CBSE Class 12

Chemistry

Previous Year Question Paper 2020

Set- 1 **Code no: 56/1/1**

- Please check that this question paper contains 21 printed pages + Maps.
- Code number given on the right-hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains 31 questions.
- Please write down the Serial Number of the question in the answer-book before attempting it.
- 15-minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

CHEMISTRY

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

General Instructions:

- Read the following instructions very carefully and strictly follow then:
- This question paper comprises four Sections - **A, B, C** and **D**. There are 37 questions in the question paper. All questions are compulsory.
- **Section A** - Questions no. **1** to **20** a very short answer type question carrying I mark each. Answer these questions in one word or one sentence.
- **Section B** - Questions no. **21** to **27** are short answer type questions, carrying **2** marks each.

- **Section C** - Questions no. **28** to **34** are long answer type-I questions, carrying **3** marks each.
- **Section D** - Questions no. **35** to **37** are long answer type.11 questions, carrying **5** marks each.
- 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 must attempt only one of the choices in such questions.
- In addition to this. separate instructions are given with each section and question, wherever necessary.
- Use of calculators and log tables is not permitted.

SECTION - A

Read the given passage and answer the questions number 1 to 5 that follow: 1x5=5 Marks

The substitution reaction of alkyl halide mainly occurs by SN1 or SN2 mechanism. Whatever mechanism alkyl halides follow for the substitution reaction to occur, the polarity of the carbon halogen bond is responsible for these substitution reactions. The rate of SN1 reactions are governed by the stability of carbocation whereas for SN2 reactions steric factor is the deciding factor. If the starting material is a chiral compound, we may end up with an inverted product or racemic mixture depending upon the type of mechanism followed by alkyl halide. Cleavage of ethers with HI is also governed by steric factors and stability of carbocation, which indicates that in organic chemistry, these two major factors help us in deciding the kind of product formed.

1. Predict the stereochemistry of the product formed if an optically active alkyl halide undergoes substitution reaction by SYI mechanism. 1 Mark

Ans: SN1 mechanism consists of two steps. In first step, C-X bond of tertiary alkyl halide undergoes heterolysis to form the carbocation. The carbocation formed is planar. In the second step, the attachment of carbocation to the nucleophile takes place. Thus, two products are formed as per attachment of Nu^-. Thus, if the reactant is optically active, then due to opposite attachments of Nu^- to the carbocation, racemic mixture with two opposite orientations (+ and -) is formed.

2. Name the instrument used for measuring the angle by which the plane polarised light is rotated. **1 Mark**

Ans: Polarimeter is the instrument used for measuring the angle by which the plane polarised light is rotated.

3. Predict the major product formed when $2-$Bromopentane reacts with alcoholic KOH. **1 Mark**

Ans: The major product formed when $2-$Bromopentane reacts with alcoholic KOH is Pent$-2-$ene. The following product is called Saytzeff's Product. The chemical reaction is given by:

$$CH_3CH(Br)CH_2CH_2CH_3+KOH_{(alc.)} \rightarrow CH_3CH=CHCH_2CH_3$$

4. Give one use of CHI_3. **1 Mark**

Ans: Iodoform (CHI_3), also called triiodomethane, a yellow, crystalline solid belonging to the family of organic halogen compounds, used as an antiseptic component of medications for minor skin diseases.

5. Write the structures of the products formed when anisole is treated with HI. **1 Mark**

Ans: The structures of the products formed when anisole is treated with HI is $C_6H_5OCH_3+HI \rightarrow C_6H_5OH+CH_3I$.

6. Identify which liquid will have a higher vapour pressure at $90°C$ if the boiling points of two liquids A and B are $140°C$ and $180°C$, respectively. **1 Mark**

Ans: Liquid A.

7. Out of zinc and tin, whose coating is better to protect iron objects? **1 Mark**

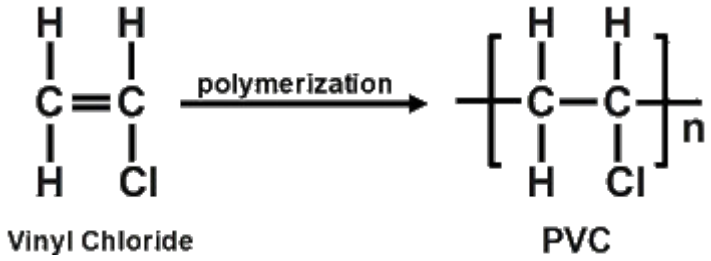
Ans: Zinc.

8. Will the rate constant of the reaction depend upon T if the E_{act}a (activation energy) of the reaction zero? 1 Mark

Ans: No, since it will not depend upon temperature.

9. Give the structure of the monomer of PVC. 1 Mark

Ans:



10. Which structural unit present in a detergent makes it non-biodegradable? 1 Mark

Ans: Branching in the hydrocarbon part of Detergents makes it non biodegradable.

11.Out of the following, the strongest base in aqueous solution is: 1 Mark

A. Methylamine.

B. Himethylamine.

C. Thmethylamine.

D. Aniline.

Ans: Option A is the correct answer i.e., Methylamine is the strongest base in aqueous solution.

12. Iodoform test is not given by 1 Mark

A. Ethanal.

B. Ethanol.

C. Pentan-2-ono.

D. Pentan-3-one.

Ans: Option D is the correct answer i.e., Iodoform test is not given by Pent−3−one.

13. Out of the following transition elements, the maximum number of oxidation states are shown by **1 Mark**

A. $\mathbf{Sc(Z=21)}$

B. $\mathbf{Cr(Z=24)}$

C. $\mathbf{Mn(Z=25)}$

D. $\mathbf{Fe(Z=26)}$

Ans: Option C is the correct answer i.e., $Mn(Z=25)$.

14. Hardening of leather in tanning industry is based on: **1 Mark**

A. Electrophoresis.

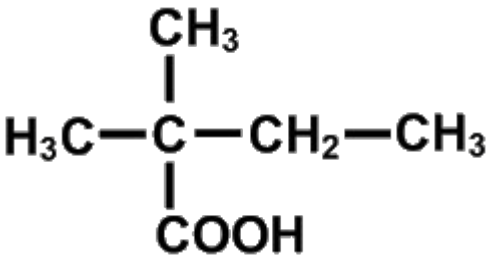
B. Electro-osmotic.

C. Mutual coagulation.

D. Tyndall effect.

Ans: Option C is the correct answer i.e., Mutual coagulation.

15. What is the correct IUPAC name of the given compound? **1 Mark**



A. 2,2 – Dimethyl butanoic acid.

B. 2 – Carboxyl –2 – methylbulane.

C. 2 – Ethyl –2 – methylpropanoic acid.

D. 3 – Methylbutane carboxylic acid.

Ans: Option A is the correct answer i.e., $2,2-$ Dimethyl butanoic acid.

For questions number 16 to 20. two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (i), (ii), (iii) and (iv) as given below:

1x5=5 Marks

Both Assertion and reason are correct, and reason is the correct explanation for assertion.

Both Assertion and reason are correct, but reason is not the correct explanation for assertion.

Assertion is correct but Reason is incorrect.

Both assertion and reason are incorrect.

16. Assertion (A): Au and Ag are extracted by leaching their ores with a dil. solution of NaCN.

Reason (R): Impurities associated with these ores dissolve in NaCN.

1 Mark

Ans: The process of leaching used for extraction of gold is known as the MacArthur Forrest Cyanide process. In this process, concentrated ore of gold is taken in large amounts made of cement or iron and is then treated with a dilute solution of KCN in the presence of air forming a soluble gold complex.

Therefore, the correct answer is option C i.e., assertion is correct, but reason is incorrect.

17. Assertion(A): F- F bond in F_2 the molecule is weak.

Reason (R): F atom is small. **1 Mark**

Ans: Lower value of bond dissociation energy of fluorine is due to the high interelectronic repulsions between non-bonding electrons of the $2p$ orbital of small sized fluorine. As a result, the Fluorine-Fluorine bond is weaker in comparison to Chlorine-Chlorine and Bromine-Bromine bonds.

Therefore, the correct answer is option C i.e., assertion is correct, but reason is incorrect.

18. Assertion (A): Linkage isomerism arises in coordination compounds because of ambidentate ligands.

Reason (R): Ambidentate ligand like NO_2 has two different donor atoms i.e., N and O. **1 Mark**

Ans: Assertion and reason both are correct, and reason is correct explanation of assertion. Linkage isomerism arises in a coordination compound which contains the ambidentate ligand since ambidentate ligands have two differ donor atoms. e.g., SCN, NO_2 etc.

Therefore, the correct answer is option A i.e., both Assertion and reason are correct, and reason is the correct explanation for assertion.

19. Assertion (A): Sucrose is a nonreducing sugar.

Reason (R): Sucrose has glycosidic linkage. **1 Mark**

Ans: Sucrose is made up of two monosaccharides: Glucose and Fructose. Since the reducing groups of glucose and fructose which are free from ketone and aldehyde groups which are involved in glycosidic formation of bonds which aren't available since sucrose is non reducing sugar.

Therefore, the correct answer is option A i.e., both assertion and reason are correct, and reason is the correct explanation for assertion.

20. Assertion (A): The molecularity of the reaction $H_2 + Br_2 \rightarrow 2HBr$ appears to be 2.

Reason (R): Two molecules of the reactants are involved in the given elementary reaction. **1 Mark**

Ans: Molecularity of reaction is the no. of molecules acting in the rate determining step while order of reaction is the sum of all powers to which concentration are raised in the rate law expression.

Therefore, the correct answer is option B i.e., both Assertion and reason are correct, but reason is not the correct explanation for assertion.

SECTION - B

21. Define the following terms:

A. Tranquilizers **1 Mark**

Ans: Tranquilizers can also refer to anti-anxiety medication. Tranquilizers are chemical compounds that are so useful for stress treatment and either for mild or severe mental diseases.

B. Antiseptic **1 Mark**

Ans: An antiseptic refers to a substance which either stops or helps in slowing down the growth of the microorganisms. Some of the antiseptics have a germicidal nature, which means that they can destroy the microbes. These kinds of antiseptics are called bactericidal antiseptics.

Or

Explain the cleansing action of soaps. **2 Marks**

Ans: Soaps can lower the surface tension of water and form an emulsion with the oily dirt present in water. When soap is added to dirty water then the hydrophobic part of the soap gets attached to the dirt while the hydrophilic part remains in contact with the water molecules. This forms a colloidal solution, and the trapped dirt can be easily rinsed off.

22. For 5% solution of urea Molar mass = 60 g / mol, calculate the osmotic pressure at 300K. $\left[\mathbf{R = 0.0821\ L\ atm\ K^{-1}mol^{-1}}\right]$ **2 Marks**

Ans: Here we have given 5% urea solution which means $5g$ urea is present in the 100ml solution. Also, Molar mass=60g/mole; T=300K and R=0.0821 L atm K^{-1} $mole^{-1}$

Now to calculate osmotic pressure we know the formula π=CRT where

$$\text{Concentration}(C)=\frac{\text{Given Mass}}{\text{Molar Mass}}=\frac{5}{60}\times\frac{1000}{100}=0.83$$

$\Rightarrow \pi=0.83\times0.0821\times300=20.44\text{atm}$

Therefore, for 5% solution of urea Molar mass =60g/mole, the osmotic pressure at 300K is 20.44atm.

Or

Visha took two aqueous solutions one containing 7.5 g of urea (Molar mass $= 60g/mol$) and the other containing 42.75 g of substance Z in 100 g of water, respectively. It was observed that both the solutions froze at the same temperature. Calculate the molar mass of Z. 2 Marks

Ans: Here we have given the mass of water $(w_2)=100g$; the mass of urea $(w_1)=7.5g$; the mass of Z $(w_3)=42.75g$; the molar mass of urea is 60g/mol.

The formula here is $\text{Molality}=\frac{\text{Moles of Solute}}{\text{Weight of Solvent}}$

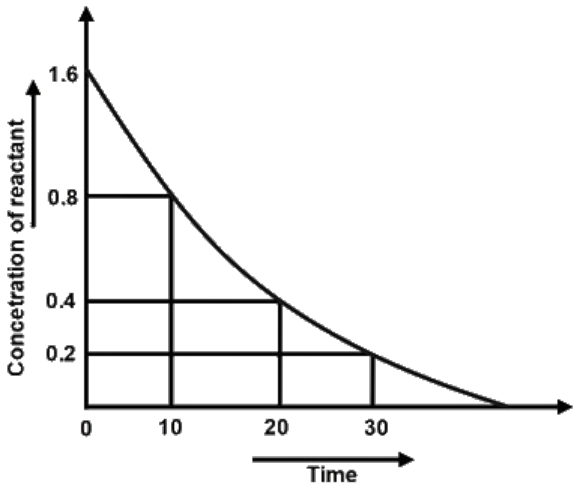
$$\Rightarrow \frac{w_1\times 1000}{Mm_1\times w_2}=\frac{w_3\times 1000}{Mm_1\times w_2}$$

On further solving we get; $Mm=\frac{w_3\times Mm_1}{w_1}$

$$\Rightarrow \frac{42.75\times 60}{7.5}=342g/mol$$

Therefore, the molar mass of Z is 342g/mol.

23. Analyze the given graph, drawn between the concentration of reactant vs. time.



A. Predict the order of the reaction. 1 Mark

Ans: We can see with an increase in time the concentration of reactant decreases exponentially so, the reaction is a first-order reaction.

B. Theoretically, can the concentration of the reactant reduce to zero after infinite time? Explain. **1 Mark**

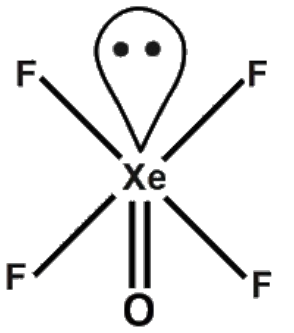
Ans: Theoretically, the concentration of reactant can reduce to zero after infinite time. Since the first-order reaction is given by: $[A]=[A]_0 e^{-kt}$ and when reaction completes, we get; $[A]=0$ but $[A]_0 \neq 0$.

When $\Rightarrow e^{-kt}=0$, t is infinite. Therefore, theoretically, the concentration of reactant can reduce to zero after infinite time.

24. Draw the shape of the following molecules:

A. $XeOF_4$ **1 Mark**

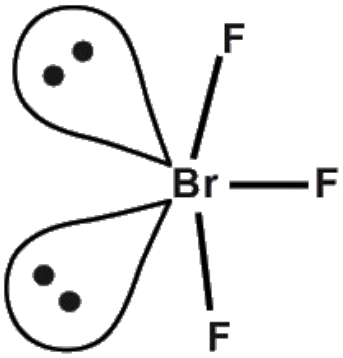
Ans: Shape/Structure of $XeOF_4$ molecule:



Square pyramidal

B. BrF_3 **1 Mark**

Ans: Shape/Structure of BrF_3 molecule:



Bent T-shaped

25. Give the formulae of the following compounds:

A. Potassium tetrahydroxidoxincate (II) **1 Mark**

Ans: The formula for Potassium tetrahydroxidoxincate

(II) i $K_2\left[Zn(OH)_4\right]^{-2}$.

B. Hexaammineplatinum (IV) chloride **1 Mark**

Ans: The formula for Hexaammineplatinum (IV) chloride is $\left[Pt(NH_3)_6\right]Cl_4$.

26. What happens when:

A. Propanone is treated with methyl magnesium iodide and then hydrolyzed, and **1 Mark**

Ans: When propanone is treated with methyl magnesium iodide and then hydrolyzed the product formed is Tert-butyl alcohol. The reaction is given by:

$$\underset{\text{Propanone}}{CH_3\text{-}CO\text{-}CH_3} + \underset{\text{Methyl Magnesium Iodide}}{CH_3MgI} \xrightarrow{\text{Hydrolyzed}(H_3O^+)} \underset{\text{Tert-butyl alcohol}}{(CH_3)_3\text{-}C\text{-}OH}$$

B. Benzene is treated with CH_3COCl in presence of anhydrous $AlCl_3$ **1 Mark**

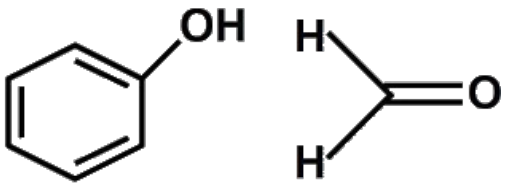
Ans: When benzene is treated with CH_3COCl in presence of anhydrous $AlCl_3$ the product formed is acetophenone. The reaction is given by

$$\underset{\text{Benzene}}{C_6H_6} + CH_3COCl \xrightarrow{\text{Anhyd.}AlCl_3} \underset{\text{Acetophenone}}{C_6H_5COCH_3} + HCl$$

27. Write the names and structures of monomers in the following polymers:

A. Bakelite. **1 Mark**

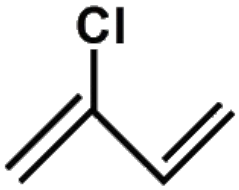
Ans: Bakelite is a phenol-formaldehyde polymer. Thus, the monomers of Bakelite are phenol and formaldehyde. The structure of monomers is given by:



Phenol Formaldehyde

B. Neoprene. **1 Mark**

Ans: Neoprene is produced by the polymerization of chloroprene. The structure of monomers is given by:



Chloroprene

SECTION - C

28. Give the structures of A and B in the following sequence of reactions:

A. $CH_3COOH \xrightarrow[\Delta]{NH_3} A \xrightarrow{NaOBr} B$ **1 Mark**

Ans: $CH_3COOH \xrightarrow[\Delta]{NH_3} \underset{(A)}{CH_3CONH_2} \xrightarrow{NaOBr} \underset{(B)}{CH_3NH_2}$

B. $C_6H_5NO_2 \xrightarrow[HCl]{Fe} A \xrightarrow[0^0-5^0C]{NaNO_2+HCl} B$ **1 Mark**

Ans: $C_6H_5NO_2 \xrightarrow[HCl]{Fe} \underset{(A)}{C_6H_5NH_2} \xrightarrow[0^0-5^0C]{NaNO_2+HCl} \underset{(B)}{C_6H_5N_2Cl}$

C. $C_6H_6N_2^+Cl^- \xrightarrow[\Delta]{CuCN} A \xrightarrow[H^+]{H_2O} B$ **1 Mark**

Ans: $C_6H_6N_2^+Cl^- \xrightarrow[\Delta]{CuCN} \underset{(A)}{C_6H_6CN} \xrightarrow[H^+]{H_2O} \underset{(B)}{C_6H_6COOH}$

Or

A. How will you distinguish between the following pairs of compounds?

(i) Aniline and Ethanamine. **1 Mark**

Ans: Both aniline and Ethanamine can be distinguished by adding of cold ice after phenol or beta naphthol are added.

Aniline: $C_6H_5\overset{gg}{N}H_2 \xrightarrow{HNO_2} \underset{\text{Diazonium}}{C_6H_5\overset{+}{N}_2\overset{-}{Cl}}$ Salt.

Ethanamine:

$CH_3CH_2\overset{gg}{N}H_2 \xrightarrow{HNO_2} CH_3CH_2\overset{+}{N}_2\overset{-}{Cl} \xrightarrow[\text{dil.NaOH}]{Ph\text{-}\overset{+}{N}_2\overset{-}{Cl}}$ Orange Dye.

(ii) Aniline and N-methylamine. **1 Mark**

Ans: $CHCl_3$ Both aniline and N-methylamine can be distinguished by adding and KOH for both compounds.

Aniline: $C_6H_5\overset{gg}{N}H_2 \xrightarrow{HNO_2} \underset{\text{Diazonium}}{C_6H_5\overset{+}{N}_2\overset{-}{Cl}}$ Salt

N-methylamine:

$C_6H_4\overset{gg}{N}H\text{-}CH_3 \xrightarrow{HNO_2} C_6H_4\text{-}N(NO)\text{-}CH_3 \xrightarrow[\text{dil.NaOH}]{Ph\text{-}\overset{+}{N}_2\overset{-}{Cl}}$ Orange Dye.

B. Arrange the following compounds in decreasing order of their boiling points: Butanol, Butanamine, Butane **1 Mark**

Ans: The compounds in decreasing order of their boiling points are Butanol > Butanamine > Butane.

29. Give the plausible explanation for the following:

A. Glucose doesn't give $2,4-$DNP test. **1 Mark**

Ans: Glucose doesn't give $2,4-$DNP test since in glucose the group(-CHO) is involved in hemiacetal formation.

B. The two strands of DNA are not identical but are complementary. **1 Mark**

Ans: DNA strands are complementary due to the presence of hydrogen bonds between the specific bases. Adenine forms two hydrogen bonds with thymine while guanine forms three hydrogen bonds with cytosine.

C. Starch and cellulose both contain glucose units as monomers, yet they are structurally different. **1 Mark**

Ans: Starch is a polymer of alpha glucose while cellulose is a polymer of beta glucose.

30. Account for the following:

A. Sulphurous acid is a reducing agent. **1 Mark**

Ans: Since sulphur readily gets oxidized to achieve more stability i.e., +6 state.

B. Fluorine forms only one oxoacid. **1 Mark**

Ans: In absence of d orbital in fluorine, the fluorine forms only one oxoacid

C. The boiling point of noble gases increases from He to Rn. **1 Mark**

Ans: Size increases from He to Radon as well as dispersion along with van der Waal forces from Helium to radon.

Or

Complete the following chemical reactions:

A. $\mathbf{MnO_2 + 4HCl \rightarrow}$ **1 Mark**

Ans: $MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$

B. $\mathbf{XeF_6 + KF \rightarrow}$ **1 Mark**

Ans: $XeF_6 + KF \rightarrow K^+[XeF_7]^-$

C. $\mathbf{I^-_{(aq)} + H^+_{(aq)} + O_{2(g)} \rightarrow}$ **1 Mark**

Ans: $I^-_{(aq)} + H^+_{(aq)} + O_{2(g)} \rightarrow 2OH^-_{(aq)} + I_{2(s)} + O_{2(g)}$

31. Explain the role of the following:

A. NaCN in the separation of ZnS and PbS. **1 Mark**

Ans: NaCN does act as depressant for the separation of ZnS and PbS.

B. $\mathbf{SiO_2}$ **in the metallurgy of Cu containing Fe as impurity.** **1 Mark**

Ans: SiO_2 does act as flux in metallurgy of Cu containing Fe as impurity.

C. Iodine in the refining of Ti. **1 Mark**

Ans: Iodine is required to convert Titanium which turns into volatile compound in refining of Ti.

32. Give three points of difference between physisorption and chemisorption. 3 Marks

Ans: The difference between physisorption and chemisorption are:

Sr. No.	Physisorption	Chemisorption
1.	The reason behind physisorption is van der Waals forces.	The chemical bonds lead to chemisorption.
2.	The Physical adsorption is reversible in nature.	The chemical adsorption is irreversible in nature.
3.	It's not specific to nature.	Chemisorption is very specific in nature.

33.How will the rate of the reaction be affected when?

A. Surface area of the reactant is reduced 1 Mark

Ans: Decreasing since the surface area of reactant is lowered/reduced

B. Catalyst is added in a reversible reaction 1 Mark

Ans: Increasing since catalyst is added in reversible reaction.

C. Temperature of the reaction is increased 1 Mark

Ans: Increasing since temperature of the reaction is higher/increased

34. Calculate the mass of ascorbic acid (Vitamin C, $C_6H_8O_6$) to be dissolved in 75 g of acetic acid to lower its melting point by 1.5°C. $\left[K_f = 3.9\ K\ kg\ mol^{-1}\right]$. 3 Marks

Ans: Molar mass of ascorbic acid is given $= (6\times12)+(8\times1)+(6\times16)$

$\Rightarrow 176 gmol^{-1}$

We know that $\Delta T_b = \frac{K_b \times 1000 \times w_2}{M_2 \times w_1}$

Rearranging the equation, we get;

$$w_2 = \frac{\Delta T_b \times M_2 \times w_1}{K_b \times 1000} = \frac{1.5 \times 176 \times 75}{3.9 \times 1000} = 5.08g$$

Therefore, $5.08g$ if ascorbic acid is needed to be dissolved.

SECTION - D

35.

A. Calculate G^0 for reaction $Zn_{(s)} + Cu^{2+}_{(aq)} = Zn^{2+}_{(aq)} + Cu_{(s)}$;

Given: E^0 for $\frac{Zn^{2+}}{Zn} = -0.76V$ and E^0 for $\frac{Cu^{2+}}{Cu} = +0.34V$

$R = 8.314JK^{-1}mol^{-1}$ and $F = 96500\ C\ mol^{-1}$ **3 Marks**

Ans: Here we know that $E^0_{Zn^{2+}|Zn}$=-0.76V and $E^0_{Cu^{2+}|Cu}$=+0.36V

Thus, $E^0_{Cell}=E^0_{Cu^{2+}|Cu}-E^0_{Zn^{2+}|Zn}=+0.34-(-0.76)=1.10V$

Now, $\Delta G^0=-nFE^0_{Cell}$ where n=96500 and n=2.

Thus, $\Delta G^0=-2\times96500\times1.10=212300J/mole$

$\Rightarrow \Delta G^0=212.3KJ/mole$.

B. Give two advantages of fuel cells **2 Marks**

Ans: Advantages of fuel cells are

Fuel cells use fossil fuel efficiently.

Fuel Cells are less polluting since they cause less exhaust pollution.

Or

A. Out of the following pairs, predict with reason which pair will allow greater conduction of electricity:

(i) Silver wire at 30°C or silver wire at 60°C. **1 Mark**

Ans: Silver wire at 60°C will be having lower conduction of electricity since temperature increases as resistance increases and conduction decreases. Thus, lower temperature i.e., 30°C will be having greater conduction.

(ii) 0.1M CH_3COOH solution/1M CH_3COOH solution. 1 Mark

Ans: Since dilution degree of ionization increases hence conduction increases thus, 0.1M CH_3COOH will have greater conduction of electricity.

(iii) KCI solution at 20°C or KCI solution at 50°C. 1 Mark

Ans: Now at higher temperature ions mobility increases and thus, conductance increases for KCl solution at $50°C$ will have greater conduction of electricity.

B. Give two points of differences between electrochemical and electrolytic cells. 2 Marks

Ans: Electrochemical Cell: The anode is negative, and Cathode is positive. It converts chemical energy into electrical energy. Electrolytic Cell: The anode is positive, and cathode is negative. It converts electrical energy to chemical energy.

36.

A. Account for the following: 1x3=3 Marks

(i) Copper(I) compounds are whereas copper and compounds are colored.

Ans: There is absence of unpaired electrons meanwhile un Cu2+ compounds are coloured since there are unpaired electrons which acts as d-d transition.

(ii)Chromates change their colour when kept in an acidic solution.

Ans: The chromates change into dichromate ions in acidic condition thus the color is changed.

(iii) Zn, Cd, Hg are considered as d block elements but not as transition elements.

Ans: Because of a completely filled d orbital at oxidized state along with ground state whereas Zn, Cd, Hg is considered the d block element and not as transition elements.

B. Calculate the spin only moment of $CO^{2+}(Z=27)$ by writing the electronic configuration of CO and CO^{2+}. 2 Marks

Ans: $\mu=\sqrt{n(n+2)}=\sqrt{3(3+2)}=\sqrt{15}=3.2BM$

Or

A. Give three points of difference between lanthanoids and actinoids. **3 Marks**

Ans: The difference between lanthanoids and actinoids are:

Sr. No.	**Lanthanide**	**Actinoids**
1.	Most of the lanthanides aren't radioactive.	All the actinides are radioactive.
2.	Similarly, most of the lanthanide ions are colourless.	Actinoids have ions coloured and not colourless.
3.	Lanthanoids have a limited oxidation state.	Actinoids have a wide range of oxidation states.

B. Give reason and select one atom/ion which will exhibit the asked property.

(i) Sc^{3+} or Cr^{3+} (Exhibit diamagnetic behaviour). **1 Mark**

Ans: Only Sc^{3+} exhibits diamagnetic behaviour since absence of unpair electron.

(ii)Cr or Cu (High melting and boiling point). **1 Mark**

Ans: Cr having higher melting and boiling point since presence of higher intermetallic bonding.

37.

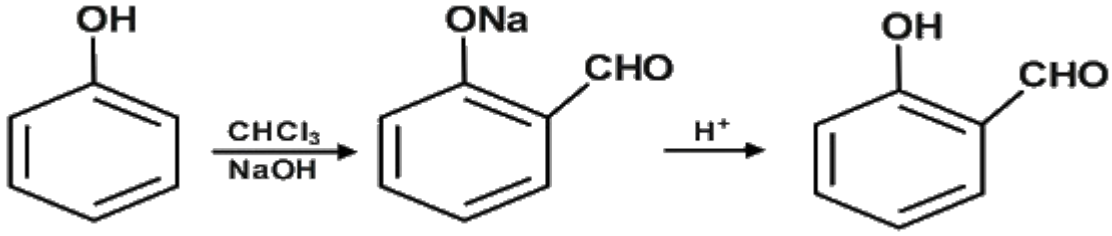
A. Out of t-butyl alcohol and n-butanol, which one will undergo acid catalyzed dehydration faster and why? **2 Marks**

Ans: t-butyl alcohol goes through acid catalyzed dehydration faster since it forms 3° carbocation more stable than 1° carbocation.

B. Carry out the following conversions:

(i) Phenol to Salicylaldehyde. **1 Mark**

Ans: Phenol to Salicylaldehyde:



(ii)t-butyl chloride to t-butyl ethyl ether. **1 Mark**

Ans:t-butyl chloride to t-butyl ethyl ether:

$$(CH_3)_3CCl + NaOH_{(aq)} \xrightarrow{C_2H5Cl} (CH_3)_3COC_2H_5$$

(iii) Propene to Propanol. **1 Mark**

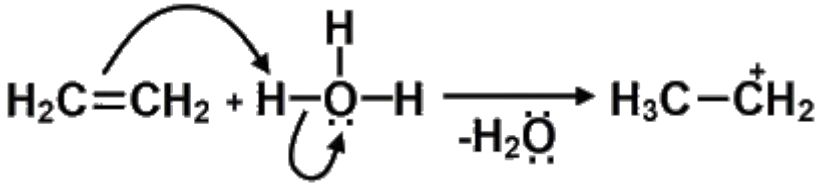
Ans: Propene to Propanol:

$$CH_3CH=CH_2 \xrightarrow[B_2H_6]{H_2O_2/OH^-} CH_3CH_2CH_2OH$$

Or

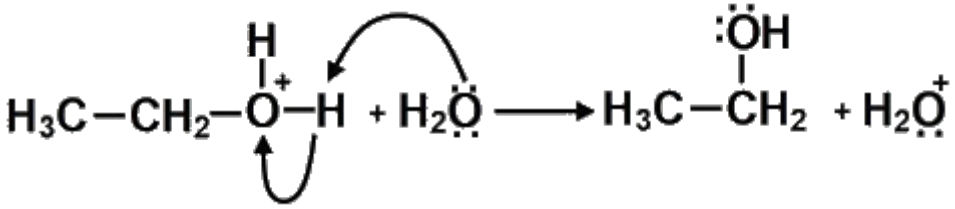
A. Give the mechanism for formation of ethanol from ethene. **2 Marks**

Ans: Step I: First step is protonation of ethene to form carbocation with the help of electrophilic attack of H_3O^+.



Step II: Nucleophilic attack on carbocation by water.

Step III: To form Alcohol(ethanol): Deprotonation.



B. Predict the reagent for carrying out the following conversions:

(i) Phenol to benzoquinone. **1 Mark**

Ans: The reagent for Phenol to benzoquinone is $K_2Cr_2O_7+H_2SO_4$ and $Na_2Cr_2O_7+H_2SO_4$

(ii) Anisole to p-bromoanisole. **1 Mark**

Ans: The reagent for Anisole to p-bromoanisole is Br_2 in CH_3COOH.

(iii) Phenol to $2,4,6-$ tribromophenol. **1 Mark**

Ans: The reagent for Phenol to 2,4,6- tribromophenol is $Br_{2(aq)}$ or bromine water.

Class XII
CHEMISTRY (Theory) CBSE 2019

Time : 3 Hrs.
Max. Marks : 70

General Instructions:

I. *All questions are compulsory*
II. *Section A : Question no. 1 to 5 are very short-answer questions and carry 1 mark each.*
III. *Section B: Question no. 6 to 12 are short-answer questions and carry 2 marks each.*
IV. *Section C: Question no. 13 to 24 are also short-answer questions and carry 3 marks each.*
V. *Section 13: Question no. 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.*

SECTION-A

Question 1: Out of $NaCl$ and $AgCl$, which one shows Frenkel defect and why?
Solution:
The Frenkel defect is that in which one smaller ion (usually cations) move from its lattice position to an interstitial site i.e. a tetrahedral octahedral hole to form a vacancy in the lattice. Of course, $AgCl$ has the defect because, the size of $AgCl$ is intermediate and since, the size of Ag^+ cation is smaller than chloride ion so it can move to interstitial spaces causing Frenkel defect while in $NaCl$ (alkali metal halide) they have larger size of cations which do not fit into voids and so the defect is not shown by the alkali metal halides.

Question 2: Arrange the following in increasing order of boiling points:
$(CH_3)_3N, C_2H_5OH, C_2H_5NH_2$
Solution:
This increasing order of boiling point can be explained by intermolecular hydrogen bonding. Tertiary amines, cannot engage in hydrogen bonding because they have no hydrogen atom bonded to the nitrogen atom, while primary amine undergoes intermolecular hydrogen bonding. But in case of alcohol, the extent of hydrogen bonding is more as compared to amines because of more electronegative oxygen atom in alcohols.
$(CH_3)_3N < C_2H_5NH_2 < C_2H_5OH$

Question 3: Why are medicines more effective in colloidal state?
OR
What is difference between an emulsion and a gel?
Solution:

Some medicines are more effective in colloidal form because medicine in colloidal form is easily absorbed by the body tissues. For example, Antibiotics like streptomycin in the form of the colloidal sol is injected into the body for the more effective result.

OR

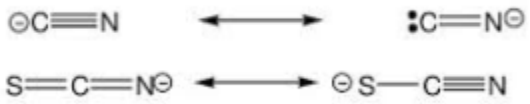
Emulsion: It is a colloidal mixture in which both the dispersed phase and the dispersion medium are liquids. The two or more liquids present in the mixture are generally immiscible in nature. Example: Milk. Gel: It is a colloid in which the dispersed phase i.e. liquid has combined with the dispersion medium i.e. solid to produce a semisolid material. Example: jellies.

Question 4: Define ambident nucleophile with an example.

Solution:

Ambident Nucleophile- An anionic nucleophile, which has two nucleophilic centres, or two negative sites is known as ambident nucleophile. In this negative charge is delocalized due to resonance.

Example – Cyanide and Thiocyanate are examples of ambident nucleophiles.



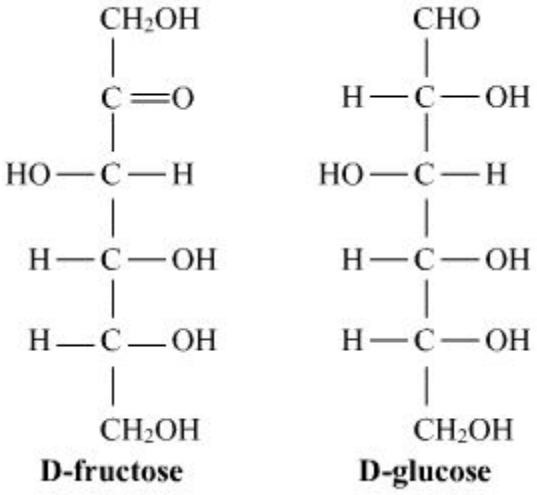
Question 5: What is the basic structural difference between glucose and fructose?

OR

Write the products obtained after hydrolysis of lactose.

Solution:

Both Glucose and Fructose are hexose sugars with six carbon atoms but Glucose is an aldohexose and fructose is ketohexose which means the functional group present in glucose is aldehyde and the functional group in fructose is ketone.



OR

Lactose is composed of β-D galactose and β-D glucose. Thus on hydrolysis, it gives β-D galactose and β-D glucose.

$$C_{12}H_{22}O_{11} + H_2O \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6$$

Lactose Water D-Glucose D-Galactose

SECTION B

Question 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**

Solution:

(i) $2XeF_2(s) + 2H_2O(l) \rightarrow 2Xe(g) + 4HF(aq) + O_2(g)$

(ii) $4HCl + MnO_2 \rightarrow Cl_2 + MnCl_2 + 2H_2O$

OR

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

(ii)The decreasing order of bond enthalpy is $HF > HCl > HBr > 2H_2O$

Question 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.

Solution:

Raoult's Law: According to Raoult's law, for a solution of two volatile liquids, the partial vapour pressure of each component of the solution is directly proportional to its mole fraction present in solution.

$P_1 \propto x_1$

Implies that

$P_1 = P_1^\circ x_1$

P_1 =Partial pressure of component 1.

x_1 =mole fraction of component 1.

P_1° =pure vapour pressure of component 1.

Ideal solution obeys Raoult's law at all concentrations. The conditions obeyed are:

(i) $\Delta_{mix} H = 0$

(ii) $\Delta_{mix}V = 0.$

Question 8:
For a reaction

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

The Proposed mechanism is given below:

(1) $H_2O_2 + I^- \rightarrow H_2O + IO^- \,(slow)$

(2) $H_2O_2 + IO^- \rightarrow H_2O + I^- + O_2\,(fast)$

(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?
Solution:
Let us consider the problem:

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

In Some cases, the rate of reaction depends not only on the reactant but may also depend on the substance present as a catalyst. This is also seen in the above reaction. The rate of reaction depends on the slowest step in case of a complex reaction.

(1) $H_2O_2 + I^- \xrightarrow{slow} H_2O + IO^-$

(2) $H_2O_2 + IO^- \xrightarrow{Fast} H_2O + I^- + O_2$

(i) Rate law:

$$\text{Rate} = -\frac{1}{2}\frac{d[H_2O_2]}{dt} = k[H_2O_2][I^-]$$

(ii) The overall order of reaction:

$$\text{Rate} = k[H_2O_2][I^-]$$

$$\text{Order} = 1 + 1 = 2$$

(iii) Slowest step is the rate determining step.Hence,step 1 is rate determining step.

Question 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).
Solution:
Potassium permanganate is prepared by fusion of MnO_2 with an alkali metal hydroxide and an oxidising agent like KNO_3. This produces the dark green K_2MnO_4 which disproportionates in a neutral or acidic solution to give permanganate.

$$2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$$

(A)Dark Green

$$3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$$

(B) purple

In acid solutions:

Iodine is librated from potassium iodine:

$$10I^- + 2MnO_4^- + 16H^+ \rightarrow 2Mn^{2+} + 8H_2O + 5I_2$$

(B) (D)

In neutral or faintly alkaline solution:

A notable reaction is the oxidation of iodine to iodate:

$$2MnO_4^- + H_2O + I^- \rightarrow 2MnO_2 + 2OH^+ + IO_3^-$$

(B) (C)

10 Write IUPAC name of the complex [Pt(en)2Cl2]. Draw structures of geometrical isomers for this complex. [2]

OR

Using IUPAC norms write the formulae for the following :

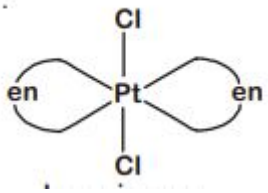
(i) Hexaamminecobalt(III) sulphate

(ii) Potassium trioxalatochromate(III)

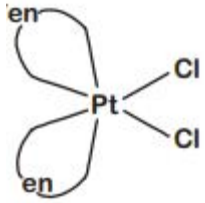
SOLUTION:

$\left[Pt(en)_2Cl_2\right]$ – Dichloridobis(ethane-1,2-diammine)platinum (II)

Geometrical isomer:



trans isomer



cis isomer

OR

(i) $\left[Co\left(NH_3\right)_6\right]_2\left(SO_4\right)_3$

(ii) $K_3\left[Cr\left(C_2O_4\right)_3\right]$

11 Out of $\left[CoF_6\right]^{3-}$ and $\left[Co(en)_3\right]^{3+}$, which one complex is [2] (i) paramagnetic (ii) more stable (iii) inner orbital complex and (iv) high spin complex (Atomic no. of Co = 27)

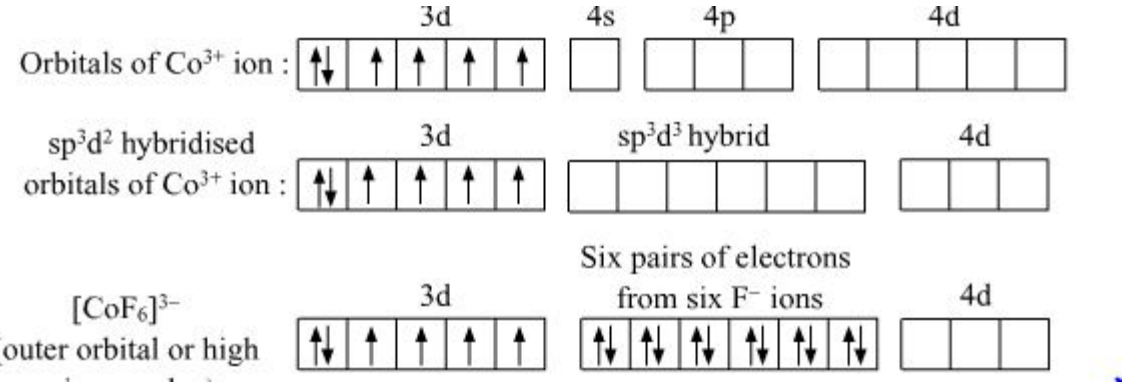
Solution:

$Co\left(Z=27\right)=1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,4s^2\,3d^7$

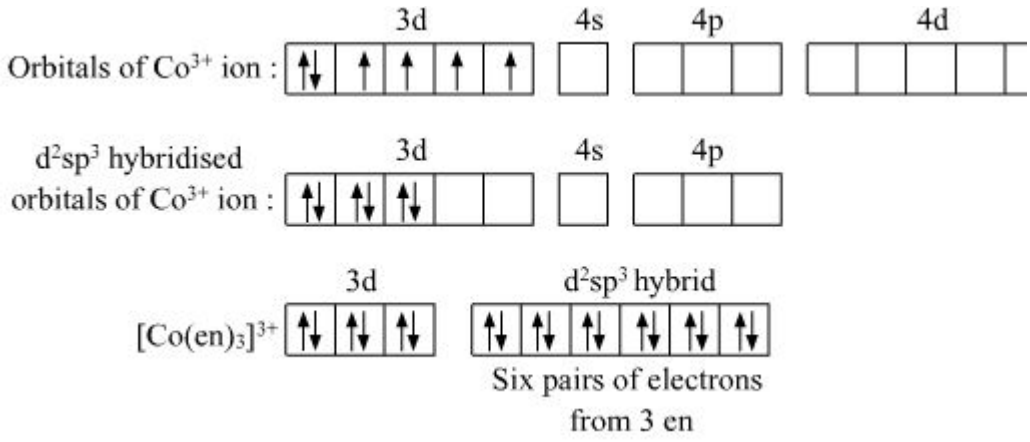
$Co^{+3}=1s^2\,2s^2\,2p^6\,3s^2\,3p^6\,3d^6$

F^- is weak field ligand:

$\left[CoF_6\right]^{3-}$



$\left[Co\left(en\right)_3\right]^{3+}$



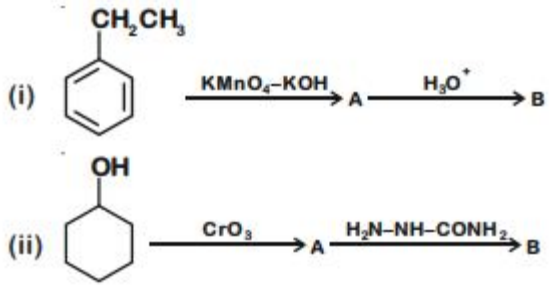
(i) $\left[CoF_6\right]^{3-}$ is paramagnetic due to presence of four unpaired electrons

(ii) $\left[Co\left(en\right)_3\right]^{3+}$ is more stable due to chelation

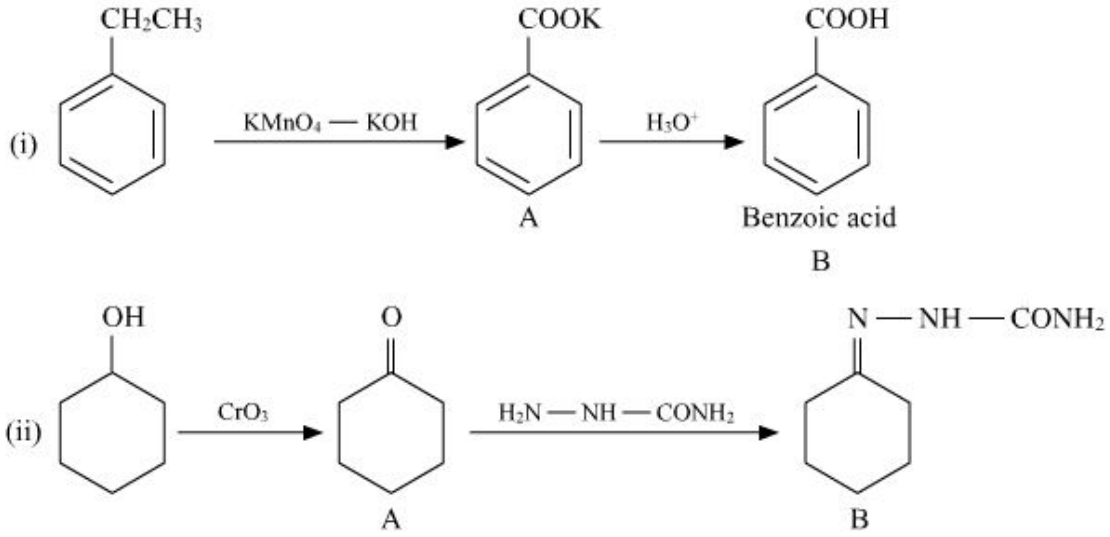
(iii) $\left[Co\left(en\right)_3\right]^{3+}$ forms inner orbital complex $\left(d^2sp^3\right)$

(iv) $\left[CoF_6\right]^{3-}$ forms high spin complex (sp3d2)

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



Solution:



SECTION C

Question 13: The decomposition of NH3 on platinum surface is zero order reaction. If rate constant (k) is $4\times10^{-3}\ ms^{-1}$, how long will it take to reduce the initial concentration of NH_3 from $0.1\ M$ to $0.064\ M$.

Solution:

Given that:

$k=4\times10^{-3}\ Ms^{-1}$

$\left[A_o\right]=0.1M$

$\left[A\right]=0.064M$

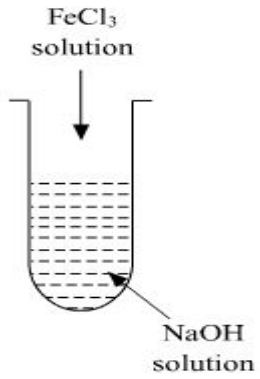
For a zero-order reaction,

$$k=\frac{1}{t}\{[A_o]-[A]\}$$

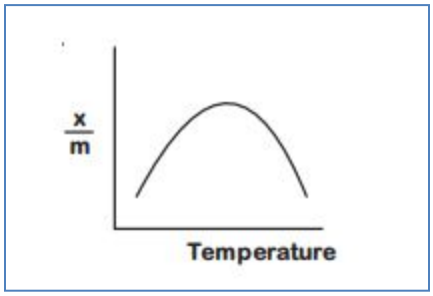
$$4\times10^{-3}\,\mathrm{Ms}^{-1}=\frac{1}{t}\{[0.1]-[0.064]\}$$

$$t=\frac{0.1-0.064}{4\times10^{-3}}=0.009\times10^{3}=9\,seconds$$

Question 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 solution represented?



(iii) How does chemisorption vary with temperature?
Solution:
(i) In gas mask activated charcoal is used to adsorb poisonous gases in coal mines.
(ii) If $FeCl_3$ is added to $NaOH$, a negatively charged sol is obtained with adsorption of OH^- ions. Sol is represented as $Fe_2O_3.xH_2O/OH^-$ (negatively charged) .
(iii) With increase in temperature chemisorption first increases as molecules get activation energy for adsorption. After certain chemisorption decreases.temperature,



Question 15 An element crystallizes in fcc lattice with a cell edge of 300 pm. The density of the element is $10.8\,\mathrm{gcm}^{-3}$. Calculate the number of atoms in $108\,\mathrm{g}$ of the element.

Solution:

Volume of unit cell

$$=(300\ pm)^3$$

$$=(3.00\times10^{-8}\ cm)^3$$

$$=2.7\times10^{-23}cm^3$$

Volume of 108 g of element $=\frac{\text{mass}}{\text{density}}=\frac{108g}{10.8cm^{-3}}=10cm^3$

Number of unit cells in this volume $=\frac{10cm^3}{2.7\times10^{-23}cm^3\ /\ \text{unit cell}}=\frac{10^{24}}{2.7}\,\text{Unit cells}$

Since each FCC unit cell contains 4 atoms, therefore the total number of atoms in 108 g

$$4\,\text{atoms/unit cell}\times\frac{10^{24}}{2.7}\,\text{unit cell}$$

$$=1.48\ \times10^{24}\ \text{atoms}$$

Question 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)

Solution

$$\text{Molality}(\mathrm{m})=\frac{\mathrm{n}}{\mathrm{W}_{\text{solvent(kg)}}}$$

For sucrose solution:

$$\mathrm{m}=\frac{\frac{4}{342}}{\frac{96}{1000}}=\frac{4}{342}\times\frac{1000}{96}=0.122\mathrm{m}$$

$$\left(\Delta T_f\right)_1=(273.15-271.15)K=2K$$

$$\left(\Delta T_f\right)_1=K_f m=K_f\times0.122$$

$$2=K_f\times0.122 \qquad \ldots(1)$$

For glucose solution :

$$\mathrm{m}=\frac{\frac{5}{180}}{\frac{95}{1000}}=\frac{5}{180}\times\frac{1000}{95}=0.292\mathrm{m}$$

$\left(\Delta T_f\right)_2 = K_f \times 0.292 \ldots(2)$

Dividing eqn. (2) by (1)

$$\frac{\left(\Delta T_f\right)_2}{2} = \frac{K_f \times 0.292}{K_f \times 0.122}$$

$$\left(\Delta T_f\right)_2 = \frac{0.292}{0.122} \times 2 = 4.79$$

$$T_f = 273.15 - 4.79 = 268.36\ K$$

Freezing point of glucose solution will be 268.36 K

Question 17 (a) Name the method of refining which is

(i) Used to obtain semiconductor of high purity.

(ii) Used to obtain low boiling metal.

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

Solution

(a)

(i) Zone refining

(ii) Distillation

(b) The sulphide ores are roasted to give oxides

$$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$$

The oxide can easily be reduced to metallic copper using coke

$$Cu_2O + C \rightarrow 2Cu + CO$$

Question 18 Give reasons for the following:

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

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

(iii) Actinoids show irregularities in their electronic configuration.

Solution

(i) Transition elements and their compounds act as catalysts. This is because of their ability to adopt multiple oxidation states and to form complexes.

(ii) E° value for $\left(Mn^{2+}|Mn\right)$ is negative whereas for $\left(Cu^{2+}|Cu\right)$ is positive as the hydration enthalpy of Cu^{2+} ion is not sufficient to compensate the sum of sublimation as well as first and second ionisation enthalpy of copper.

(iii) Actinoids show irregularities in their electronic configuration are related to their stabilities of the f_0, f_7 and f_{14} occupancies of the 5f orbital.

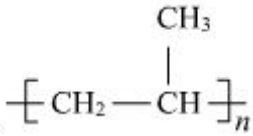
Question 19: Write the structures of monomers used for getting the following polymers:

(i) Nylon-6, 6

(ii) Glyptal

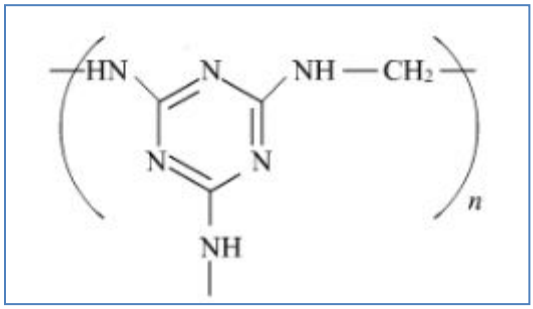
(iii) Buna-S

OR



(i) Is a homopolymer or copolymer? Give reason.

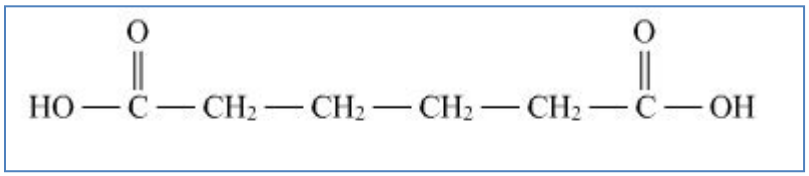
(ii) Write the monomers of the following polymer :



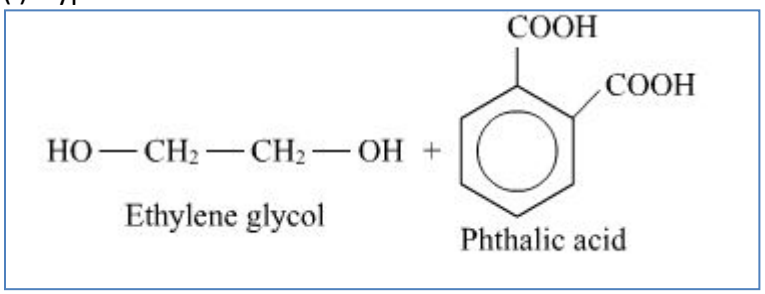
(iii) What is the role of Sulphur in vulcanization of rubber?

Solution:

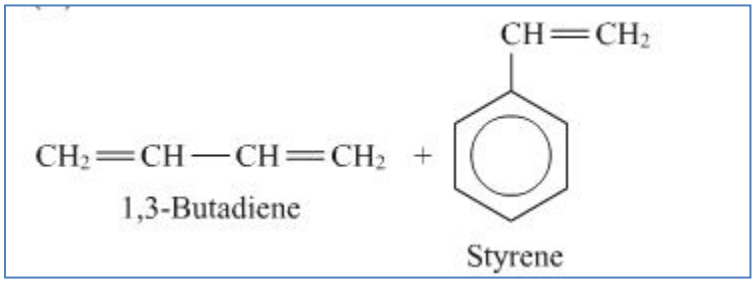
(i) Nylon-6, 6 : Hexamethylenediamine $\rightarrow H_2N\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}NH_2$



(i)Glyptal:

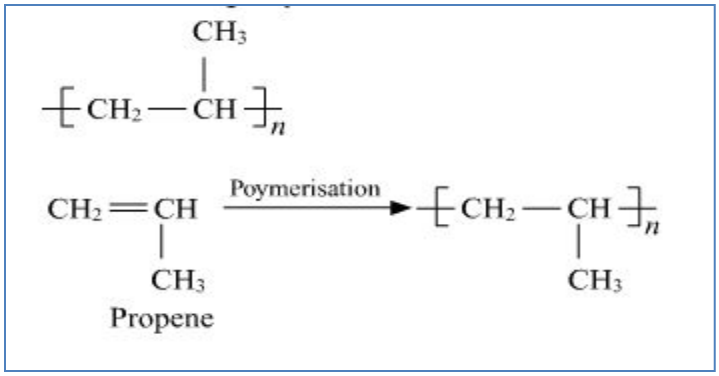


(iii) Buna-S

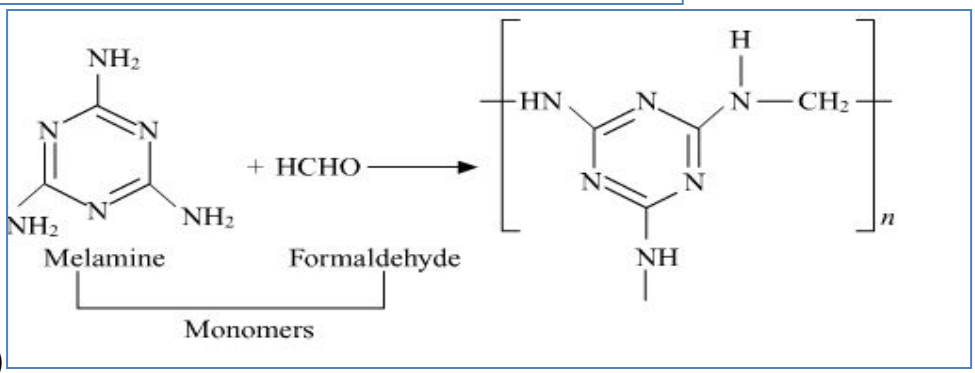


OR

(i) This is a homopolymer formed by a propene monomer because in this polymerization only one monomer is being used without losing any molecule.



(ii)



(iii) In vulcanization, sulphur forms cross links at the reactive sites of double bonds of natural rubber so the rubber gets stiffened.

Question 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
Solution
(i) Tranquilizers are used in sleeping pills.
(ii) Anionic detergents are used in toothpastes.
(iii) The control of sweetness of food is difficult while using alitame, hence its use as artificial sweetener is not recommended.

OR

(i) Broad-spectrum antibiotics – Antibiotics which kill or inhibit a wide range of gram-positive and gram-negative bacteria are called broad-spectrum antibiotics.
e.g. – Chloramphenicol / Vancomycin / Ofloxacin
(ii) Disinfectants – The chemicals which either kill or prevent the growth of microorganisms are called disinfectants.

e.g. Chlorine or SO_2

(iii) Cationic detergents – They are quaternary ammonium salts of amines with acetates, chlorides or bromides as anions.

e.g. Cetyltrimethylammonium bromide

Question 21:

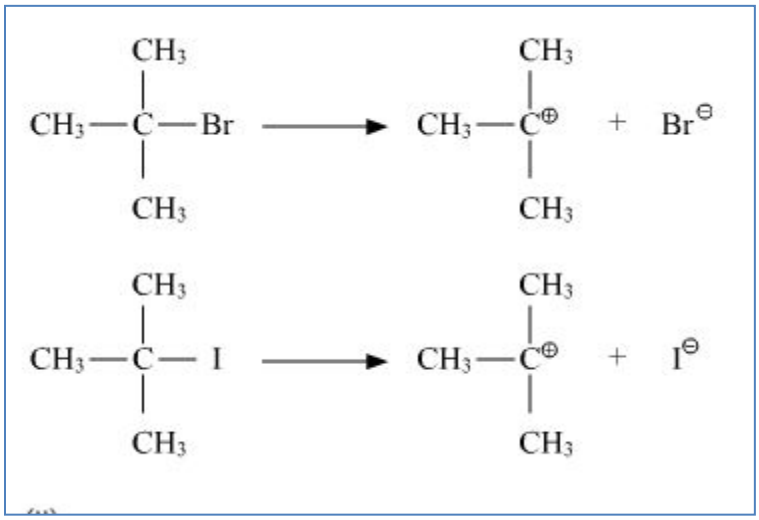
(i) Out of $(CH_3)_3C–Br$ and $(CH_3)_3C–I$, which one is more reactive towards S_N1 and why?

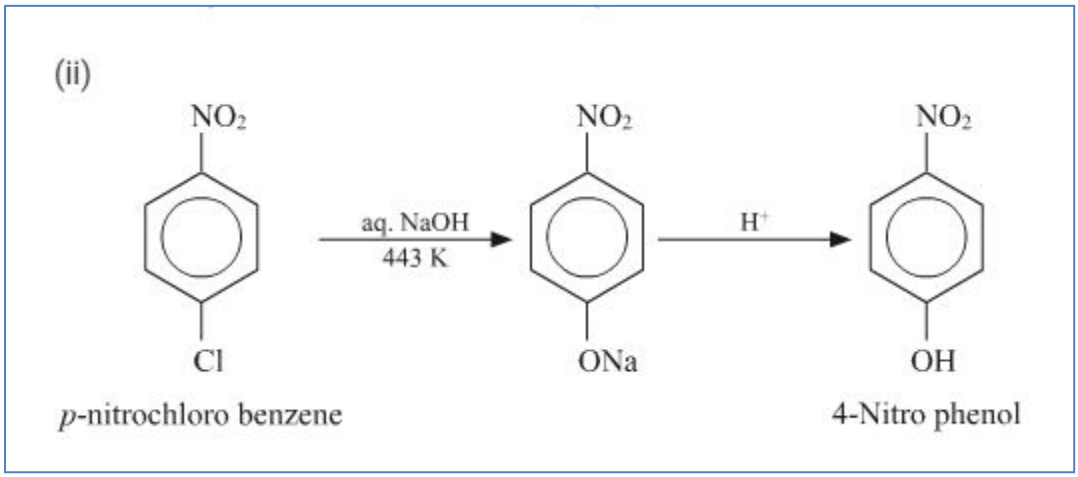
(ii) Write the product formed when p-nitrochlorobenzene is heated with aqueous $NaOH$ at $443K$ followed by acidification?

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

Solution

(i) In S_N1 reactions, reactivity depends on the stability of carbocation after removing the leaving group form the reactant. Since the carbocation is same here, so, we will see the tendency of leaving group. As we can see in the following reactions Br and r are the leaving groups, out of them r is a better leaving group. Hence SN1 reaction will be faster in $(CH_3)_3C–I$ $(CH_3)_3–Br$

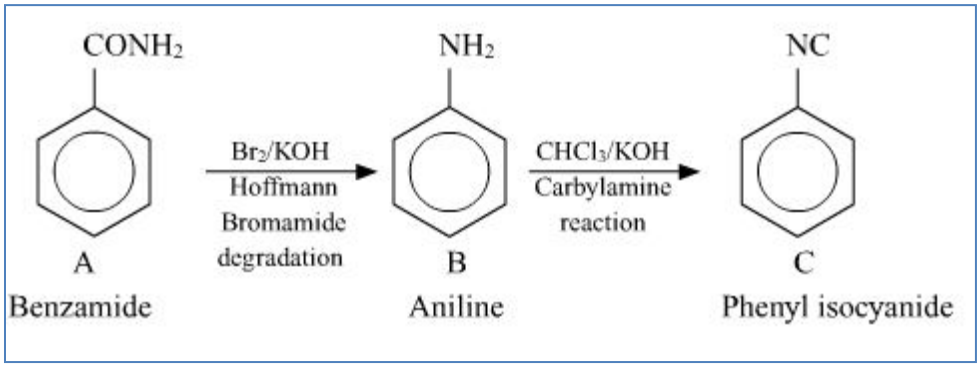




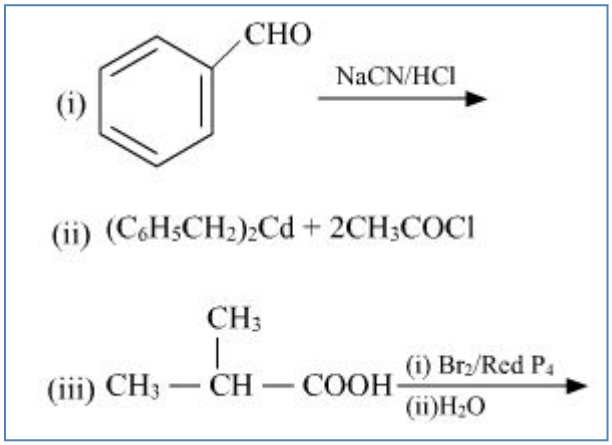
(iii) Dextro and laevo rotatory isomers of Butan-2-ol are enantiomers of each other and both have same boiling point and hence they cannot be separated by fractional distillation.

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.

Solution



Question 23: complete the following reactions:



OR

Write chemical equations for the following reactions :

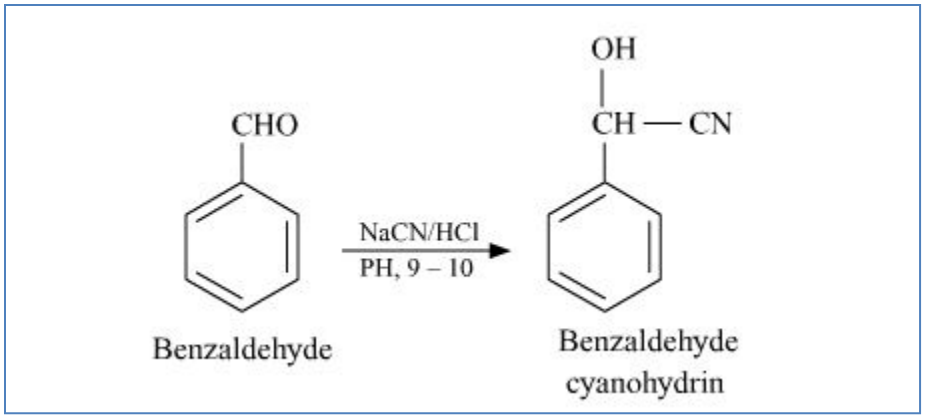
(i) Propanone is treated with dilute $Ba(OH)_2$.

(ii) Acetophenone is treated with $\frac{Zn(Hg)}{Conc.HCl}$.

(iii) Benzoyl chloride is hydrogenated in presence of $\frac{Pd}{BaSO4}$.

Solution:

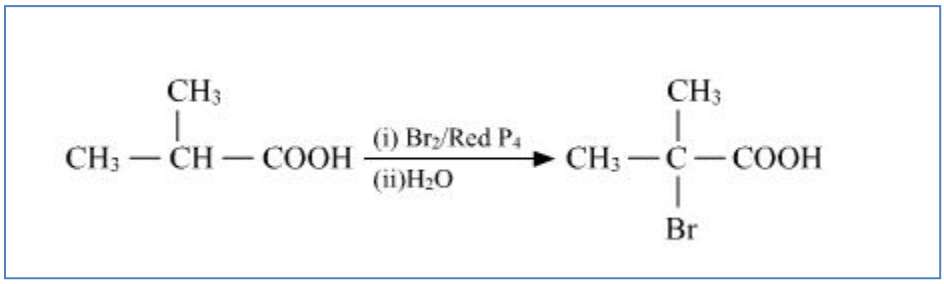
Reaction of benzaldehyde with $NaCN/HCL$ gives cyanohydrins.



(II)Treatment of acyl chlorides with dialkycadium gives a ketone.

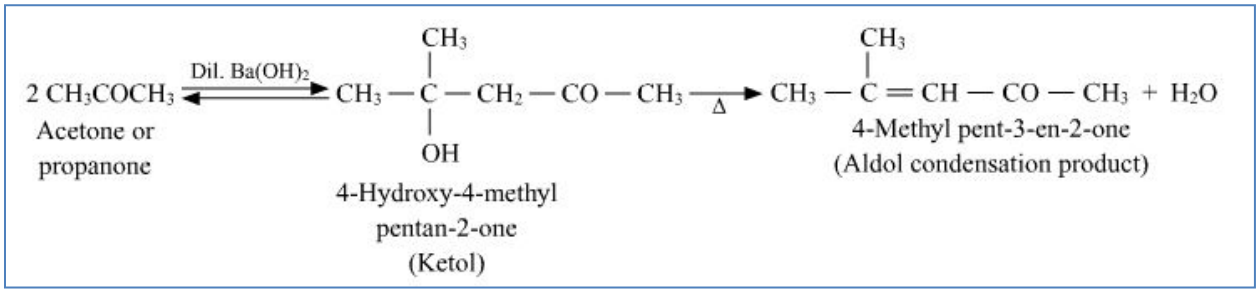
$$\left(C_6H_5CH_2\right)_2 Cd + 2CH_3COCl \rightarrow 2C_6H_5CH_2—\overset{\overset{O}{\|}}{C}—CH + CdCl_2$$

(iii)Carboxylic acid having a-hydrogen are halogenated at a-position on treatment with Br_2 in presence of red phosphorous to give a -halocarboxylic acids. This is HeII-Volhard-Zelinsky reaction.

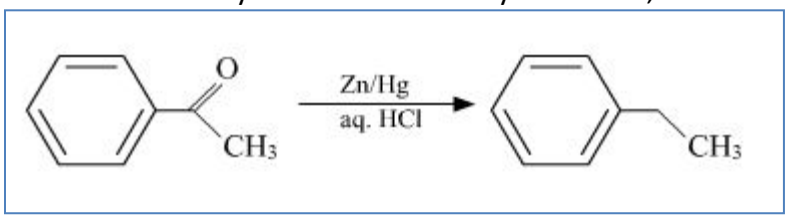


OR

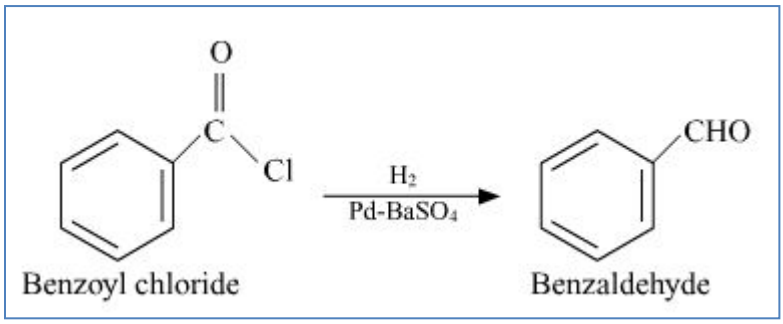
This is a self-aldol condensation reaction.



(ii) The reaction of aldehydes and ketones with zinc amalgam $\left(Zn/Hg\right)$ in concentrated HCl, reduces the aldehyde or ketone to a hydrocarbon,and is called Clemmensen reduction.



(iii) Benzoyl chloride is hydrogenated over catalyst $Pd\text{-}BaSO_4$ to give benzaldehyde. This reaction is called Rosenmund Reaction.



Question 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
Solution:
(i)

	Amylose	Amylopectin
(a)	Only C_1–C_4 glycosidic linkage	C_1–C_4 glycosidic linkage but, branching occurs by C_1–C_6 glycosidic linkage
(b)	Water soluble component of starch (15-20%)	Water insoluble component of starch (80-85%)

(ii)

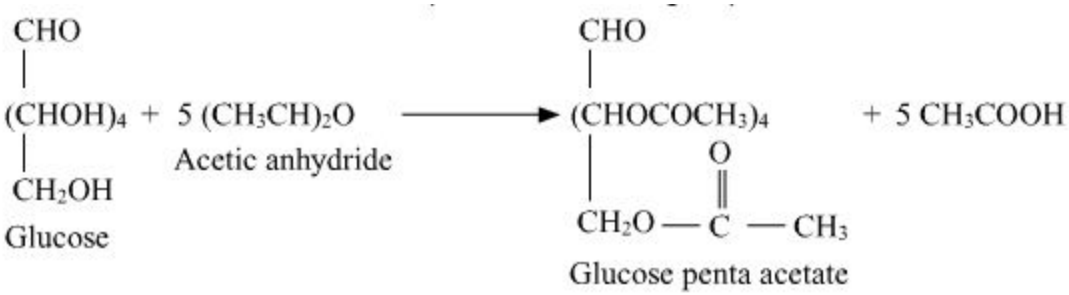
Peptide linkage	Glycosidic linkage
It is –CONH- linkage which exists in proteins formed by condensation of amino acids.	It is –O– linkage. In disaccharide two monosaccharide units are joined through oxygen atom i.e. glycosidic linkage.

(iii)

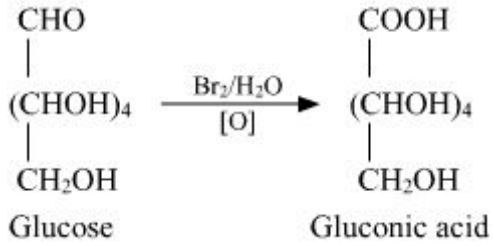
	Fibrous proteins	Globular protein
(a)	Polypeptide chains run parallel to give fibre-like structure	Polypeptide chains coil around to give spherical shape
(b)	Generally insoluble in water such as keratin, myosin	Usually soluble in water such as insulin, albumins

OR

(i)On prolonged heating with HI, glucose forms n-hexane, suggesting that all the six carbon atoms are linked in a straight chain.
(ii)Acetylation of glucose with acetic anhydride gives glucose pentaacetate which confirms the presence of five $-OH$ groups. Since it exists as a stable compound, five $-OH$ groups should be attached to different carbon atoms.



(iii)Glucose gets oxidised to six carbon carboxylic acid (gluconic acid) on reaction with a mild oxidising agent like bromine water. This indicates that the carbonyl group is present as an aldehydic group



Question 25: $E°$ **cell for the given redox reaction is** $2.71\ V$

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

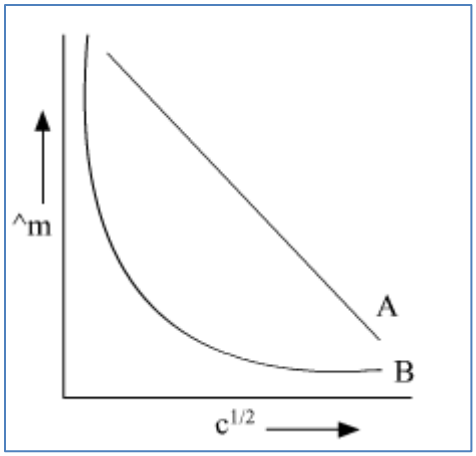
Calculate E_{cell} **for the reaction. Write the direction of flow of current when an external opposite potential applied is (i) less than** $2.71\ V$ **and (ii) greater than** $2.71\ V$

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 **.**

$\left(\text{Molar mass : Fe=56g mol}^{-1}, \text{Zn=65.3g mol}^{-1}, \text{1 F=96500C mol}^{-1}\right)$

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



Solution:

$$Mg(s)+Cu^{2+}(aq)\rightarrow Mg^{2+}(aq)+Cu(s)$$

$$Q=\frac{\left[Mg^{2+}\right][Cu]}{[Mg]\left[Cu^{2}\right]}=\frac{(0.001)(1)}{(1)(0.01)}=0.1$$

Using Nernst equation,

$$E_{cell}=E^{\circ}_{cell}-\frac{0.0591}{n}\log Q$$

$$E_{cell}=2.71-\frac{0.0591}{2}\log 0.1$$

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

(i) Since the voltage applied externally is less than E_{cell} then the direction of flow of current is from cathode to anode

(ii) When the external voltage applied exceeds E_{cell}, the direction of flow of current is from anode to cathode.

If voltage is applied is greater than $2.74\,V$, the direction of current is from anode to cathode.

OR

(a)

$$I=2\ A$$

$$W_1=2.8\ g$$

$$Fe^{2+}(aq)+2e^{-}\rightarrow Fe(s)$$

96500×2 C of charge is required to deposit=56 g of Fe

9650 C of charge is required to deposit=2.8 g of Fe

$$\because\ Q=1t \text{ or } t=\frac{9650}{2}=4825\,s$$

Using Faraday's second law of electrolysis,

$$\frac{W_1(\text{Weight of Fe deposited})}{W_2(\text{Weight of Zn deposited})}=\frac{E_1(\text{Equivalent weight of Fe})}{E_2(\text{Equivalent weight of Fe})}$$

$\frac{2.8}{W_2}=\frac{56/2}{65.3/2}=\frac{56}{65.3}$

Or W_2=3.265 g

(b) Electrolyte A is strong electrolyte & Electrolyte B is weak electrolyte On extrapolation of Λ_m to concentration approaching zero for strong electrolytes, we get the value of Λ°_m i.e. molar conductance at infinite dilution In the case of weak electrolytes, Λ_m increases steeply on dilution. Therefore, Λ°_m cannot be obtained by extrapolation.

Question 26:

(a) How do you convert the following :

(i) Phenol to Anisole

(ii) Ethanol to Propan-2-ol

(b) Write mechanism of the following reaction :

$C_2H_5OH \xrightarrow[443K]{H_2SO_4} CH_2=CH_2+H_2O$

(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

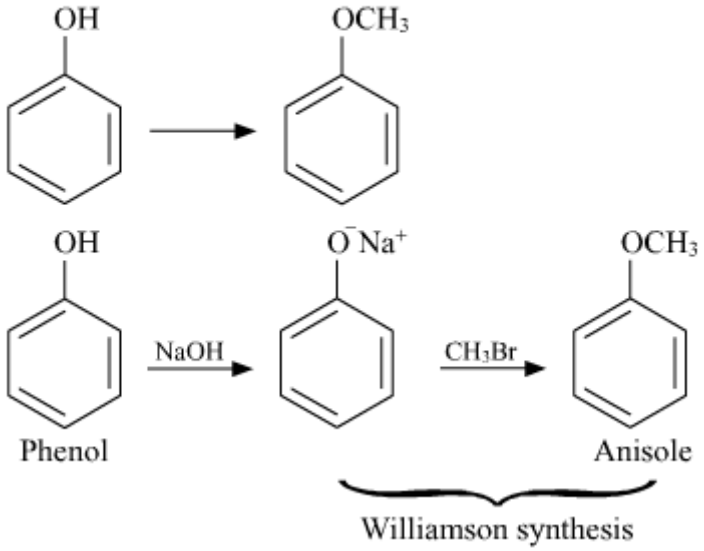
(ii) Friedal-Crafts Alkylation of Phenol

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

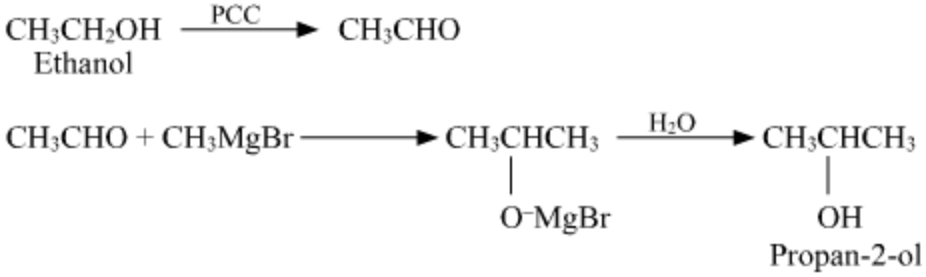
Solution:

(a) (i)

Phenol to anisole

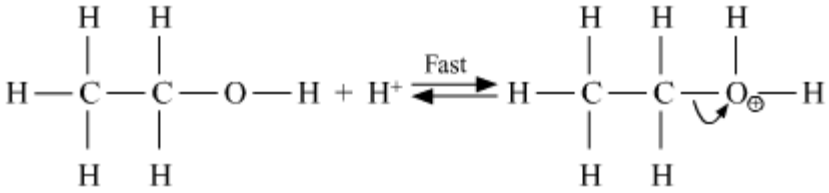


(a) (ii)

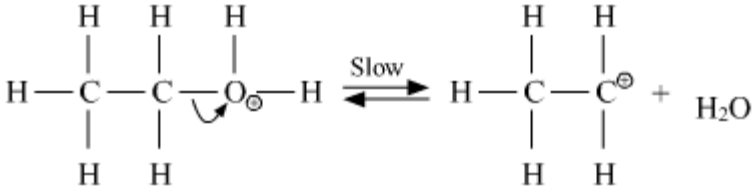


(b) Mechanism : Dehydration of ethanol

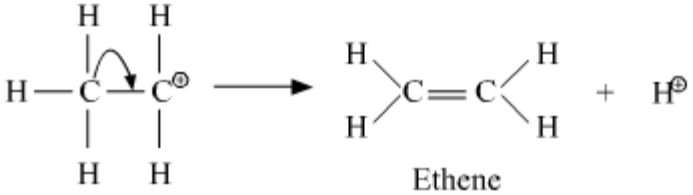
Step 1: Formation of protonated alcohol



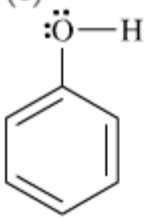
Step 2: Formation of carbocation (slow step)

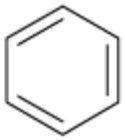


Step 3: Formation of ethene



(c)

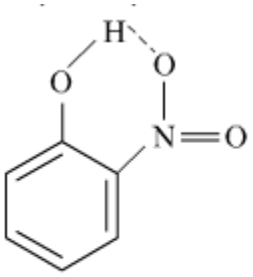

Phenol


Benzene

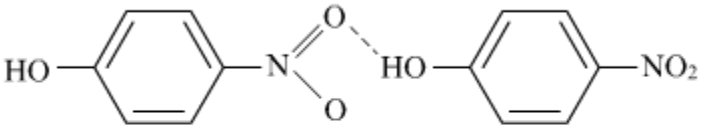
(c) –OH group of phenol is activating group which increases the electron density at ortho/para position within the benzene ring so that electrophile can easily attack at ortho/para position in phenol than in benzene.

OR

(a) (i) o-Nitrophenol is steam volatile due to intramolecular hydrogen bonding while p-nitrophenol is less volatile due to intermolecular hydrogen bonding

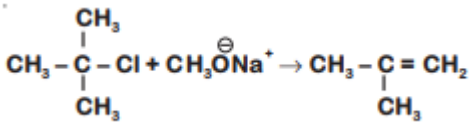


Intramolecular
hydrogen bonding
(*o*-nitrophenol)

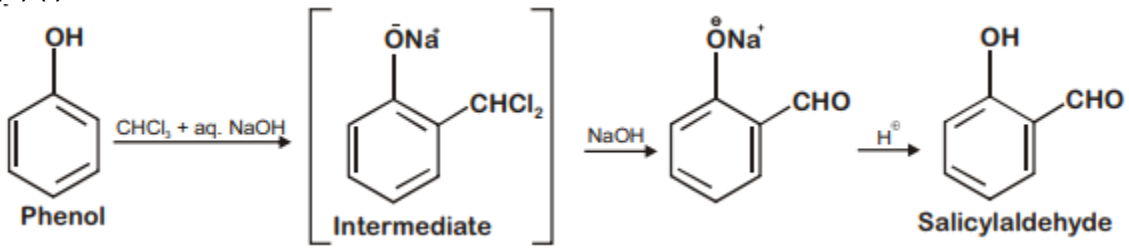


Intermolecular
hydrogen bonding
(*p*-nitrophenol)

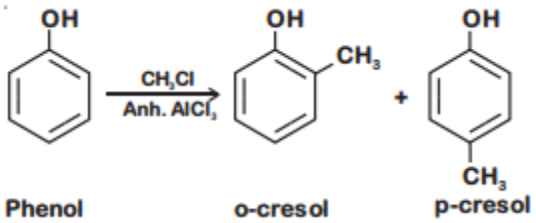
(ii) Sodium methoxide is a strong base hence elimination pre-dominates over substitution



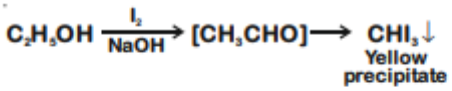
(b) (i) Reimer-Tiemann reaction

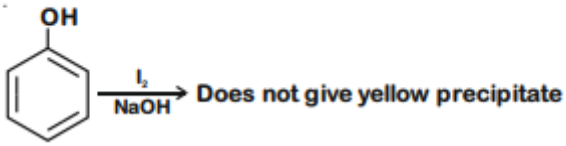


(ii) Friedel Craft's reaction of phenol



(c) Ethanol and phenol can be chemically distinguished by Iodoform test





Question 27:

(a) Give reasons for the following :

(i) Sulphur in vapour state shows paramagnetic behaviour.

ii) N-N bond is weaker than 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.

Solution:

(a) (i) Sulphur in vapor state exists as S_2 which has two unpaired electrons in the pi-antibonding molecular orbital and is paramagnetic

(ii) Due to small size of N, there is strong interelectronic repulsion of the non-bonding electrons and as a result the $N\text{-}N$ single bond is weaker than $P\text{-}P$ single bond.

(iii) Decomposition of ozone into oxygen results in the liberation of heat $(\Delta H<0)$ and an increase in entropy $(\Delta S>0)$ resulting in a large negative Gibb's energy change. Hence, ozone is thermodynamically less stable than oxygen.

(b) (i) With dil. $HNO_3 \rightarrow$ Nitrogen monoxide (NO)

$$3Cu+8HNO_3 \rightarrow 3Cu(NO_3)_2 +2NO+4H_2O$$
$$(dil.)$$

(ii) With Conc. $HNO_3 \rightarrow$ Nitrogen dioxide (NO_2)

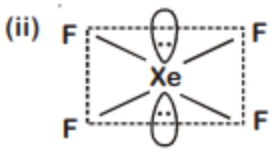
$$Cu+4HNO_3 \rightarrow Cu(NO_3)_2 +2NO_2+2H_2O$$
$$(conc.)$$

OR

(a)

(i) $4H_3PO_3 \rightarrow 3H_3PO_4+PH_3$

(ii)



(b) (i) Due to small size, fluorine has less negative electron gain enthalpy. The oxidizing power is dependent upon hydration energy, bond dissociation energy as well as electron gain enthalpy. Due to small size, fluorine has very high hydration energy, therefore F_2 acts as strong oxidising agent.

(ii) As electronegativity of atom decreases, acidic strength of oxide decreases, hence acidic character decreases from N_2O_3 to Bi_2O_3

(c) $5SO_2+2MnO_4^- + 2H_2O \rightarrow 5SO_4^{2-} + 4H^+ + 2Mn^{2+}$

Series SGN

CHEMISTRY

Paper & Solution

SET-1

Code : 56/1

Time : 3 Hrs. **Max. Marks : 70**

General Instructions :

(i) All questions are compulsory.

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

(iii) Questions **6** to **10** are short answer questions and carry **2** marks each.

(iv) Question number **11 to 22** are also short-answer questions and carry **3** marks each.

(v) Question number **23** is a value based questions and carry **4** marks.

(vi) Question number **24 to 26** are long-answer questions and carry **5** marks each.

(vii) Use Log Tables, if necessary. Use of calculators is **not** allowed.

1. Analysis shows that FeO has a non-stoichiometric composition with formula $Fe_{0.95}O$. Give reason. **[1]**

Sol. Since in FeO, Fe present in both +2 & +3 O.S.. Hence FeO has non-Stoichometric composition

2. CO (g) and H_2 (g) react to give different products in the presence of different catalysts. Which ability of the catalyst is shown by these reactions ? **[1]**

Sol. It specify selectivity of a catalyst in this reaction which means a catalyst for one reaction can be inhibitors for another

3. Write the coordination number and oxidation state of Platinum in the complex $[Pt(en)_2Cl_2]$. **[1]**

Sol. Complex given –

$[Pt\ (en)_2Cl_2]$

Coordination no. = denticity × number of ligand

Coordination number = $2 \times 2 + 2 \times 1 = 6$

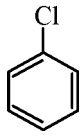
Charge on ligand + O.S. of metal ion = charge on complex

$-2 + x = 0$

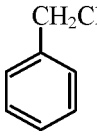
$\Rightarrow \quad x = +2$

4. Out of chlorobenzene and benzyl chloride, which one gets easily hydrolysed by aqueous NaOH and why ? **[1]**

Sol.



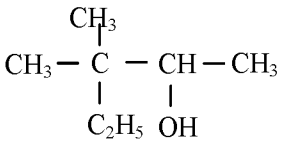
Chloro Benzene

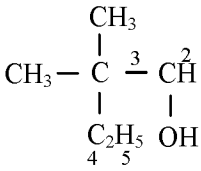


Benzyl chloride

The benzyl chloride is more readily hydrolysed in aq. NaOH as in chloro Benzene the lone pair of chlorine are in conjugation with π-Bond of Benzene due to which partial double bond character develop and it reduce its reactivity.

5. Write the IUPAC name of the following : **[1]**



Sol.  3, 3-dimethyl pentan-2-ol

6. Calculate the freezing point of a solution containing 60 g of glucose (Molar mass = 180 g mol^{-1}) in 250 g of water. (K_f of water = 1.86 K kg mol^{-1}) **[2]**

Sol. $W_1 = 250$ g, $w_2 = 60$ g, $mw_2 = 180$ g/mol, $K_f = 1.86$ k kg mol^{-1}

$\Delta t_f = k_f m$

or $\Delta t_f = k_f \times \dfrac{w_2 \times 1000}{m.w_2 \times w_1(g)}$

$= 1.86 \times \dfrac{60 \times 1000}{180 \times 250}$

$= \dfrac{1.80 \times 600}{18 \times 25}$

$= \dfrac{1116}{450}$

$= 2.48$ K

$\Delta t_f = t_{(solvent)} - t_{(Solution)}$

Or $t_{(solution)} = t_{(solvent)} - \Delta t_f$

$= 273.15 - 2.48$

$= 270.67$ K

7. For the reaction

$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$

the rate of formation of NO_2 (g) is 2.8×10^{-3} M s^{-1}. Calculate the rate of disappearance of N_2O_5 g. **[2]**

Sol. A reaction is given

$2\,N_2O_5(g) \longrightarrow 4\,NO_2(g) + O_2(g)$

$\dfrac{\Delta NO_2}{\Delta t} = 2.8 \times 10^{-3}$ M /sec

So rate of reaction – (representation)

$$-\frac{1}{2}\frac{\Delta N_2O_5}{\Delta t} = \frac{1}{4}\frac{\Delta NO_2}{\Delta t} = \frac{\Delta O_2}{\Delta t}$$

or $$\frac{\Delta N_2O_5}{\Delta t} = \frac{1}{2}\frac{\Delta NO_2}{\Delta t}$$

$$\frac{\Delta N_2O_5}{\Delta t} = \frac{1}{2} \times 2.8 \times 10^{-3} = 1.4 \times 10^{-3}\ M/sec$$

8. Among the hydrides of Group-15 elements, which have the

(a) lowest boiling point ?

(b) maximum basic character ?

(c) highest bond angle ?

(d) maximum reducing character ? **[2]**

Sol. Among group is element hydrides

(a) PH_3 has a lowest boiling point

(b) NH_3 has a maximum basic character

(c) NH_3 has a highest bond angle

(d) BiH_3 has maximum reducing character

9. How do you convert the following ?

(a) Ethanal to Propanone

(b) Toluene to Benzoic acid **[2]**

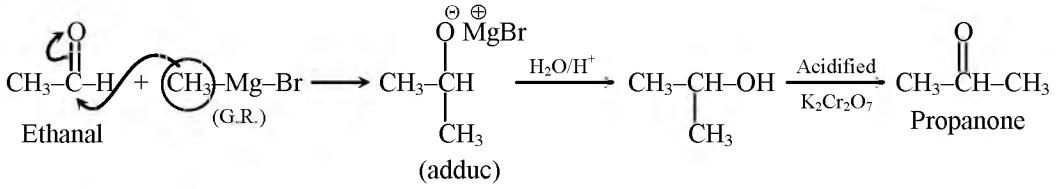
OR

Account for the following :

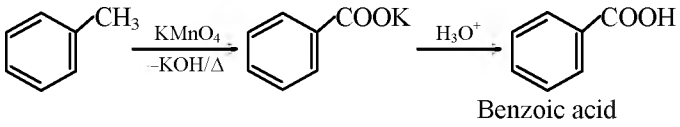
(a) Aromatic carboxylic acids don not undergo Friedel-Crafts reaction.

(b) pK_a value of 4-nitrobenzoic acid is lower than that of benzoic acid.

Sol. (a) Ethanal to Propanone



(b) Toluene to Benzoic acid



OR

(a) In case of aromatic carboxylic acid –COOH attach to the Benzene ring having electron with drawing effect and deactivated the benzene ring, hence do not exhibit friedel craft reaction.

(b) pK_a value of 4-nitrobenzoic acid is lower then benzoic acid is due to e^- with drawing nature of $-NO_2$ attach at para position of Benzene due to which tendency to loose H^+ ion increases and acidic character increases.

10. Complete and balance the following chemical equations :

(a) $Fe^{2+} + MnO_4^- + H^+ \rightarrow$

(b) $MnO_4^- + H_2O + I^- \rightarrow$ **[2]**

Sol. (a) $5Fe^{2+} + MnO_4^- + 8H^+ \rightarrow Mn^{+2} + 8H_2O + 5I_2$

(b) $2MnO_4^- + H_2O + I^- \rightarrow 2MnO_2 + 20H^- + IO_3^-$

11. Give reasons for the following :

(a) Measurement of osmotic pressure method is preferred for the determination of molar masses of macromolecules such as proteins and polymers.

(b) Aquatic animals are more comfortable in cold water than in warm water.

(c) Elevation of boiling point of 1 M KCl solution is nearly double than that of 1 M sugar solution. **[3]**

Sol. (a) Protein are high molecular mass material the magnitude of colligative property depends inversely on the molecular mass and osmotic pressure is the only colligative property have measurable magnitude.

(b) Oxygen is in dissolved states in water and as temperature rises solubility of oxygen decreases which means solubility of oxygen in warm water is less.

(c) Since the elevation of boiling point is $\Delta t_b = iK_bm$ in both 1M KCl & 1 M sugar. The solvent is some but KCl is ionic due to which its dissociates completely. Hence the value van't hoff factor is twice in 1m KCl then 1M sugar due to which elevation in boiling point is more.

12. An element 'X' (At. mass = 40 g mol^{-1}) having f.c.c. structure, has unit cell edge length of 400 pm. Calculate the density of 'X' and the number of unit cells in 4 g of 'X'. ($N_A = 6.022 \times 10^{23}$ mol^{-1}) **[3]**

Sol. Atomic mass = 40 g/mol

$A = 400 \text{ pm} = 400 \times 10^{-10}$ cm or 4×10^{-8} cm

$$\Rightarrow \text{So } d = \frac{z \times M}{a^3 \times N_A} = \frac{4 \times 40}{(4 \times 10^{-8})^3 \times 6.023 \times 10^{23}}$$

$$d = \frac{160}{64 \times 6.023 \times 10^{-1}} = \frac{160}{6.4 \times 6.023} \cong 4.18 \text{gm/cc}$$

$\Rightarrow$ 40 g contain $\longrightarrow$ Na atoms

$$4\text{g g contain} \longrightarrow \frac{N_A \times 4}{40} \text{ atoms} = \frac{N_A \text{Atom}}{10}$$

$$90 = \frac{6.023 \times 10^{23}}{10} \text{atoms or } \frac{6.023 \times 10^{22}}{4} = 1.50 \times 10^{22} \text{ unit cell}$$

13. A first order reaction is 50 % completed in 40 minutes at 300 K and in 20 minutes at 320 K. Calculate the activation energy of the reaction. (Given : log 2 = 0.3010, log 4 = 0.6021, R = 8.314 JK^{-1} mol^{-1}) **[3]**

Sol. $T_1 = 300$ K $\quad t_{1/2} = 40$ min

$T_2 = 320$ K $\quad t_{1/2} = 20$ min

We know $\quad t_{1/2} = \dfrac{.693}{K}$

$$\frac{\log K_2}{K_1} = \frac{Ea}{2.303\ R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

$$K \propto \frac{1}{t_{1/2}}$$

or $$\frac{\log (t_{1/2})_1}{(t_{1/2})_2} = \frac{Ea}{2.303\ R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

$$\Rightarrow \log\left(\frac{40}{20}\right) = \frac{Ea}{2.303 \times 8.314}\left(\frac{20}{320 \times 300}\right)$$

$$0.3010 = \frac{20\,Ea}{2.303 \times 8.314 \times 320 \times 300}$$

$$Ea = \frac{0.3010 \times 2.303 \times 8.314 \times 320 \times 300}{20 \times 1000} = 27.67 \text{ KJ/mol.}$$

14. What happens when

(a) a freshly prepared precipitate of $Fe(OH)_3$ is shaken with a small amount of $FeCl_3$ solution.

(b) persistent dialysis of a colloidal solution is carried out ?

(c) an emulsion is centrifuged ? **[3]**

Sol. (a) When precipitate particles of $Fe(OH)_3$ added in small amount of $FeCl_3$ Reptization occur. The common ion Fe^{+3} adsorbed on precipitate particles and converts to smaller colloidal particles.

(b) To increase the stability of colloids a small amount of electrolyte is added, so during the electrolyte almost remove and so the colloidal sol will coagulate.

(c) It the emulsion is centrifuged then it demulsified the immiscible mixture of two liquid and both get separate out.

15. Write the chemical reactions involved in the process of extraction of Gold. Explain the role of dilute NaCN and Zn in this process. **[3]**

Sol. Chemical reaction during extraction of gold –

$$4Au_{(s)} + 8CN^-_{(aq)} + 2H_2O_{(aq)} + O_{2(g)} \longrightarrow 4[Au(CN)_2]^-_{(aq)} + 4OH^-_{(aq)}$$

$$2[Au(CN)_2]^-_{(aq)} + Zn_{(s)} \longrightarrow [Zn(CN)_4]^{2-}_{(aq)} + 2Au_{(s)}$$

"the dilute NaCN and KCN is used to leached the metal in the presence of air while Zn is act as a reducing agent".

16. Give reasons :

(a) E^o value for Mn^{3+}/Mn^{2+} couple is much more positive than that for Fe^{3+}/Fe^{2+}.

(b) Iron has higher enthalpy of atomization than that of copper.

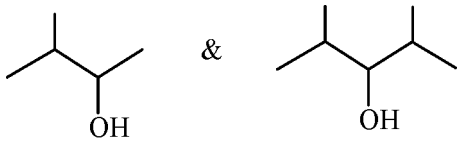
(c) Sc^{3+} is colourless in aqueous solution whereas Ti^{3+} is coloured. **[3]**

Sol. (a) E^o value for Mn^{+3}/Mn^{+2} is more positive it is due to fact that Mn^{+2} have higher stability then Mn^{+3} due to half filled d^5 configuration.

(b) Iron has higher no of unpaired electron then copper due to which extent of covalent bonding is more hence enthalpy of atomization is more.

(c) Sc^{+3} is colurless is due to absence of unpaired electron as it attain $3d^0$ configuration while Ti^{+3} has $3d^1$ configuration.

17. (a) Identify the chiral molecule in the following pair :

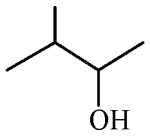


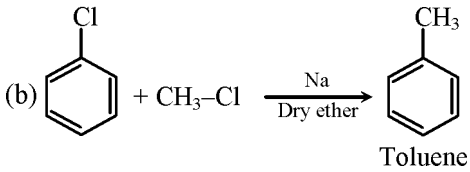
(i) (ii)

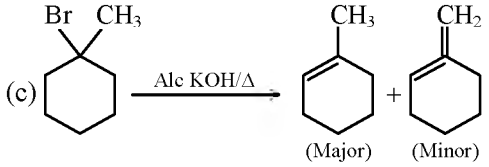
(b) Write the structure of the product when chlorobenzene is treated with methyl chloride in the presence of sodium metal and dry ether.

(c) Write the structure of the alkene formed by dehydrohalogenation of 1-bromo-1-methylcyclohexane with alcoholic KOH **[3]**

Sol. (a) The chiral molecule







18. (A), (B) and (C) are three non-cyclic functional isomers of carbonyl compound with molecular formula C_4H_8O. Isomers (A) and (C) give positive Tollens' test whereas isomer (B) does not give Tollens' Test but gives positive Iodoform test. Isomers (A) and (B) on reduction with Zn(Hg)/cons.HCl give the same product (D).

(a) Write the structures of (A), (B), (C) and (D)

(b) Out of (A), (B) and (C) isomers, which one is least reactive towards addition of HCN ? **[3]**

Sol. (a) (A) $CH_3–CH_2–CH_2–CHO$

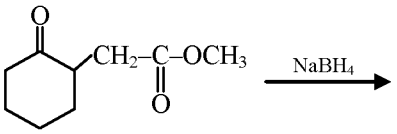
(B) $CH_3–\overset{\overset{O}{\|}}{C}–CH_2–CH_3$

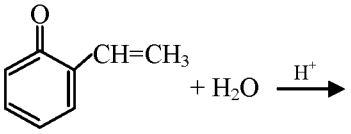
(C) $CH_3–\overset{\overset{CH_3}{|}}{CH}–\overset{\overset{O}{\|}}{C}–H$

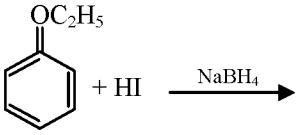
(D) $CH_3–CH_2–CH_2–CH_3$

(b) Since (B) is ketons so it will be less reactive towards nucleophilic addition reaction with HCN due to +I effect & sterric hinderence.

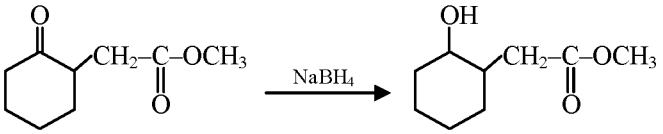
19. Write the structures of the main products in the following reactions :

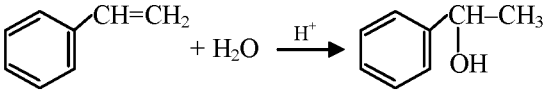
(i) 

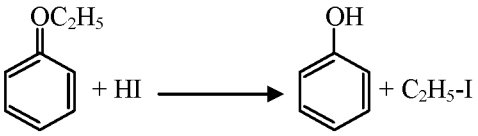
(ii) 

(iii) 

[3]

Sol. (i) 

(ii) 

(iii) 

20. (a) Why is bithional added to shop ?

(b) What is tincture of iodine ? write its one use.

(c) Among the following, which one acts as a food preservative ?

Aspartume, Asprin, Sodium Benzoate, Paracetamol. **[3]**

Sol. (a) Bithional added in soap to impart antiseptic property and to reduce odour produced by Bacterial decomposition.

(b) Tincture of iodine or iodine tincture is 2-7 % elemental iodine along with potassium iodide or sodium iodide in mixture of ethanol and water.
Uses : "use to prevent infection on minor cuts, scraps and burns"

(c) "Sodium Benzoate work as food preservative"

21. Define the following with an example of each :

(a) Polysaccharides

(b) Denatured protein

(c) Essential amino acids

OR

(a) Write the product when D-glucose reacts with conc. HNO_3?

(b) Amino acids show amphoteric behaviour. Why ?

(c) Write one difference between α-helix and β-pleated structures of proteins. **[3]**

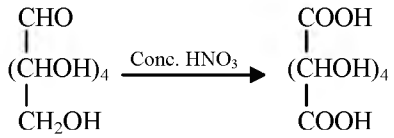
Sol. (a) Polysaccharides :
The compound that yield large number of monosaccarides unit on hydrolysis
Eg. Starch, Cellulose etc.

(b) Denatured Protein :
"Due to change in temperature on pH secondary & tertiary structure are destoryed but primary structure remain intact"

(c) Essential amino acids :
The amino acids which can not Bℓ synthesised within the body and obtained through diet.

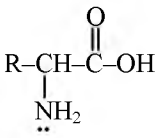
OR

(a). Product of reaction of D-glucose with concentrate HNO_3



D-glucose D-saccharic acid

(b) "The amino acids contain both acidic –COOH group and basic $-NH_2$ (amino) group in their structure due to which they can exist both as acid & base & exibit amphoteric nature.



α-amino acid

(c) In α-helix a polyreptide chain form by all possible hydrogen bonds by twisting into a right handed helical structure with –NH group of each amino acid.

"In β-pleated all reptide chains are stretched out to nearly extensions and then laid side by side which are held together by intermolecular hydrogen bond.

22. (a) Write the formula of the following coordination compounds: Iron(III)Hexacyanoferrate(II)

(b) What type of isomerism is exhibited by the complex $[Co(NH_3)_5Cl]SO_4$?

(c) Write the hybridisation and number of unpaired electrons in the complex $[CoF_6]^{3-}$

(Atomic No. of Co = 27) **[3]**

Sol. (a) $Fe_4[Fe(CN)_6]_3$

(b) $[Co(NH_3)_5Cl]SO_4$ (ionization isomers)

(c) $[CoF_6]^{-3}$

(i) Hybridization : sp^3d^2

(ii) Unpaired electron : 4-unpaired electron

23. Shyam went to a grocery shop to purchase some food items. The shopkeeper packed all the item in polythene bags and gave them to Shyam. But Shyam refused to accept the polythese bags and asked the shopkeeper to pack the items in paper bags. He informed the shopkeeper about the heavy penalty imposed by the government for using polythene bags. The shopkeeper promised that he would use paper bags in future in place of polythene bags.

Answer the following :

(a) Write the values (at least two) shown by Shyam

(b) Write one structural difference between low-density polythene and high-density polythene

(c) Why did Shyam refuse to accept the items in polythene bags ?

(d) What is a biodegradable polymer ? Give an example. **[4]**

Sol. (a) The value display by Shyam is awareness and concern about the consequences of using polythene bags.

(b) Low density polyethese form by free radical polymerization and posses highly branch structure while high density polythene posses a linear structure due to which it has high density due to closed packing

(c) As he knew about the consequences that they get into soil and slowly release toxic chemical as they are non-biodegradable polymers.

(d) Polymers broken down rapidly by enzyme catalysed reaction are called biodegradable polymers

Eg. Poly-β-hydroxybutyrate-co-β-hydroxyvalerate (PHBV) etc.

24. (a) Give reasons :

(i) H_3PO_3 undergoes disproportionation reaction but H_3PO_4 does not.

(ii) When Cl_2 reacts with excess of F_2, ClF_3 is formed and not FCl_3.

(iii) Dioxygen is a gas while sulphur is a solid at room temperature.

(b) Draw the structures of the following

(i) XeF_4

(ii) $HClO_3$

OR

(a) When concentrated sulphuric acid was added to an unknown salt present in a test tube a brown gas (A) was evolved. This gas intensified when copper turnings were added to this test tube. On cooling, the gas (A) changed into a colourless solid (B)

(i) Identify (A) and (B)

(ii) Write the structures of (A) and (B)

(iii) When does gas (A) change to solid on cooling ? **[5]**

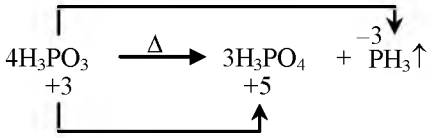
(b) Arrange the following in the decreasing order of their reducing character

HF, HCl, HBr, HI

(c) Complete the following reaction :

$XeF_4 + SbF_5 \longrightarrow$

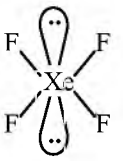
Sol. (i) Since in H_3PO_3 O.S. of central atom is +3 and on dissociation it undergo both oxidation +5 & reduction –3 in their respective compound

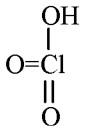


(ii) Due to high electronegativity & small size and absence of higher vaccant orbital flourine exibit only –1 O.S. so due to which FCl_3 is not possible.

(iii) Electron in oxygen atom, owing to small size of atom and tightly held hence less induced dipole-induced dipole attraction while electron of sulphur atom, owing to large size of the atom reach farther and cause. Strong induced dipole-induced dipole attraction.

Structure of compound –

(A) 

(B) 

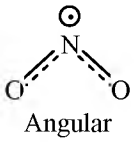
$(HClO_3)$

OR

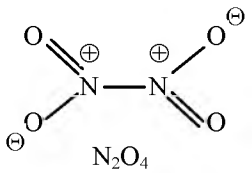
(a) (i) A $\rightarrow NO_2$ (nitrogen dioxide)

B $\rightarrow N_2O_4$ (dimitrogen tetra oxide)

(ii) Structures of A and B –



Angular



N_2O_4
(Planar)

(iii) "NO_2 contain odd number of valence electron hence behave as odd molecule and dimerized to convert into stable N_2O_4 molecule

(b) Decreasing order of reducing character -

HI > HBr > HCl > HF

(c) Complete following reaction

$XeF_4 + SbF_5 \longrightarrow [XeF_3]^+[SbF_6]^-$

25. (a) Write the cell reaction and calculate the e.m.f. of the following cell at 298K:

$Sn\ (s)\ |\ Sn^{2+}\ (0.004\ M)\ ||\ H^+\ (0.020\ M)\ |\ H_2\ (g)\ (1\ bar)\ |\ Pt\ (s)$

(Given : $E^0_{Sn^{2+}/Sn} = 0.14$)

(b) Give reasons :

(i) On the basis of E^0 values, O_2 gas should be liberated at anode but it is Cl_2 gas which is liberated in the electrolysis of aqueous NaCl.

(ii) Conductivity of CH_3COOH decreases on dilution.

OR

(a) For the reaction,

$2\ AgCl\ (s) + H_2\ (g)\ (1\ atm) \longrightarrow 2Ag\ (s) + 2H^+\ (0.1\ M) + 2Cl^-\ (0.1\ M)$

$\Delta G^o = -43600$ J at 25°C

Calculate the e.m.f. of the cell

[$\log 10^{-n} = -n$]

(b) Define fuel cell and write its two advantages. **[5]**

Sol. (a) Anode : $Sn(s) \longrightarrow Sn^{+2}(aq) + 2e^-$

Cathode : $2H^+_{(aq)} + 2e^- \longrightarrow H_2(g)$

Overall reaction :

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

$$E^o_{cell} = E^o_{Sn/sn^{+2}} - E^o_{H^+/H_2}$$

$$= -(-.14)$$

$$= 0.14\ V$$

$$E_{cell} = E^o_{cell} - \frac{0.0591}{2}\log_{10}\frac{[Sn^{+2}]}{[H^+]^2}$$

$$= 0.14 - \frac{0.0591}{2}\log_{10}\frac{[0.004]}{[0.020]^2}$$

$$= 0.14 - 0.0295$$

$$= +0.1105\ V$$

(b) (i) E^o_{Value} of O_2 is higher then Cl_2 but O_2 will lie liberate from H_2O only when the higher voltage is applied so because of this Cl_2 liberate instead of O_2.

Eg. $NaCl \rightarrow Na^+ + Cl^-$

$H_2O \rightleftharpoons H^+ + OH^-$

(ii) Conductivity changes as the concentration of the electrolyte changes. The number of ions per unit volume carrying the current decreases on dilution so conductivity will always decreases with decrease in concentration hence CH_3COOH conductivity decreases on dilution.

OR

A reaction is given –

(a) $2\,AgCl(s) + H_2(g)\,(a\ atm) \longrightarrow 2Ag(s) + 2H^+\,(0.1M) + 2Cl^-\,(0.1M)$

$\Delta G^o = -\,n\,F\,E^o_{cell}$

So $E^o_{cell} = \frac{-\Delta G^o}{nF} = \frac{-(-43600)}{2\times 96500} = 0.23\ V$

$E_{cell} = E^o_{cell} - \frac{0.0591}{n}\log_{10}[H^+]^2[Cl^-]^2$

$\Rightarrow\ 0.23 - \frac{0.0591}{2}\log 10[10^{-1}]^2[10^{-1}]^2$

$\Rightarrow\ 0.23 + 0.12 = 0.35$ volt

(b) They are galvanic cell that are designed to convert the energy of combustion of fuel like hydrogen, methane, methanol directly into electrical energy.

Eg. Hydrogen-oxygen fuel cell

Two advantages

(1) Do not cause any pollution like thermal plant

(2) Due to continuous supply of fuels, these cells never become dead.

26. (a) Write the reactions involved in the following,

(i) Hofmann bromamide degradation reaction

(ii) Diazotisation

(iii) Gabriel phthalimide synthesis

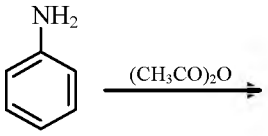
(b) Give reasons :

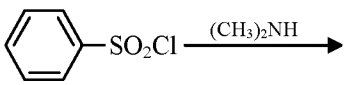
(i) $(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution

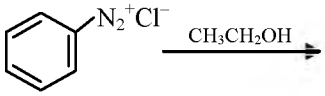
(ii) Aromatic diazonium salts are more stable than aliphatic diazonium salts.

OR

(a) Write the structures of the main products of the following reactions :

(i) 

(ii) 

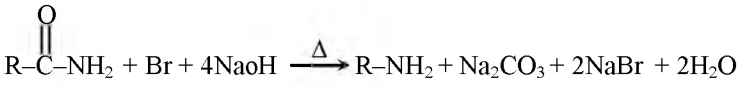
(iii) 

(b) Give a simple chemical test to distinguish between Aniline and N,N-dimethylaniline.

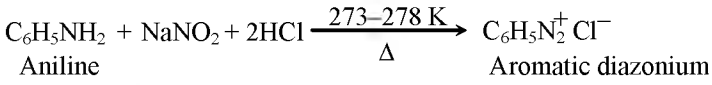
(c) Arrange the following in the increasing order of their pK_b values. :

$C_6H_5NH_2$, $C_2H_5NH_2$, $C_6H_5NHCH_3$ **[5]**

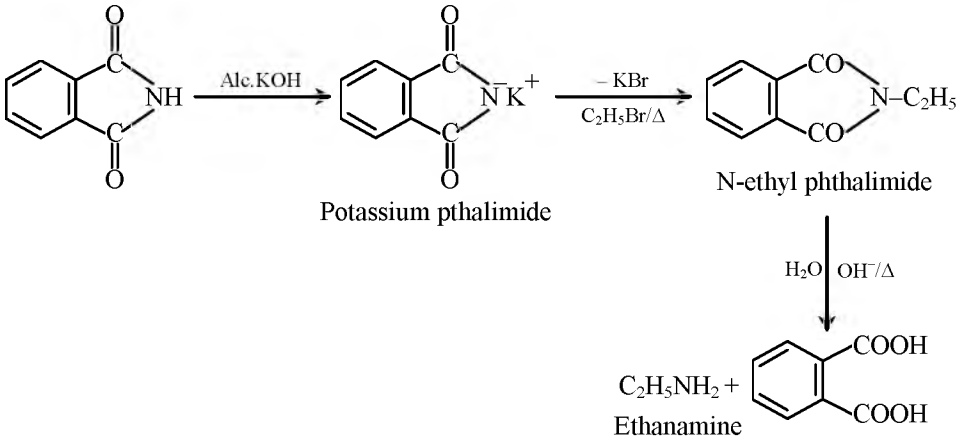
Sol. (a) (i) Hofmann Bromamide degradation reaction –



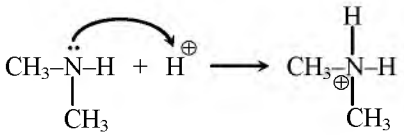
(ii) Diazotisation –

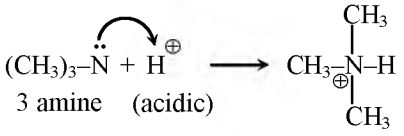


(iii) Gabriel Pthalimide reaction - Salt



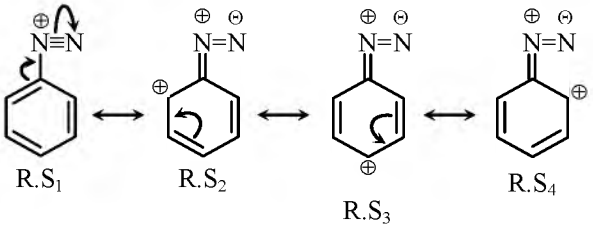
(b) (i) Hofmann bromamide degradation reaction –





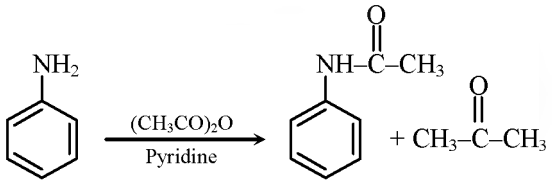
Since 2 amine salt form are more stable then 3 amine salt due to inductive effect (+I effect) and higher degree of hydration, so higher the state of salt more will be the reactivity of corresponding compound.

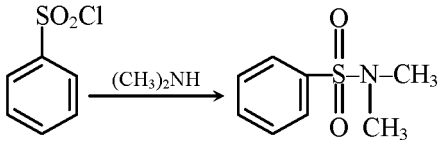
(ii) The aromatic diazonium salt more stable then aliphatic diazonium salt is due to resonance.



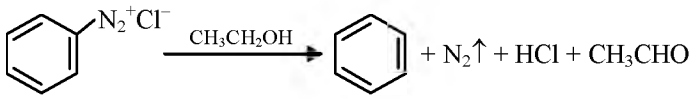
OR

(a) Write the product

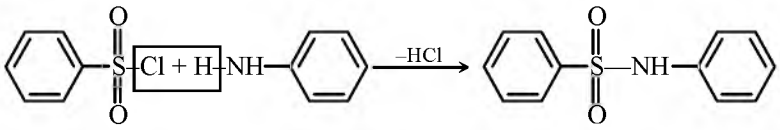
(i) 

(ii) 

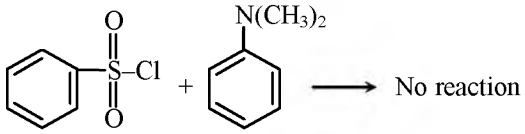
N, N-dimethyl Benzene sulphonamide

(iii) 

(b) Test to distinguish aniline & N,N-dimethyl aniline



Himsberg reagent Aniline Product



Benzene sulphonamide N,N-di methyl aniline

(c) Increasing order of pK_b :

$C_2H_5–NH_2 < C_6H_5–NH–CH_3 < C_6H_5–NH_2$

CBSE-XII-2017 EXAMINATION

Series GBM

CHEMISTRY

Paper & Solution

SET-1

Code : 56/1

Time : 3 Hrs. **Max. Marks : 70**

General Instructions :

(i) All questions are compulsory.

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

(iii) Questions **6** to **10** are short answer questions and carry **2** marks each.

(iv) Question number **11 to 22** are also short-answer questions and carry **3** marks each.

(v) Question number **23** is a value based questions and carry **4** marks.

(vi) Question number **24 to 26** are long-answer questions and carry **5** marks each.

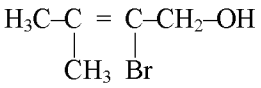
(vii) Use Log Tables, if necessary. Use of calculators is **not** allowed.

1. Write the formula of the compound of phosphorus which is obtained when conc. HNO_3 oxidises P_4. **[1]**

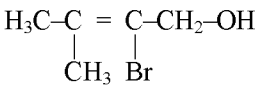
Sol. H_3PO_4 (phosphoric acid)

$$P_4 + 20HNO_3 \longrightarrow 4H_3PO_4 + 20NO_2 + 4H_2O$$

2. Write the IUPAC name of the following compound : **[1]**



Sol.



2-Bromo-3-methyl
But-2-en-1-ol

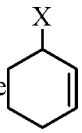
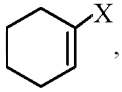
3. What is the effect of adding a catalyst on **[1]**

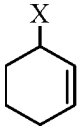
(a) Activation energy (E_a), and

(b) Gibbs energy (ΔG) of a reaction ?

Sol. (a) Catalyst provide a new reaction pathway in which a lower activation is offered. Hence catalyst increased rate of reaction by lowering the activation energy.

(b) Gibbs free energy will remain same as for catalyzed & uncatalyzed reaction, the equilibrium constant is not affected which is a function of Gibbs free energy.

4. Out of the  and  , which is an example of allylic halide ? **[1]**

Sol.  allylic halides.

5. What type of colloid is formed when a liquid is dispersed in a solid ? Give an example. **[1]**

Sol. "The colloid formed when a liquid is dispersed in a solid is gel for example : - Cheese, butter etc"

6. (a) Arrange the following compounds in the increasing order of their acid strength :

P-cresol, p-nitrophenol, phenol

(b) Write the mechanism (using curved arrow notation) of the following reaction :

$$CH_2 = CH_2 \xrightarrow{H_3O^+} CH_3 - CH_2^+ + H_2O$$ **[1 + 1 = 2]**

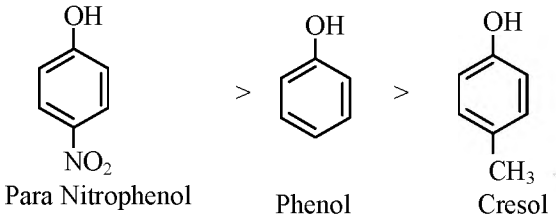
OR

Write the structures of the products when Butan-2-ol reacts with the following : **[1 + 1 = 2]**

(a) CrO_3

(b) $SOCl_2$

Sol. (a) the order of increasing acid strength is

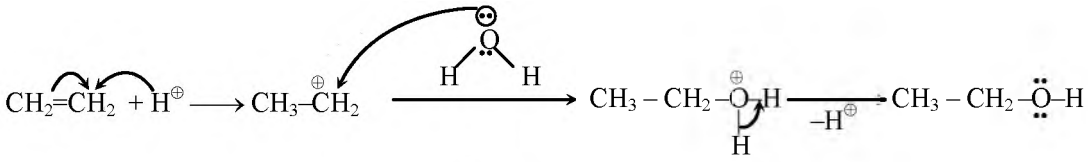


Para Nitrophenol Phenol Cresol

Reason : -

Since the $-NO_2$ group is (–M) group so it withdraw the e^- density from benzene. A stabilized the conjugate Base of para nitrophenol so "higher the stability of conjugate base more will be the reactivity of corresponding acids" while in case of cresol +H effect of Methyl group destabilised conjugate base

(b) Mechanism : -



OR

(a) $CH_3–CH_2–\underset{\underset{OH}{|}}{CH}–CH_3 + CrO_3 \longrightarrow CH_3–CH_2–\underset{\underset{O}{||}}{C}–CH_3$

2-Butanol Butan-2-one

(b) $CH_3–CH_2–\underset{\underset{OH}{|}}{CH}–CH_3 + SOCl_2 \longrightarrow CH_3–CH_2–\underset{\underset{Cl}{|}}{CH}–CH_3$

2-chloro butane

7. Calculate the number of unit cells in 8.1 g of aluminium if it crystallizes in a face-centred cubic (f.c.c.) structure. (Atomic mass of Al = 27 g mol^{-1}) **[2]**

Sol. Moles of aluminium = $\frac{\text{Mass}}{\text{Molecular mass}}$

$$n_{Al} \Rightarrow \frac{8.1}{2.7} = 0.3 \text{ moles}$$

We know that one unit of f.c.c., No. of atoms = 4

4 - atoms are found in unit cell = 1

1 - atoms are found in unit cell = 1/4

(1 mole) N_A atoms are found in unit cell = $N_A/4$

0.3 moles atoms are found in unit cell = $\frac{N_A}{4} \times 0.3$

$$\Rightarrow .075 \times N_A$$

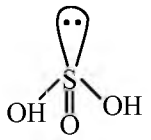
8. Draw the structures of the following : **[2]**

(a) H_2SO_3

(b) $HClO_3$

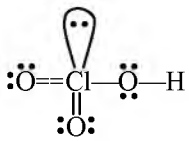
Sol. Structure of the following compound : -

(a) H_2SO_3 : -



Sulphurous acid

(b) $HClO_3$: -



9. Write the name of the cell which is generally used in hearing aids. Write the reactions taking place at the anode and the cathode of this cell. **[2]**

Sol. The Mercury cell are used in the hearing aids which consist of zinc-mercury amalgam as anode and a paste of Hgo and carbon at the cathode.

Reaction occur at the 2-electrode : -

anode : $Zn(Hg) + 2OH^{\ominus} \longrightarrow ZnO(g) + H_2O + 2e^{\ominus}$

cathode : - $HgO + H_2O + 2e^{\ominus} \longrightarrow Hg(\ell) + 2OH^{\ominus}$

10. Using IUPAC norms write the formulae for the following : **[1 + 1 = 2]**

(a) Sodium dicyanidoaurate (I)

(b) Tetraamminechloridonitrito-N-plantinum(IV) sulphate

Sol. (a) Sodium dicyanidoaurate (I)

$Na[Au(CN)_2]$

(b) Tetraammine chloridonitritoN-platinum (IV) sulphate

$[Pt(NH_3)_4Cl(NO_2)](SO_4)_2$

11. (a) Based on the nature of intermolecular forces, classify the following solids :
Silicon carbide, Argon

(b) ZnO turns yellow on heating. Why ?

(c) What is meant by groups 12-16 compounds ? Give an example. **[3]**

Sol. (a) On the basis of intermolecular forces : -

(i) Silicon carbide : - Covalentor network solid (Covalent Bonding)

(ii) Argon : - Non-polar molecular solid which posses dispersion or london forces.

(b) zinc oxide is white in colour at room temperature. On heating it loses oxygen & turns yellow

$$ZnO \xrightarrow{\Delta} Zn^{+2} + 1/2O_2 + 2e^{\ominus}$$

the excess zn^{+2} ions move to interstitial sites and the electron to neighbouring interstitial sites.

(c) Some of the compound like Zns, CdSe and HgTe are example of group 12 – 16 compound.
In these compound bonds are having same ionic character along with covalent.

12. (a) The cell in which the following reaction occurs :

$2Fe^{3+}(aq) + 2I^{-}(aq) \longrightarrow 2Fe^{2+}(aq) + I_2(s)$

has $E^{\circ}_{cell} = 0.236$ V at 298 K. Calculate the standard Gibbs energy of the cell reaction.

(Given : 1F = 96,500 C mol^{-1})

(b) How many electrons flow through a metallic wire if a current of 0.5 A is passed for 2 hours ?

(Given 1 F = 96,500 C mol^{-1}) **[3]**

Sol. (a) The two half cell reaction for the cell are : -

$2Fe^{+3}(aq) + 2e^{\ominus} \longrightarrow 2Fe^{+2}$ (reduction)

$2I^{\ominus} \longrightarrow I_2 + 2e^{\ominus}$ (Oxidation)

So the no of $e^{\ominus}$ transfer during reaction = 2

So $\Delta_r G^{\circ} = -nF\ E^{\circ}_{cell}$

$= -(2\ mol) \times (96500\ mol^{-1}) \times (.236\ V)$

$= -45548$ CV

or

$\Delta_r G^{\circ} = -45548$J or –45.55 kJ

(b) Charge (Q) passed $\Rightarrow$ Current (I) × Time (t) $\Rightarrow$ (0.5A) × (2 × 60 × 60 s)

$\Rightarrow$ (3600) Ampere Sec. $\Rightarrow$ 3600 C

No of electrons flowing through the wire on passing charge of one faraday (96500C) = 6.023×10^{23}

So the no. of electrons flowing through the wire on passing a charge of 3600C

$$\Rightarrow \frac{6.022 \times 10^{23} \times (3600C)}{(96500C)} \Rightarrow 2.246 \times 10^{22} \text{ "no. of electron"}$$

13. (a) What type of isomerism is shown by the complex $[Co(NH_3)_5(SCN)]^{2+}$?

(b) Why is $[NiCl_4]^{2-}$ paramagnetic while $[Ni(CN)_4]^{2-}$ is diamagnetic ?
(Atomic number of Ni = 28)

(c) Whey are low spin tetrahedral complexes rarely observed ? **[1 × 3 = 3]**

Sol. (a) The complex $[Co(NH_3)_5(SCN)]^{2+}$ exhibit the linkage isomerism.

(b) In both $[NiCl_4]^{2-}$ & $[Ni(CN)_4]^{2-}$ the nickel is in +2 o.s. and having configuration $3d^8$ and it contain 2 unpaired $e^{\ominus}$ but CN is a strong ligand compare to Cl so it repel the $e^{\ominus}$ density of metal ion because of which $e^{\ominus}$ get paired in case of $[Ni(CN)_4]^{-2}$ hence it is diamagnetic in nature.

(c) "The low spin complex rarely observed in tetrahedral as energy gap between the two energy level eg : - eg & t_{2g} in tetrahedral complex are very low. Because of which electron always go to higher states avoiding pairing".

14. Write one difference in each of the following : **[1 × 3 = 3]**

(a) Multimolecular colloid and Associated colloid

(b) Coagulation and Peptization

(c) Homogeneous catalysis and Heterogeneous catalysis.

OR

(a) Write the dispersed phase and dispersion medium of milk.

(b) Write one similarity between physisorption and chemisorption.

(c) Write the chemical method by which $Fe(OH)_3$ sol is prepared from $FeCl_3$. **[1 × 3 = 3]**

Sol. (a) "Multimolecular collidal solution consist of aggregates of atoms or small molecules with diameter of less than 1 nm eg : - gold sol etc"

Macromolecular collids are those in which dispersed particles are themselves large molecules of colloidal dimensions eg : - cellulose etc.

(b) "Coagulation is the change in the state from colloidal to suspended of colloidal particles"

"Coversion of precipitate into colloidal sol by shaking it with dispersion medium in presence of an electrolyte.

(c) "Homogenous catalysis are reaction in which reactant and catalyst are in same phase"

"Netrogenous catalysis are reaction in which reactant and catalyst are in different phase".

OR

(a) Both the dispersed phase & dispersion medium of milk are liquid. "It is an example of emulsion".

(b) Both the physisoption & chemisorption are the surface phenomena occur at the surface of adsorbent.

(c) Chemical method for preparation of $Fe(OH)_3$ Sol : -

Reaction involved : -

$$FeCl_3 + 3H_2O \xrightarrow{\text{Hydrolysis}} \underset{\text{(Sol)}}{Fe(OH)_3} + 3HCl$$

"In this method the hydrolysis of Ferric chloride occur by which molecule then aggregate and lead to the formation ferric hydroxide collidal sol"

15. A first order reaction takes 20 minutes for 25% decomposition. Calculate the time when 75% of the reaction will be completed. **[3]**

(Given : log 2 = 0.3010, log 3 = 0.4771, log 4 = 0.6021)

Sol. It is given : - (for 1st order reaction)

$t = 20$ min

$A_O = 100\%$

$A = 100 - 25 \Rightarrow 75\%$

$k = ?$

$$k = \frac{1}{t} \times 2.303 \log A_O/A$$

$$\Rightarrow k = \frac{1}{20} \times 2.303 \log \frac{100}{75}$$

$$k = \frac{1}{20} \times 2.303 \times \log (1.33)$$

$$\Rightarrow \frac{1}{20} \times 2.303 \times 0.1248 \Rightarrow k = .0143 \text{ min}^{-1}$$

So for 75% completion of reaction : -

$$t = \frac{1}{k} 2.303 \times \log \frac{A_O}{A}$$

$$\Rightarrow \frac{1}{0.0143} \times 2.303 \times \log \frac{100}{25} \Rightarrow \frac{1}{0.0143} \times 2.303 \times 0.6021 \Rightarrow 96.96 \text{ min.}$$

16. The following compounds are given to you :

2-Bromopentane, 2-Bromo-2-methylbutane, 1-Bromopentane

(a) Write the compound which is most reactive towards S_N2 reaction.

(b) Write the compound which is optically active.

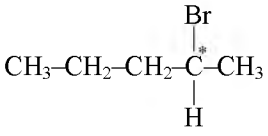
(c) Write the compound which is most reactive towards β-elimination reaction. **[3]**

Sol. (a) The compound most reactive towards S_N2 reaction : -

$CH_3–CH_2–CH_2–CH_2–CH_2–Br$

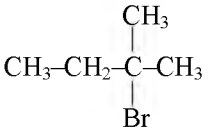
1-Bromopentane

(b) The compound which is optically active : -



2-Bromopentane

(c) The compound which is most reactive towards β-elimination reaction is



2-Bromo-2-methyl butane

17. Write the principle of the following : **[1 × 3 = 3]**

(a) Zone refining

(b) Froth floatation process

(c) Chromatography

Sol. (a) Zone refining : -

It is used to obtain metal of high purity. It is based on the principal that the impurities are more soluble in molten state than in the solid state.

(b) Froth floatation process : -

It is used to concentrate sulphide ore. It is based on the fact that the mineral. Particles become wet by oil while a gangue particles by water. A rotating paddle agitates the mixture and draws air in it. As a result froth is formed which carries the mineral particles.

(c) Chromatography : -

It is based on the principle that different component of a mixture are differently adsorbed on an adsorbent. The adsorbed component are removed by using suitable solvents.

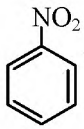
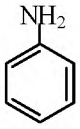
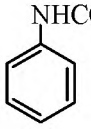
18. Write the structures of compounds A, B and C in the following reactions :

(a) $CH_3–COOH \xrightarrow{NH_3/\Delta} A \xrightarrow{Br_2/KOH(aq)} B \xrightarrow{CHCl_3+alc.KOH} C$

(b) $C_6H_5N_2^+BF_4^- \xrightarrow[\Delta]{NaNO_2/Cu} A \xrightarrow{Fe/HCl} B \xrightarrow{CH_3COCl/pyridine} C$ **[$1\frac{1}{2}\times 2 = 3$]**

Sol. (a) $CH_3–COOH \xrightarrow[\Delta]{NH_3/} CH_3–\overset{\overset{O}{\|}}{C}–NH_2 \xrightarrow[(aq)]{Br_2/KOH} CH_3–NH_2 \xrightarrow{CHCl_3+alc.KOH} CH_3–N\equiv C$

(A) (B) (C)

(b) $C_6H_5N_2^{\oplus}BF_4^{\ominus} \xrightarrow[\Delta]{NaNO_2/Cu}$  $\xrightarrow{Fe/HCl}$  $\xrightarrow{CH_3COCl/pyridine}$ 

(A) (B) (C)

19. Write the structures of the monomers used for getting the following polymers : **[1 × 3 = 3]**

(a) Nylon-6, 6

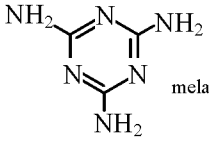
(b) Melamine-formaldehyde polymer

(c) Buna-S

Sol. (a) Nylon-6, 6

$\underset{\text{hexamethylene diamine}}{NH_2-(CH_2)_6-NH_2}$ $\underset{\text{adapic acid}}{COOH-(CH_2)_4-COOH}$

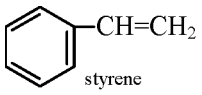
(b) Melamine-formaldehyde polymer



melamine

$\underset{\text{formaldehyde}}{HCHO}$

(c) Buna-S

$\underset{\text{1,3–butadiene}}{CH_2=CH-CH=CH_2}$ 

styrene

20. Define the following : **[1 × 3 = 3]**

(a) Anionic detergents

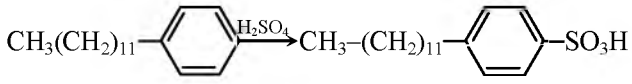
(b) Limited spectrum antibiotics

(c) Antiseptics

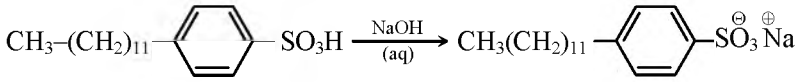
Sol. (a) Anionic detergents

These are sodium salt of sulphonated long chain alcohols or hydrocarbon eg : - Sodium dodecyl benzene sulphonate.

eg : -



Dodecyl benzene — Dodecyl benzene Sulphonic acid



Sodium dodecyl benzene sulphonate

(b) Limited spectrum antibiotics

The antibiotics which kill or inhibit a short range of gram-positive or gram negative bacteria are known as narrow spectrum antibiotics" but if they are effective against a single organism or disease, they are referred as " limited spectrum antibiotics".

(c) Antiseptics

"The chemical that kill microorganism and are not harmful to living Tissues. eg : - Dettol, Tincture of iodine etc."

21. Give reasons for the following : **[1 × 3 = 3]**

(a) Red phosphorus is less reactive than white phosphorus.

(b) Electron gain enthalpies of halogens are largely negative.

(c) N_2O_5 is more acidic than N_2O_3.

Sol. (a) Red phosphorus are less reactive than white phosphorus as the white phosphorous posses angle strain in the P_4 molecule where the angle are only 60 & also they have low M.P."

(b) Electron gain enthalpy of halogen are largely negativity it is due to the fact that they have high effective nuclear charge & smallest size among period. Although they contain $7e^{\ominus}$ in valence shell & required one electron to attain their nearest noble gas configuration.

(c) N_2O_5 is more acidic then N_2O_3 as in N_2O_5 the N is in +5 O.S. while in N_2O_3 it is in +3 O.S.

So higher the oxidation state of central atom in a given oxide, higher will be acidic character"

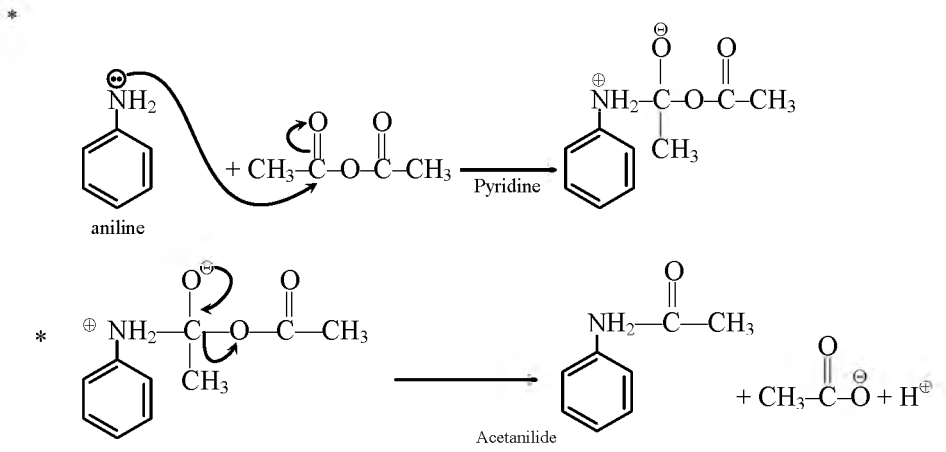
22. Give reasons for the following : **[1 × 3 = 3]**

(a) Acetylation of aniline reduces its activation effect.

(b) CH_3NH_2 is more basic than $C_6H_5NH_2$.

(c) Although $-NH_2$ is o/p directing group, yet aniline on nitration gives a significant amount of m-nitroaniline.

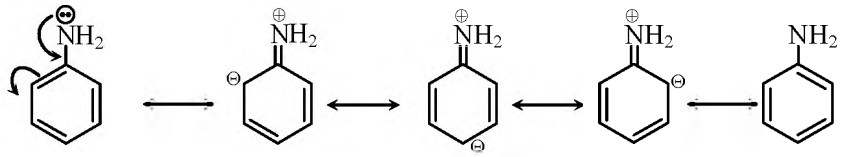
Sol. (a)



Reason : -

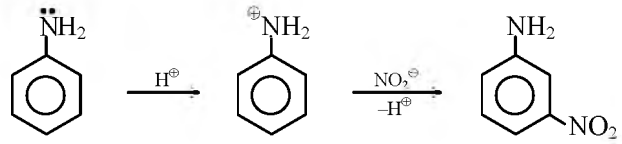
"Reactivity of aromatic amine is very high so when accetylation aniline occur with acid anhydride it get convert into acetanilide in which L.P on Nitrogen are in conjugate with oxygen atom due to resonance hence the reactivity reduce"

(b) $CH_3–NH_2$ is more basic then $C_6H_5–NH_2$ Because In case of aniline the L.P of $–NH_2$ (amino group) are in conjugation with benzene ring due to which e^- density less available on N-atom hence higher the "electron density on N-atom more will be the basicity."



5-resonating structure

(c) "$–NH_2$ group of aniline is ortho-para directing group but on nitration it also give meta product as the aromatic amine (aniline) is highly reactive and it react with acidic hydrogen of nitrating agent and form anilinium ion which gives meta product".



23. After watching a programme on TV about the presence of carcinogens (cancer causing agents) Potassium bromate and Potassium iodate in bread and other bakery products, Rupali a Class XII student decided to make others aware about the adverse effects of these carcinogens in foods. She consulted the school principal and requested him to instruct the canteen contractor to stop selling sandwiches, pizzas, burgers and other bakery products to the students. The principal took an immediate action and instructed the canteen contractor to replace the bakery products with some protein and vitamin rich food like fruits, salads, sprouts, etc. The decision was welcomed by the parents and the students.

After reading the above passage, answer the following questions : **[4]**

(a) What are the values (at least two) displayed by Rupali ?

(b) Which polysaccharide component of carbohydrates is commonly present in bread ?

(c) Write the two types of secondary structures of proteins.

(d) Give two examples of water soluble vitamins.

Sol. (a) The value displaced by rupali are -

(i) Awareness regarding about the adverse effect of these carcinogens in foods.

(ii) She is concern for the health and have feeling of humanity.

(b) The polysaccharide component of carbohydrates is commonly by present in bread is starch.

(c) "The two types of secondary structure of proteins are α-helix β-Sheet"

(d) "Vitamins B & C are water soluble vitamin"

24. (a) Account for the following :

(i) Transition metals show variable oxidation states.

(ii) Zn, Cd and Hg are soft metals.

(iii) E^{o} value for the Mn^{3+}/Mn^{2+} couple is highly positive (+1.57 V) as compared to Cr^{3+}/Cr^{2+}.

(b) Write one similarity and one difference between the chemistry of lanthanoid and actinoid elements. **[3 + 2 = 5]**

OR

(a) Following are the transition metal ions of 3d series :

Ti^{4+}, V^{2+}, Mn^{3+}, Cr^{3+}

(Atomic numbers : Ti = 22, V = 23, Mn = 25, Cr = 24)

Answer the following :

(i) Which ion is most stable in an aqueous solution and why ?

(ii) Which ion is a strong oxidising agent and why ?

(iii) Which ion is colourless and why ?

(b) Complete the following equations :

(i) $2\,MnO_4^- + 16H^+ + 5S^{2-} \longrightarrow$

(ii) $KMnO_4 \xrightarrow{heat}$

Sol. (a)

(i) In case of transition element ns and (n – 1)d electron both participate in bonding due to less energy difference when ns electron take part in bonding they exhibit lower oxidation state while in case of higher O.S. (n – 1)d and ns $e^{\ominus}$ both involve in bonding.

(ii) Transition element are hard & have high M.P & B.P. as they exhibit two types of bonding both covalent and metallic due to which constituent particles are tightly packed while group 12 element (Zn, Cd, Hg) do not exhibit covalency bonding as their (n – 1) d is fully filled so they are soft.

(iii) E^{o} value for the Mn^{+3}/Mn^{+2} is high due to the fact that Mn^{+2} (d^5) more stable due to half filled configuration while low for chromium due to stability of Cr^{+3}, therefore Cr^{+3} cannot reduce to Cr^{+2}.

(b) Similarity : -

* "Both series element exhibit mainly +3 oxidation state"
* Both show magnetic and spectral properties.

Difference : -

	Lanthanoids	**Actinoids**
*	Less tendency of complex formation	High tendency of complex formation
*	Do not form oxo cations	Form oxo cations eg : - UO_2^{+2} etc.

OR

(a)

(i) Stability of ions in aq state depends on the electrode potential because the stability of ion in aq solution depend on electrode potential due to small size Cr^{+3} is more stable.

(ii) Mn^{+3} is the strong oxidising agent as the Mn^{+2} is more stable then Mn^{+3} due to its half filled configuration

(iii) Ti^{+4} is colourless ion it due to d^0 configuration of the ion as if do not contain electron for the excitation.

(b) Complete the following reactions :

(i) $2\,MnO_4^- + 16H^+ + 5S^{2-} \longrightarrow 2Mn^{+2} + 8H_2O + 5S$

(ii) $2KMnO_4 \xrightarrow{\text{heat}} K_2MnO_4 + MnO_2 + O_2\uparrow$

25. (a) A 10% solution (by mass) of sucrose in water has a freezing point of 269.15 K. Calculate the freezing point of 10% glucose in water if the freezing point of pure water is 273.15 K.

Given :

(Molar mass of sucrose = 342 g mol^{-1})

(Molar mass of glucose = 180 g mol^{-1})

(b) Define the following terms :

(i) Molality (m)

(ii) Abnormal molar mass **[3+ 2 = 5]**

OR

(a) 30 g of urea (M = 60 g mol^{-1}) is dissolved in 846 g of water. Calculate the vapour pressure of water for this solution if vapour pressure of pure water at 298 K is 23.8 mm Hg.

(b) Write two differences between ideal solutions and non-ideal solutions. **[3 + 2 = 5]**

Sol. (a) It is given that

Mass of sucrose (w) = 10g

Mass of water = 90g

Molecular weight of sucrose = 342 g/mol

Molecular weight of water = 18 g/mol

So $\Delta t_f = k_f\, m$

$\Delta t_f = t_{f(solvent)} - t_{f(solution)}$

$\Delta t_f = 273.15 - 269.15 = 4$

So $m = \frac{10}{90} \times \frac{1000}{342} \Rightarrow \frac{1000}{3070} \Rightarrow .325$

So $\Delta t_f = k_f m \Rightarrow k_f = \frac{4}{.325} \Rightarrow 12.30$

So for glucose : -

$\Delta t_f = k_f \times m \Rightarrow 12.3 \times \frac{10 \times 1000}{180 \times 90} \Rightarrow 7.7$

$\Delta t_f = t_{(solvent)} - t_{(solution)}$

So $t_{(solution)} \Rightarrow 273.15 - 7.7 \Rightarrow 265.45$ k

(b) (i) Molality (m) : -

It is defined as the number of moles of solute per kilogram of the solvent.

(ii) Abnormal molar mass : -

When the substance undergo association or dissociation in the solution, molecular mass determine from colligative property is different from expected value. This is abnormal molecular mass.

OR

(a) Urea (w) = 30 g $\qquad$ H_2O(w) = 846 g

Urea (M.w) = 60 g/mol. $\qquad$ H_2O(M.w.) = 18 g/mol.

So $\frac{P^o - P_s}{P^o} = x_2$

$\frac{23.8 - P_s}{23.8} = \frac{W_{(urea)} \times M.w._{(H_2O)}}{M.w_{(urea)} \times W_{(H_2O)}}$

$\frac{23.8 - P_s}{23.8} = \frac{30}{60} \times \frac{18}{846}$

$23.8 - P_s \Rightarrow .0106 \times 23.8$

$23.8 - P_s \Rightarrow .2531$

So $P_s \Rightarrow 23.8 - .2530$

$\Rightarrow 23.54$ mm of Hg

(b)	**Ideal solution**	**Non-ideal solution**
(i)	Obey rault's law at every range of concentration	They do not obey rault's law
(ii)	Neither the heat is absorbed or evolve	Heat is evolve or absorbed during dissolution.

during dissolution

26. (a) Write the product(s) in the following reactions :

(i)  $+ HCN \longrightarrow ?$

(ii)  $+ NaOH \xrightarrow[\Delta]{CaO} ?$

(iii) $CH_3–CH=CH–CN \xrightarrow[(b)\,H_2O]{(a)\ DIBAL-H} ?$

(b) Give simple chemical tests to distinguish between the following pairs of compounds :

(i) Butanal and Butan-2-one

(ii) Benzoic acid and Phenol **[3 + 2 = 5]**

OR

(a) Write the reactions involved in the following :

(i) Etard reaction

(ii) Stephen reduction

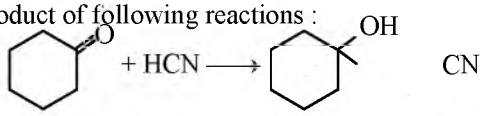
(b) How will you convert the following in not more than two steps :

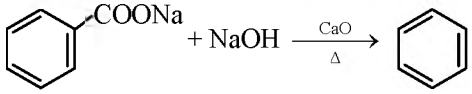
(i) Benzoic acid to Benzaldehyde

(ii) Acetophenone to Benzoic acid

(iii) Ethanoic acid to 2-Hydroxyethanoic acid **[2 + 3 = 5]**

Sol. (a) Product of following reactions :

(i) 

(ii) 

(iii) $CH_3–CH=CH–CN \xrightarrow[(b)\,H_2O]{(a)\ DIBAL\ -H} \underset{(Product)}{CH_3-CH=CH-CHO}$

(b) Test to distinguish following compound are -

(i) Butanal and Butan-2-one

These compound can be distinguish by Tollen's reagent : -

* $\underset{Butanal}{CH_3CH_2CH_2CHO} + 2\underset{Tollens\ reagent}{[Ag(NH_3)_2]^{\oplus}} + 3OH^{\ominus} \longrightarrow \underset{Butanoate\ ion}{CH_3CH_2CH_2COO^{\ominus}} + \underset{silver\ mirror}{2Ag\downarrow} + 4NH_3 + 2H_2O$

* $\underset{Butan-2-one}{CH_3COCH_2CH_3} \xrightarrow[Reagent]{Tollen's} \text{No silver mirror}$

(ii) Benzoic acid and phenol : -

Both can distinguished by $FeCl_3$ test

* $\underset{Phenol}{C_6H_5OH} + FeCl_3 \longrightarrow$ violet colouration

26. What are emulsions ? What are their different types ? Give one example of each type. **3**

Sol. Colloidal solution of liquid in liquid is called as emulsion

We have two types of emulsions

(1) Oil in water (o/w)

(2) Water in oil (w/o)

(i) Oil in water : In this type of emulsion water is medium and oil is dispersed phase, it soluble in H_2O, Ex. Milk

(ii) Water is oil : In this type of emulsion oil is medium and water is dispersed into it, it is soluble in oil Ex. Butter

27. Given reasons for the following :

(i) $(CH_3)_3$ P = O exists but $(CH_3)_3N$ = O does not.

(ii) Oxygen has less electron enthalpy with negative sign than sulphur.

(iii) H_3PO_2 is a stronger reducing agent than H_3PO_3.

Sol. (i) Due to absence of vacant d-orbitals N can not form 5 covalent bonds

(ii) O has exceptionally small size. Hence, incoming electron feels more repulsion than expected and its negative electron gain enthalpy becomes less than expected

(iii) In H_3PO_2 oxidation state of P is '+1' while in H_3PO_3 oxidation state of P is '+3' . In H_3PO_2 oxidation state of P is lower than that in H_3PO_3

28. **(a)** Complete the following equations: **5**

(i) $Cr_2O_7^{2-} + 2OH^- \longrightarrow$

(ii) $MnO_4^- + 4H^+ + 3e^- \longrightarrow$

(b) Account for the following :

(i) Zn is not considered as a transition element.

(ii) Transition metals form a larger number of complexes.

(iii) The E^o value for the Mn^{3+} / Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+} couple.

OR

(i) With reference to structural variability and chemical reactivity, write the difference between lanthanoids and action ions.

(ii) Name of member of the lanthanoid series which is well known to exhibit +4 oxidation state.

(iii) Complete the following equations :

$$MnO^-_4 + 8H^+ + 5e^- \longrightarrow$$

(iv) Out of Mn^{3+} and Cr^{3+}, which is more paramagnetic and why ? **3, 2**

(atomic nos. : Mn = 25, r = 24)

Sol. (a)

(i) $Cr_2O_7^{2-} + 2OH^- \longrightarrow 2CrO_4^{-2} + H_2O$

(ii) $MnO_4^- + 4H^+ + 3e^- \longrightarrow MnO_2 + 2H_2O$

(b)

(i) In Zn inner 3d-subshell is full filled.

(ii) Conditions required to form complex are :

• Metal ion must have high charge density.

• Metal ion must have vacant orbitals. Transition elements follow these requirements. Hence, they form complexes.

CHEMISTRY

Paper & Solution

Code : 56/1/N

Time : 3 Hrs. **Max. Marks : 70**

General Instructions :

(i) All questions are compulsory.

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

(iii) Questions **6** to **10** are short answer questions and carry **2** marks each.

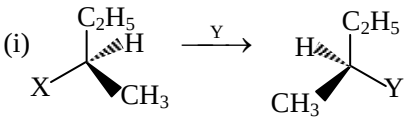
(iv) Question number **11 to 22** are also short-answer questions and carry **3** marks each.

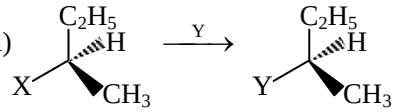
(v) Question number **23** is a value based questions and carry **4** marks.

(vi) Question number **24 to 26** are long-answer questions and carry **5** marks each.

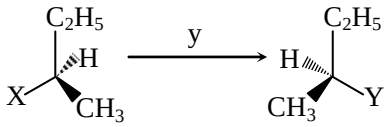
(vii) Use Log Tables, if necessary. Use of calculators is **not** allowed.

1. Which of the following two reactions is S_N2 and why ?

(i) 

(ii) 

Sol. In following reaction the reaction (i) is a SN^2 reaction. due to backside attack of nucleophile (y)



2. On heating $Pb(NO_3)_2$ a brown gas is evolved which undergoes dimerization on cooling. Identify the gas.

Sol. **Students may find similar question in CP board pattern exercise sheet:**

Chapter: p-block elements, Section-A, Q.30(a)(i)

On heating $Pb(NO_3)_2$, NO_2 gas is evolved which forms N_2O_4 on cooling

$$2Pb(NO_3)_2 \xrightarrow{\Delta} 2PbO + \underset{\text{(Brown)}}{4NO_2}\uparrow + O_2\uparrow$$

$$2NO_2 \xrightarrow{\text{upon cooling}} \underset{\text{(dimer of } NO_2\text{)}}{N_2O_4}$$

3. ZnO turns yellow on heating. Why ?

Sol. On heating ZnO, looses oxygen to atomsphere

$$ZnO \rightarrow Zn^{+2} + \frac{1}{2}O_2 + 2e^-$$

Free electrones present in interstitial site get excited on heating when they returns to normal state, yellow colour radiation are evolved. This is also known as metal excess defect.

4. Write the IUPAC name of the given compound:

$CH_3 - NH - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_3$

Sol. $CH_3-NH-\overset{1}{C}H_2-\underset{\displaystyle CH_3}{\underset{|}{\overset{2}{C}H}}-\overset{3}{C}H_3$

[N,2-Di-Methyl-1-propanamine]

5. Write the reason for the stability of colloidal sols.

Sol. For lyophobic colliods $\Rightarrow$ charge in responsible for stability

For lyophillic colloids $\Rightarrow$ solvation is responsible for stability.

6. (i) Write the colligative property which is used to find the molecular mass of macromolecules.

(ii) In non-ideal solution, what type of deviation shows the formation of minimum boiling azeotropes ?

Sol. (i) The colligative property used to find molecular mass of macromolecules is osmotic pressure

(ii) The solution showing positive deviation from ideal solution forms minimum boiling point azeotropes.

7. Write the structures of the following:

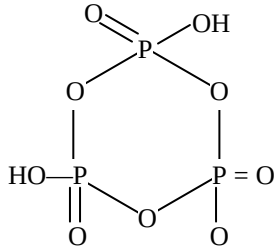
(i) $(HPO_3)_3$ (ii) XeF_4

Sol. **Students may find similar question in CP board pattern exercise sheet:**

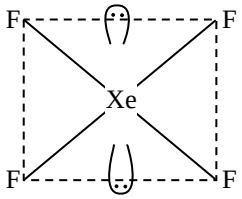
(i) Chapter: p-block elements, Section-B, Q.5(a)(i)

(ii) Chapter: p-block elements, Section-A, Q.11

(i) $(HPO_3)_3$



(ii) XeF_4



8. When a coordination compound $NiCl_2 \cdot 6H_2O$ is mixed with $AgNO_3$, 2 moles of AgCl are precipitated per mole of the compound. Write

(i) Structural formula of the complex

(ii) IUPAC name of the complex

Sol. $\underset{1\text{mole}}{NiCl_2 \cdot 6H_2O} + AgNO_3 \longrightarrow \underset{2\text{moles}}{AgCl}$

(i) Structural formula of the complex is $[Ni(H_2O)_6]Cl_2$

(ii) IUPAC name of the complex is Hexaaquanickel (II) chloride

9. For a reaction: $2NH_3(g) \xrightarrow{Pt} N_2(g) + 3H_2(g)$

Rate = k

(i) Write the order and molecularity of this reaction.

(ii) Write the unit of k.

Sol. $2NH_3(g) \xrightarrow{Pt} N_2(g) + 3H_2(g)$

(i) Rate law of above reaction is given

$$r = k$$

$\because$ rate does not depends upon concentration of NH_3

$\therefore$ order of reaction will be zero but

Molecularity = 2 ($\because$ it is total number of reacting molecules taking part in a balance chemical reaction)

(ii) Unit of k = mol lit^{-1} sec^{-1}

10. Write the chemical equations involved in the following reactions:

(i) Kolbe's reaction

(ii) Friedal-Crafts acetylation of anisole

OR

How do you convert:

(i) Phenol to toluene

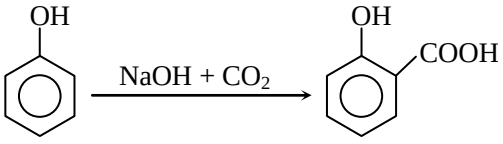
(ii) Formaldehyde to Ethanol

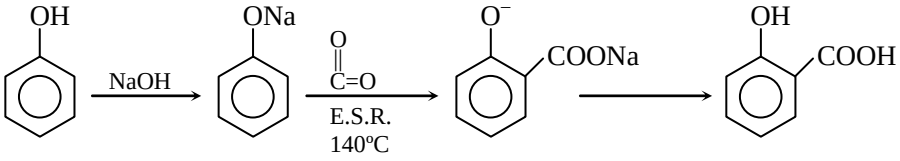
Sol. **Students may find same question in CP board pattern exercise sheet:**

(i) Chapter: Alcohol, Phenol & Ether (Oxygen-I), Section-A, Q.50(i)

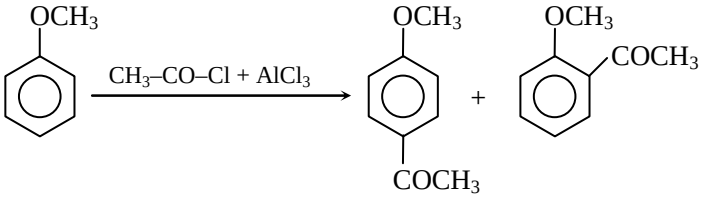
(ii) Chapter: Alcohol, Phenol & Ether (Oxygen-I), Section-A, Q.60(i)

(i) Kolbe's Reaction



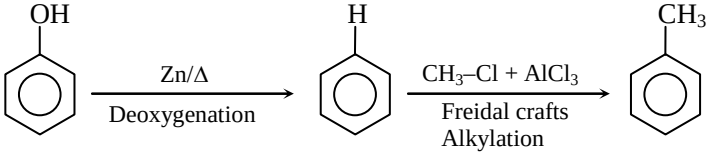


(ii)



OR

(i)



(ii) $CH_3–Mg–Br + \begin{matrix} H \\ \diagdown \\ C=O \\ \diagup \\ H \end{matrix} \longrightarrow CH_3–CH_2–O–Mg–Br \xrightarrow{H^+ / HOH} CH_3–CH_2–OH$

11. An element crystallizes in a f.c.c. lattice with cell edge of 400 pm. The density of the element is 7 g cm^{-3}. How many atoms are present in 280 g of the element ?

Sol. **Given** $a = 400\ pm = 400 \times 10^{-12} m = 400 \times 10^{-10}\ cm$

$\rho = 7 g/cm^3$

$m_A = 280\ gm$

fcc lattice, $N = 4$

Formula $$d = \frac{N \times M}{N_A \times a^3}$$

$$7 = \frac{4 \times M}{6.023 \times 10^{23} \times (4 \times 10^{-8})^3}$$

$M = 67.2\ g/mol$

Now no. of moles $= \frac{\text{mass}}{\text{molar mass}}$

$$n = \frac{280}{67.2} = 4.17$$

no. of atoms $= n \times N_A = 4.17 \times 6.023 \times 10^{23} = 25.11 \times 10^{23}$ **Ans**

12. The rate constant for the first order decomposition of H_2O_2 is given by the following equation:

$$\log k = 14.2 - \frac{1.0 \times 10^4 K}{T}$$

Calculate E_a for this reaction and rate constant k if its half-life period be 200 minutes.
(Given: $R = 8.314\ JK^{-1}\ mol^{-1}$)

Sol. **Students may find same question in CP board pattern exercise sheet:**
Chapter: Chemical Kinetics, Section-A, Q.57

For calculation of 'E_a'

Formula: $\log_{10} k = \log_{10} A - \frac{E_a}{2.303RT}$

so, on comparing $\frac{-E_a}{2.303R} = -10^4$

$E_a = 2.303 \times 8.314 \times 10^4\ J/mol$

or

$E_a = 19.147 \times kJ/mol$

For calculation of 'k'

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

so, $k = \frac{0.693}{200} min^{-1}$

$k = 3.465 \times 10^{-3}\ min^{-1}$ **Ans**

13. Define the following terms:
(i) O/W Emulsion
(ii) Zeta potential
(iii) Multimolecular colloids

Sol. **Students may find same question in CP board pattern exercise sheet:**

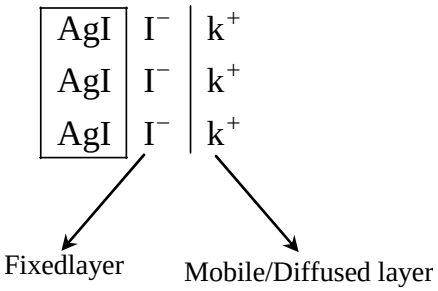
(i) Chapter: Surface Chemistry, Section-A, Q.15

(iii) Chapter: Surface Chemistry, Section-A, Q.17

(i) **O/W Emulsion:** It is a type of emulsion in which oil is dispersed phase and water is dispersed medium. For Example: milk, it is an emulsion of liquids fat dispersed in water.

(ii) **Zeta potential:** The absorbed ion on the surface of collidol particle form a fixed lyer, the absorbed ion attracts oppositively charged ions to form diffused layer

The electrical doubled layer thus formed is called Helmholtz electrical double layer. The potential between fixed and diffused layer is called zeta potential.



Formation of electrical double layer

(iii) **Multimolecular colloids :** In this type of colloid, the dispersed phase consist of aggregotes of atoms (or) small molecules with molecular size less than 1 nm. For example, Collidal sol of sulphur consist of aggregates of S_8 molecules.

14. (i) Name the method of refining which is based on the principle of adsorption.

(ii) What is the role of depressant in froth floatation process ?

(iii) What is the role of limestone in the extraction of iron from its oxides ?

Sol. **Students may find similar question in CP board pattern exercise sheet:**

(ii) Chapter: Metallurgy, Section-A, Q.5

(i) Chromatography is the method of refining which is based on the principle of adsorption.

(ii) Depressant in froth floatation process does not allow some specific impurity to come with froth. It forms soluble complex with impurity.

(iii) Limestone ($CaCO_3$) acts as flux in the extraction of iron from its oxides. It forms slag with impurity SiO_2.

$$CaCO_3 \xrightarrow{\Delta} CaO + CO_2\uparrow$$

$$CaO + \underset{\text{(impurity)}}{SiO_2} \longrightarrow \underset{\text{(Slag)}}{CaSiO_3}$$

15. Calculate the boiling point of solution when 2 g of Na_2SO_4 (M = 142 g mol^{-1}) was dissolved in 50 g of water, assuming Na_2SO_4 undergoes complete ionization.

(K_b for water = 0.52 K kg mol^{-1})

Sol. **Given**

$W_{Na_2SO_4} = 2$ gm $M = 142$ $W_{B\ (H_2O)} = 50$ gm $\alpha = 1$ $k_{b(H_2O)} = 0.52$

Formula

$\Delta T_b = i \times k_b \times m$

$$= 3 \times 0.52 \times \frac{2/142}{50/1000} \qquad \left\{ \begin{array}{l} \alpha = \dfrac{i-1}{n-1} \\ 1 = \dfrac{i-1}{3-1} \\ i = 3 \end{array} \right\}$$

$\Delta T_b = 0.439$

B.P. $= 100 + \Delta T_b$

$= 100.439$ K. **Ans**

16. Assign reason for the following :

(i) H_3PO_2 is a stronger reducing agent than H_3PO_4.

(ii) Sulphur shows more tendency for catenation than Oxygen.

(iii) Reducing character increases from HF to HI.

Sol. **Students may find similar question in CP board pattern exercise sheet:**

(i) Chapter: p-block elements, Section-A, Q.34(iii)

(ii) Chapter: p-block elements, Section-A, Q.25 (C)

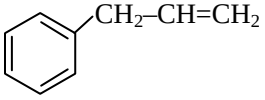
(i) H_3PO_2 is a stronger reducing agent than H_3PO_4 because in H_3PO_2 oxidation state of 'P' is +1 while in H_3PO_4 oxidation state of 'P' is +5.
Hence, H_3PO_2 can be oxidized to higher oxidation state while in H_3PO_4, 'P' is present in its highest oxidation state.

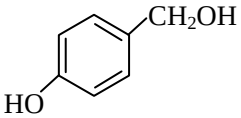
(ii) Sulphur shows more tendency for catenation than oxygen because S-S bond energy is higher than O-O bond energy. Tendency of catenation depends on bond energy of single bond between identical atoms.

(iii) As we move from HF to HI bond length increases. Hence, removal of hydrogen becomes easier and chance of oxidation also increases.
Order of reducing character:
HF < HCl < HBr < HI

17. Write the major monohalo products(s) in each of the following reactions :

(i)  $+ Br_2 \xrightarrow{\text{UV light}} ?$

(ii)  $+ HBr \xrightarrow{\text{Peroxide}} ?$

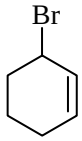
(iii)  $+ HCl \xrightarrow{\text{heat}} ?$

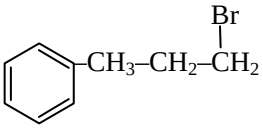
Sol. **Students may find same/similar question in CP board pattern exercise sheet:**

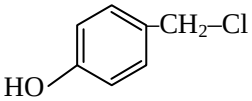
(i) Chapter: Haloalkane, Haloarene, Section-A, Q.34(vi)

(ii) Chapter: Haloalkane, Haloarene, Section-A, Q.6(vii)

(iii) Chapter: Haloalkane, Haloarene, Section-A, Q.34(iii)

(i) 

(ii) 

(iii) 

18. **Students may find same question in CP board pattern exercise sheet:**

(a) Chapter: Alcohol, Phenol & Ether (Oxygen-I), Section-A, Q.23

(c) Chapter: Alcohol, Phenol & Ether (Oxygen-I), Section-A, Q.26

Give reasons for the following :

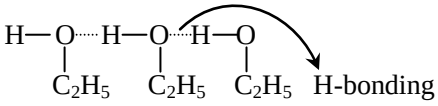
(a) Protonation of Phenols is difficult whereas ethanol easily undergoes protonation

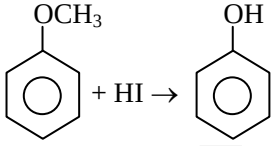
(b) Boiling point of ethanol is higher than that of dimethyl ether.

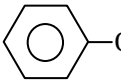
(c) Anisole on reaction with HI gives phenol and CH_3–I as main products and not iodobenzene and CH_3OH.

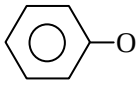
Sol. (a) The protonation of phenol is difficult because in phenol the ℓp. of oxygen atom are use in resonance with benzene ring and oxygen atom have low electron density where as in ethanol the electron density on oxygen atom is increases due to +I effect of C_2H_5 group which makes it's protonation easy.

(b) Boiling point of ethanol is higher because ethanol form intermolecular hydrogen bond with each other but in ether there is no hydrogen bonding is possible and hence ether have low boiling point in comparison to ethanol



(c) 

because in Anisol 

bond is stronger due to resonance so dissociation of 

bond is not possible and hence phenol and CH_3 – I are obtained by the reaction of anisol with HI.

19. Write the structures of A, B and C in the following reactions :

(i) $C_6H_5–COO^- NH_4^+ \xrightarrow{\Delta} A \xrightarrow{Br_2/KOH} B \xrightarrow{CH_3COCl/\text{pyridine}} C$

(ii) $C_6H_5N_2^+BF_4^- \xrightarrow[\Delta]{NaNO_2/Cu} A \xrightarrow{Sn/HCl} B \xrightarrow{CHCl_3+\text{alc.KOH}} C$

Sol. **Students may find same/similar question in CP board pattern exercise sheet:**

(i) Chapter: Organic compound containing nitrogen, Section-B, Q.5(iii)

(ii) Chapter: Organic compound containing nitrogen, Section-A, Q.20(vii)

(i) $A \Rightarrow C_6H_5 – CO – NH_2$

$B \Rightarrow C_6H_5 –NH_2$

$C \Rightarrow C_6H_5 – NH – CO – CH_3$

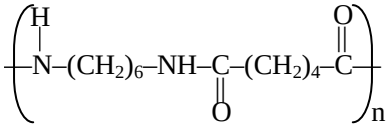
(ii) $A \Rightarrow C_6H_5 – NO_2$

$B \Rightarrow C_6H_5 – NH_2$

$C \Rightarrow C_6H_5 – N \equiv C$

20. (i) What is the role of benzoyl peroxide in the polymerization of ethene ?

(ii) Identify the monomers in the following polymer :



(iii) Arrange the following polymers in the increasing order of their intermolecular forces :
Nylon–6, 6 Polythene, Buna-S

OR

Write the mechanism of free radical polymerization of ethene

Sol. **Students may find same/similar question in CP board pattern exercise sheet:**

(ii) Chapter: Polymer, Section-A, Q.5

OR

(ii) Chapter: Polymer, Section-B, Q.10(iii)

(iii) Chapter: Polymer, Section-B, Q.7(iii)

(i) Benzoyl peroxide is initiated the free radical polymerization due to formation of free radical by decomposition.

(ii) $NH_2–(CH_2)_6–NH_2$ Hexamethelene-di-amine

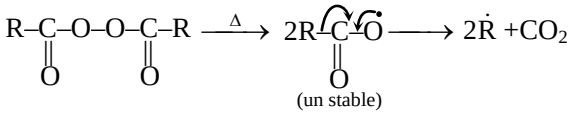
$HOOC–(CH_2)_4–COOH$ Adipic Acid

(iii) Buna-S < Polythene < Nylon 6, 6
(Elastomer < Plastic < Fiber)

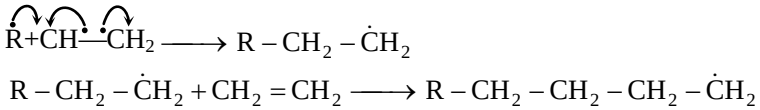
OR

Mechanism of free radical polymerization of ethene. It is completed in following three steps

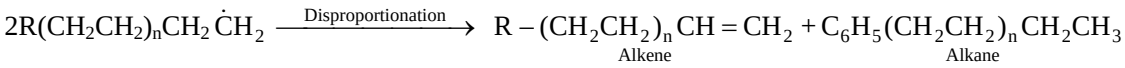
(i) Chain initiation : Homolysis of peroxide



(ii) Chain propagation :



(iii) Chain termination :



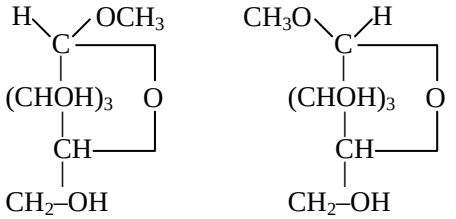
21. (i) Write one reaction of D-Glucose which cannot be explained by its open chain structure.

(ii) What type of linkage is present in Nucleic acids

(ii) Give one example each for water-soluble vitamins and fat-soluble vitamins?

Sol. (i) Formation of glycosides :

When glucose react with $CH_3–OH$, a mixture of α and β-methyl ether is formed, it is only possible by cyclic structure of glucose.



α-D methyl glycoside β-D methyl glycoside

(ii) Phosphodi-ester bond

(iii) Water soluble vitamin $\Rightarrow$ Vit–B–1
fat soluble vitamin $\Rightarrow$ Vit –A

22. (a) For the complex $[Fe(CN)_6]^{4-}$, write the hybridization, magnetic character and spin type of the complex. (At. number : Fe = 26)

(b) Draw one of the geometrical isomers of the complex $[Co(en)_2Cl_2]^+$ which is optically active.

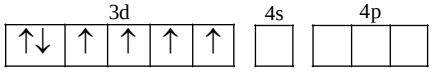
Sol. **Students may find similar question in CP board pattern exercise sheet:**

(b) Chapter: Coordination Compounds, Section-B, Q.3(i)

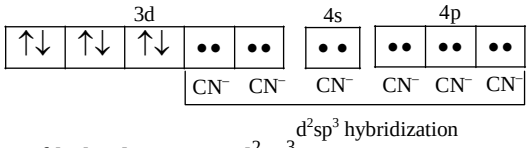
(a) In the complex $[Fe(CN)_6]^{4-}$, oxidation state of Fe is +2.

Electronic configuration of Fe^{+2} is [Ar] $4s^0$ $3d^6$.

Orbital diagram is,



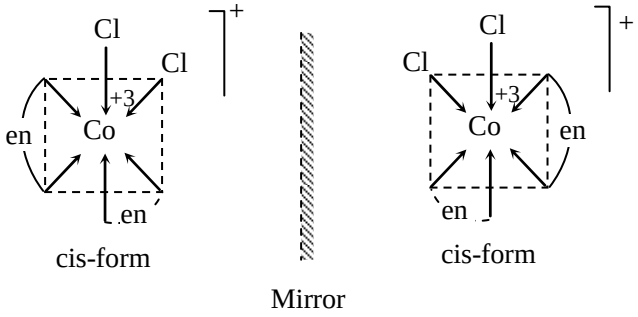
CN^- is a strong field ligand hence, pairing of electron occurs. After pairing configuration becomes,



Name of hybridization is d^2sp^3.

Magnetic character is diamagnetic and this complex is low spin complex.

(b) Complex $[Co(en)_2Cl_2]^+$ has two geometrical isomers :- cis and trans, trans form is optically inactive while cis form is optically active.



23. Due to hectic and busy schedule, Mr. Awasthi made his life full of tensions and anxiety. He started taking sleeping pills to overcome the depression without consulting the doctor. Mr. Roy, a close friend of Mr. Awasthi advised him to stop taking sleeping pills and suggested to change his lifestyle by doing Yoga, meditation and some physical exercise. Mr. Awasthi followed his friend's advice and after few days he started feling better.

After reading the above passage, answer the following :

(i) What are the values (at least two) displayed by Mr. Roy ?

(ii) Why it is not advisable to take sleeping pills without consulting doctor ?

(iii) What are tanquilizers ? Give two examples.

Sol. (i) (a) caring

(b) true friendship

(ii) Because sleeping drugs are made addict and increase acidity in stomach and made adverse effect on other body organ like liver, kideny etc

(iii) (a) Diazepam

(b) Barbituric acid

24. (a) Calculate E^o_{cell} for the following reaction at 298 K:

$2Cr(s) + 3Fe^{2+}(0.01\ M) \rightarrow 2Cr^{3+}(0.01\ M) + 3Fe(s)$

Given : $E_{cell} = 0.261$ V

(b) Using the E^o values of A and B, predict which one is better for coating the surface of iron [$E^o(Fe^{2+}/Fe) = -0.44$ V] to prevent corrosion and why ?

Given : $E^o(A^{2+}/A) = -2.37$ V : $E^o(B^{2+}/B) = -0.14$ V

OR

(a) The conductivity of 0.001 mol L^{-1} solution of CH_3COOH is 3.905×10^{-5} S cm^{-1}. Calculate its molar conductivity and degree of dissociation(α). Given $\lambda^o(H^+) = 349.65\ cm^2mol^{-1}$ & $\lambda^o(CH_3COO^-) = 40.95\ cm^2mol^{-1}$

(b) Define electrochemical cell. What happens if external potential applied becomes greater than E^o_{cell} of electrochemical cell ?

Sol. (a) $E_{Cell} = E^o_{Cell} - \frac{0.0591}{n}\log\frac{[Cr^{+3}]^2}{[Fe^{+2}]^3}$ (Nernst Equation)

$$0.261 = E^o_{Cell} = \frac{0.0591}{6}\log\frac{[0.01]^2}{[0.01]^3}$$

$$0.261 = E^o_{Cell} - \frac{0.591\times 2}{6}$$

$E^o_{Cell} = 0.2807$ V **Ans**

(b) 'A' is better for coating the surface of iron because SOP of A is greater than that of iron so before oxidation of iron oxidation of A will take place.

OR

Students may find similar question in CP board pattern exercise sheet:
Chapter: ElectroChemistry, Section-A, Q.26

(a) $\lambda^\infty_{M\ CH_3COOH} = \lambda^\infty_{M(H^+)} + \lambda^\infty_{M(CH_3COO^-)}$ (Kohlarausch's Law)

$= 349.6 + 40.9 = 390.5$

$$\lambda_{CH_3COOH} = \frac{1000\times k}{M} = \frac{1000\times 3.905\times 10^{-5}}{0.001} = 39.05$$

$$\alpha_{CH_3COOH} = \frac{\lambda_{M\,CH_3COOH}}{\lambda^\infty_{M\,CH_3COOH}} = \frac{39.05}{390.5} = 0.1 \text{ or } 10\ \%$$ **Ans**

(b) Electrochemical Cell :- It is a device in which redox reactin is carried out to convert chemical energy in to electrical energy.

If external potential applied becomes greater than E^o_{Cell} of electrochemial cell than electrochemical cell starts workings as electrolytic cell and polarity of electrode get reversed. .

25. (a) Account for the following :

(i) Mn shows the highest oxidation state of +7 with oxygen but with fluorine it shows the highest oxidation state of +4

(ii) Zirconium and Hafnium exhibit similar properties.

(iii) Transition metals act as catalysts.

(b) Complete the following equations :

(i) $2MnO_2 + 4KOH + O_2 \xrightarrow{\Delta}$

(ii) $Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow$

OR

The elements of 3d transition series are given as :

Sc Ti V Cr Mn Fe Co Ni Cu Zn

Answer the following :

(i) Write the element which is not regarded as a transition element. Give reason.

(ii) Which element has the highest m.p ?

(iii) Write the element which can show an oxidation state of +1.

(iv) Which element is a strong oxidizing agent in +3 oxidation state and why ?

Sol. Students may find similar question in CP board pattern exercise sheet:

(a) (i) Chapter: d & f-block elements, Section-B, Q.7(a) (iii)

(ii) Chapter: d & f-block elements, Section-A, Q.14

(iii) Chapter: d & f-block elements, Section-A, Q.7(iv)

(b) (i) Chapter: d & f-block elements, Section-A, Q.9

(ii) Chapter: d & f-block elements, Section-B, Q.5(i)

OR

(i) Chapter: d & f-block elements, Section-A, Q.6

(iv) Chapter: d & f-block elements, Section-A, Q.21

(a) (i) Mn shows the highest oxidation state of +7 with oxygen but with fluorine it shows the highest oxidation state of +4 because oxygen can form multiple bond while fluorine can form single bond.

(ii) Due to lanthanoid contraction, Zirconium and Hafnium exhibit similar properties.

(iii) Transition metals act as catalysts because they can show variable oxidation state and they are good adsorbent.

(b) (i) $2MnO_2 + 4KOH + O_2 \xrightarrow{\Delta} 2K_2MnO_4 + 2H_2O$

(ii) $Cr_2O_7^{-2} + 14H^+ + 6I^- \longrightarrow 2Cr^{+3} + 3I_2 + 7H_2O$

OR

(i) Zn is not regarded as a transition element because in transition elements or ions inner d-subshell must be partially filled but in Zn, inner d-subshell is fully filled

(ii) Cr has the highest m.p.

(iii) Cu can show an oxidation state of +I

(iv) Mn is a strong oxidizing agent in +3 oxidation state because its +2 Oxidation state is more stable. Mn^{+2} has half filled d-subshell

26. (a) Write the structures of A, B, C and D in the following reactions :

$$CH_3CN \xrightarrow[(ii)\,H_2O]{(i)\,SnCl_2-HCl} A \xrightarrow{dil..NaOH} B \xrightarrow{heat} C$$

$$A \xrightarrow{HCN} D$$

(b) Distinguish between :

(i) $C_6H_5–CH=CH–COCH_3$ and $C_6H_5–CH=CH–CO\ CH_2CH_3$

(ii) CH_3CH_2COOH and $HCOOH$

(c) Arrange the following in the increasing order of their boiling points :

CH_3CH_2OH, CH_3COCH_3, CH_3COOH

OR

(a) Write the chemical reaction involved in Etard reaction.

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

$CH_3–CHO$ $C_6H_5COCH_3$, $HCHO$

(c) Why pKa of $Cl–CH_2–COOH$ is lower than the pKa of CH_3COOH ?

(d) Write the product in the following reaction.

$$CH_3CH_2CH=CH–CH_2CN \xrightarrow[2.\,H_2O]{1.\,(i-Bu)_2AlH}$$

(e) A and B are two functional isomers of compound C_3H_6O. On heating with NaOH and I_2, isomer A forms yellow precipitate of iodoform whereas isomer B does not form any precipitate. Write the formulae of A and B.

Sol. **Students may find same/similar question in CP board pattern exercise sheet:**
(a) Chapter: Aldehyde, Ketone & Carboxylic Acid, Section-B, Q.5(a)(iii)

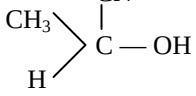
OR

(a) Chapter: Aldehyde, Ketone & Carboxylic Acid, Section-A, Q.15 (iv)
(b) Chapter: Aldehyde, Ketone & Carboxylic Acid, Section-B, Q.6 (i)
(c) Chapter: Aldehyde, Ketone & Carboxylic Acid, Section-B, Q.5(a)(i)

(a) A $\Rightarrow CH_3 - CHO$

B $\Rightarrow CH_3 - \underset{\underset{OH}{|}}{CH} - CH_2 - CHO$

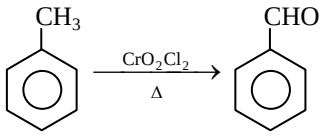
C $\Rightarrow CH_3 - CH = CH - CHO$

D $\Rightarrow$ 

(b) (i) Iodoform test
(ii) Tollen's test (Tollen's reagent)

(c) $CH_3 - \underset{\underset{O}{||}}{C} - CH_3 < CH_3 - CH_2 - OH < CH_3 - COOH$

OR

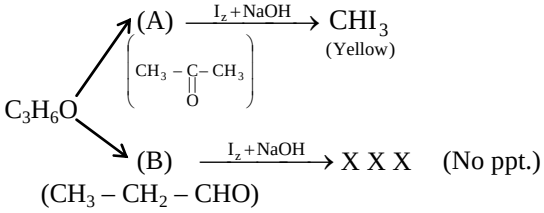
(a) 

(b) Rate of $\underset{\left(\begin{array}{c}\text{Nucleophilic}\\ \text{Addition Rx}^n\end{array}\right)}{\text{NAR}} \Rightarrow HCHO > CH_3 - CHO > C_6H_5COCH_3$

(c) Due to presence of Cl as a – I group which increases the Ka Value of $Cl - CH_2 - COOH$.

(d) $CH_3 - CH = CH - CH_2 - CH_2 - CHO$

(e)



CBSE Board Pattern 2015
CHEMISTRY

Q.1 Write the formulae of any two oxoacids of phosphorus. **[1]**

Q.2 Which would undergo SN^2 reaction faster in the following pair **[1]**

$C_6H_5–CH_2–CH_2–Br$ and $C_6H_5–\underset{\displaystyle Br}{\underset{|}{CH}}–CH_3$

Q.3 Out of $AlCl_3$ and NaCl, which is more effective in causing coagulation of a negative sol and why ? **[1]**

Q.4 Write the formula of a compound in which the element Y forms ccp lattice and atoms of X occupy $1/3^{rd}$ of tetrahedral voids **[1]**

Q.5 Write the IUPAC name of the given compound : $CH_3–\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}–CH_2–OH$ **[1]**

Q.6 Why do transition elements show variable oxidation states ? How is the variability in oxidation states of d-block different from that of the p-block elements ? **[2]**

Q.7 (i) Write down the IUPAC name of the following complex : **[2]**
$[Pt(NH_3)(H_2O)Cl_2]$

(ii) Write the formula for the following complex :
tris(ethane-1,2-diamine)chromium(III) chloride

Q.8 Calculate the time to deposit 1.5 g of silver at cathode when a current of 1.5 A was passed through the solution of $AgNO_3$. (Molar mass of Ag = 108 g mol^{-1}, 1 F = 96500 C mol^{-1}) **[2]**

Q.9 Write the reagents used in the following reactions **[2]**

(i) $C_6H_5–CO–CH_3 \xrightarrow{?} C_6H_5–CH_2–CH_3$

(ii) $CH_3–COOH \xrightarrow{?} CH_3–COCl$

or

Arrange the following compounds in increasing order of their property as indicated

(i) CH_3CHO, C_6H_5CHO, HCHO
(reactivity towards nucleophilic addition reaction)

(ii) 2,4-dinitrobenzoic acid, 4-methoxybenzoic acid, 4-nitrobenzoic acid (acidic character)

Q.10 (i) Why are aquatic species more comfortable in cold water than in warm water ? **[2]**

(ii) What happens when we place the blood cell in saline water solution (hypertonic solution) ? Give reason.

Q.11 (i) Name the method used for the refining of titanium **[3]**

(ii) What is the role of Zn in the extraction of silver ?

(iii) Reduction of metal oxide to metal becomes easier if the metal obtained is in liquid state. Why

Q.12 (i) E^0 value for the Mn^{3+}/Mn^{2+} couple is positive (+1.5 V) whereas that of Cr^{3+}/Cr^{2+} is negative (– 0.4 V). Why ?

(ii) Transition metals form coloured compounds. Why ?

(iii) Complete the following equation :

$$2MnO_4^- + 16H^+ + 5C_2O_4^{2-} \longrightarrow$$ **[3]**

Q.13 (i) What type of isomerism is shown by $[CO(NH_3)_5ONO]Cl_2$? **[3]**

(ii) On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_0 < P$

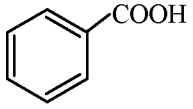
(iii) Write the hybridization and shape of $[Fe(CN)_6]^{3-}$

(Atomic number of Fe = 26)

Q.14 Predict the products of the following reactions : **[3]**

(i) $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}} = O \xrightarrow{H_2N-NHCONH_2} ?$

(ii) $C_6H_5-CH_2-CH_3 \xrightarrow[(b)H^+]{(a)KMnO_4/KOH} ?$

(iii)  $\xrightarrow{\text{conc. } HNO_3 / H_2SO_4}$

Q.15 Write the names and structures of the monomers of the following polymers : **[3]**

(i) Nylon-6,6

(ii) Bakelite

(iii) Polystyrene

Q.16 (i) Which one of the following is a disaccharide : **[3]**

Starch, maltose, fructose, glucose

(ii) What is the difference between acidic amino acid and basic amino acid?

(iii) Write the name of the linkage joining two nucleotides.

Q.17 Vapour pressure of water at 20°C is 17.5 mm Hg. Calculate the vapour pressure of water at 20°C when 15 g of glucose (Molar mass = 180 g mol^{-1}) is dissolved in 150 g of water. **[3]**

Q.18 Examine the given defective crystal : **[3]**

X^+ Y^- X^+ Y^- X^+

Y^- X^+ Y^- X^+ Y^-

X^+ Y^- X^+ e^- X^+

Y^- X^+ Y^- X^+ Y^-

Answer the following questions :

(i) Is the above defect stoichiometric or non-stoichiometric?

(ii) Write the term used for the electron occupied site.

(iii) Give an example of the compound which shows this type of defect.

Q.19 How do you convert the following : **[3]**

(i) Prop-1-ene to Propan-2-ol

(ii) Bromobenzene to 2-bromoacetophenone

(iii) 2-bromobutane to But-2-ene

OR

What happens when

(i) Ethyl chloride is treated with NaI in the presence of acetone,

(ii) Chlorobenzene is treated with Na metal in the presence of dry ether,

(iii) Methyl chloride is treated with KNO_2 ?

Write chemical equations in support of your answer.

Q.20 Give reasons for the following : **[3]**

(i) p-nitrophenol is more acidic than p-methylphenol.

(ii) Bond length of C – O bond in phenol is shorter than that in methanol.

(iii) $(CH_3)_3C$ – Br on reaction with sodium methoxide ($Na^+ {}^-OCH_3$) gives alkene as the main product and not an ether.

Q.21 Calculate E^0_{cell} and $\Delta_r G^0$ for the following reaction at 25°C : **[3]**

$A^{2+} + B^+ \longrightarrow A^{3+} + B$

Given : $K_C = 10^{10}$, 1 F = 96500 C mol^{-1}

Q.22 Define adsorption with an example. Why is adsorption exothermic in nature? Write the types of adsorption based on the nature of forces between adsorbate and adsorbent. **[3]**

Q.23 Seeing the growing cases of diabetes and depression among young children, Mr. Lugani, the principal of one reputed school organized a seminar in which he invited parents and principals. They all resolved this issue by strictly banning junk food in schools and introducing healthy snacks and drinks like soup, lassi, milk, etc. in school canteens. They also decided to make compulsory half an hour of daily physical activities for the students in the morning assembly. After six months, Mr. Lugani conducted the health survey in most of the schools and discovered a tremendous improvement in the health of the students. **[4]**

After reading the above passage, answer the following questions :

(i) What are the values (at least two) displayed by Mr. Lugani?

(ii) As a student, how can you spread awareness about this issue?

(iii) What are antidepressant drugs? Give an example.

(iv) Name the sweetening agent used in the preparation of sweets for a diabetic patient.

Q.24 For the hydrolysis of methyl acetate in aqueous solution, the following results were obtained : **[5]**

t/s	0	30	60
$[CH_3COOCH_3]$/mol L^{-1}	0.60	0.30	0.15

(i) Show that is follows pseudo first order reaction, as the concentration of water remains constant.

(ii) Calculate the average rate of reaction between the time interval 30 to 60 seconds.

OR

(a) For a reaction A + B → P the rate is given by

Rate = k $[A]^2[B]$

(i) How is the rate of reaction affected if the concentration of A is doubled?

(ii) What is the overall order of reaction if B is present in large excess?

(b) A first order reaction takes 23.1 minutes for 50% completion. Calculate the time required for 75% completion of this reaction.

(Given : log 2 = 0.301, log 3 = 0.4771, log 4 = 0.6021)

Q.25 (a) Account for the following : **[5]**

(i) Bond angle in NH_4^+ is greater than that in NH_3.

(ii) Reducing character decreases from SO_2 to TeO_2.

(iii)$HClO_4$ is a stronger acid than HClO.

(b) Draw the structures of the following :

(i) $H_2S_2O_8$

(ii) $XeOF_4$

OR

(a) Which poisonous gas is evolved when white phosphorus is heated with conc. NaOH solution? Write the chemical equation.

(b) Write the formula of first noble gas compound prepared by N. Bartlett. What inspired N. Bartlett to prepare this compound?

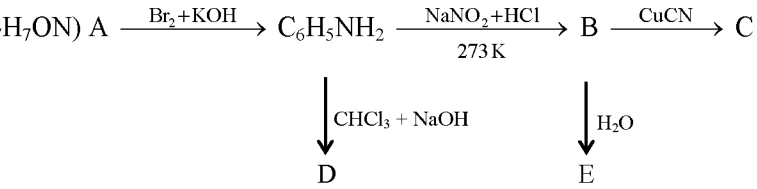
(c) Fluorine is a stronger oxidizing agent than chlorine. Why?

(d) Write one use of chlorine gas.

(e) Complete the following equation :

$CaF_2 + H_2SO_4 \rightarrow$

Q.26 An aromatic compound 'A' of molecular formula C_7H_7ON undergoes a series of reactions as shown below. Write the structures of A, B, C, D and E in the following reactions : **[5]**



OR

(a) Write the structures of the main products when aniline reacts with the following reagents :

(i) Br_2 water

(ii) HCl

(iii) $(CH_3CO)_2O$ / pyridine

(b) Arrange the following in the increasing order of their boiling point :

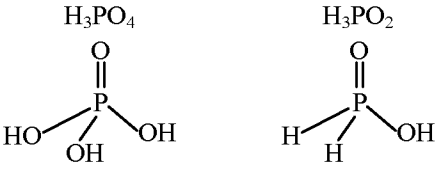
$C_2H_5NH_2$, C_2H_5OH, $(CH_3)_3N$

(c) Give a simple chemical test to distinguish between the following pair of compounds :

$(CH_3)_2 - NH$ and $(CH_3)_3N$

Solution

1.



Orthophosphoric acid Hypophosphorous acid

2. $C_6H_5CH_2–CH_2–Br$ 1° , Because

$$\text{Rate of } SN^2 \propto \text{stability of T.S.} \propto \frac{1}{\text{steric hinderance}}$$

3. $AlCl_3$, because the greater the valence of the flocculating ion added, the greater is its power to cause precipitation $Al^{3+} > Na^+$

4. Y is present in ccp

$\therefore$ effective ions $= \frac{1}{8} \times 8 + \frac{1}{2} \times 6 = 4$

X is present at $\frac{1}{3}$ of T.V. $\quad \therefore X = \frac{1}{3} \times 8$

$\therefore$ Formula is X : Y or X_2Y_3

4 : 8/3

5. 2, 2-Dimethyl propan-1-ol

6. Transition elements show variable oxidation states because electrons in ns and (n–1)d-orbitals are available for bond formation

The oxidation states of d-block differ from each other by unity (due to incomplete filling of d-orbitals) where as oxidation states of p-block elements normally differ by two units.

7. (i) Ammineaquadichloridoplatinum(II)

(ii) $[Cr(en)_3]Cl_3$

8. $Ag^+ + e^- \longrightarrow Ag$

108 g of Ag are deposited by 96500 C

$\therefore$ 1.5g of Ag will be deposited by $\frac{96500}{100} \times 1.5 = 1340.27C$

$t = \frac{Q}{I} = \frac{1340.27}{1.5} = 893.5$ s

OR

$$W = \frac{E}{F} It$$

$$1.5 = \frac{108}{96500} \times 1.5 \times t$$

$$t = 893.5 \text{ s}$$

9. (i) $C_6H_5–CO–CH_3 \xrightarrow[\text{Clemensen's reaction / Wolf Kishner reaction}]{Zn–Hg+HCl/N_2H_4+H_2O_2} C_6H_5–CH_2CH_3$

(ii) $CH_3–COOH \xrightarrow{PCl_5/PCl_3/SOCl_2} CH_3–COCl$

OR

(i) $C_6H_5CHO < CH_3CHO < HCHO$

(ii) 4-methoxy benzoic acid < 4-nitrobenzoic acid < 2,4-dinitro benzoic acid

10. (i) Solubility of gases in liquid decreased with rise in temp. So aquatic species are more comfortable in cold water due to availability of more oxygen than hot water

(ii) The blood cell shrinks due to loss of water by osmosis because osmosis takes place from low conc. to high conc.

11. (i) Van-Arkel method , In this method Ti is converted into volatile iodide.

(ii) Zn act as a reducing agent in the extraction of Ag

$2[Ag(CN)_2\ (aq)\ \ Zn(s) \rightarrow 2Ag(s) + [ZnC(CN)_4]^{2-}{}_{(aq)}]$

(iii) The entropy is higher in liquid state of metal & the value of entropy change (ΔS) of reduction process is more on the product side. So the value of ΔG become more negative on right side and reduction becomes easier.

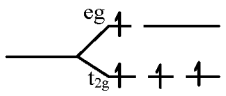
12. (i) Because Mn^{2+} is more stable as it has half filled configuration $3d^5\ 4s^0$, where as comparatively negative value of Cr show the extra stability of Cr^{3+}

(ii) Due to d-d transition, when visible light falls on a transition metal compound, they absorb certain radiation of visible light and when energy is emitted definite colour is observed.

(iii) $2MnO_4^- + 16H^+ + 5C_2O_4^{2-} \longrightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

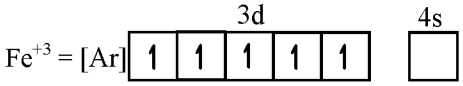
13. (i) Linkage isomerism, when ever ambidentate ligand is present coordination compound shows linkage isomerism.

(ii) $t_{2g}^3 e_g^1$,

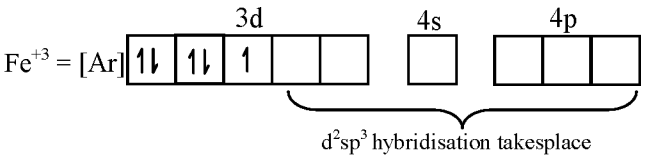


when $\Delta_O <$ P tendency pairing of electron in same orbital is not present

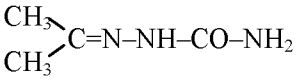
(iii) d^2sp^3, octahedral , $_{26}Fe = [Ar]\ 3d^6\ 4s^2$



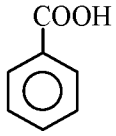
In the presence of S.F. ligand CN^-



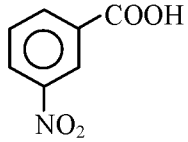
14.

(i) 

Acetone semi carbazide

(ii) 

(Strong oxidation)

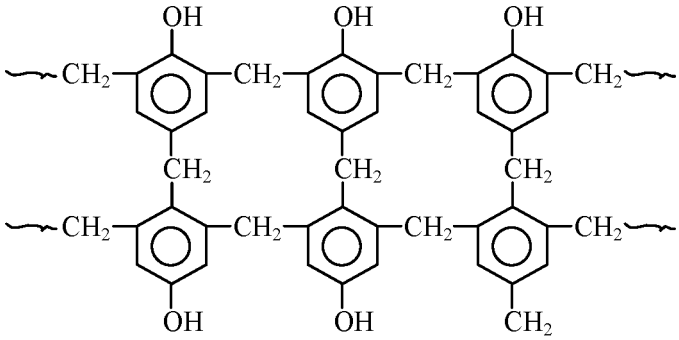
(iii) 

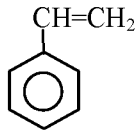
m-product is obtained due to deactivating nature of -COOH group

15. (i) $H_2N-(CH_2)_6-NH_2$ & $HOOC-(CH_2)_4-COOH$

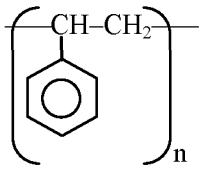
Hexamethylene diamene — Adipic acid

(ii) Phenol + formaldehyde



(iii) 

(Styrene)



(Polystyrene)

16. (i) Maltose

(ii) Acidic amino acids (contain one $-NH_2$ group & two –COOH groups eg. glutamic)

Basic amino acids contain two $-NH_2$ group & one –COOH groups eg lysine.

(iii) Phosphodiester linkage

17. $\frac{P^o - P}{P^o} = \frac{w_B \times M_A}{M_B \times w_A}$

Here w_B = 15 g (glucose)

M_A = 15 g (water)

M_B = 150 (glucose)

w_B = 150 (water)

$\frac{17.5 - P}{17.5} = \frac{15 \times 18}{180 \times 150}$

$17.5\ P = 17.5 \times 0.01$

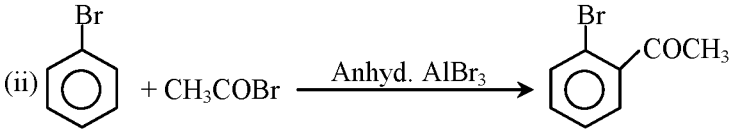
$P = 17.325$ mmHg

18. (i) Non-stoichiometric defect , because ratio of cation and anion changes after the formation of defect.

(ii) F-centre , The site at which e^- is present is called as F-centre or Farbe centre, which means colour because free e^- absorb energy and transit to higher energy state that makes compound coloured.

(iii) NaCl , when NaCl is heated in the presence of Na vapour this defect is formed

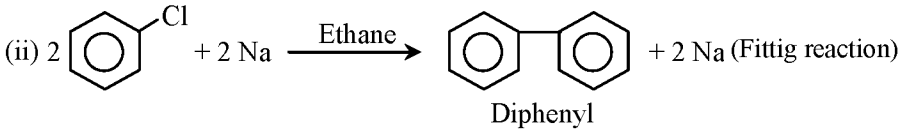
19. (i) $CH_3–CH=CH_2 + H_2O \xrightarrow[\text{dil. } H_2SO_4]{H^+} CH_3–\underset{\underset{OH}{|}}{CH}–CH_3$

(ii) 

(iii) $CH_3–CH_2–\underset{\underset{Br}{|}}{CH}–CH_3 \xrightarrow[\Delta]{\text{Alc. KOH}} CH_3–CH=CH–CH_3$

OR

(i) $C_2H_5Cl + NaI \xrightarrow{\text{Acetone}} \underset{\text{Ethyliodide}}{C_2H_5I} + NaCl$ (Finkelstein reaction)

(ii) 

(iii) $CH_3Cl + KNO_2 \longrightarrow \underset{\text{(methyl nitrite)}}{CH_3ONO} + KCl$

20. (i) NO_2 group is electron withdrawing group & methyl group is electron releasing group. Withdrawing group help in increasing acidic nature, where as electron releasing group decreases acidic nature of phenol.

(ii) Due to sp^2 hybridised C and resonance in phenol to which –OH group attached, where as in CH_3OH, C is sp^3 hybridised bond length in $sp^3 > sp^2$

(iii) Because alkoxides are not only nucleophile but strong bases as well. They react with 3° alkyl halides leading to elimination reaction.

$$(CH_3)_3\text{–C–Br} + NaOCH_3 \xrightarrow{H^+} CH_3\text{–}\underset{\underset{OH}{|}}{CH}\text{–}CH_3 + NaBr + CH_3OH$$

21. $A^{2+} + B^+ \longrightarrow A^{3+} + B$

$K_c = 10^{10}$; $E\,E^o_{cell} = ?$

$n = 1$, $\Delta G^o = ?$

$$E^o_{cell} = \frac{0.059}{1}\log K_c \qquad [\log 10^{10} = 10]$$

$E^o_{cell} = 0.059 \times 10 = 0.59$ V

$\Delta G^o = -nFE_{cell}$

$= -1 \times 96500 \times 0.59$

$= -56935$ J/mol or -56.935 kJ/mol

22. Adsorption : "The accumulation of molecular species at the surface rather than in the bulk of a solid is termed as adsorption. eg the air becomes dry in the presence of silica gel because the water molecules get adsorption on the surface of the gel.

During adsorption, there is always bond formation between adsorbate and adsorbent and it results in release of energy.

There are two types of adsorption on the basis of nature of forces –

(i) Physisorption which occur due to Vander Waal's force of attraction

(ii) Chemisorption which occur due to chemical bond

23. (i) Mr. Lugani is well aware of harmful effects of junk food & diseases related to it, he is caring and concerning person for others

(ii) As a student we can make poster and plays to aware people about adverse effects of junk foods

(iii) Antidepresant drugs help in treatment of stress, relieve anxiety & induce a sense of well being by inhibiting the enzyme which catalysis degradation of noradrenaline

(iv) Aspartame

24. (i) For pseudo first order reaction, the reaction should be first order with respect to ester when H_2O is excess.
for first order reaction

$K = \frac{2.303}{t} \log \frac{[R_0]}{[R]}$ where $K = K'[H_2O]$, $[R]_0 = 0.60$ M

t/s	[R]	K/s^{-1}	
0	0.60	-	-
30	0.30	$= \frac{2.303}{30}\log\frac{0.60}{0.30}$	$= 1.91\times10^{-2}$
60	0.15	$= \frac{2.303}{60}\log\frac{0.30}{0.15}$	$= 1.96\times10^{-2}$

It can be seen that $K'[H_2O]$ is constant & equal to $1.91 \times 10^{-2} s^{-1}$

(ii) $= -\frac{C_2 - C_1}{t_2 - t_1} = -\frac{0.15 - 0.30}{60 - 30} = \frac{0.15}{30} = 5 \times 10^3$ mol L^{-1} sec^{-1}

OR

a(i) Rate (r) = $K[A]^2[B]$

$r_1 = K[2A]^2[B]$

$\frac{r_1}{r} = 2^2$ or $r_1 = 4r$

The rate will increase 4 times

(ii) It has overall order as 2 because concentration of B does not get attered during the course of reaction.

b(ii) $t = \frac{2.303}{k}\log\frac{[R]_0}{[R]}$

$$\frac{t_{75\%}}{t_{50\%}} = \frac{\frac{2.303}{k}\log\frac{[R]_0}{[R]_0 - 0.75[R]_0}}{\frac{2.303}{k}\log\frac{[R]_0}{[R]_0 - 0.20[R]_0}} = \frac{\log 4}{\log 2}$$

$$\frac{t_{75\%}}{23.1} = \frac{0.6021}{0.301}$$

$t_{75\%} = \frac{0.6021 \times 23.1}{0.301} = 47.6$ minute

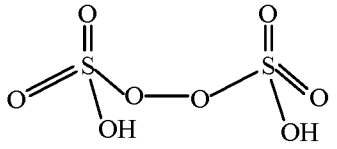
25. (A) (i) In NH_4^+ all the four orbitals are bonded where as in NH_3, there is a lone pair of electron s on p, which is responsible for lone pair-bond pair repulsion in NH_3 & reduce the bond angle

(ii) Acidic character increases due to decrease in bond enthalpy as we move down the group and due to increasing of size E–H bond breaks more easily.

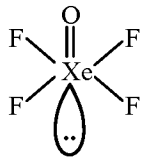
(iii) In case of HClO ; O–Cl bond order is 1 and in $HClO_4$; O–Cl bond order is 1.75, as B.O.↑ B.S.↑ and tendency to give oxygen ↓

∴ oxidising character ↓

B (i)



(ii)



OR

(a) $\underset{\text{White}}{P_4} + 3NaOH + 3H_2O \longrightarrow \underset{\text{Phosphine}}{PH_3} + NaH_2PO_2$

(b) N.Bartlett first prepared $O_2^+PtF_6^-$ & then the made effort to make first noble gas compound $Xe^+PtF_6^-$ because I.E. of xenon is almost same as oxygen .

(c)(i) The E^0_{cell} value of F_2 is much higher than that of Cl_2

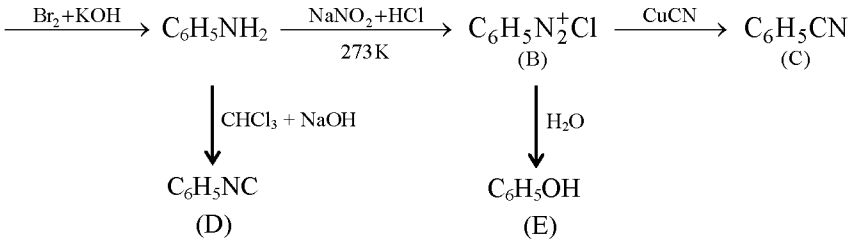
(ii) F_2 has low bond dissociation enthalphy than Cl_2

(iii) F_2 has more electronegativity than Cl_2

(d) Cl_2 is used in bleaching wood pulp

(e) $CaF_2 + H_2SO_4 \longrightarrow CaSO_4 + 2HF$

26.



A → $C_6H_5CONH_2$

B → $C_6H_5N_2Cl$

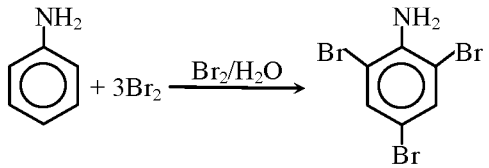
C → C_6H_5CN

D → C_6H_5NC

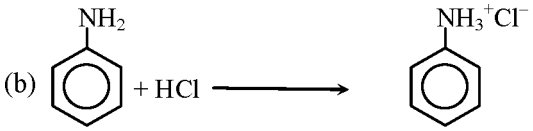
E → C_6H_5OH

OR

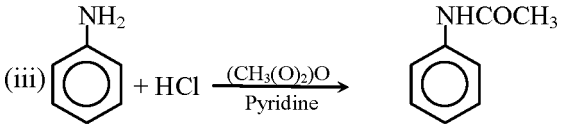
(a)



2, 4, 6 tribromo aniline

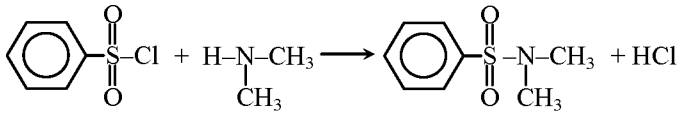
(b) 

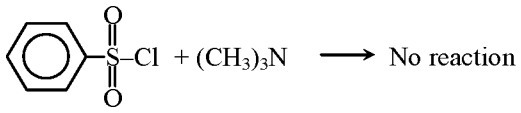
Anilinium chloride

(iii) 

(b) $(CH_3)_3N < C_2H_5NH_2 < C_2H_5OH$

(c) 2° Amine give sulphonamide with Hinsberg's reagent ($C_6H_5SO_2Cl$), where as 3° amine do not react with Hinsberg reagen





CHEMISTRY

Paper & Solution

Code : 56/3

Time : 3 Hrs. **Max. Marks : 70**

General Instructions :

(i) All questions are compulsory.

(ii) Questions number **1 to 8** are very short answer questions and carry **1** mark each.

(iii) Questions **9** to **18** are short answer questions and carry **2** marks each.

(iv) Question number **19 to 27** are also short-answer questions and carry **3** marks each.

(v) Question number **28 to 30** are long-answer questions and carry **5** marks each.

(vi) Use Log Tables, if necessary. Use of calculators is **not** allowed.

---

1. What are the dispersed phase and dispersion medium in milk ? **1**

Sol. Dispersed phase : Oil

Dispersion medium : Water

2. Name the method used for refining of copper metal. **1**

Sol. Electrorefining

3. Why does NH_3 act as a Lewis base ? **1**

Sol. NH_3 acts as a Lewis base because N-atom has a ℓp

4. The conversion of primary aromatic amines into diazonium salts is known as_____ **1**

Sol. Diazotisation Reaction

5. Which of the following is a fibre ? **1**

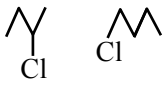
Nylon, Neoprene, PVC

Sol. Nylon

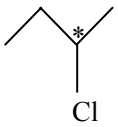
6. Write the products of hydrolysis of lactose. **1**

Sol. β-D-Glucose and β-D-Galactose

7. Identify the chiral molecule in the following pair: **1**

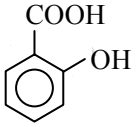


Sol.



8. Write the structure of 2-hydroxybenzoic acid. **1**

Sol.



9. Complete the following equations: **2**

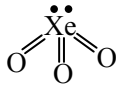
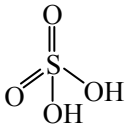
(i) $C + \text{conc. } H_2SO_4 \rightarrow$

(ii) $XeF_2 + H_2O \rightarrow$

Sol. (i) $C + 2H_2SO_{4(conc)} \rightarrow CO_2 + 2SO_2 + 2H_2O$

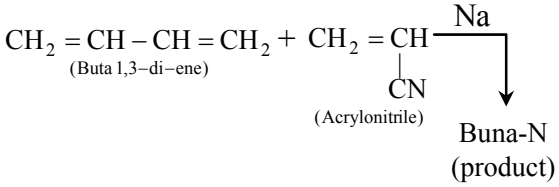
(ii) $2XeF_2 + 2H_2O \rightarrow 2Xe + O_2 + 4HF$

10. Draw the structures of the following: **2**
(i) XeO_3 (ii) H_2SO_4

Sol. (i)  (ii) 

11. Write the name of monomers used for getting the following polymers: **2**
(i) Teflon (ii) Buna-N

Sol. (i) $CF_2 = CF_2$ (Tetrafuoro ethylene)
(ii)



12. An element with density 2.8 g cm^{-3} forms a f.c.c. unit cell with edge length 4×10^{-8} cm. Calculate the molar mass of the element. **2**
(Given: $N_A = 6.022 \times 10^{23}\ mol^{-1}$)

Sol. We know $d = \dfrac{Z \times M}{V \times N_A}$

$d = 2.8$ g/cmq $Z = 4$ $a = 4 \times 10^{-8}$ cm

$$2.8 = \frac{4 \times M}{(4 \times 10^{-8})^3 \times 6.02 \times 10^{23}}$$

$$2.8 = \frac{4 \times M}{4^3 \times 6.022 \times 10^{-1}}$$

$M = 26.97$

13. (i) Write the type of magnetism observed when the magnetic moments are aligned in parallel and anti-parallel directions in unequal numbers.
(ii) Which stoichiometric defect decreases the density of the cystal ? **2**

Sol. (i) When magnetic moment is aligned in parallel direction, it is called Ferromagnetic and it magnetic moment is aligned in antiparallel direction, it is called antiferromagnetic.
(ii) Due to schottky defect vacancies are formed and density decreases

14. Define the following terms: **2**
(i) Molar conductivity (Λ_m)
(ii) Secondary batteries

Sol. (i) Molar Conductivity Λ_m : Molar conductivity can be defined as conductance of all the ions present in a certain volume (V cm^3). If solution is kept between electrodes present 1 cm apart and area of electrode such that whole solution is confined them.
(ii) Secondary batteries :
The batteries which can be recharged again and again are called as secondary batteries.
Eg. Lead storage battery

15. Write the mechanism of the following reaction: **2**
$CH_3CH_2OH \xrightarrow{HBr} CH_3CH_2Br + H_2O$

Sol. Step-I :

$$CH_3–CH_2–OH \xrightarrow{\overset{+}{H}Br^-} CH_3-CH_2-\overset{\oplus}{O}H_2$$
(oxonium ion)

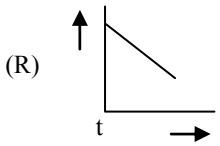
Step-II :

$$CH_3–CH_2–\overset{\oplus}{O}H_2 \longrightarrow CH_3–\overset{\oplus}{C}H_2$$

Step-III :

$$CH_3–\overset{\oplus}{C}H_2 \xrightarrow{Br^-} CH_3–CH_2–Br$$

16. For a chemical reaction R → P, the variation in the concentration (R) vs. time (t) plot is given as



(i) Predict the order of the reaction.
(ii) What is the slope of the curve ?

Sol. (i) Order of reaction = 0
As integrated rate law
is $(a_0 - x) = -kt + a_0$
and slope of curve = –k

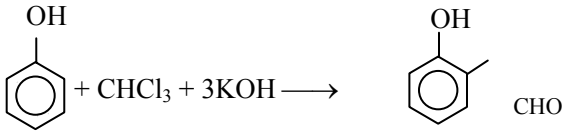
17. Write the principle behind the froth floatation process. What is the role of collectors in this process ? **2**

Sol. Froth floatation process is used when ore has wettiability towards oil while impurities have wettiability towards water. Collectors are used in froth floatation process to collect ore particles and to remove them with froth.

18. Write the equations involved in the following reactions : **2**
(i) Reimer – Tiemann reaction
(ii) Williamson synthesis

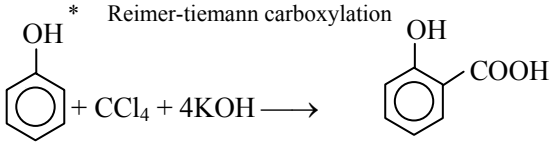
Sol. (i) Reimer tiemann Reaction

* Reimer tiemann formylation



(Salicyldehyde)

* Reimer-tiemann carboxylation



(Salicylic acid)

(ii) Williamson's synthesis

$$C_2H_5–Br + C_2H_5\overline{O}\,Na^+ \xrightarrow{Heat} C_2H_5–O–C_2H_5 + NaBr$$

19. (i) Write the IUPAC name of the complex $[Cr(NH_3)_4Cl_2]Cl$. **3**

(ii) What type of isomerism is exhibited by the complex $[Co(en)_3]^{3+}$?

(en = ethane-1,2-diamine)

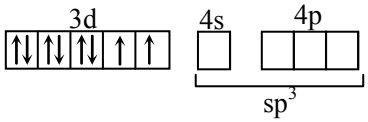
Sol. (i) $[Cr(NH_3)_4Cl_2]Cl$

Tetraamminedichloridochromium(III) chloride

(ii) $[Co(en)_3]^{+3}$ shows optical isomerism

(iii) $[NiCl_4]^{-2}$

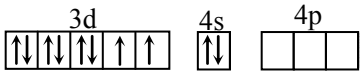
$Ni^{+2} = [Ar]\ 4s^0 3d^8$



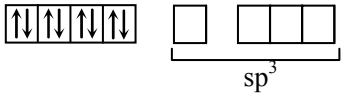
Ni^{+2} has 2 unpaired e^- hence, this complex is paramagnetic

$[Ni(CO)_4]$

$Ni = [Ar]\ 4s^2\ 3d^8$

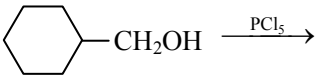


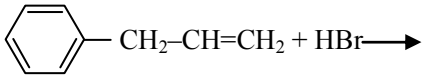
CO is strong field ligand. Hence, pairing occurs.



Ni has zero unpaired electron, this complex is diamagnetic

20. (a) Draw the structures of major monohalo products is each of the following reactions : **3**

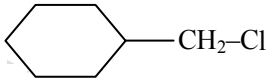
(i) 

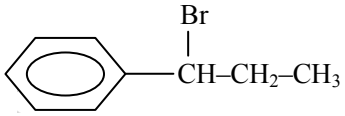
(ii) 

(b) Which halogen compound in each of the following pairs will react faster in S_N2 reaction :

(i) CH_3Br or CH_3I

(ii) $(CH_3)_3C–Cl$ or $CH_3–Cl$

Sol. (a) (i) 

(ii) 

(b) (i) CH_3I

(ii) CH_3Cl

21. Account for the following : **3**

(i) Primary amines ($R\text{-}NH_2$) have higher boiling point than tertiary amines (R_3N).

(ii) Aniline does not undergo Friedel-Crafts reaction.

(iii) $(CH_3)_2NH$ is more basic than $(CH_3)_3N$ in an aqueous solution.

Sol. (i) Due to maximum intermolecular hydrogen bonding in primary amines (due to presence of more number of H-atoms) primary amines have high BP in comparison to tertiary amines.

(ii) Aniline does not undergo Friedel-Crafts reaction due to Acid-Base reaction between Basic compound. Aniline and Lewis Acid/Protic Acid, which is use in Friedel-crafts reaction.

(iii) In $(CH_3)_3$ N there is maximum steric hindrance and least solvation but in $(CH_3)_2NH$ the solvation is more and the steric hindrance is less than in $(CH_3)_3N$; Although +I effect is less, since there are two methyl group; di-methyl amine is still a stronger base than tri-methyl amine.

OR

(i) $C_6H_5NO_2 \xrightarrow{Sn+HCl} \underset{(A)}{C_6H_5NH_2} \xrightarrow[273\,K]{NaNO_2+HCl} \underset{(B)}{C_6H_5N_2Cl} \xrightarrow{H_2O} \underset{(c)}{C_6H_5OH}$

(ii) $CH_3–CN \xrightarrow{H_2O/H^+} \underset{(A)}{CH_3-COOH} \xrightarrow{NH_3} \underset{(B)}{CH_3-CONH_2} \xrightarrow{Br_2+KOH} \underset{(C)}{CH_3-NH_2}$

22. On the occasion of World Heath Day, Dr. Satpal organized a 'health camp' for the poor farmers living in a nearby village. After check-up, he was shocked to see that most of the farmers suffered from cancer due to regular exposure to pesticides and many were diabetic. They distributed free medicines to them. Dr. Satpal immediately reported the matter to the National Human Rights Commission (NHRC). On the suggestions of NHRC, the government decided to provide medical care, financial assistance, setting up of super-speciality hospitals for treatment and prevention of the deadly disease in the affected villages all over India. **3**

(i) Write the values shown by
  (a) Dr. Satpal
  (b) NHRC

(ii) What type of analgesics are chiefly used for the relief of pains of terminal cancer ?

(iii) Give an example of artificial sweetener that could have been recommended to diabetic patients.

Sol. (i) (a) Dr. Satpal distributed free medicines to them.

(b) Dr. Satpal immediately reported the matter to the National Human Rights Commission.

(ii) Aspirin (iii) Aspartame

23. Define the following terms :

(i) Nucleotide

(ii) Anomers

(iii) Essential amino acids

Sol. (i) **Nucleotide :** It is the monomer unit of DNA which is formed by nitrogenous base, Deoxyribose sugar and Phosphoric acid.

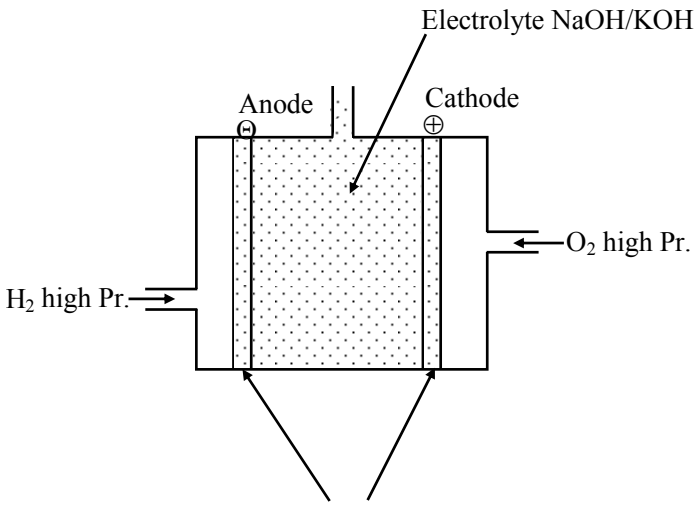
(ii) **Anomer :** Anomers are cyclic monosaccaride which are differing from each other in the configuration of c-1 if they are aldose or in the configuration at c-2 if they are ketoses.

(iii) **Essential amino acid :** The Amino acid can not synthesised by body and essential for body.

24. (a) Calculate Δ_rG^o for the reaction
$Mg(s) + Cu^{2+}(aq) \rightarrow Mg^{2+}(aq) + Cu(s)$
Given : $E^o_{cell} = +2.71$ V, 1 F = 96500 C mol^{-1}.

Sol. **(a)** $\Delta G° = –nF\ E°_{Cell}$
$= –2 \times 96500 \times 2.71$
$= –523030$
$= – 523.03$ kJ

(b) Fuel cell



Porous carbon or graphite electrodes impregnated with black Pt particles

* In fuel cell porous carbon electrodes impregnated with Pt particles are used.
* NaOH or KOH are used as electrolyte
* Reaction at anode :

$$H_2 + 2OH^- \rightleftharpoons 2H_2O + 2e^-$$

At cathode $\frac{1}{2}O_2 + H_2O + 2e^- \rightleftharpoons 2OH^-$

Overall cell reaction

$$H_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons H_2O(l)$$

Advantage of fuel cell

(i) High efficiency
(ii) No harmful products are formed
(iii) No part of the cell creats environmental hazards

25. The following data were obtained during the first order thermal decomposition of SO_2Cl_2 at a constant volume : **3**

$$SO_2Cl_2(g) \longrightarrow SO_2(g) + Cl_2(g)$$

Experiment	Time/s^{-1}	Total pressure/atm
1	0	0.4
2	100	0.7

Sol. $SO_2Cl_2(g) \rightarrow SO_2(g) + Cl_2(g)$

Initial Pr. 0.4
After time (t) $0.4 - x$ x x

$\therefore$ Total pressure $= 0.4 + x = 0.7 \Rightarrow x = 0.3$

$$K = \frac{2.303}{t}\log\left(\frac{P_0}{P_0 - x}\right)$$

$$= \frac{2.303}{100}\log\frac{0.4}{0.1}$$

$$= \frac{2.303}{100}\log 4 = \frac{2.303}{100} \times 0.6021$$

$$= 1.3866 \times 10^{-2}\ sec^{-1}$$

26. What are emulsions ? What are their different types ? Give one example of each type. **3**

Sol. Colloidal solution of liquid in liquid is called as emulsion

We have two types of emulsions

(1) Oil in water (o/w)

(2) Water in oil (w/o)

(i) Oil in water : In this type of emulsion water is medium and oil is dispersed phase, it soluble in H_2O, Ex. Milk

(ii) Water is oil : In this type of emulsion oil is medium and water is dispersed into it, it is soluble in oil Ex. Butter

27. Given reasons for the following :

(i) $(CH_3)_3$ P = O exists but $(CH_3)_3N$ = O does not.

(ii) Oxygen has less electron enthalpy with negative sign than sulphur.

(iii) H_3PO_2 is a stronger reducing agent than H_3PO_3.

Sol. (i) Due to absence of vacant d-orbitals N can not form 5 covalent bonds

(ii) O has exceptionally small size. Hence, incoming electron feels more repulsion than expected and its negative electron gain enthalpy becomes less than expected

(iii) In H_3PO_2 oxidation state of P is '+1' while in H_3PO_3 oxidation state of P is '+3' . In H_3PO_2 oxidation state of P is lower than that in H_3PO_3

28. **(a)** Complete the following equations: **5**

(i) $Cr_2O_7^{2-} + 2OH^- \longrightarrow$

(ii) $MnO_4^- + 4H^+ + 3e^- \longrightarrow$

(b) Account for the following :

(i) Zn is not considered as a transition element.

(ii) Transition metals form a larger number of complexes.

(iii) The E^o value for the Mn^{3+} / Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+} couple.

OR

(i) With reference to structural variability and chemical reactivity, write the difference between lanthanoids and action ions.

(ii) Name of member of the lanthanoid series which is well known to exhibit +4 oxidation state.

(iii) Complete the following equations :

$$MnO^-_4 + 8H^+ + 5e^- \longrightarrow$$

(iv) Out of Mn^{3+} and Cr^{3+}, which is more paramagnetic and why ? **3, 2**

(atomic nos. : Mn = 25, r = 24)

Sol. (a)

(i) $Cr_2O_7^{2-} + 2OH^- \longrightarrow 2CrO_4^{-2} + H_2O$

(ii) $MnO_4^- + 4H^+ + 3e^- \longrightarrow MnO_2 + 2H_2O$

(b)

(i) In Zn inner 3d-subshell is full filled.

(ii) Conditions required to form complex are :

• Metal ion must have high charge density.

• Metal ion must have vacant orbitals. Transition elements follow these requirements. Hence, they form complexes.

(iii) For Mn '+2' oxidation state is more stable than '+3' oxidation state while for Cr '+3' oxidation state is more stable '+2' oxidation state.

OR

(I)

	Lanthanoids		Actinoids
(a)	They are not radioactive (except Pm)	(a)	They are radioactive
(b)	They mainly show '+3' oxidation state. They can show upto '+4' oxidation state.	(b)	They mainly show '+3' oxidation state. They can show upto '+7' oxidation state.
(c)	Their magnetic nature can be easily explained.	(c)	Their magnetic nature can not be easily explained.
(d)	Their physical and chemical properties have been studied throughly.	(d)	Their physical and chemical properties have not been studied throughly.

(ii) Cerium (Ce)

(iii) $MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$

(iv) $Mn^{+3} = [Ar]\ 4s^0\ 3d^4$ (4 unpaired e^-)

$Cr^{+3} = [Ar]\ 4s^0\ 3d^3$ (3 unpaired e^-)

Mn^{+3} has more no. of unpaired e^- than Cr^{+3}.

29. **(a)** Writhe the products formed when CH_3CHO reacts with the following reagents : **2,2,1**

(i) HCN

(ii) $H_2N - OH$

(iii) CH_3CHO in the presence of dilute NaOH

(b) Give simple chemical tests to distinguish between the following Paris of compounds.

(i) Benzoic acid and Phenol

(ii) Propanal and Propanone.

OR

(a) Account for the following :

(i) $Cl–CH_2COOH$ is a stronger acid than CH_3COOH.

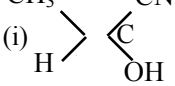
(ii) Carboxylic acids do not give reactions of carbonyl group.

(b) Write the chemical equations to illustrate the following name reactions :

(i) Rosenmund reduction

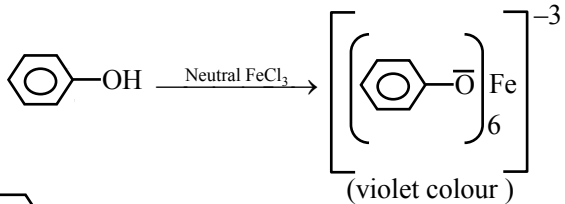
(ii) Cannizzaro's reaction

(c) Out of $CH_3CH_2–CO–CH_2–CH_3$ and $CH_3CH_2–CH_2–CO–CH_3$, which give iodoform test ?

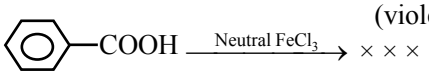
Sol. (a) (i) 

(ii) $CH_3–CH=N–OH$

(iii) $CH_3–\underset{\displaystyle OH}{\underset{|}{CH}}–CH_2–CHO$

(b) (i) 

(violet colour)



(ii) $CH_3–\underset{\displaystyle O}{\underset{\|}{C}}–CH_3 \xrightarrow[-\text{ve Iodoform test}]{I_2+NaOH} CHI_3$ (Iodoform)

$CH_3–CH_2–CHO \xrightarrow[+\text{ve Iodoform test}]{I_2+NaOH} \times\times\times$

OR

(a) (i) Due to presence of –Cl as a – I group

(ii) The carbonyl group is involve in resonance in –COOH grp so the double bond character is decreases here hence –COOH group do not give reaction of carbonyl group although it have >C = O.

(b) (i) Rosenmund reduction :

$$R-\underset{\underset{O}{\|}}{C}-Cl \xrightarrow{(Pd+BaSO_4)} R-CHO$$

(ii) Cannizzaro's Reaction

$$2H-CHO \xrightarrow{50\%\ NaOH(conc.\ base)} CH_3-OH + H-COONa$$

(c) $CH_3-CH_2-CH_2-\underset{\underset{O}{\|}}{C}-CH_3$

(methyl ketone)

30. (a) Define the following terms : **2,3**

(i) Molarity

(ii) Molal elevation constant (K_b)

(b) A solution containing 15 g urea (molar mass = 60 g mol^{-1}) per litre of solution in water has the same osmotic pressure (isotonic) as a solution of glucose (molar mass = 190 g mol^{-1}) in water. Calculate the mass of glucose present in one litre of its solution.

OR

(a) What type of deviation is shown by a mixture of ethanol and acetone ? Give reason.

(b) A solution of glucose (molar mass = 180 g mol^{-1}) in water is labeled as 10% (by mass). What would be the molality and molarity of the solution ?
(Density of solution = 1.2 g mL^{-1})

Sol. **(a)** (i) Molarity (M) : Molarity can be defined as no. of moles of solute dissolved per litre of solution

$$\text{Molarity M} = \frac{\text{Moles of solute}}{\text{Vol. of solution (litre)}}$$

(ii) Molal elevation constant (K_b) :
When 1 molal solution is prepared, the elevation in boiling point is called as molal boiling point elevation constant.

(b) For isotonic solution

$$\pi_1 = \pi_2$$

$C_1 = C_2$ {at same temp.}

or $n_1 = n_2$ {is same vol.}

$$\therefore \frac{15}{60} = \frac{x}{180}$$

x = 45 g , mass of glucose per lit. of solution.

OR

(a) Ethanol and acetone shows +ve deviation because both are non polar compounds and after mixing force of attraction decreases
Like particle force of attraction > unlike particle force of attraction

(b) $$\text{Molarity} = \frac{\%\ \text{Mass} \times 10 \times \text{density}}{\text{Mol. mass of solute}}$$

$$= \frac{10 \times 10 \times 1.2}{180} = 0.66\text{M}$$

$$\text{Molality} = \frac{\%\,\text{Mass}}{\text{Mol. mass of solute}} \times \frac{1000}{(100 - \%\ \text{Mass})}$$

$$= \frac{10}{180} \times \frac{1000}{90} = 0.617\,\text{m}$$

(CHEMISTRY)

Code : 55/3

General Instructions :

(i) All questions are compulsory.

(ii) Questions number **1 to 8** are very short answer questions and carry **1** mark each.

(iii) Questions **9** to **18** are short answer questions and carry **2** marks each.

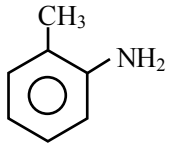
(iv) Question number **19 to 27** are also short-answer questions and carry **3** marks each.

(v) Question number **28 to 30** are long-answer questions and carry **5** marks each.

(vi) Use Log Tables, if necessary. Use of calculators is not allowed.

1. Write the structure of 2-aminotoluene **1**

Sol.



2-Amino toluene

2. Which aerosol depletes ozone layer ? **1**

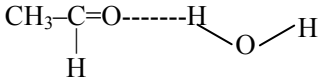
Sol. CFC's and NO

3. Of physisorption or chemisorption, which has a higher enthalpy of adsorption ? **1**

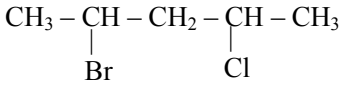
Sol. Chemisorption has higher enthalpy of adsorption

4. Ethanal is soluble in water. Why ? **1**

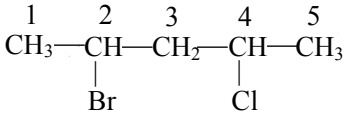
Sol. Due to formation of H-bond with water



5. Write the IUPAC name of the following compound **1**



Sol.

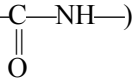


(2-Bromo-4-chloro pentane)

6. Name the method used for refining of copper metal. **1**

Sol. Electrorefining

7. Write the name of linkage joining two amino acids. **1**

Sol. Peptide bond ()

8. Give one example of a condensation polymer. **1**

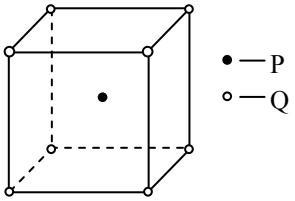
Sol. Nylon-6

9. (a) Why does presence of excess of lithium makes LiCl crystals pink ? **2**

(b) A solid with cubic crystal is made of two elements P and Q. Atoms of Q are at the corners of the cube and P at the body-centre. What is the formula of the compound ?

Sol. (a) Presence of metal excess defect results due to presence of e^- at the position of –ve ions this results in generation of F-centre and LiCl become pink

(b)



Effective P atoms = 1

Effective Q atoms = $1/8 \times 8 = 1$

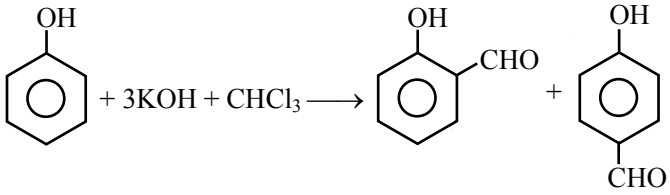
Formula of compound is PQ

10. Write the equations involved in the following reactions : **2**

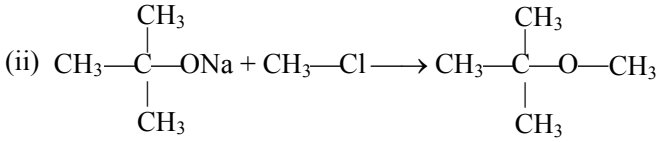
(i) Reimer – Tiemann reaction

(ii) Williamson's ether synthesis

Sol. (i)



(ii)



11. Define thermoplastic and thermosetting polymers. Give one example of each. **2**

OR

What is a biodegradable polymer ? Give an example of a biodegradable aliphatic polyester.

Sol. Thermoplastic – polymers in which the intermolecular forces of attraction are in between those of elastomer and fibers are called thermoplastic

Ex. PVC

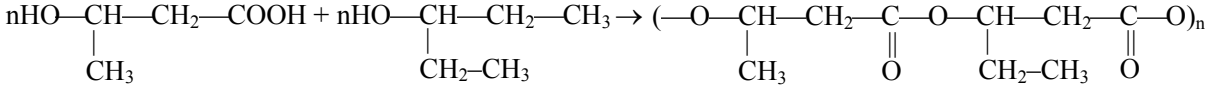
Thermosetting polymers – The cross linked polymer which have hard infusible and insoluble mass are called thermosetting polymer.

Ex. Bakelite

OR

Biodegradable polymer – Polymer, such as starch, cellulose protein, nucleic acid which control the various life processes and are decomposed by microorganism are called biodegradable polymer

Ex. Poly hydroxyl butyrate-CO-β-hydroxy valerate (PHBV)



PHBV

12. Explain the mechanism of the following reaction : **2**

$CH_3 - CH_2 - OH \xrightarrow[443K]{H^+} CH_2 = CH_2 + H_2O$

Sol. Step-I : protonation

$CH_3–CH_2–\ddot{O}H \xrightarrow{H^{\oplus}} CH_3–CH_2–\overset{\oplus}{\ddot{O}}H_2$

Step-II : formation of carbocation

$CH_3–CH_2–\overset{\oplus}{\ddot{O}}H_2 \longrightarrow CH_3–\overset{\oplus}{C}H_2$ (carbocation)

Step-III : deprotonation

$CH_3–\overset{\oplus}{C}H_2 \longrightarrow CH_2=CH_2$

13. How are interhalogen compounds formed ? What general compositions can be assighed to them ? **2**

Sol. Interhalogen compounds are formed due to combination of two different halogens. General formula of Interhalogen compounds are

(i) AX

(ii) AX_3

(iii) AX_5

(iv) AX_7

A = Less E.N. halogen

X = More E.N. halogen

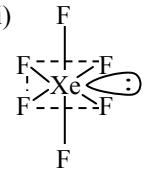
14. Draw the structures of the following molecules **2**

(i) XeF_6

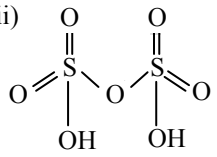
(ii) $H_2S_2O_7$

Sol.

(i)



(ii)



15. Aluminium crystalizes in an fcc structure. Atomic radius of the metal is 125pm. What is the length of the side of the unit cell of the metal ? **2**

Sol. For F.C.C.

$\sqrt{2}a = 4r$

$\sqrt{2}a = 4 \times 125pm$

$a = \frac{500}{\sqrt{2}} = 250\sqrt{2} = 353.5$ pm

16. The standard electrode potential (E^o) for Danial cell is +1.1V. Calculate the ΔG^o for the reaction **2**

$Zn(s) + Cu^{2+}(aq) \longrightarrow Zn^{2+}(aq) + Cu(s)$

($1F = 96500\ C\ mol^{-1}$)

Sol. $\Delta G = - nFE^0_{cell}$

$= - 2 \times 96500 \times 1.1$

$= - 212300$ J

$= - 212.3$ kJ

17. (a) For a reaction $A + B \rightarrow P$, the rate law is given by **2**
$r = k[A]^{1/2}[B]^2$
What is the order of this reaction ?
(b) A first order reaction is found to have a rate constant $k = 5.5 \times 10^{-14}\ s^{-1}$. Find the half life of the reaction.

Sol. (a) order of reaction is $= 2 + \frac{1}{2} = 2\frac{1}{2}$

(b) $t_{1/2} = \frac{0.693}{K} = \frac{0.693}{5.5\times10^{-14}} = 0.126 \times 10^{14} = 1.26 \times 10^{13}$ sec

18. Outline the principles of refining of metals by the folliowing methods **2**
(i) Zone refining
(ii) Vapour phase refining

Sol. (i) **Zone refining :** This method is used when very high degree of purity is required eg., Zn, Ga, Si, Ge, etc. This method is used when impurities have lower melting point than pure metal.
(ii) **Vapour phase refining**
In this method solid is converted into vapour phase by chemical reaction and when these vapours are heated at high temperature, again metal is obtained.
(a) **Mond's process :**
This process is used for purification of Ni. In this process volatile complex $[Ni(CO)_4]$ is formed.

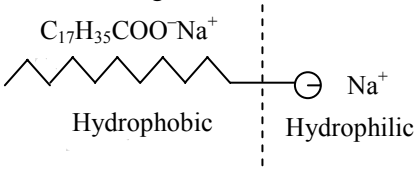
$$\underset{\text{impure}}{Ni} + 4CO \xrightarrow{\Delta} \underset{\text{volatile}}{[Ni(CO)_4]} \xrightarrow{\Delta} \underset{\text{Pure}}{Ni} + 4CO\uparrow$$

(b) **Van-Arkel process :**
Used for Zr and Ti. They form their volatile iodide

$$\underset{\text{Impure}}{Zr \text{ or } Ti} + 2I_2 \xrightarrow{\Delta} \underset{\text{Volatile}}{ZrI_4 \text{ or } TiI_4} \xrightarrow{\Delta} \underset{\text{Pure}}{Zr \text{ or } Ti} + 2I_2\uparrow$$

19. Define the following terms given an example of each **3**
(i) Associated colloids
(ii) Lyophillic solution
(iii) Adsorption

Sol. **(i) Associated colloids :**
Certain substance form true solution at low concentration but as concentration become greater than critical micelle concentration the particles get associated to form colloidal particle and collidal solution is obtained.
Ex. soap
Soap is sodium or potassium salt of fatty acid, when its concentration become greater than C.M.C. particles get associated to give colloidal solution.



(ii) Lyophillic solution :
When particles of dispersed phase are solvated by disperssion medium lyophillic colloidal solution is obtained.
This is more stable due presence of force of attraction between dispersed phase and dispersion medium.
Ex. Starch solution in H_2O

(iii) Adsorption
When particles of certain substance get associated at the surface of solid, it is called as adsorption.
In other words we can say adsorption at the surface is called as adsorption.
Ex. Adsorption of gases by activated charcoal.

20. Calculate the emf of the following cell at 25ºC **3**
$Ag\,(s) \mid Ag^{+}(10^{-3}M) \parallel Cu^{2+}(10^{-1}M) \mid Cu\,(s)$

Given $E^{o}_{Cell} = +0.46$ V and $\log 10^{n} = n$

Sol. Cell rx^{n} : $2Ag(s) + Cu^{2+}_{(aq)} \rightleftharpoons 2Ag^{+}_{(aq)} + Cu(s)$

$$E_{cell} = E^{o}_{cell} - \frac{0.0591}{n}\log\frac{[Ag^{+}]^2}{[Cu^{+2}]}$$

$$= 0.46 - \frac{0.0591}{n}\log\frac{(10^{-3})^2}{(10^{-1})}$$

$$= 0.46 - \frac{0.0591}{2}\log(10^{-5})$$

$$= 0.46 - \frac{0.0591}{2} \times (-5)$$

$$= 0.46 + 0.14775 = 0.60775 \text{ V}$$

21. Shanti, aa domestric helper of Mrs. Anuradha, fainted while mopping the floor. Mrs. Anuradha immediately took her to the nearby hospital where she was diagnosed to be severely 'anaemic.' The doctor prescribed an iron rich diet and multivitamins supplement to her. Mrs. Anuradha supported her financially to get the medicines. After a month, Shanti was diagnosed to be normal. **3**

After reading the above passage, answer the following questions :

(i) What values are displayed by Mrs. Anuradha ?

(ii) Name the vitamin whose deficiency causes 'pernicious anaemia'.

(iii) Give an example of waer soluble vitamin.

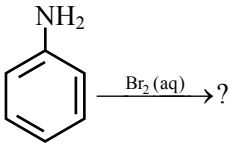
Sol. (i) Self

(ii) Vit-B_{12}

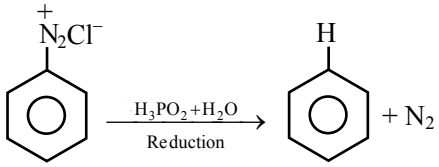
(iii) Vit – C

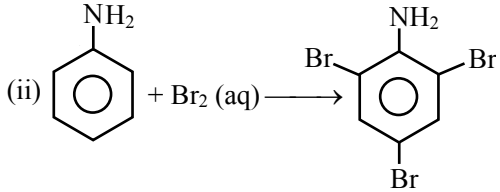
22. Write the main products of the following reaction : **3**

(i) $C_6H_5N_2^{+}Cl^{-} \xrightarrow{H_3PO_2 + H_2O} ?$

(ii)  $\xrightarrow{Br_2\,(aq)} ?$

(iii) $CH_3{-}\underset{\underset{O}{\|}}{C}{-}NH_2 \xrightarrow{Br_2 + NaOH} ?$

Sol. (i) 

(ii) 

(iii) $CH_3{-}\underset{\underset{O}{\|}}{C}{-}NH_2 + Br_2 + NaOH \longrightarrow CH_3{-}NH_2$

23. The rate of a reaction becomes four times when the temperature changes from 293 K to 313 K. Calculate the energy of activation (E_a) of the reaction assuming that it does not change with temperature. **3**
[R = 8.314 J K^{-1} $mole^{-1}$, log 4 = 0.6021]

Sol. $$\log \frac{K_2}{K_1} = \frac{E_a}{2.303R}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

$$\log 4 = \frac{Ea}{2.303 \times 8.314}\left(\frac{1}{293} - \frac{1}{313}\right)$$

$$0.6021 = \frac{Ea}{2.303 \times 8.314}\left(\frac{313 - 293}{293 \times 313}\right)$$

$$E_a = \frac{0.6021 \times 2.303 \times 8.314 \times 293 \times 313}{20}$$

= 52863.33 J
= 52.863 kJ.

24. For the complex $[NiCl_4]^{-2}$, write **3**
(i) The IUPAC name
(ii) The hybridization type
(iii) The shape of the complex
(Atomic no. of Ni = 28)

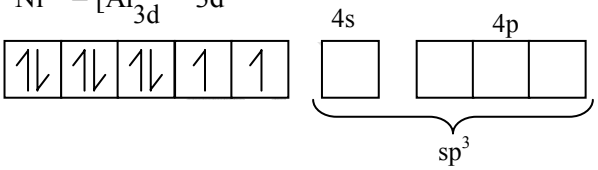
Or

What is meant by crystal field splitting energy ? On the basis of crystal field theory, write the electronic configuration of d4 in terms of t2g and eg in an octahedral field when
(i) $\Delta_0 > P$
(ii) $\Delta_0 < P$

Sol. (i) Tetrachloridonickelate(II)ion

(ii) $[NiCl_4]^{-2}$

$Ni^{+2} = [Ar] 4s^0 3d^8$



Cl^- is weak field ligand hence, pairing does not occur

Type of hybridization is sp^3

(iii) Tetrahedral

Or

It is the energy difference between lower energy and higher energy d-orbitals after splitting of d-orbitals

(i) $\Delta_0 > P$

t_{2g}^4 eg^0

(ii) $\Delta_0 < P$

t_{2g}^3 eg^1

25. Give reasons for the following : **3**

(i) Ethyl iodide undergoes S_{N^2} reaction faster than ethyl bromide.

(ii) (±) 2-Butanol is optically inactive.

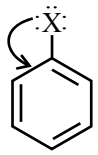
(iii) C — X bond length in halobenzene is smaller than C — X bond length in $CH_3 - X$.

Sol. (i) Because in ethyl iodide, iodide (I) is act as a best L.G. among all the halide ion.

Rate of S_{N^2} reaction $\propto$ L.G. ability of L.G.

(ii) (±) 2-butanol is a racemic mixture which is optically inactive due to external compensation.

(iii) Due to resonance in halobenzene it have less bond length value in comparsion to CH_3–X



CH_3—X:

26. (i) What class of drug is Ranitidine ? **3**

(ii) If water contains dissolved Ca^{2+} ions, out of soaps and synthetic detergents, which will you use for cleaning clothes ?

(iii) Which of the following is an antiseptic ?

0.2% phenol, 1% phenol

Sol. (i) It is a Antacid

(ii) In this case we use synthetic detergents because it gives foams with hard water

(iii) 0.2% phenol is act as antiseptic.

27. Given reasons for the following : **3**

(i) Oxygen is a gas but sulphur is a solid

(ii) O_3 acts as a powerful oxidizing agent

(iii) BiH_3 is the strongest reducing agent amongst all the hydrides of group 15 elements

Sol. (i) In oxygen discrete O_2 molecules are present while sulphur is polymeric

(ii) O_3 acts as a powerful oxidizing agent because it can produce nascent oxygen [O]

(iii) As we move top to bottom in hydrides of group 15 bonds length increases. Chance of H-removal also increases hence chance of oxidation increases and BiH_3 is the strongest reducing agent amongst all the hydrides of group 15.

28. (a) How will you convert the following : **5**

(i) Propanone to Propan-2-ol

(ii) Ethanal to 2-hydroxy propanoic acid

(iii) Toluene to benzoic acid

(b) Give simple chemical test to distinguish between :

(i) Pentan-2-one and Pentan-3-one

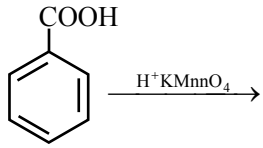
(ii) Ethanal and Propananl

OR

(a) Write the products of the following reactions :

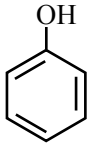
(i) $CH_3–\underset{\underset{O}{\|}}{C}–CH_3 \xrightarrow[\text{सान्द्र HCl}]{Zn–Hg} ?$

(ii) $CH_3–\underset{\underset{O}{\|}}{C}–Cl + H_2 \xrightarrow{Pd–BaSO_4} ?$

(iii)  $\xrightarrow{H^+KMnnO_4}$

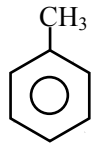
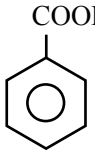
(b) Which acid of each pair shown here would you expect to be stronger ?

(i) $F – CH_2 – COOH$ or $Cl – CH_2 – COOH$

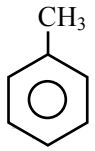
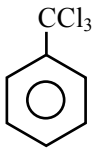
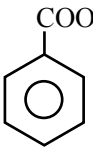
(ii)  or CH_3COOH

Sol. (a) (i) $\begin{matrix}CH_3\\CH_3\end{matrix}\!\!>\!C=O \xrightarrow[NaBH_4]{H_2/Ni/LiAlH_4/} \begin{matrix}CH_3\\CH_3\end{matrix}\!\!>\!\underset{H}{\overset{OH}{C}}$

(ii) $CH_3–\underset{H}{\overset{}{C}}=O \xrightarrow{HCN} CH_3–\underset{H}{\overset{CN}{C}}–OH \xrightarrow{2H_2O/H^+} CH_3–\underset{H}{\overset{COOH}{CH}}–OH$

(iii)  $\xrightarrow{H^+KMnnO_4}$ 

OR

 $\xrightarrow[hv]{Cl_2\ (Excess)}$  $\xrightarrow{aq.KOH}$ 

(b) (i) Pentane 2-one gives +ve iodoform test but not pentane 3-one

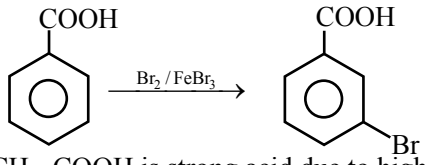
(ii) Ethanal gives +ve iodoform test but not propanal

OR

(a) (i) $CH_3–\underset{\underset{O}{\|}}{C}–CH_3 \xrightarrow[Con.HCl]{Zn–Hg} CH_3 – CH_2 – CH_3$

Clemenson's Reduction

(ii) $CH-\underset{\underset{O}{\|}}{C}-Cl + H_2 \xrightarrow[\text{Rosenmund's Reduction}]{Pd-BaSO_4} CH_3 - CHO$

(iii) 

(b) (i) F-CH_2–COOH is strong acid due to high -I power of F.
(ii) CH_3–COOH, due to more stable conjugate base CH_3–COO^-

29. (a) State Raoult's law for a solution containing volatile components. How does Raoult's law become a special case of Henry's law ?

(b) 1.00 g of a non-electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.40 K. Find the molar mass of the solute. (K_f for benzene = 5.12 K kg mol^{-1}) **5**

OR

(a) Define the following terms :
(i) Ideal solution
(ii) Azeotrope
(iii) Osmotic pressure

(b) A solution of glucose ($C_6H_{12}O_6$) in water is labelled as 10% by weight. What would be the molality of the solution ?
(Molar mass of glucose = 180 g mol^{-1})

Sol. (a) According to Raoults law vapour pressure of a component is directly proportional to its mole fraction at a particular temperature

$$P_A \propto x_A$$

$$P_A = P_A^O x_A$$

Similarly $P_B = P_B^O x_B$

$\therefore$ $P_T = P_A^O x_A + P_B^O x_B$

In Henry's law mole fraction of a gas at a particular temp. is proportional to the pressure exerted over gas

$$P_{gas} = k\, x_{gas}$$

$\therefore$ we can says for volatile substance it is a special case of Henry's law

(b) $\Delta T_f = K_f\, m$

$$\Delta T_f = K_f \cdot \frac{W_B}{M_B} \times \frac{1000}{W_A}$$

$$0.40 = 5.12 \times \frac{1}{M_B} \times \frac{1000}{50}$$

$$M_B = \frac{512}{2} = 256 \text{ g/mol.}$$

OR

(a) (i) Ideal solution : Ideal solution is that solution which follows Raoults law.
In ideal solutions like force of attraction are equals to unlike force of attraction and therefore
(i) $\Delta H_{mixing} = 0$
(ii) $\Delta V_{mixing} = 0$
(iii) $\Delta S_{mixing} > 0$

(ii) Azeotrope : At a particular conc. the mixture two or more than two components boils at constant temp. Such mixture is called as azeotropic mixture.

The components of the azeotropic mixture cannot be seperated by distillation.

(iii) Osmotic pressure : When two solution (of same solvent) having different conc. are seperated by semipermeable membrane the solvent particles moves from less conc. to more conc. It results in rising of liquid level on more conc. side

$\therefore$ amount of external pressure required to be applied on more conc. side to stop the movement of solvent particles in called as osmotic pressure

(b) $\text{Molality} = \dfrac{\%\,\text{by wt}}{\text{mol. mass}} \times \dfrac{1000}{(100 - \%\ \text{w/w})}$

$= \dfrac{10}{180} \times \dfrac{(1000)}{(100-10)}$

$= \dfrac{10}{180} \times \dfrac{1000}{90} = 0.617$ m.

30. (a) Given reasons for the following : **5**

(i) Mn^{3+} is a good oxidizing agent

(ii) $E^{o}_{M^{2+}/M}$ values are not regular for first row transition metals (3d series)

(iii) Although 'F' is more electronegative than 'O', the highest Mn fluoride is MnF_4, whereas the highest oxide is Mn_2O_7

(b) Complete the following equation :

(i) $2\,CrO_4^{2-} + 2H^+ \longrightarrow$

(ii) $KMnO_4 \xrightarrow{\text{heat}}$

Or

(a) Why do transition elements show variable oxidation states ?

(i) name the elements showing maximum number of oxidation states among the first series of transtition metals from Sc (Z = 21) to Zn (Z=30)

(ii) Name the element which shows only +3 oxidation state

(b) What is lanthanide contraction ? Name an important alloy which contains some of the lanthanoid metals

Sol. (a) (i) Because +2 oxidation state of Mn is more stable than +3

$Mn^{+3} \xrightarrow{\text{Reduction}} Mn^{+2}$

(ii) Because values of $IE_1 + IE_2$ are not regular for first row transition metals (3d series)

(iii) O can form mutltiple bonds while F can form single bond

(b) (i) $2CrO_4^{-2} + 2H^+ \longrightarrow Cr_2O_7^{-2}$

(ii) $KMnO_4 \xrightarrow{\Delta} K_2MnO_4 + MnO_2 + O_2$

Or

(a) Due to partially filled inner d-subshell

(i) Mn

(ii) Sc

(b) As atomic number increases atomic or ionic radius gradually decreases in lanthanoids, it is called as lanthanoid cantraction Misch metal is an alloy which contains some lanthanoid metals