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Contents

CBSE Examination Paper, 2020
Delhi [Set (I, II, III)]

Time Allowed : 3 hours] [*Maximum Marks* : 70

General Instructions:

(*i*) *Question paper comprises four sections – A, B, C and D.*

(*ii*) *There are 37 questions in the questions paper.* ***All*** *questions are compulsory.*

(*iii*) ***Section–A*** *: Question no.* ***1*** *to* ***20*** *are very short answer type questions carrying* ***one*** *mark each. Answer these questions in one word or one sentence.*

(*iv*) ***Section–B*** *: Question no.* ***21*** *to* ***27*** *are short answer type questions carrying* ***two*** *marks each.*

(*v*) ***Section–C*** *: Question no.* ***28*** *to* ***34*** *are long answer type-I questions carrying* ***three*** *marks each.*

(*vi*) ***Section–D*** *: Question no.* ***35*** *to* ***37*** *are long answer type-II questions carrying* ***five*** *marks each.*

(*vii*) *There is NO overall choice in the question paper. However, an internal choice has been provided in* ***2*** *questions of* ***two*** *marks, 2 questions of* ***three*** *marks and all the* ***3*** *questions of* ***five*** *marks. You have to attempt* ***only one of the choices*** *in such questions.*

(*viii*) *However, separate instructions are given with each section and question, wherever necessary.*

(*ix*) *Use of calculators and long tables is NOT permitted.*

Set-I

SECTION — A

Read the given passage and answer the questions 1 to 5 that follow:

The halogens have the smallest atomic radii in their respective periods. The atomic radius of fluorine is extremely small. All halogens exhibit – 1 oxidation state. They are strong oxidising agents and have maximum negative electron gain enthalpy. Among halogens, fluorine shows anomalous behaviour in many properties. For example, electro negativity and ionisation enthalpy are higher for fluorine than expected whereas bond dissociation enthalpy, m.p. and b.p. and electron gain enthalpy are quite lower than expected. Halogens react with hydrogen to give hydrogen halides (HX) and combine amongst themselves to form a number of compounds of the type XX′, XX'_3, XX'_5 and XX'_7 called inter-halogens.

1. Why halogens have maximum negative electron gain enthalpy?

Ans. It is because halogens are smallest in size and have high effective nuclear charge. They attain stable electronic configuration on gaining one electron.

2. Why fluorine shows anomalous behaviour as compared to other halogens?

Ans. It is because 'F' has smallest size, highest electronegativity, absence of *d*-orbitals and low bond dissociation enthalpy of F—F bond.

3. Arrange the hydrogen halides (HF to HI) in the decreasing order of their reducing character.

Ans. HI > HBr > HCl > HF is decreasing order of reducing power.

4. Why fluorine is a stronger oxidizing agent than chlorine?

Ans. It is due to low bond dissociation energy/enthalpy and high hydration enthalpy of F^- ion.

5. What are the sizes of X and X′ in the interhalogen compounds?

Ans. X is bigger in size than X′ in interhalogen compounds.

6. Name the cell used in hearing aids and watches.

Ans. Mercury cell.

7. How much charge in terms of Faraday is required to reduce one mol of MnO_4^- to Mn^{2+}?

Ans. 5 Faraday.

8. Write the slope value obtained in the plot of log $[R_0]$ / [R] Vs time for a first order reaction.

Ans. $\text{Slope} = \dfrac{k}{2.303}$

9. Name the sweetening agent used in the cooking of sweets for a diabetic patient.

Ans. Sucralose/Sachharine/Alitame (except aspartame)

10. Name the polymer which is used for making electrical switches and combs.

Ans. Bakelite

Question 11 to 15 are multiple choice.

11. In the Mond's process the gas used for the refining of a metal is

(*a*) H_2 **(*b*) CO_2**

(*c*) CO **(*d*) N_2**

Ans. (*c*) $\underset{\text{(Impure)}}{Ni} + 4CO \longrightarrow Ni(CO)_4 \xrightarrow{\text{heat}} \underset{\text{(Pure)}}{Ni} + 4CO$

12. The conversion of an alkyl halide into an alcohol by aqueous NaOH is classified as

(*a*) a dehydrohalogenation reaction **(*b*) a substitution reaction**

(*c*) an addition reaction **(*d*) a dehydration reaction**

Ans. (*b*) $RX + NaOH(aq) \longrightarrow ROH + NaX$ (substitution reaction)

13. CH_3CONH_2 on reaction with NaOH and Br_2 in alcoholic medium gives

(*a*) $CH_3CH_2NH_2$ **(*b*) CH_3CH_2Br**

(*c*) CH_3NH_2 **(*d*) CH_3COONa**

Ans. (*c*) $CH_3CONH_2 + Br_2 + 4NaOH \longrightarrow CH_3NH_2 + Na_2CO_3 + 2NaBr + 2H_2O$

14. The oxidation state of Ni in $[Ni(CO)_4]$ is

(*a*) 0 **(*b*) 2**

(*c*) 3 **(*d*) 4**

Ans. (*a*) $[Ni(CO)_4] \quad x + 0 = 0 \quad \Rightarrow \quad x = 0$

15. Amino acids are

(*a*) acidic **(*b*) basic**

(*c*) amphoteric **(*d*) neutral**

Ans. (*c*) Amino acids are amphoteric due to presence of acidic —COOH (carboxylic) and basic —NH_2 (amino) group.

Note: In this question all four options are correct. [1 Mark is to be awarded for any option.]

Question 16 to 20.

(A) Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explanation of the Assertion (A).

(C) Assertion (A) is correct, but Reason (R) is wrong statement.

(D) Assertion (A) is wrong, but Reason (R) is correct statement.

16. Assertion (A): Conductivity of an electrolyte increases with decrease in concentration.

Reason (R): Number of ions per unit volume decreases on dilution.

Ans. (D) 'A' is wrong but 'R' is true. Conductivity decreases with decrease in concentration.

17. Assertion (A): The C—O—C bond angle in ethers is slightly less than tetrahedral angle.

Reason (R): Due to the repulsive interaction between the two alkyl groups in ethers.

Ans. (D) 'A' is wrong but 'R' is true. The C—O—C bond angle in ethers is slightly more than tetrahedral angle (110°).

18. Assertion (A): Low spin tetrahedral complexes are rarely observed.

Reason (R): Crystal field splitting energy is less than pairing energy for tetrahedral complexes.

Ans. (A) Both 'A' and 'R' are correct and 'R' is correct reason of 'A'.

19. Assertion (A): Elevation in boiling point is a colligative property.

Reason (R): Elevation in boiling point is directly proportional to molarity.

Ans. (C) 'A' is correct but 'R' is wrong because $\Delta T_b \propto m$ (molality).

20. Assertion (A): Oxidation of ketones is easier than aldehydes.

Reason (R): C—C bond of ketones is stronger than C—H bond of aldehydes. 20×1=20

Ans. (D) 'A' is wrong but 'R' is true because aldehydes can be oxidised more easily than ketones.

SECTION – B

21. State Raoult's law for a solution containing volatile components. What is the similarity between Raoult's law and Henry's law? 2

Ans. Raoult's law: Both law state that partial vapour pressure of each component is directly proportional to its mole fraction when both solute and solvent are volatile.

$$\left.\begin{aligned} p_A \propto x_A \;&\Rightarrow\; p_A = p_A^{\circ} x_A \\ \text{and}\quad p_B \propto x_B \;&\Rightarrow\; p_B = p_B^{\circ} x_B \end{aligned}\right] \text{Raoult's law}$$

$$p_{gas} = K_H \times x_{gas} \text{ Henry's law}$$

22. Write the role of

(*a*) Dilute NaCN in the extraction of Gold.

(b) CO in the extraction of Iron. **1+1=2**

Or

How is leaching carried out in the case of low grade copper ores? Name the method used for refining of copper metal. **2**

Ans. (*a*) $4Au + 8NaCN + 2H_2O + O_2 \longrightarrow 4Na[Au(CN)_2] + 4NaOH$

NaCN acts as leaching agent. NaCN forms a complex with impure Gold, sodium dicyanido aurate (I) while Zn acts as a reducing agent.

$$2Na[Au(CN)_2] + Zn \longrightarrow Na_2[Zn(CN)_4] + 2Au$$

(*b*) Carbon monoxide(CO) is better reducing agent at lower temperature range,

$$Fe_2O_3 + CO \longrightarrow 2FeO + CO_2$$

$$FeO + CO \longrightarrow Fe + CO_2$$

or $$Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$$

Or

Extraction of Copper from low grade ores and scraps: It is extracted by hydrometallurgy. It is carried out in two steps:

- **Leaching:** Low grade copper ores and scraps are leached by using acid or bacteria.
- **Reduction:** The solution containing copper ions is treated with H_2.

$$Cu^{2+}(aq) + H_2(g) \longrightarrow Cu(s) + 2H^+(aq)$$

It is called hydrometallurgy.

Copper is refined by electrolytic refining.

23. Define adsorption with an example. What is the role of adsorption in heterogeneous catalysis? **2**

Or

Define Brownian movement. What is the cause of Brownian movement in colloidal particles? How is it responsible for the stability of Colloidal Sol? **2**

Ans. **Adsorption:** When concentration of solute is different at surface than bulk, it is called adsorption, e.g. O_2, H_2, CO, Cl_2, NH_3 or SO_2 get adsorbed on the surface of charcoal.

Adsorption of reactants on solid surface of catalyst increases the rate of reaction due to more probability of collisions and effective collision.

or

Adsorption is the accumulation of molecular species at the surface rather than the bulk of the solid or liquid e.g.,gases get adsorbed on the surface of activated charcoal.

Or

Brownian movement. The zig-zag motion of colloidal particles due to collision between particles of dispersion medium among themselves and with particles of dispersion medium is called Brownian movement. It leads to stability of colloidal solution.

or

Brownian movement is caused by unbalanced bombardment of particles by the molecules of dispersion medium.

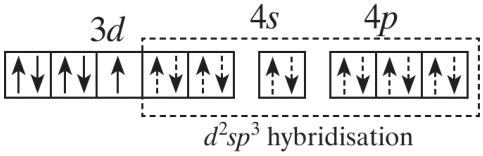
The Brownian movement has stirring effect which does not permit colloidal particle to settle down and thus, it is responsible for the stability of colloidal solution.

24. (*a*) **Write the IUPAC name and hybridisation of the complex $[Fe(CN)_6]^{3-}$. (Given: Atomic number of Fe = 26)**

(*b*) **What is the difference between an ambidentate ligand and a chelating ligand? 1+1=2**

Ans. (*a*) Hexacyanido ferrate (III) or Hexacyano ferrate (III)

CN^- is a strong field ligand, therefore, it causes pairing of electrons, forms low spin.

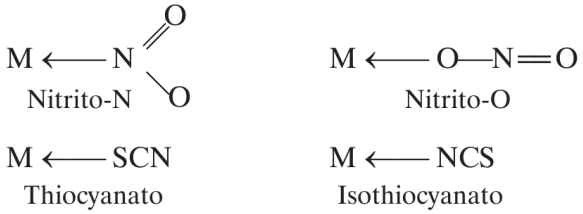


$[Fe(CN)_6]^{3-}$ has d^2sp^3 hybridization, weakly paramagnetic due to presence of one unpaired electron, therefore, low spin complex.

(*b*) Chelating ligands form cyclic complex where as ambidentate ligands form non-cyclic ligands.

or

Ambidentate ligand: Ligands which can ligate (link) through two different atoms present in it are called *ambidentate ligands*, e.g. NO_2^-, SCN^-, CNO^- and CN^-. NO_2^- can link through 'N' as well as oxygen while SCN^- can link through 'S' as well as 'N' atoms.



Chelating or Polydentate ligand: The ligand which can form two or more σ bond with central metal atom or ion, e.g., $\begin{matrix} COO^- \\ | \\ COO^- \end{matrix}$

Polydentate ligand are also called chelating agents.

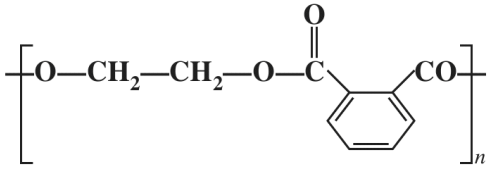
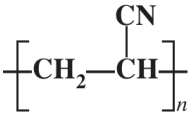
25. How do antiseptics differ from disinfectants? Name a substance which can be used as a disinfectant as well as an antiseptic. 2

Ans. Antiseptics are applied to living tissue where as disinfectants are applied to inanimate / non-living objects. 1 to 2 percent solution of phenol is used as disinfectant.

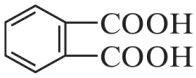
or

Antiseptics do not harm living tissue where as disinfectants are harmful for living tissues. 0.2% solution of phenol is antiseptic, where as 2% solution of phenol is disinfectant.

26. Identify the monomers in the following polymers:

(*i*)  (*ii*)  **1+1=2**

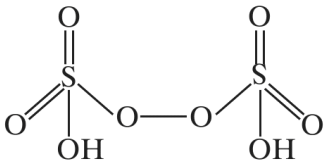
Ans. (*i*) Ethane 1,2 - diol and Benzene 1,2-dicarboxylic acid.

$CH_2OH—CH_2OH$ and 

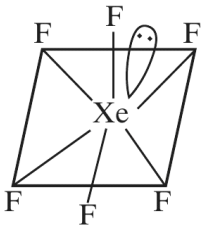
(*ii*) $CH_2=\underset{\displaystyle CN}{\underset{|}{C}}H$ is monomer. (Acrylonitrile/Propene nitrile)

27. Draw the structures of the following:

(*i*) **$H_2S_2O_8$** (*ii*) **XeF_6** **1+1=2**

Ans. (*i*) 

$(H_2S_2O_8)$

(*ii*) 

(XeF_6)

SECTION – C

28. A 0.01 m aqueous solution of $AlCl_3$ freezes at – 0.068 °C. Calculate the percentage of dissociation.

[Given: K_f for Water = 1.86 K kg mol^{-1}] **3**

Ans. $m = 0.01$ m, $\Delta T_f = 0°C - (-0.068°C) = +0.068°C$

$$\Delta T_f = i\,K_f \times m \qquad \text{[where '}i\text{' is van't Hoff factor]}$$

$$0.068 = i \times 1.86 \times 0.01$$

$$i = \frac{0.068}{.0186} = 3.656$$

$AlCl_3(aq) \longrightarrow Al^{3+}(aq) + 3Cl^-$ $(n = 4)$

$$\alpha = \frac{i-1}{n-1} = \frac{3.656-1}{4-1} = \frac{2.656}{3} = 0.885$$

$$\alpha = 0.885 \times 100 = 88.5\%$$

The percentage dissociation of $AlCl_3$ is 88.5%.

29. When a steady current of 2A was passed through two electrolytic cells A and B containing electrolytes $ZnSO_4$ and $CuSO_4$ connected in series, 2 g of Cu were deposited at the cathode of cell B. How long did the current flow? What mass of Zn was deposited at cathode of cell A? **3**

[Atomic mass : Cu = 63.5 g mol^{-1}, Zn = 65 g mol^{-1}, 1F = 96500 C mol^{-1}]

Ans. I = 2A, W_{Cu} = 2g, t = ?, W_{Zn} = ?

$$m = Z \times I \times t$$

$$2 = \frac{63.5}{2 \times 96500} \times 2 \times t \qquad \left[Z = \frac{\text{Atomic mass}}{\text{Valency} \times 96500}\right]$$

$$t = \frac{2 \times 2 \times 96500}{2 \times 63.5} = \frac{193000}{63.5} = 3039.37 = 3039.4 \text{ s}$$

$$t = \frac{3039.4}{60} = 50.656 \text{ min}$$

$$\frac{W_{Cu}}{E_{Cu}} = \frac{W_{Zn}}{E_{Zn}}$$

$$E_{Cu} = \frac{63.5}{2} = \frac{\text{Atomic mass}}{\text{Valency}}$$

$$E_{Zn} = \frac{65}{2} = \frac{\text{Atomic mass}}{\text{Valency}}$$

$$\frac{2}{\frac{63.5}{2}} = \frac{W_{Zn}}{\frac{65}{2}}$$

$$W_{Zn} = \frac{2 \times 65}{63.5} = \frac{130}{63.5} = 2.047 \text{ g} = 2.05 \text{ g}$$

30. Differentiate between following:

(*i*) Amylose and Amylopectin

(*ii*) Globular protein and Fibrous protein

(*iii*) Nucleotide and Nucleoside **1+1+1=3**

Ans. (*i*) **Amylose:** It is a linear chain polymer of α-glucose, water soluble component of starch which constitute 15-20% of starch. It has $C_1 - C_4$ linkages.

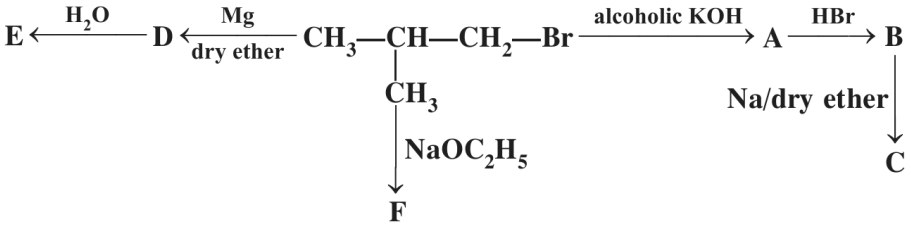
Amylopectin: It is branched chain polymer of α-glucose, water insoluble component, form 80-85% of starch. It has $C_1 - C_4$ and $C_1 - C_6$ linkages.

(*ii*) **Fibrous proteins:** Thread like structure, insoluble in water, e.g. keratin (hair, wool, silk), myosin (muscles) etc, have β-pleated structure.

Globular proteins: Chains of polypeptidic coil around (α-helix), spherical shape, soluble in water, e.g. insulin, albumin.

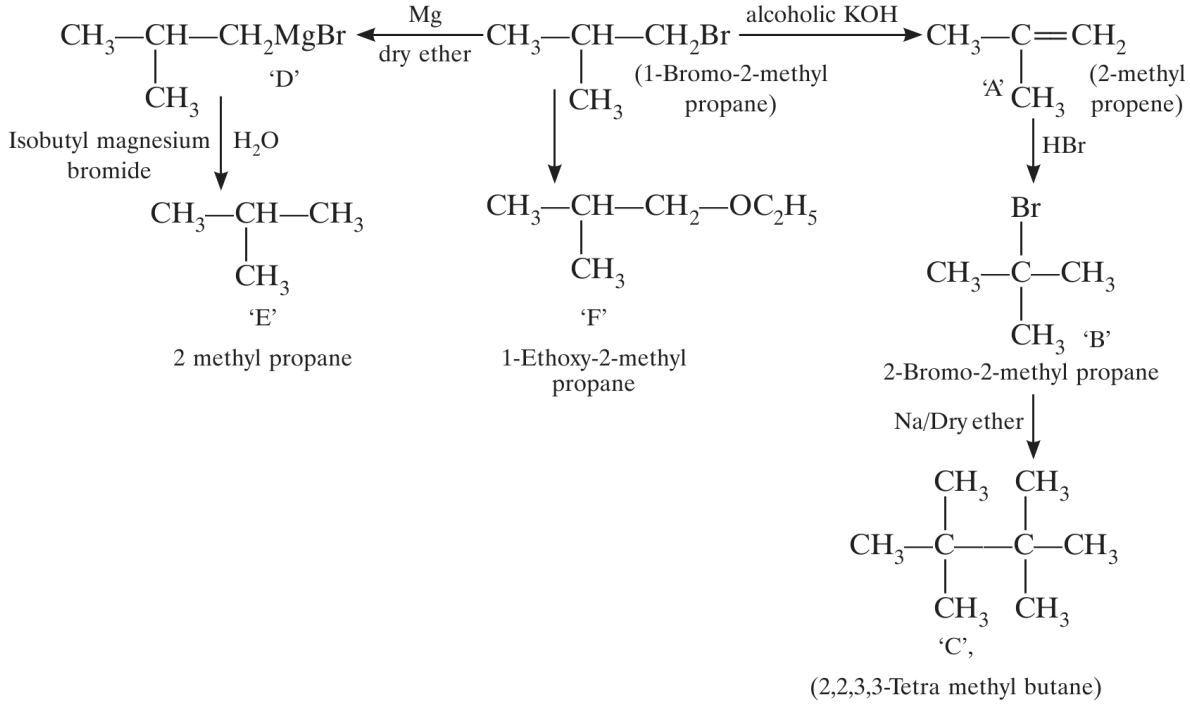
(*iii*) Nucleoside contains ribose or deoxyribose sugar and heterocyclic base, e.g. adenosine, whereas nucleotides contain phosphoric acid residue along with heterocyclic base and pentose sugar, e.g. adenosine triphosphate (ATP).

31. Identify A, B, C, D, E and F in the following:



6×½=3

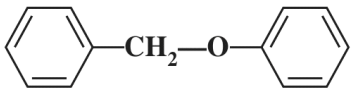
Ans.



32. Give the structures of final products expected from the following reactions:

(*i*) Hydroboration of propene followed by oxidation with H_2O_2 in alkaline medium.

(*ii*) Dehydration of $(CH_3)_3C—OH$ by heating it with 20% H_3PO_4 at 358 K.

(*iii*) Heating of  **with HI.** **3×1=3**

Or

How can you convert the following?

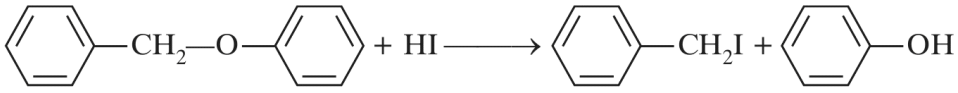
(*i*) Phenol to *o*-hydroxybenzaldehyde

(*ii*) Methanal to ethanol

(*iii*) Phenol to phenyl ethanoate **1+1+1=3**

Ans. (*i*) $CH_3—CH=CH_2 \xrightarrow[(ii)\ H_2O_2/OH^-]{(i)\ B_2H_6} CH_3—CH_2—CH_2—OH$

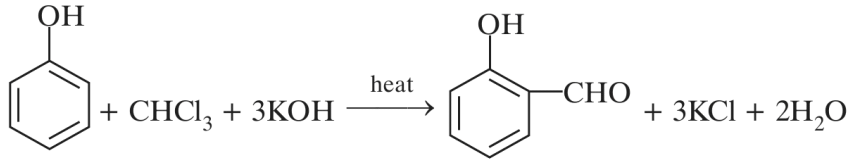
(*ii*) $CH_3—\underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}}—CH_3 \xrightarrow[358\ K]{20\%\ H_3PO_4} CH_3—\overset{\overset{CH_3}{|}}{C}=CH_2 + H_2O$

(*iii*) 

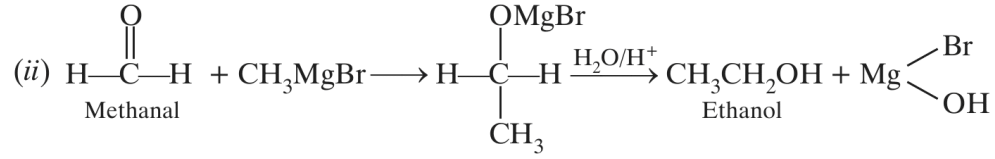
Or

(*i*) **Reimer-Tiemann reaction:**

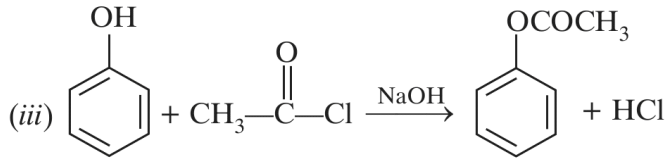
When phenol is heated with $CHCl_3$ and KOH, salicylaldehyde is formed.



Phenol Salicyldehyde

(*ii*) 

Methanal Ethanol

(*iii*) 

Phenol Phenyl ethanoate

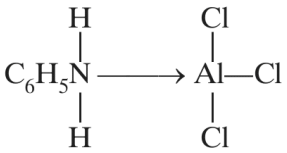
33. Give reasons:

(*i*) **Aniline does not undergo Friedal-Crafts reaction.**

(*ii*) **Aromatic primary amines cannot be prepared by Gabriel's phthalimide synthesis.**

(*iii*) **Aliphatic amines are stronger bases than ammonia.** **3×1=3**

Ans. (*i*) It is because aniline is basic which can form adduct (Salt) with $AlCl_3$ (Lewis acid).



(*ii*) It is because aryl halides do not undergo nucleophilic substitution reaction easily.

(*iii*) It is because ethyl group is electron releasing and increases electron density on 'N' of $C_2H_5NH_2$ than NH_3.

or

It is because alkyl groups are electron releasing. In alkyl amines, they will increase electron density on 'N', therefore, they are more basic than NH_3.

34. Write three differences between lyophobic sol and lyophilic sol. **3**

Or

Define the following terms:

(*i*) Protective colloid

(*ii*) Zeta potential

(*iii*) Emulsifying agent **1+1+1=3**

Ans. Difference between lyophilic sols and lyophobic sols:

Lyophilic sols	Lyophobic sols
(*i*) There is force of attraction between dispersed phase and dispersion medium.	(*i*) There is no affinity between dispersed phase and dispersion medium.
(*ii*) They are easily prepared by shaking dispersed phase with dispersion medium.	(*ii*) They are prepared by indirect methods, e.g. peptization hydrolysis, electro-dispersion, etc.
(*iii*) These are self-stabilized.	(*iii*) They need stabilizing agent.
(*iv*) These are reversible sols, e.g. gums, starch, albumin and other proteins in water.	(*iv*) These are irreversible sols, e.g. As_2S_3, sulphur, $Fe(OH)_3$ sol, gold sol, etc.

Or

Ans. (*i*) The lyophilic colloid which help in stability of lyophobic sol and prevents its coagulation e.g. Starch, gelatin.

(*ii*) Zeta potential (Electrokinetic Potential): The potential difference between the fixed layer and the diffused layer of colloidal solution having opposite charges is called zeta potential or electrokinetic potential.

(*iii*) **Emulsifying agents:** Those substances which stabilizes emulsion are called emulsifying agents. E.g. Soaps and detergents, bile juice etc.

SECTION – D

35. (*a*) Give reasons:

(*i*) Transition metals and their compounds show catalytic activities.

(*ii*) Separation of a mixture of Lanthanoid elements is difficult.

(*iii*) Zn, Cd and Hg are soft and have low melting point.

(*b*) Write the preparation of the following:

(*i*) $Na_2Cr_2O_7$ from Na_2CrO_4

(*ii*) K_2MnO_4 from MnO_2 **3+2=5**

Or

(*a*) Account for the following:

(*i*) Ti^{3+} is coloured whereas Sc^{3+} is colourless in aqueous solution.

(*ii*) Cr^{2+} is a strong reducing agent.

(*b*) Write two similarities between chemistry of lanthanoids and actinoids.

(*c*) Complete the following ionic equation: **2+2+1=5**

$3MnO_4^{2-} + 4H^+ \longrightarrow$

Ans. (*a*) (*i*) It is because they show variable oxidation states and have vacant *d*-orbitals forming unstable intermediates which readily change into products.

(*ii*) It is due to similar ionic size, similar properties due to lanthanoid contraction, their separation is difficult.

(*iii*) It is because they have weak metallic bonds due to absence of unpaired electrons.

(*b*) (*i*) $2Na_2CrO_4 + H_2SO_4\,(conc.) \longrightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$

(*ii*) $2MnO_2 + 4KOH + O_2 \longrightarrow 2K_2MnO_4 + 2H_2O$

[Balancing may be ignored while awarding marks.]

Or

(*a*) (*i*) Ti^{3+} has one unpaired electron and undergoes *d-d* transitions by absorbing visible light and radiates violet colour, Sc^{3+} does not have unpaired electrons.

(*ii*) Cr^{2+} is stronger reducing agent because it will get oxidised to Cr^{3+} which has half-filled t_{2g}^3 which is more stable than $3d^5$ in Fe^{3+}.

(*b*) **Similarity:** (*i*) Both lanthanoids and actinoids show contraction.

(*ii*) The most characteristic oxidation state of both lanthanoid and actinoid is +3.

(*iii*) Both show variable oxidation state.

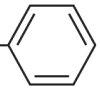
(*iv*) Both show *f-f* transition.

(*v*) electrons of *f*-orbitals in both have poor shielding effect. (*Any two*)

(*c*) $3MnO_4^{2-} + 4H^+ \longrightarrow 3MnO_4^- + MnO_2 + 2H_2O$

36. (*a*) Write the products formed when benzaldehyde reacts with the following reagents:

(*i*) CH_3CHO in presence of dilute NaOH

(*ii*) $H_2N—NH$ 

(*iii*) Conc. NaOH

(*b*) Distinguish between following:

(*i*) $CH_3—CH=CH—CO—CH_3$ and $CH_3—CH_2—CO—CH=CH_2$

(*ii*) Benzaldehyde and Benzoic acid. **3+(1+1)=5**

Or

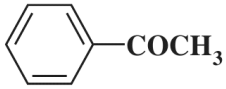
(*a*) Write the final products in the following:

(*i*) $CH_3-C(=O)-CH_3 \xrightarrow[\text{Conc. HCl}]{\text{Zn/Hg}}$

(*ii*)  $\xrightarrow[\Delta]{\text{NaOH/CaO}}$

(*iii*) $CH_2=CH-CH_2-CN \xrightarrow[(b)\ H_3O^+]{(a)\ \text{DIBAL—H}}$

(*b*) Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction:

CH_3COCH_3, HCHO, CH_3CHO, 

(*c*) Draw the structure of 2, 4 DNP derivative of acetaldehyde. **3+1+1=5**

Ans. (*a*) (*i*) $C_6H_5-\overset{O}{\overset{\|}{C}}-H + CH_3-\overset{O}{\overset{\|}{C}}-H \xrightarrow{NaOH} C_6H_5-\underset{OH}{CH}-CH_2-\overset{O}{\overset{\|}{C}}-H$

3-hydroxy -3-phenyl propanal.

(*ii*) $C_6H_5-\overset{H}{\underset{|}{C}}=O + H_2N-NH-C_6H_5 \longrightarrow C_6H_5CH=N-NH-C_6H_5$

Phenyl hydrazone of Benzaldehyde

(*iii*) $2C_6H_5-\overset{O}{\overset{\|}{C}}-H \xrightarrow{\text{Conc. NaOH}} C_6H_5CH_2OH + C_6H_5COONa$

Benzyl alcohol Sodium benzoate

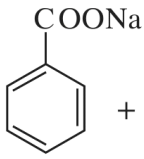
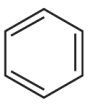
(*b*) (*i*) Add I_2 and NaOH. $CH_3-CH=CH-COCH_3$ will give yellow ppt of iodoform where as $CH_3-CH_2-CO-CH=CH_2$ will not.

(*ii*) Add $NaHCO_3$ to each. Benzaldehyde will not react, Benzoic acid will give brisk effervescence due to CO_2.

Or

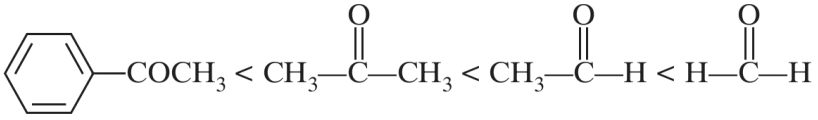
(*a*) (*i*) $CH_3-\overset{O}{\overset{\|}{C}}-CH_3 \xrightarrow[\text{conc. HCl}]{\text{Zn (Hg)}} CH_3-CH_2-CH_3 + H_2O$

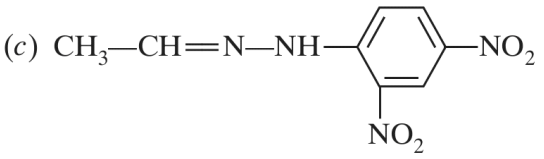
Propanone Propane

(*ii*)  $+ NaOH(CaO) \xrightarrow{\Delta}$  $+ Na_2CO_3$

Sodium benzoate Benzene

(*iii*) $CH_2=CH-CH_2-CN \xrightarrow[(b)\ H_3O^+]{(a)\ \text{DIBAL-H}} CH_2=CH-CH_2-\overset{O}{\overset{\|}{C}}-H$

(*b*)  $< CH_3-\overset{O}{\overset{\|}{C}}-CH_3 < CH_3-\overset{O}{\overset{\|}{C}}-H < H-\overset{O}{\overset{\|}{C}}-H$

(*c*) 

37. (*a*) **A first order reaction is 25% complete in 40 minutes. Calculate the value of rate constant. In what time will the reaction be 80% completed?** **3+2=5**

(*b*) **Define order of reaction. Write the condition under which a bimolecular reaction follows first order kinetics.**

Or

(*a*) **A first order reaction is 50% complete in 30 minutes at 300 K and in 10 minutes at 320 K. Calculate activation energy (E_a) for the reaction. (R = 8.314J K^{-1} mol^{-1})**

(*b*) **Write the two conditions for collisions to be effective collisions.**

(*c*) **How order of reaction and molecularity differ towards a complex reaction?**

[Given: log 2 = 0.3010, log 3 = 0.4771, log 4 = 0.6021, log 5 = 0.6991] **3+1+1=5**

Ans. (*a*) $k = \dfrac{2.303}{t}\log\dfrac{[R]_0}{[R]}$

$k = \dfrac{2.303}{40\text{ min}}\log\dfrac{[R]_0}{3[R]_0/4}$ $\quad [\text{R} = [R]_0 - [R]_0/4]$

$k = \dfrac{2.303}{40}(\log 4 - \log 3) = \dfrac{2.303}{40}(0.6021 - 0.4771)$ $\quad [\text{R}]_0 - [R]_0/4$

$k = \dfrac{2.303}{40} \times 0.1250 = 7.197 \times 10^{-3}\ \text{min}^{-1}$

$t_{80\%} = \dfrac{2.303}{k}\log\dfrac{[R]_0}{[R]}$

$t_{80\%} = \dfrac{2.303}{2.303} \times \dfrac{40}{0.125} \times \log\dfrac{[R]_0}{\frac{20}{100}[R]_0}$ $\quad \left[\because [R] = [R]_0 - \dfrac{80}{100}[R_0]\right]$

$t_{80\%} = 320 \times \log 5$

$= 320 \times 0.6991$

$= 223.7\ \text{min}$

(*b*) Order of reaction is defined as sum of powers to which conc. terms are raised in rate law or rate equation. If one of the reactants is present in large amount (excess) biomolecular reaction follows first order kinetics.

Or

(*a*)
$$k_1 = \frac{0.693}{t_{1/2}} = \frac{0.693}{30 \text{ min}} \text{ at } T_1 = 300 \text{ K}$$

$$k_2 = \frac{0.693}{t_{1/2}} = \frac{0.693}{10 \text{ min}} \text{ at } T_2 = 320 \text{ K}$$

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303\,R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

$$\log \frac{0.693}{10} \times \frac{30}{0.693} = \frac{E_a}{2.303 \times 8.314}\left(\frac{1}{300} - \frac{1}{320}\right)$$

$$E_a = \frac{19.147 \times 300 \times 320}{20} \log 3$$

$$E_a = 19.147 \times 4800 \times 0.4771 \text{ J}$$

$$E_a = 43847.16 \text{ J mol}^{-1}$$

$$E_a = 43.848 \text{ kJ mol}^{-1}$$

(*b*) (*i*) Molecule must have activation energy.

(*ii*) These molecules must collide in proper orientation.

(*c*) In complex reaction, slowest step is the rate determining step which determines order of reaction.

Each step of complex reaction is called elementary reaction which has its own molecularly.

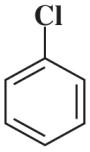
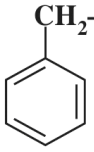
or

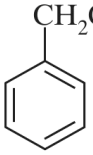
For a complex reaction, order of reaction is applicable while molecularity has no meaning.

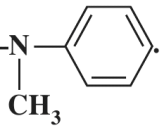
Set-II (Uncommon Questions to Set-I)

SECTION – A

Question 6 to 10 are one word answers:

6. Out of  **and**  **, which will undergo S_N1 reaction faster with OH^-?**

Ans.  will undergo S_N1 reaction faster with OH^-.

7. Write the IUPAC name of  .

Ans. N, N-Dimethyl benzenamine or N, N-Dimethyl aniline.

8. What type of linkage is present in polysaccharides?

Ans. Glycosidic linkage.

9. Name an artificial sweetener whose use is limited to cold drinks.

Ans. Aspartame.

10. Name the polymer which is used for making non-stick utensils.

Ans. Teflon/PTFE (poly tetrafluoro ethylene)

Question 11 to 15 are multiple choice questions.

11. Kohlrausch given the following relation for strong electrolytes:

$\Lambda = \Lambda_0 - A\sqrt{C}$

Which of the following equality holds?

(a) $\Lambda = \Lambda_0$ **as** $C \longrightarrow \sqrt{A}$ **(b)** $\Lambda = \Lambda_0$ **as** $C \longrightarrow \infty$

(c) $\Lambda = \Lambda_0$ **as** $C \longrightarrow 0$ **(d)** $\Lambda = \Lambda_0$ **as** $C \longrightarrow 1$

Ans. (c) $\Lambda = \Lambda_0$ as $C \longrightarrow 0$

12. In an electrochemical process, a salt bridge is used

(a) as a reducing agent.

(b) as an oxidizing agent.

(c) to complete the circuit so that current can flow.

(d) None of these

Ans. (c) In an electrochemical process, a salt bridge is used to complete the circuit so that current can flow.

13. In a chemical reaction X $\longrightarrow$ Y, it is found that the rate of reaction doubles when the concentration of X is increased four times. The order of the reaction with respect to X is

(a) 1 **(b) 0** **(c) 2** **(d) 1/2**

Ans. (d) 1/2

14. Which of the following will give a white precipitate upon reacting with $AgNO_3$?

(a) $K_2[Pt(en)_2Cl_2]$ **(b)** $[Co(NH_3)_3Cl_3]$ **(c)** $[Cr(H_2O)_6]Cl_3$ **(d)** $[Fe(H_2O)_3Cl_3]$

Ans. (c) $[Cr(H_2O)_6]\ Cl_3$

15. Copper matte contains

(a) Cu_2S, Cu_2O **and silica** **(b)** Cu_2S, **CuO and silica**

(c) Cu_2S, **FeO and silica** **(d)** Cu_2S, **FeS and silica**

Ans. (d) Copper matte contains Cu_2S, FeS and silica.

Questions 16 and 18

(A) Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explanation of the Assertion (A).

(C) Assertion (A) is correct, but Reason (R) is wrong statement.

(D) Assertion (A) is wrong, but Reason (R) is correct statement.

16. Assertion (A): 0.1 M solution of KCl has greater osmotic pressure than 0.1 M solution of glucose at same temperature.

Reason (R): In solution, KCl dissociates to produce more number of particles.

Ans. (A) Both 'A' and 'R' are correct statements and 'R' is correct explanation of 'A'.

18. Assertion (A): Ortho and para-nitrophenols can be separated by steam distillation.

Reason (R): Ortho isomer associates through intermolecular hydrogen bonding while Para isomer associates through intramolecular hydrogen bonding.

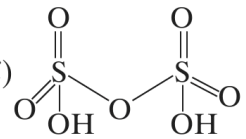
Ans. (C) 'A' is true statement 'R' is wrong statement.

SECTION – B

23. Draw the structures of the following:

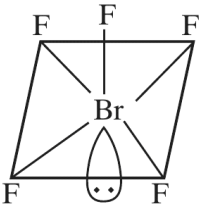
(*i*) $H_2S_2O_7$ **(*ii*) BrF_5** **2**

Ans. (*i*)



$(H_2S_2O_7)$

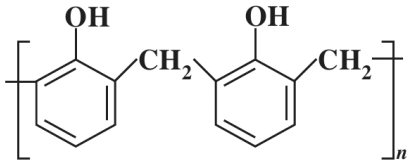
(*ii*)



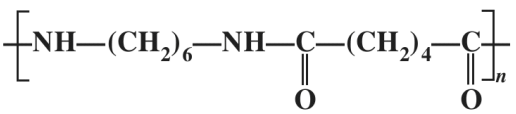
Square pyramidal

25. Identify the monomers in the following polymers:

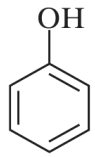
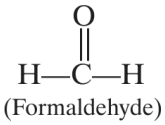
(*i*)



(*ii*)



2

Ans. (*i*)  and 

(Phenol) (Formaldehyde)

(*ii*) $H_2N—(CH_2)_6—NH_2$ and $HO—C(=O)—(CH_2)_4—C(=O)—OH$

Hexamethylene diamine (Adipic acid)

26. Discuss the nature of bonding in metal carbonyls. **2**

Ans. It involves both σ bond as well as π-bond. σ bond is formed by donation of lone pair of electron to the vacant *d*-orbitals of transition metals.

π-bond is formed by back donation of pair of electrons from transition metal to antibonding molecular orbital of CO.

It makes bond between metal and CO very strong.

[**Note:** Give 2 marks for attempting the question.]

SECTION – C

30. Define the following terms with a suitable example in each:

(*a*) Polysaccharides

(*b*) Denatured protein

(*c*) Fibrous protein **1+1+1=3**

Ans. (*a*) Those carbohydrate which on hydrolysis give large number of monosaccharides are called polysaccharide e.g. starch, glycogen, cellulose (*Any one*)

(*b*) **Denaturation of proteins:** On heating or change in pH, hydrogen bonds are disturbed, globules unfold and helix get uncoiled and leads to loss of biological activity, e.g. coagulation of egg white, curdling of milk.

(*c*) **Fibrous proteins:** Thread like structure, insoluble in water, e.g. keratin (hair, wool, silk), myosin (muscles) etc, have β-pleated structure.

or

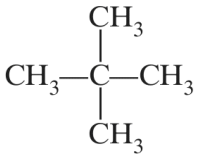
Fibrous proteins: When polypeptide chain run parallel and are held together by H-bonds and have disulphide bonds, the thread like structure is called fibrous proteins, e.g.,Keratin, Myosine.

Set-III (Uncommon Questions to Set-I and Set-II)

SECTION – A

Questions 6 to 10 are one word answers:

6. A hydrocarbon C_5H_{12} gives only one monochloride on photochemical chlorination. Identify the compound.

Ans.  (2,2-dimethyl propane)

7. Out of $(CH_3)_3N$ and $(CH_3)_2NH$, which one is more basic in aqueous solution?

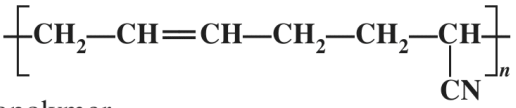
Ans. $(CH_3)_2NH$

8. Out of *Cis* – $[Pt(en)_2Cl_2]^{2+}$ and *Trans* – $[Pt(en_2)Cl_2]^{2+}$, Which one is optically active?

Ans. *Cis* $[Pt\ (en)_2Cl_2]^{2+}$

9. Name the method of refining used to obtain semiconductor of very high purity.

Ans. Zone refining

10. Is  **a homopolymer or copolymer?**

Ans. Copolymer

Question 11 to 15 are multiple choice questions:

11. The amount of electricity required to produce one mole of Zn from $ZnSO_4$ solution will be:

(*a*) **3F** (*b*) **2F**

(*c*) **1F** (*d*) **4F**

Ans. (*b*) 2F

12. Zinc is coated over iron to prevent rusting of iron because

(*a*) $E^\circ_{Zn^{2+}/Zn} = E^\circ_{Fe^{2+}/Fe}$ (*b*) $E^\circ_{Zn^{2+}/Zn} < E^\circ_{Fe^{2+}/Fe}$

(*c*) $E^\circ_{Zn^{2+}/Zn} > E^\circ_{Fe^{2+}/Fe}$ (*d*) **None of these**

Ans. (*b*) $E^\circ_{Zn^{2+}/Zn} < E^\circ_{Fe^{2+}/Fe}$

13. The unit of rate constant depends upon the

(*a*) **molecularity of the reaction.** (*b*) **activation energy of the reaction.**

(*c*) **order of the reaction.** (*d*) **temperature of the reaction.**

Ans. (*c*) Order of reaction

14. The formula of the complex triamminetri (nitrito-O) Cobalt (III) is

(*a*) $[Co(ONO)_3\ (NH_3)_3]$ (*b*) $[Co(NO_2)_3\ (NH_3)_3]$

(*c*) $[Co(ONO_2)_3\ (NH_3)_3]$ (*d*) $[Co(NO_2)\ (NH_3)_3]$

Ans. (*a*) $[Co(ONO)_3(NH_3)_3]$

15. Which of the following is a disaccharide?

(*a*) **Glucose** (*b*) **Starch**

(*c*) **Cellulose** (*d*) **Lactose**

Ans. (*d*) Lactose

Questions 16 and 18

(A) Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explanation of the Assertion (A).

(C) Assertion (A) is correct, but Reason (R) is wrong statement.

(D) Assertion (A) is wrong, but Reason (R) is correct statement.

16. Assertion (A): An ideal solution obeys Henry's law.

Reason (R): In an ideal solution, solute-solute as well as solvent-solvent interactions are similar to solute-solvent interaction.

Ans. (D) 'A' is wrong statement 'R' is correct statement.

18. Assertion (A): Benzaldehyde is less reactive than ethanal towards nucleophilic addition reactions.

Reason (R): Ethanal is more sterically hindered.

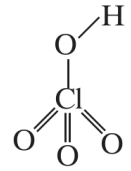
Ans. (C) 'A' is true statement 'R' is wrong statement.

SECTION – B

22. Draw the structures of the following:

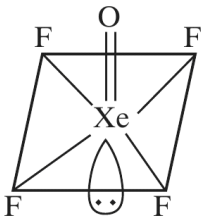
(*i*) **$HClO_4$** (*ii*) **$XeOF_4$** **1+1=2**

Ans. (*i*)



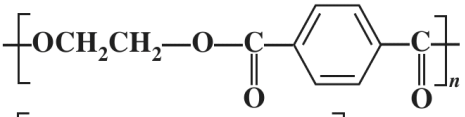
(Tetrahedral)

(*ii*)

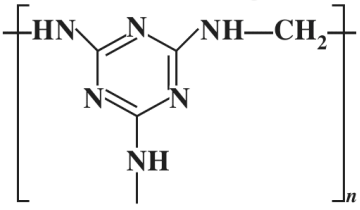


24. Identify the monomers in the following polymers:

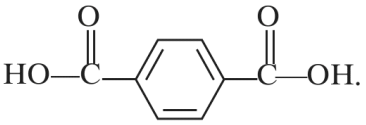
(*i*)



(*ii*)

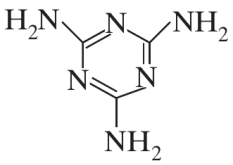
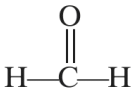


1+1=2

Ans. (*i*) $HOCH_2—CH_2OH$ and  .

Glycol

Terephthalic acid

(*ii*)  and 

Melamine

Methanal (Formaldehyde)

27. Define the following terms with a suitable example in each: **2**

(*i*) Bacteriocidal antibiotics

(*ii*) Food preservatives

Ans. (*i*) **Bactericidal antibiotics:** Those antibiotics which kill bacteria are called bacteriocidal antibiotics, e.g., Penicillin, Amino glycosides, Ofloxacin (*Any one*).

or

Those antibiotics which in low concentration inhibit the growth or destroy microorganism.

(*ii*) **Food preservatives:** Those chemicals which prevent undesirable changes in flavour, colour, texture and appetitic appeal during storage are called preservatives. They delay these changes and prevent spoilage of food due to microbial growth. The most common preservative is sodium benzoate, C_6H_5COONa. The salts of propanoic acid and sorbic acid are also used as preservatives.

SECTION – C

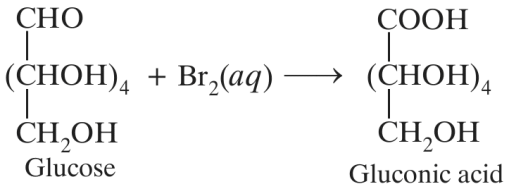
31. (*i*) What are the hydrolysis products of DNA?

(*ii*) What happens when D-glucose is treated with Bromine water?

(*iii*) What is the effect of denaturation on the structure of proteins? **1+1+1=3**

Ans. (*i*) Adenine, Guanine, Cytosine, Thymine, Deoxyribose and phosphoric acid are products of hydrolysis of DNA.

(*ii*) Gluconic acid is formed.



Glucose

Gluconic acid

(*iii*) **Denaturation of proteins:** On heating or change in pH, hydrogen bonds are disturbed, globules unfold and helix get uncoiled and leads to loss of biological activity, e.g. coagulation of egg white, curdling of milk.

Contents

Examination Papers, 2019

[Delhi Set-I, II, III]

Time Allowed : 3 hours] [*Maximum Marks* : 70

Solution based on marking scheme by CBSE.

General Instructions:

(*i*) ***All** questions are compulsory.*

(*ii*) *Section A: Questions number **1** to **5** are very-short answer questions and carry **1** mark each.*

(*iii*) *Section B: Questions number **6** to **12** are short-answer questions and carry **2** marks each.*

(*iv*) *Section C: Questions number **13** to **24** are also short-answer questions and carry **3** marks each.*

(*v*) *Section D: Questions number **25** to **27** are long-answer questions and carry **5** marks each.*

(*vi*) *There is no overall choice. However, an internal choice has been provided in **two** questions of **one** mark, **two** questions of **two** marks, **four** questions of **three** marks and all the **three** questions of **five** marks weightage. You have to attempt only one of the choices in **such** questions.*

(*vii*) *Use log tables, if necessary. Use of calculators is **not** allowed.*

Set-I

SECTION — A

***1. Out of NaCl and AgCl, which one shows Frenkel defect and why?**

Ans. Out of syllabus.

2. Arrange the following in increasing order of boiling points:

$(CH_3)_3N$, C_2H_5OH, $C_2H_5NH_2$

Ans. $(CH_3)_3N < C_2H_5NH_2 < C_2H_5OH$ is increasing order of boiling point.

3. Why are medicines more effective in colloidal state?

OR

What is difference between an emulsion and a gel?

Ans. It is due to large surface area and medicines are easily assimilated in this form.

OR

Emulsion: When liquid is dispersed in another liquid, it is called emulsion, e.g. milk.

Gel: When liquid is dispersed in solid, it is called gel, e.g. cheese, butter, etc.

4. Define ambidient nucleophile with an example.

Ans. **Ambidient nucleophiles:** Those nucleophiles which can form bond through either of the two atoms are called ambident nucleophiles, *e.g.* CN^- can link through 'C' or 'N' to form cyanide or isocyanide as follows:

$$C_2H_5Cl + KCN \longrightarrow C_2H_5C{\equiv}N + KCl$$

$$C_2H_5Br + AgCN \longrightarrow C_2H_5N{=}C + AgBr$$

5. What is the basic structural difference between glucose and fructose?

OR

Write the products obtained after hydrolysis of lactose.

Ans. Glucose has aldehyde group whereas fructose has keto group.

OR

Lactose on hydrolysis give glucose and galactose.

SECTION — B

6. Write balanced chemical equations for the following processes:

(*i*) XeF_2 undergoes hydrolysis.

(*ii*) MnO_2 is heated with conc. HCl.

OR

Arrange the following in order of property indicated for each set:

(*i*) H_2O, H_2S, H_2Se, H_2Te — increasing acidic character.

(*ii*) HF, HCl, HBr, HI — decreasing bond enthalpy.

Ans. (*i*) $2XeF_2 + 2H_2O \longrightarrow 2Xe + 4HF + O_2$

(*ii*) $MnO_2 + 4HCl(conc.) \longrightarrow MnCl_2 + 2Cl_2 + 2H_2O$

OR

(*i*) $H_2O < H_2S < H_2Se < H_2Te$ is increasing order of acidic character.

(*ii*) HF > HCl > HBr > HI is decreasing order of bond enthalpy.

7. State Raoult's law for a solution containing volatile components. Write two characteristics of the solution which obeys Raoult's law at all concentrations.

Ans. (*i*) Raoult's law: It states that partial vapour pressure of each component is directly proportional to its mole fraction when both solute and solvent are volatile.

$$p_A \propto x_A \Rightarrow p_A = p_A^o x_A$$

and $$p_B \propto x_B \Rightarrow p_B = p_B^o x_B$$

(*ii*) 1. $\Delta H_{mix} = 0$

2. $\Delta V_{mix} = 0$

3. They follow Raoult's law.

4. They can be separated by fractional distillation. [*Any two*]

8. For a reaction

$$2H_2O_2 \xrightarrow[\text{alkaline medium}]{I^-} 2H_2O + O_2$$

the proposed mechanism is as given below:

1. $H_2O_2 + I^- \longrightarrow H_2O + IO^-$ (slow) 2. $H_2O_2 + IO^- \longrightarrow H_2O + I^- + O_2$ (fast)

(*i*) Write rate law for the reaction.

(*ii*) Write the overall order of reaction.

(*iii*) Out of steps (1) and (2), which one is rate determining step?

Ans. (*i*) $\frac{dx}{dt} = k\,[H_2O_2]\,[I^-]$

There action is first order with respect to $[H_2O_2]$ and first order w.r.t $[I^-]$ although I^- is catalyst.

(*ii*) Overall order is 2.

(*iii*) Step (I) is rate determining step because it is slow step.

9. When MnO_2 is fused with KOH in the presence of KNO_3 as an oxidizing agent, it gives a dark green compound (A). Compound (A) disproportionates in acidic solution to give purple compound (B). An alkaline solution of compound (B) oxidises KI to compound (C) whereas an acidified solution of compound (B) oxidises KI to (D). Identify (A), (B), (C) and (D).

Ans. 'A' is potassium manganate (K_2MnO_4), 'B' is potassium permanganate ($KMnO_4$), 'C' is potassium iodate (KIO_3) and 'D' is molecular iodine.

$$2MnO_2 + 4KOH + O_2 \longrightarrow \underset{\text{'A'}}{2K_2MnO_4} + 2H_2O$$

(Dark green solution)

K_2MnO_4 gives MnO_4^{2-} ions which undergoes oxidation as well as reduction (disproportionation) into MnO_4^- and MnO_2.

$$\underset{\text{'B'}}{3MnO_4^{2-}} + 4H^+ \longrightarrow \underset{\text{'B'}}{3MnO_4^-} + MnO_2 + 2H_2O$$

Purple

Purple coloured $KMnO_4$ 'C' gives MnO_4^- ions which convert KI to KIO_3 in basic medium and 'A' (MnO_2) is also formed.

$$\underset{\text{'B'}}{2MnO_4^-} + H_2O + KI \longrightarrow 2MnO_2 + 2OH^- + \underset{\substack{\text{'C'}\\ \text{Potassium}\\ \text{iodate}}}{KIO_3}$$

In acidic medium, the iodide ion will oxidise to molecular iodine.

$$2MnO_4^- + 10\,I^- + 16\,H^+ \longrightarrow 2Mn^{2+} + \underset{\text{'D'}}{5I_2} + 8H_2O$$

10. Write IUPAC name of the complex $[Pt(en)_2Cl_2]$. Draw structures of geometrical isomers for this complex.

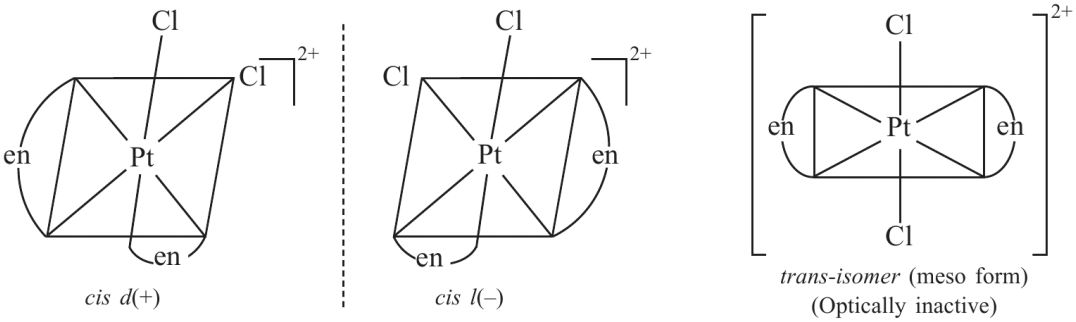
OR

Using IUPAC norms write the formulae for the following:

(*i*) Hexaamminecobalt(III) sulphate

(*ii*) Potassium trioxalatochromate(III).

Ans.



cis d(+) *cis l*(–) *trans-isomer* (meso form) (Optically inactive)

Dichlorido bis (ethane 1, 2-diamine) platinum II

OR

(*i*) $[Co(NH_3)_6]_2(SO_4)_3$

(*ii*) $K_3[Cr(C_2O_4)_3]$

11. Out of $[CoF_6]^{3-}$ and $[Co(en)_3]^{3+}$, which one complex is

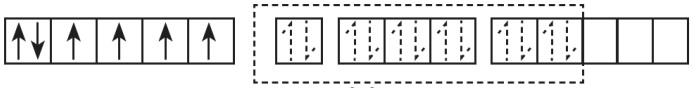
(*i*) paramagnetic **(*ii*) more stable**

(*iii*) inner orbital complex and **(*iv*) high spin complex**

(Atomic number of Co = 27)

Ans. (*i*) $[CoF_6]^{3-}$ is paramagnetic.

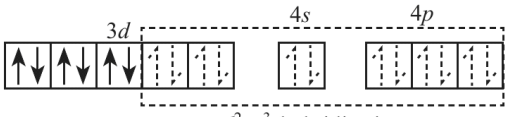
$[CoF_6]^{3-}$:



sp^3d^2 hybridisation

(*ii*) $[Co(en)_3]^{3+}$ is more stable.

(*iii*) $[Co(en)_3]^{3+}$ is inner orbital complex.

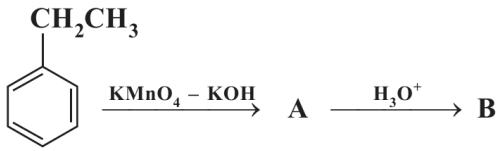


d^2sp^3 hybridisation

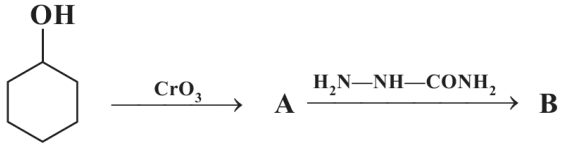
(*iv*) $[CoF_6]^{3-}$ is high spin complex.

12. Write structures of compounds A and B in each of the following reactions:

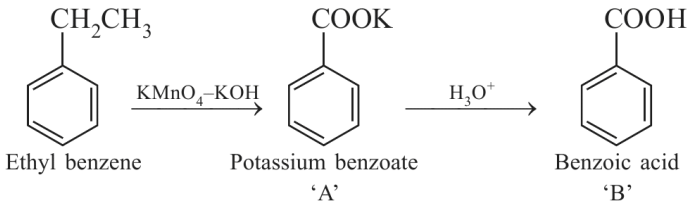
(*i*)



(*ii*)

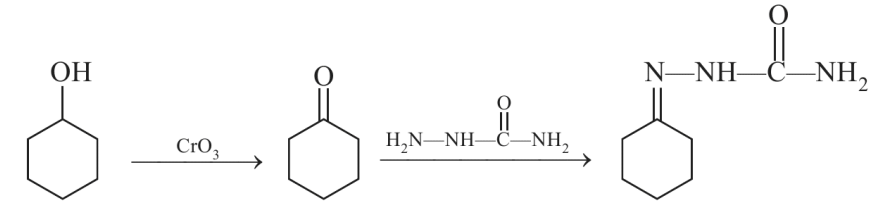


Ans. (*i*)



Ethyl benzene — Potassium benzoate 'A' — Benzoic acid 'B'

(*ii*)



Cyclohexanol — Cyclohexanone 'A' — Cyclohexanone semicarbazone 'B'

SECTION — C

13. The decomposition of NH_3 on platinum surface is zero order reaction. If rate constant (k) is 4×10^{-3} Ms^{-1}, how long will it take to reduce the initial concentration of NH_3 from 0.1 M to 0.064 M.

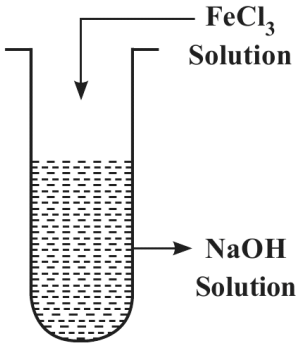
Ans. $k = 4 \times 10^{-3}$ Ms^{-1} $t = ?$ $[R]_0 = 0.1$ M $[R] = 0.064$ M

$$k = \frac{[R]_0 - [R]}{t}$$

$$\Rightarrow \quad 4 \times 10^{-3}\ Ms^{-1} = \frac{0.1 - 0.064}{t} \quad \Rightarrow \quad t = \frac{0.1 - 0.064}{4 \times 10^{-3}} = \frac{0.036}{0.004} = 9 \text{ seconds.}$$

14. (*i*) What is the role of activated charcoal in gas mask?

(*ii*) A colloidal sol is prepared by the given method in figure. What is the charge on hydrated ferric oxide colloidal particles formed in the test tube? How is the sol represented?



(*iii*) How does chemisorption vary with temperature?

Ans. (*i*) Activated charcoal adsorbs poisonous gases but not oxygen, therefore, it is used to save us from harmful gases.

(*ii*) Since NaOH is in excess, therefore, negatively charged colloid will be formed. $Fe(OH)_3/OH^-$ is representation of $Fe_2O_3.xH_2O/OH^-$.

(*iii*) Chemisorption first increases and then decreases with increase in temperature because some activation energy is needed for formation of covalent bonds but at high temperature, bonds will break.

***15. An element crystallizes in *fcc* lattice with a cell edge of 300 pm. The density of the element is 10.8 g cm^{-3}. Calculate the number of atoms in 108 g of the element.**

Ans. Out of syllabus.

16. A 4% solution (w/w) of sucrose (M = 342 g mol^{-1}) in water has a freezing point of 271.15 K. Calculate the freezing point of 5% glucose (M = 180 g mol^{-1}) in water. (Given: Freezing point of pure water = 273.15 K)

Ans. $W_B = 4$ g, $W_A = 100 - 4 = 96$ g, $M_B = 342$ g mol^{-1}, $\Delta T_f = 273.15\text{ K} - 271.15\text{ K} = 2.0$ K,

$$2.0\text{ K} = \Delta T_f = K_f \times \frac{W_B}{M_B} \times \frac{1000}{W_A} = K_f \times \frac{4}{342} \times \frac{1000}{96} \quad ...(i)$$

For Glucose:
$$\Delta T_f = K_f \times \frac{5}{180} \times \frac{1000}{95} \quad ...(ii)$$

Dividing (*i*) and (*ii*) we get

$$\frac{2.0}{\Delta T_f} = \frac{4}{342} \times \frac{180}{5} \times \frac{1000}{96} \times \frac{95}{1000}$$

$$= \frac{4 \times 36 \times 95}{342 \times 96} = \frac{36 \times 95}{342 \times 24} = \frac{3420}{8208}$$

$$\Delta T_f = \frac{2.0 \times 8208}{3420} = \frac{16416}{3420} = 4.8\text{ K}$$

Freezing point of Glucose solution = Freezing point of water $-\Delta T_f$

$= 273.15 - 480\text{ K} = 268.35$ K

17. (*a*) Name the method of refining which is

(*i*) used to obtain semicondutor of high purity,

(*ii*) used to obtain low boiling metal.

(*b*) Write chemical reactions taking place in the extraction of copper from Cu_2S.

Ans. (*a*) (*i*) Zone refining (*ii*) Distillation

(*b*) $2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$

$Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2$

18. Give reasons for the following:

(*i*) Transition elements and their compounds act as catalysts.

(*ii*) E° value for ($Mn^{2+}|Mn$) is negative whereas for ($Cu^{2+}|Cu$) is positive.

(*iii*) Actinoids show irregularities in their electronic configuration.

Ans. (*i*) It is because they show variable oxidation states and have vacant *d*-orbitals forming unstable intermediates which readily change into products.

(*ii*) It is due to Mn^{2+} is stable due to exactly half filled $3d^5$ configuration. ECu_2^+/Cu is +ve due to high enthalpy of atomisation and low hydration enthalpy.

(*iii*) All actinoids are radioactive and some of them of very short half life. They have comparable energy of 7*s*, 6*d* and 5*f* orbitals, therefore, irregularity in their electronic configuration.

19. Write the structures of monomers used for getting the following polymers:

(*i*) Nylon-6, 6

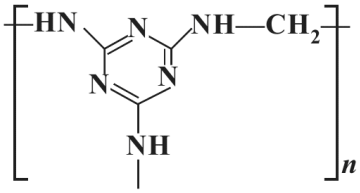
(*ii*) Glyptal

(*iii*) Buna-S

OR

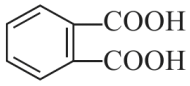
(*i*) Is $+CH_2—\underset{CH_3}{\underset{|}{C}}H+_n$ a homopolymer or copolymer? Give reason.

(*ii*) Write the monomers of the following polymer:



(*iii*) What is the role of Sulphur in vulcanization of rubber?

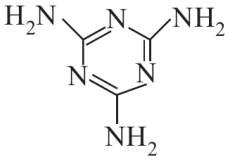
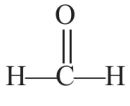
Ans. (*i*) Hexa methylene diamine (Hexane 1,6 diamine, $H_2N(CH_2)_6NH_2$) and $HO—\overset{O}{\overset{\|}{C}}—(CH_2)_4—\overset{O}{\overset{\|}{C}}—OH$ (Adipic acid, Hexane 1,6-dioic acid)

(*ii*) Glycol ($CH_2OH—CH_2OH$) and  (Phthalic acid)

(*iii*) Buta-1, 3-diene ($CH_2=CH—CH=CH_2$) and vinyl cyanide ($CH_2=CH—CN$)

OR

(*i*) It is homopolymer because it is polymer of only one type of monomer.

(*ii*)  and 

Melamine

Methanal (Formaldehyde)

(*iii*) Sulphur helps in formation of cross linkages between monomers which makes it hard, more elastic and more tensile strength.

20. (*i*) What type of drug is used in sleeping pills?

(*ii*) What type of detergents are used in toothpastes?

(*iii*) Why the use of alitame as artificial sweetener is not recommended?

OR

Define the following terms with a suitable example in each:

(*i*) Broad-spectrum antibiotics.

(*ii*) Disinfectants.

(*iii*) Cationic detergents.

Ans. (*i*) Hypnotics. e.g., chloretone.

(*ii*) Anionic detergents.

(*iii*) Its sweetness cannot be controlled.

OR

(*i*) **Broad spectrum antibiotics** are effective against large number of micro-organisms, *e*.g. Chloramphenicol is a broad spectrum antibiotic. It is readily absorbed in gastro-intestinal tract and hence can be given orally in case of typhoid, dysentery and acute fever, certain type of urinary infections, meningitis and pneumonia.

(*ii*) **Disinfectants:** They kill micro-organisms but are not safe for contact with living tissues. These are applied to inanimate objects such as floor, instruments, walls, etc. 2% solution of phenol acts as disinfectant, 0.2 to 0.4 parts per million is used for disinfecting drinking water and low concentration of SO_2 is used for sterilising squashes for preservation.

(*iii*) **Cationic detergents:** These are mostly acetates or chlorides or bromides of quarternary ammonium salts. They are more expensive, therefore used to limited extent. Such detergents possess germicidal properties and are used extensively as germicides, e.g. cetyl trimethyl ammonium chloride $[CH_3(CH_2)_{15}N(CH_3)_3]^+Cl^-$ is cationic detergent.

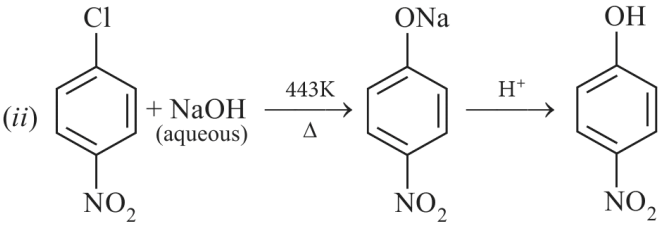
21. (*i*) Out of $(CH_3)_3C$—Br and $(CH_3)_3C$—I, which one is more reactive towards S_NI and why?

(*ii*) Write the product formed when *p*-nitrochlorobenzene is heated with aqueous NaOH at 443 K followed by acidification.

(*iii*) Why *dextro* and *laevo* – rotatory isomers of Butan-2-ol are difficult to separate by fractional distillation?

Ans. (*i*) (CH_3) C—I will be more reactive because C—I has lower bond dissociation enthalpy than C—Br bond, due to longer bond length.

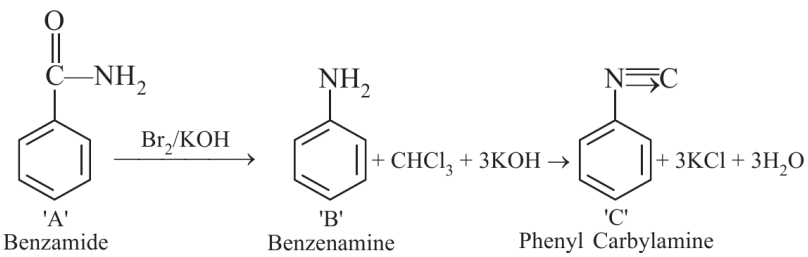
(*ii*)



(*iii*) It is because they do not differ appreciably in their boiling points (physical properties), differ in optical rotation and biological properties.

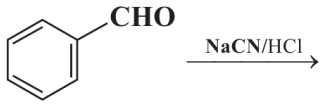
22. An aromatic compound 'A' on heating with Br_2 and KOH forms a compound 'B' of molecular formula C_6H_7N which on reacting with $CHCl_3$ and alcoholic KOH produces a foul smelling compound 'C'. Write the structures and IUPAC names of compounds A, B and C.

Ans.



'A' is Benzamide, 'B' is Benzenamine, 'C' is isocyanobenzene.

23. Complete the following reactions:

(*i*) 

(*ii*) $(C_6H_5CH_2)_2Cd + 2CH_3COCl \longrightarrow$

(*iii*) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-COOH \xrightarrow[(ii)\ H_2O]{(i)\ Br_2/Red\ P_4}$

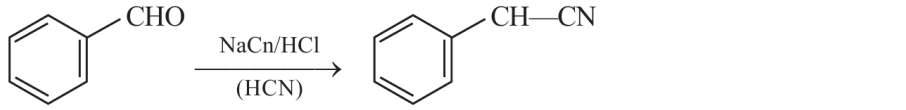
OR

Write chemical equations for the following reactions:

(*i*) Propanone is treated with dilute $Ba(OH)_2$.

(*ii*) Acetophenone is treated with Zn(Hg)/Conc. HCl

(*iii*) Benzoyl chloride is hydrogenated in presence of $Pd/BaSO_4$.

Ans. (*i*) 

Benzaldehyde — Benzaldehyde cyanohydrin (2-hydroxy-2-phenyl ethane)

(*ii*) $(C_6H_5-CH_2)_2Cd + 2CH_3COCl \longrightarrow 2C_6H_5-CH_2-\overset{\displaystyle O}{\overset{\|}{C}}-CH_3 + CdCl_2$

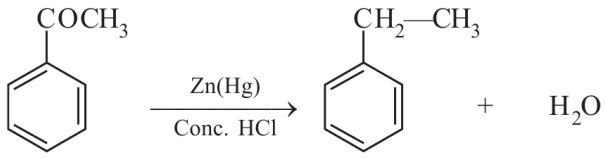
Dibenzyl Cadmium — Acetyl Chloride — 1-Phenyl propan-2-one

(*iii*) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-COOH \xrightarrow[(ii)\ H_2O]{(i)\ Br_2/RedP_4} CH_3-\underset{\displaystyle Br}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-COOH$

OR

(*i*) $2CH_3-\overset{\displaystyle O}{\overset{\|}{C}}-CH_3 \xrightarrow{dil.\ Ba(OH)_2} CH_3-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle OH}{\overset{|}{C}}}}-CH_2-\overset{\displaystyle O}{\overset{\|}{C}}-CH_3$

Acetone (Propanone) — 4-hydroxy-4-methyl pentan-2-one

(*ii*) 

Acetophenone — Ethyl benzene

(*iii*) $C_6H_5-\overset{\displaystyle O}{\overset{\|}{C}}-Cl + H_2 \xrightarrow{Pd/BaSO_4} C_6H_5-\overset{\displaystyle O}{\overset{\|}{C}}-H + HCl$

24. Differentiate between the following:

(*i*) Amylose and Amylopectin

(*ii*) Peptide linkage and Glycosidic linkage

(*iii*) Fibrous proteins and Globular proteins

OR

Write chemical reactions to show that open structure of D-glucose contains the following:

(*i*) Straight chain

(*ii*) Five alcohol groups

(*iii*) Aldehyde as carbonyl group

Ans. (*i*) **Amylose:** It is a linear chain polymer of α-glucose, water soluble component of starch which constitute 15-20% of starch. It has $C_1 - C_4$ linkages.

Amylopectin: It is branched chain polymer of α-glucose, water insoluble component, form 80-85% of starch. It has $C_1 - C_4$ and $C_1 - C_6$ linkages.

(*ii*) **Peptide bond or peptide linkage:** The bond $-\left(-\overset{\overset{O}{\|}}{C}-NH-\right)-$ between two or more amino acids in polypeptides and proteins.

Glycosidic linkage: It is oxide linkage between two or more monosaccharide units in Polysaccharides.

(*iii*) **Fibrous proteins:** Thread like structure, insoluble in water, e.g. keratin (hair, wool, silk), myosin (muscles) etc, have β-placated structure.

Globular proteins: Chains of polypeptidic coil around (α-helix), spherical shape, soluble in water, e.g. insulin, albumin.

OR

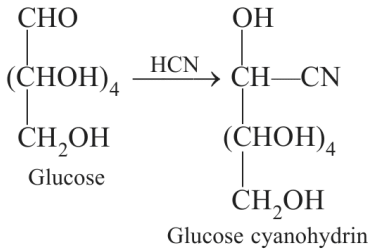
(*i*) *n*-hexane is formed, $CH_3—CH_2—CH_2—CH_2—CH_2—CH_3$

$$\begin{array}{l} CHO \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array} + HI \longrightarrow \underset{\text{n-hexane}}{CH_3—(CH_2)_4—CH_3}$$

(*ii*)
$$\underset{\text{Glucose}}{\begin{array}{l} CHO \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array}} + 5(CH_3CO)_2O \longrightarrow 5CH_3COOH + \underset{\text{Glucose pentaacetate}}{\begin{array}{l} CHO \\ | \\ (CHOCOCH_3)_4 \\ | \\ CH_2OCOCH_3 \end{array}}$$

(*iii*)
$$\underset{\text{D-Glucose}}{\begin{array}{l} CHO \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array}} + Br_2(aq) \longrightarrow \underset{\text{Gluconic acid}}{\begin{array}{l} COOH \\ | \\ (CHOH)_4 \\ | \\ CH_2OH \end{array}}$$

or



Glucose

Glucose cyanohydrin

SECTION — D

25. **E°_{cell} for the given redox reaction is 2.71 V.**

$$Mg(s) + Cu^{2+}_{(0.01\ M)} \longrightarrow Mg^{2+}_{(0.001\ M)} + Cu(s)$$

Calculate E_{cell} for the reaction. Write the direction of flow of current when an external opposite potential applied is

(*i*) less than 2.71 V and

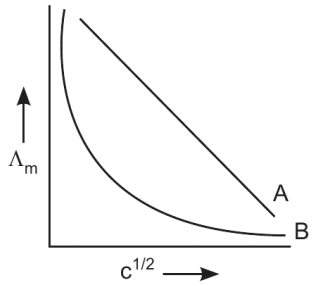
(*ii*) greater than 2.71 V

OR

(*a*) A steady current of 2 amperes was passed through two electrolytic cells X and Y connected in series containing electrolytes $FeSO_4$ and $ZnSO_4$ until 2.8 g of Fe deposited at the cathode of cell X. How long did the current flow? Calculate the mass of Zn deposited at the cathode of cell Y.

(Molar Mass: Fe = 56 g mol^{-1}, Zn = 65.3 g mol^{-1}, 1F = 96500 C mol^{-1})

(*b*) In the plot of molar conductivity (Λ_m) vs square root of concentration ($c^{1/2}$), following curves are obtained for two electrolytes A and B:



Answer the following:

(*i*) Predict the nature of electrolytes A and B.

(*ii*) What happens on extrapolation of Λ_m to concentration approaching zero for electrolytes A and B?

Ans. (*i*) If external opposite potential is less than 2.71 V, the flow of current will be from (copper) cathode to anode (Mg).

(*ii*) If external opposite potential is greater than 2.71 V, current will flow from cathode (Mg) to anode (copper) cathode will become anode and anode will become cathode. Mg (cathode), Cu (anode).

$$Mg(s) \longrightarrow Mg^{2+} + 2e^-$$

$$Cu^{2+} + 2e^- \longrightarrow Cu(s)$$

$$E_{cell} = E^\circ_{cell} - \frac{2.303\,RT}{nF} \log \frac{[Mg^{2+}]}{[Cu^{2+}]}$$

$$= 2.71\ V - \frac{0.0591}{2} \log \frac{10^{-3}}{10^{-2}}$$

$$= 2.71\ V - 0.0295 \log 10^{-1}$$

$$= 2.71\ V + 0.0295 \qquad [\because \log 10^{-1} = -1]$$

$$E_{cell} = 2.7395\ V = 2.74\ V$$

OR

(*a*) I = 2 A, t = ?,

Atomic weight of Fe = 56 g mol^{-1}, Z = 65.3 g mol^{-1}, m = 2.8 g

$$m = Z \times I \times t$$

$$2.8 = \frac{56}{2 \times 96500} \times 2 \times t$$

$$Z = \frac{\text{Eq. wt}}{96500} = \frac{\text{Atomic mass}}{\text{valency} \times 96500} = \frac{56}{2 \times 96500} \text{ for Iron}$$

$$t = \frac{2.8 \times 2 \times 96500}{56 \times 2} = 4825\ s$$

$$t = \frac{4825}{60 \times 60} = 1.34 \text{ hours}$$

$$\frac{m_{Zn}}{E_{Zn}} = \frac{m_{Fe}}{E_{Fe}}$$

$$\Rightarrow \quad \frac{m_{Zn}}{\frac{65.3}{2}} = \frac{2.8}{\frac{56}{2}}$$

$$\Rightarrow \quad m_{Zn} = \frac{2.8}{28} \times \frac{65.3}{2} = 3.265\ g$$

(*b*) (*i*) 'A' is strong electrolyte, 'B' is weak electrolyte.

(*ii*) Λ°_m (limiting molar conductivity) of 'A' can be obtained by extrapolation but Λ°_m of 'B' cannot be obtained because a curve cannot be extrapolated.

26. **(*a*) How do you convert the following:**

(*i*) Phenol to Anisole

(*ii*) Ethanol to Propan-2-ol

(*b*) Write the mechanism of the following reaction:

$$C_2H_5CH_2OH \xrightarrow[443\ K]{H_2SO_4} CH_2{=}CH_2 + H_2O$$

(*c*) Why phenol undergoes electrophilic substitution more easily than benzene?

OR

(*a*) Account for the following:

(*i*) *o*-nitrophenol is more steam volatile than *p*-nitrophenol.

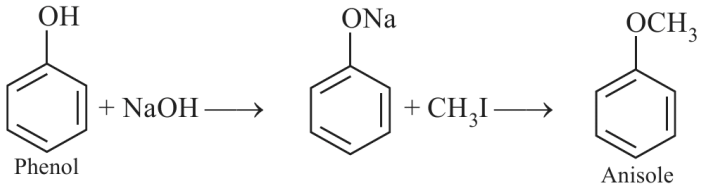
(*ii*) *t*-butyl chloride on heating with sodium methoxide gives 2-methylpropene instead of *t*-butylmethylether.

(*b*) Write the reaction involved in the following:

(*i*) Reimer-Tiemann reaction

(*ii*) Friedal-Crafts Alkylation of Phenol.

(*c*) Give simple chemical test to distinguish between Ethanol and Phenol.

Ans. (*a*) (*i*) 

(*ii*) $CH_3CH_2OH \xrightarrow[573K]{Cu} CH_3-\overset{O}{\overset{\|}{C}}-H \xrightarrow[(ii)\ H_2O/H^+]{(i)\ CH_3MgBr} CH_3-\overset{OH}{\overset{|}{CH}}-CH_3$

Ethanol — Ethanal — 2-Propanol

(*b*) When ethanol is heated with concentrated sulphuric acid at 443 K, ethene is formed.

$$CH_3CH_2OH \xrightarrow[443\ K]{Conc.\ H_2SO_4} CH_2{=}CH_2 + H_2O$$

$$H_2O + H^+ \longrightarrow H_3O^+$$

Mechanism:

(*i*) $CH_3CH_2\ddot{\underset{\cdot\cdot}{O}}H + H_3O^+ \longrightarrow CH_3-CH_2-\overset{\oplus}{\underset{\cdot\cdot}{O}}(H)-H + H_2O$

(*ii*) $CH_3CH_2-\overset{\oplus}{\underset{\cdot\cdot}{O}}(H)-H \longrightarrow CH_3\overset{\oplus}{C}H_2 + H_2O$

(*iii*) $H-\underset{H}{\overset{H}{C}}-\overset{H}{\underset{H}{\overset{\oplus}{C}}} + H_2O \longrightarrow H-C{=}C-H + H_3O^+$

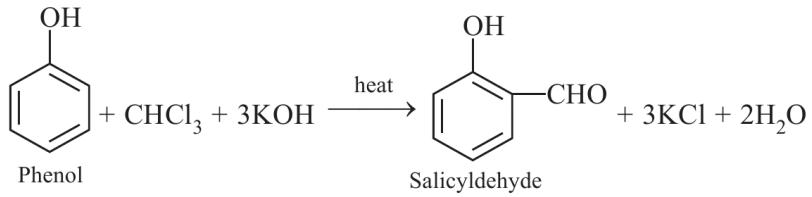
(*c*) It is because –OH group is electron releasing, activating, therefore, it undergoes electrophilic substitution more readily than benzene.

OR

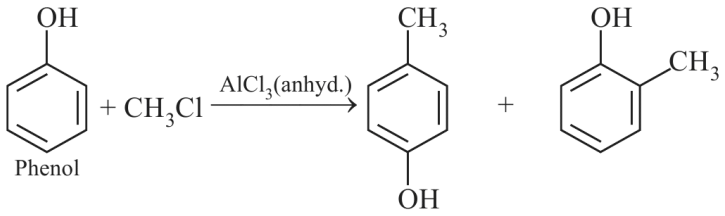
(*a*) (*i*) Ortho nitrophenol is steam volatile because of weak intra-molecular H-bonding, whereas *p*-nitrophenol is associated with inter-molecular H-bonding. Therefore, it is not steam volatile.

(*ii*) It is due to –I and –R effect of —NO_2 group and +I and +R effect of CH_3 group, *p*-nitrophenoxide ion is more stable than *p*-methyl phenoxide ion.

(*b*) (*i*) **Reimer–Tiemann reaction:** When phenol is heated with $CHCl_3$ and KOH, salicylaldehyde is formed.



(*ii*)



(*c*) Add neutral $FeCl_3$. Ethanol does not react. Phenol gives violet colour.

27. (*a*) Give reasons for the following:

(*i*) Sulphur in vapour state shows paramagnetic behaviour.

***(*ii*) N—N bond is weaker then P—P bond.**

(*iii*) Ozone is thermodynamically less stable than oxygen.

***(*b*) Write the name of gas released when Cu is added to**

(*i*) dilute HNO_3 and

(*ii*) conc. HNO_3

OR

(*a*) *(*i*) Write the disproportionation reaction of H_3PO_3.

(*ii*) Draw the structure of XeF_4.

(*b*) Account for the following:

(*i*) Although Fluorine has less negative electron gain enthalpy yet F_2 is strong oxidizing agent.

***(*ii*) Acidic character decreases from N_2O_3 to Bi_2O_3 in group 15.**

(*c*) Write a chemical reaction to test sulphur dioxide gas. Write chemical equation involved.

Ans. (*a*) (*i*) It is due to presence of unpaired electron in sulphur like O_2.

(*ii*) Out of syllabus.

(*iii*) It is because O_3 has low bond dissociation energy due to which it is more reactive, therefore, it liberates nascent oxygen easily.

$$O_3 \longrightarrow O_2 + [O]$$

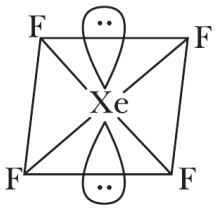
(*b*) (*i*) Out of syllabus.

(*ii*) Out of syllabus.

OR

(*a*) (*i*) Out of syllabus.

(*ii*)



(*b*) (*i*) It is because F_2 has higher standard reduction potential.

(*ii*) Out of syllabus.

(*c*) Pass SO_2 gas through acidified potassium dichromate.

It will become green.

$$Cr_2O_7^{2-} + 3SO_2 + 2H^+ \longrightarrow \underset{\text{(Green)}}{2Cr^{3+}} + 3SO_4^{2-} + H_2O$$

Set-II (Uncommon Questions to Set-I)

SECTION — A

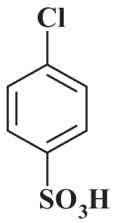
2. Arrange the following in increasing order of base strength in gas phase:
$(C_2H_5)_3N$, $C_2H_5NH_2$, $(C_2H_5)_2NH$

Ans. $C_2H_5NH_2 < (C_2H_5)_2NH < (C_2H_5)_3N$ is increasing order of base strength in gas phase.

***3. Why conductivity of silicon increases on doping with phosphorus?**

Ans. Out of syllabus.

5. Write IUPAC name of the given compound:



Ans. 4-Chlorobenzene sulphonic acid.

SECTION — B

8. Write two difference between ideal solutions and non-ideal solution.

Ans.

Ideal solution	Non-ideal solution
(*i*) It obey Raoult's law at every range of concentration (at all values of concentration)	(*i*) It does not obey Raoult's law.
(*ii*) $\Delta H_{mix} = 0$, $\Delta V_{mix} = 0$	(*ii*) $\Delta H_{mix} \neq 0$, $\Delta V_{mix} \neq 0$

10. Write IUPAC name of the complex $[Cr(NH_3)_4Cl_2]^+$. Draw structures of geometrical isomers for this complex.

OR

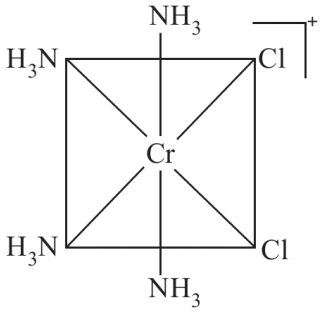
Using IUPAC norms write the formulae for the following:

(*i*) Pentaamminenitrito-O-cobalt(III) chloride

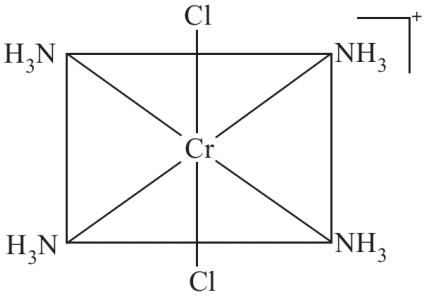
(*ii*) Potassium tetracyanidonickelate(II)

Ans. Tetraamminedichloridochromium(III).

It exhibits geometrical isomerism.



cis-isomer



trans-isomer

OR

(*i*) $[Co(NH_3)_5ONO]Cl_2$

(*ii*) $K_2[Ni(CN)_4]$

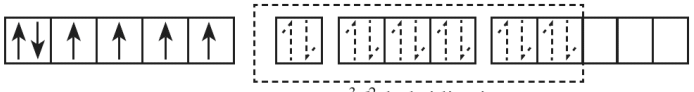
11. Out of $[CoF_6]^{3-}$ and $[Co(C_2O_4)_3]^{3-}$, which one complex is

(*i*) diamagnetic **(*ii*) more stable**

(*iii*) outer orbital complex **(*iv*) low spin complex?**

Ans. (*i*) $[CoF_6]^{3-}$ is paramagnetic and $[Co(C_2O_4)_3]^{3-}$ is diamagnetic.

$[CoF_6]^{3-}$:



sp^3d^2 hybridisation

(*ii*) $[Co(C_2O_4)_3]^{3-}$ is more stable.

(*iii*) $[CoF_6]^{3-}$ is outer orbital complex.

(*iv*) $[Co(C_2O_4)_3]^{3-}$ is low spin complex.

SECTION — C

***13. An element crystallizes in fcc lattice with a cell edge of 300 pm. The density of the element is 10.8 g cm^{-3}. Calculate the number of atoms in 108 g of the element.**

Ans. Out of syllabus.

17. (*i*) Write the role 'CO' in the purification of nickel

(*ii*) State the role of silica in the metallurgy of copper.

(*iii*) What type of metals are generally extracted by electrolytic method?

Ans. (*i*) CO reacts with impure Ni to form $Ni(CO)_4$ which decomposes to form pure Ni on heating.

$$\underset{\text{(Impure)}}{Ni + 4CO} \longrightarrow Ni(CO)_4 \xrightarrow{heat} \underset{\text{(Pure)}}{Ni + 4CO}$$

(*ii*) It acts as flux. It reacts with FeO to form $FeSiO_3$ (slag) which can be easily removed.

$FeO + SiO_2 \longrightarrow FeSiO_3$

(*iii*) Highly reactive metals are generally extracted by electrolytic method.

18. Give reasons for the following:

(*i*) Transition metals form alloys.

(*ii*) Mn_2O_3 is basic whereas Mn_2O_7 is acidic.

(*iii*) Eu^{2+} is a strong reducing agent.

Ans. (*i*) Transition metal do not differ appreciably in their size, therefore, can replace each other in metallic bond and form alloys.

(*ii*) In Mn_2O_3, Mn is in +3 oxidation state, it forms $Mn(OH)_3$ on heating with water, therefore, it is basic.

Mn_2O_7 is acidic because Mn^{7+} (highest oxidation state), dissolves in water forming $HMnO_4$ (Permanganic acid), therefore, acidic in nature.

(*iii*) Eu^{2+} can lose on electron to form Eu^{3+} which has higher hydration energy, therefore, easily formed.

20. (*i*) Why bithional is added in soap?

(*ii*) Why soaps are biodegradable whereas detergents are non-biodegradable?

OR

Define the following terms with a suitable example in each:

(*i*) Antibiotics

(*ii*) Artificial sweeteners

(*iii*) Analgesics.

Ans. (*i*) It is added to soaps to impart antiseptic properties.

(*ii*) Soaps are 100% biodegradable because it is decomposed by micro-organisms and does not create water pollution.

OR

(*i*) **Antibiotics:** Those drugs which kill or prevent the growth of bacteria and other micro-organisms are called antibiotics, *e.g.* Streptomycin.

(*ii*) **Artificial sweetener:** Sweetening agents which do not add calories for diabetic and over weight (obese) people, e.g. saccharine, alitame, aspartame, sucralose.

(*iii*) **Analgesics:** Those drugs, which relieve or decrease pain without causing unconsciousness, paralysis or incoordination, mental confusion are termed as analgesics. Aspirin, analgin, seridon, anacine, aspro, morphine, codeine. (*any one example*)

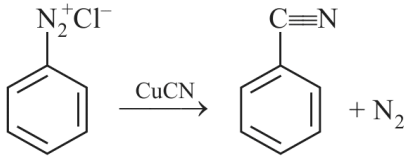
21. Write the structures of main products when benzene diazonium chloride reacts with the following reagents:

(*i*) CuCN

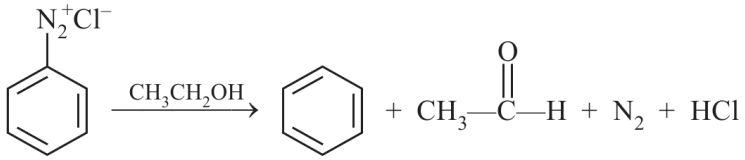
(*ii*) CH_3CH_2OH

(*iii*) KI

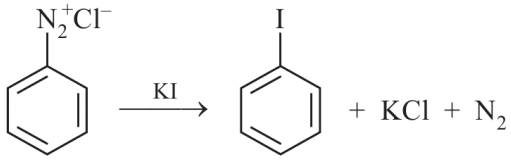
Ans. (*i*)



(*ii*)



(*iii*)



Set-III (Uncommon Questions to Set-I and Set-II)

SECTION — A

1. Arrange the following in decreasing order of solubility in water:

$(CH_3)_3N$, $(CH_3)_2NH$, CH_3NH_2

Ans. $CH_3NH_2 > (CH_3)_2NH > (CH_3)_3N$ is decreasing order of solubility in water.

***2. What type of stoichiometric defect is shown by ZnS and why?**

Ans. Out of syllabus.

3. Write one stereochemical difference between S_N1 and S_N2 reactions.

Ans. In S_N1, racemisation takes place, whereas in S_N2 mechanism stereochemical inversion (optical inversion) takes place.

SECTION — B

7. State Henry's law and write its two applications.

Ans. **Henry's Law:** It states that the partial vapour pressure of a gas in vapour phase (p) is directly proportional to the mole fraction of the gas (x) in the solution.

Mathematically, $p = K_H \times x$

where K_H is Henry's law contant.

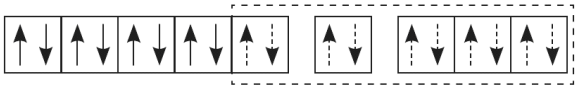
Applications of Henry's Law:

(i) To minimise the painful effects accompanying the decompression of deep sea divers (bends), oxygen diluted with less soluble helium gas is used as breathing gas.

(ii) To increase the solubility of CO_2 in soft drinks and soda water, the bottle is sealed under high pressure.

11. Write the hybridisation, and magnetic character of $[Fe(CO)_5]$.

Ans. $[Fe(CO)_5]$

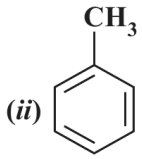


dsp^3

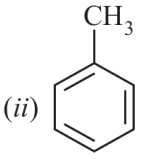
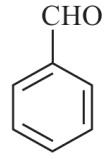
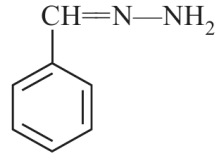
It has dsp^3 hybridisation, trigonal bipyramidal shape, diamagnetic.

12. Write structures of main compounds A and B in each of the following reactions:

(i) $\mathbf{CH_3CH_2CN \xrightarrow{CH_3MgBr/H_3O^+} A \xrightarrow{LiAlH_4} B}$

(ii)  $\xrightarrow[(ii)\ H_3O^+/\Delta]{(i)\ CrO_3/(CH_3CO)_2O}$ **A** $\xrightarrow{H_2N—NH_2}$ **B**

Ans. (i) $CH_3CH_2CN \xrightarrow{CH_3MgBr/H_3O^+} CH_3CH_2\overset{\overset{O}{\|}}{C}—CH_3$ ('A') $\xrightarrow{LiAlH_4} CH_3CH_2\overset{\overset{OH}{|}}{C}H—CH_3$ ('B')

(ii)  $\xrightarrow[(ii)\ H_3O^+/\Delta]{(i)\ CrO_3/(CH_3CO)_2O}$  ('A') $\xrightarrow{H_2N—NH_2}$  ('B')

SECTION — C

17. How will you convert the following:

(i) Impure Nickel to pure Nickel

(ii) Zinc blende to Zinc metal

(iii) $[Ag(CN)_2]^-$ to Ag

Ans. (*i*) $Ni + 4CO \longrightarrow \underset{\text{(Impure)}}{Ni(CO)_4}$

$$Ni(CO)_4 \xrightarrow{\text{Heat}} \underset{\text{(Pure)}}{Ni} + 4CO$$

(*ii*) $2ZnS + 3O_2 \longrightarrow 2ZnO + 2SO_2$

$ZnS + 2ZnO \longrightarrow 3Zn + SO_2$

OR

$ZnO + C \longrightarrow Zn + CO$

(*iii*) $2[Ag(CN)_2]^- + Zn \longrightarrow [Zn(CN)_4]^{2-} + 2Ag$

18. Give reasons for the following:

(*i*) The transition metals generally form coloured compounds.

(*ii*) The E° value for the Mn^{3+}/Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+} couple or Fe^{3+}/Fe^{2+} couple.

(*iii*) The Chemistry of actinoids elements is not so smooth as that of the lanthanoids.

Ans. (*i*) It is because their high ionic charges, comparatively smaller sizes of the metal ions and the availability of *d*-orbitals for bond formation.

(*ii*) It is because Mn^{2+} is more stable than Mn^{3+} due to stable half filled $3d^5$ configuration, whereas $Cr^{3+}(t_{2g}^3)$ and $Fe^{3+}(3d^5)$ are more stable than Cr^{2+} and Fe^{2+} respectively.

(*iii*) It is because all actinoids are radioactive and some of them very short half life.

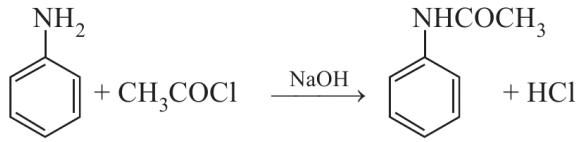
22. Write equations of the following reactions:

(*i*) Acetylation of aniline

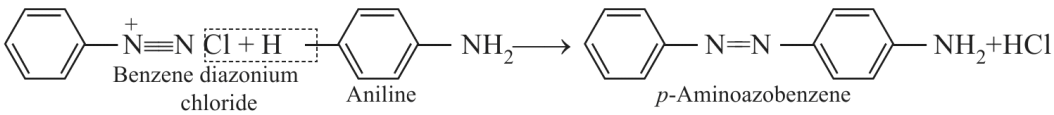
(*ii*) Coupling reaction

(*iii*) Carbyl amine reaction

Ans. (*i*) **Acetylation or acylation:** The process, in which acetyl group ($CH_3—\overset{\overset{O}{\|}}{C}—$) is introduced, is called acetylation. It is done by reaction with acetyl chloride or acetic anhydride. It reduces its activation effect because $CH_3—\overset{\overset{O}{\|}}{C}—$ is electron withdrawing.



(*ii*) **Coupling reaction:** When benzene diazonium chloride reacts with aniline or phenol, orange azo dye is formed.



(*iii*) **Carbyl amine reaction:** When primary amine reacts with $CHCl_3$ and KOH, it forms isocyanide which is an offensive smelling compound.

$$RNH_2 + CHCl_3 + 3KOH \longrightarrow RN{\equiv}C + 3KCl + 3H_2O$$

24. Define the following with a suitable example in each:

(*i*) Oligosaccharides (*ii*) Denaturation of protein (*iii*) Vitamins

OR

Write the reactions involved when D-glucose is treated with the following reagents:

(*i*) Br_2 water (*ii*) H_2N—OH (*iii*) $(CH_3CO)_2O$

Ans. (*i*) **Oligosaccharide:** They give 2 to 10 units of monosaccharide on hydrolysis, e.g. raffinose is trisaccharide of glucose, fructose and galactose.

(*ii*) **Denaturation of proteins:** On heating or change in pH, hydrogen bonds are disturbed, globules unfold and helix get uncoiled and leads to loss of biological activity, e.g. coagulation of egg white, curdling of milk.

(*iii*) **Vitamins:** Vitamins are the group of organic compounds which are required in very small amounts for the healthy growth and functioning of animal organism. They cannot be made by organism and so have to be part of our diet. The deficiency of a vitamin can cause a specific disease. Vitamins A, D, E and K are fat-soluble substances, whereas vitamin B complex and vitamin C are water-soluble.

OR

(*i*) $(CHOH)_4(CHO)(CH_2OH) + Br_2(aq) \longrightarrow (CHOH)_4(COOH)(CH_2OH)$

Glucose → Gluconic acid

(*ii*) $(CHOH)_4(CHO)(CH_2OH) + NH_2OH \longrightarrow (CHOH)_4(CH{=}NOH)(CH_2OH)$

Glucose + Hydroxyl amine → Glucose monoxime

(*iii*) $(CHOH)_4(CHO)(CH_2OH) + 5(CH_3CO)_2O \longrightarrow 5CH_3COOH + (CHOCOCH_3)_4(CHO)(CH_2OCOCH_3)$

Glucose + Acetic anhydride → Glucose pentaacetate