond in metal carbonyls.

(vii) This phenomenon is shown diagrammatically as follows.



36. (a) Schottky defect :

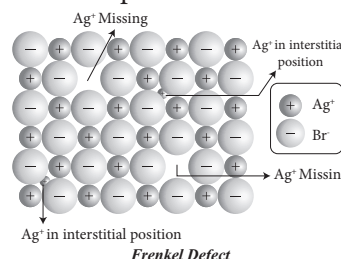
- (i) Schottky defect arises due to the missing of equal number of cations and anions from the crystal lattice.
- (ii) This effect does not change the stoichiometry of the crystal.
- (iii) Ionic solids in which the cation and anion are of almost of similar size show Schottky defect. **Ex :** NaCl.
- (iv) Presence of large number of schottky defects in a crystal, lowers its density.



Schottky Defect

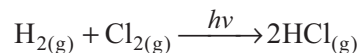
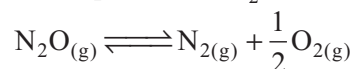
Frenkel defect :

- (i) Frenkel defect arises due to the dislocation of ions from its crystal lattice.
- (ii) The ion which is missing from the lattice point occupies an interstitial position.
- (iii) 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.
- (iv) For example AgBr, in this case, small Ag^+ ion leaves its normal site and occupies an interstitial position.



Frenkel Defect

(OR)

(b) (i) **Zero order reaction :**(i) Photochemical reaction between H_2 and I_2 (ii) Decomposition of N_2O on hot platinum surface(ii) **Colloids usage in Industries :****Tanning of leather :**

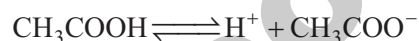
Skin and hides are protein containing positively charged particles which are coagulated by adding tannin to give hardened leather for further application. Chromium salts are used for the purpose. Chrome tanning can produce soft and polishable leather.

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) Ostwald's dilution law relates the dissociation constant of the weak acid (K_a) 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.

The dissociation of acetic acid can be represented as



The dissociation constant of acetic acid is,

$$K_a = \frac{[H^+][CH_3COO^-]}{[CH_3COOH]} \quad \dots(1)$$

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

Substituting the equilibrium concentration in equation (1)

$$K_a = \frac{(\alpha C)(\alpha C)}{(1 - \alpha) C} = \frac{\alpha^2 C}{1 - \alpha} \quad \dots(2)$$

The weak acid dissociates only to a very small extent. Compared to one, α is so small and hence in the denominator $(1 - \alpha) \simeq 1$. The above expression (2) now becomes,

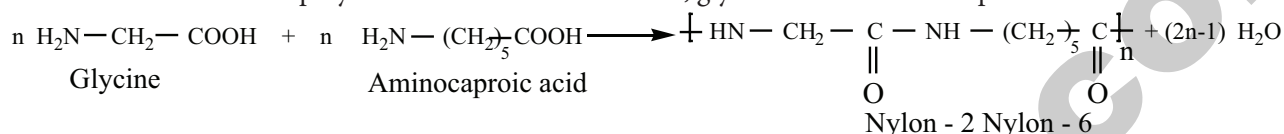
$$K_a = \alpha^2 C \Rightarrow \alpha^2 = \frac{K_a}{C}$$

$$\alpha = \sqrt{\frac{K_a}{C}}$$

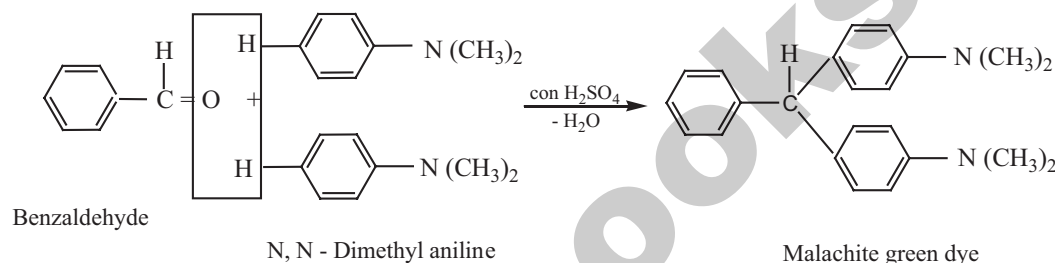
(OR)

(b) (i) **Aniline** does not undergo Friedel-Crafts reaction (alkylation and acetylation) since aniline is basic in nature and it donates its lone pair to the Lewis acid AlCl_3 to form an adduct which inhibits further the electrophilic substitution reaction.

(ii) **Nylon-2-Nylon-6**: It is a co-polymer which contains polyamide linkages. It is obtained by the condensation polymerisation of the monomers, glycine and ϵ -amino caproic acid.

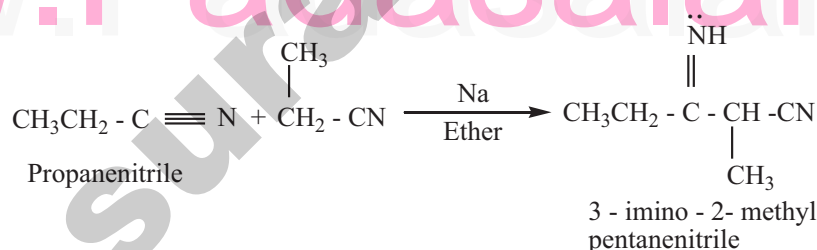


38. (a) (i) **Malachite green from Benzaldehyde**: Benzaldehyde condenses with tertiary aromatic amines like N, N - dimethyl aniline in the presence of strong acids to form triphenyl methane dye.



(ii) **Thorpe nitrile Condensation reaction**:

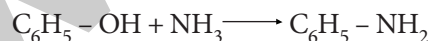
Self condensation of two molecules of alkyl nitrile (containing α -H atom) in the presence of sodium to form iminonitrile.



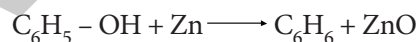
(OR)

(b) $\text{C}_6\text{H}_5-\text{OH} + \text{Neutral FeCl}_3 \longrightarrow \text{Purple colour}$

(A)



(B)



(C)

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

