CBSE
Class XII Chemistry
Sample Paper 1

Time: 3 Hors **Total marks: 70**

General Instructions:

- There are 33 questions in this sample paper. All questions are compulsory.
- Section A: Q. Nos. 1 to 2 are case-based questions having four MCQs or Reason Assertion type based on given passage each carrying 1 mark.
- Section A: Question 3 to 16 are MCQs and Reason Assertion type questions carrying 1 mark each.
- Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.
- Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.
- Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.
- Use of calculators and log tables is not permitted.

Section A

1. Read the given passage and answer the following questions.

Every generation of each and every species resembles its ancestors in many ways. It has been observed that the nucleus of a living cell is responsible for this transmission of inherent characters, also called heredity. The particles in the nucleus of the cell, responsible for heredity, are called chromosomes which are made of proteins and another type of biomolecules called nucleic acids. These are mainly of two types DNA and RNA. Since nucleic acids are long chain polymers of nucleotides, they are also called polynucleotides. James Watson and Francis Crick gave a double helix structure for DNA.

(i) Which sugars are present in DNA and RNA?
   a) β-D-2-deoxyribose, β-D-ribose
   b) β-D-2-deoxyribose, β-L-ribose
   c) α-D-2-deoxyribose, β-D-ribose
   d) α -D-2-deoxyribose, α -D-ribose

(ii) What are the different types of RNA?
   a) r-RNA, t-RNA, g-RNA
   b) m-RNA, r-RNA, a-RNA
   c) t-RNA, m-RNA, r-RNA
   d) t-RNA, n-RNA, m-RNA

(iii) What type of bond is present to keep DNA strands complementary to each other?
   a) Covalent bond
   b) Hydrogen bond
   c) Metallic bond
   d) Ionic bond

(iv) What are the bases present in DNA?

a) A, G, C, T
b) A, T, C, U
c) D, T, C, G
d) A, T, C, G

2. Read the passage given below and answer the following questions:

The amount of moisture that leather adsorbs or loses is determined by temperature, relative humidity, degree of porosity, and the size of the pores. Moisture has great practical significance because its amount affects the durability of leather, and in articles such as shoes, gloves, and other garments, the comfort of the wearer. High moisture content accelerates deterioration and promotes mildew action. On the other hand, a minimum amount of moisture is required to keep leather properly lubricated and thus prevent cracking.

The study indicates that adsorption of moisture by leather is a multi-molecular process and is accompanied by low enthalpies of adsorption. Further 75-percent relative humidity the adsorption is a function of surface area alone. Untanned hide and chrome-tanned leathers have the largest surface areas. The leathers tanned with the vegetable tanning materials have smaller surface areas since they are composed of less hide substance and the capillaries are reduced to smaller diameters, in some cases probably completely filled by tanning materials. This process of tanning occurs due to mutual coagulation of positively charged hide with negatively charged tanning material. The result of the study indicated that untanned hide and chrome-tanned leather adsorb the most water vapour.

(Source: Kanagy, J. R. (1947). Adsorption of water vapor by untanned hide and various leathers at 100 F. Journal of Research of the National Bureau of Standards, 38(1), 119-128.)

In these questions (Q. No 5-8, a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices).

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
c) Assertion is correct statement but reason is wrong statement.
d) Assertion is wrong statement but reason is correct statement.

(i) Assertion: Vegetable tanned leather cannot adsorb a large amount of moisture.
Reason: Porous materials have higher surface area.

(ii) Assertion: Animal hide soaked in tannin results in hardening of leather.
Reason: Tanning occurs due to mutual coagulation.

(iii) Assertion: Adsorption of moisture by leather is physisorption.
Reason: It is a multimolecular process and is accompanied by low enthalpies of Adsorption.

(iv) Assertion: The vegetable tanning materials have smaller surface areas

Reason: The capillaries present in leather are reduced to smaller diameters

OR

Assertion: Leather absorbs different amount of moisture.

Reason: Some moisture is necessary to prevent cracking of leather.

Questions 3 to 11 are multiple choice questions carrying 1 mark each:

3. What is the P-P-P bond angle in the P_4 molecule in degrees?

a) 90
b) 120
c) 45
d) 60

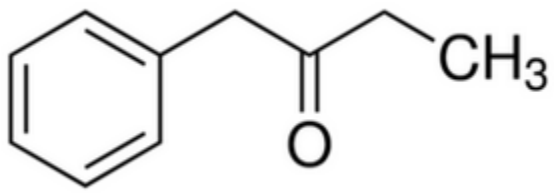
4. What is the most common oxidation state for actinoids?

a) +2
b) +3
c) +5
d) +7

5. $[Pt(NH_3)_4Cl_2]Br_2$ and $[Pt(NH_3)_4Br_2]Cl_2$ is a type of

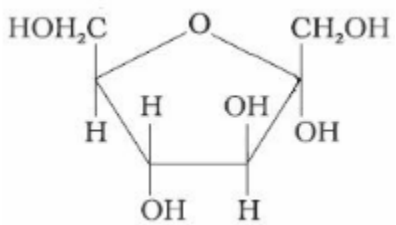
a) Linkage isomer
b) Ionisation isomer
c) Structural isomer
d) Coordinate isomer

6. What is the IUPAC name of the compound shown below?



a) Ethyl benzyl ketone
b) Methyl phenyl ketone
c) Diphenyl ketone
d) 1-phenyl-2-butanone

7. Identify the following compound:



a) α-D-(-) Fructofuranose
b) β-D-(-) Fructofuranose
c) α-D-(+) Glucopyranose
d) β-D-(+) Glucopyranose

8. Which of the following is the reason for Zinc not exhibiting variable oxidation state?
a) inert pair effect
b) completely filled 3d subshell
c) completely filled 4s subshell
d) common ion effect

OR

Which of the following is a diamagnetic ion? (Atomic numbers of Sc, V, Mn and Cu are 21, 23, 25 and 29 respectively)
a) V^{2+}
b) Sc^{3+}
c) Cu^{2+}
d) Mn^{3+}

9. Propanamide on reaction with bromine in aqueous NaOH gives:
a) Propanamine
b) Etanamine
c) N-Methyl ethanamine
d) Propanenitrile

OR

IUPAC name of product formed by reaction of methyl amine with two moles of ethyl chloride
a) N,N-Dimethylethanamine
b) N,N-Diethylmethanamine
c) N-Methyl ethanamine
d) N-Ethyl ,N-methylethanamine

10. Ambidentate ligands like NO_2^- and SCN- are:
a) unidentate
b) didentate
c) polydentate
d) has variable denticity

OR

The formula of the coordination compound Tetraammineaquachloridocobalt(III) chloride is
a) $[Co(NH_3)_4(H_2O)Cl]Cl_2$
b) $[Co(NH_3)_4(H_2O)Cl]Cl_3$
c) $[Co(NH_3)_2(H_2O)Cl]Cl_2$
d) $[Co(NH_3)_4(H_2O)Cl]Cl$

11. Which set of ions exhibit specific colours? (Atomic number of Sc = 21, Ti = 22, V=23, Mn =25 , Fe = 26, Ni = 28 Cu = 29 and Zn =30)

a) Sc^{3+}, Ti^{4+}, Mn^{3+}
b) Sc^{3+}, Zn^{2+}, Ni^{2+}
c) V^{3+}, V^{2+}, Fe^{3+}
d) Ti^{3+}, Ti^{4+}, Ni^{2+}

In the following questions (Question number 12 to 16) a statement of assertion is followed by a statement of reason is given. Choose the correct answer out of the following choices.

(a) Both assertion and reason are correct, and the reason is the correct explanation of the assertion.
(b) Both assertion and reason are correct, but the reason is not the correct explanation of the assertion.
(c) Assertion is correct, but reason is wrong.
(d) Assertion is wrong, but reason is correct.

12. Assertion: Decreasing concentration by dilution increases the equivalence conductance of aqueous NaCl solution.
Reason: With dilution, degree of ionisation of NaCl increases.

13. Assertion: $MgCO_3$ is soluble in water when a current of CO_2 is passed.
Reason: The solubility of $MgCO_3$ is due to the formation of $Mg(HCO_3)_2$.

14. Assertion: A pink-coloured solution of potassium permanganate turns green on passing O_3 through it.
Reason: K_2MnO_4 is oxidised by O_3 to $KMnO_4$.

15. Assertion: Ozonolysis of 3-hexyne followed by hydrolysis gives propanoic acid.
Reason: The byproduct H_2O_2 oxidises ozonide to acid.

16. Assertion: Benzonitrile is prepared by the reaction of chlorobenzene with potassium cyanide.
Reason: Cyanide (CN^-) is a strong nucleophile.

Section B

The following questions Q. No. 17-25 are short answer type and carry 2 marks each.

17. State Henry's law. What is the significance of K_H?

Or

What is the value of van't Hoff factor for a dilute solution of K_2SO_4 in water?

18. Account for the following:

(a) Alkaline medium inhibits the rusting of iron.

(b) Iron does not rust even if the zinc coating is broken in galvanised iron pipes.

19. Calculate the overall order of a reaction which has the rate expression

(a) Rate = $k[A]^{1/2}[B]^{3/2}$

(b) Rate = $k[A]^{3/2}[B]^{-1}$

20. Complete the following chemical reaction equations:

(a) $XeF_2 + H_2O \rightarrow$

(b) $PH_3 + HgCl_2 \rightarrow$

21. What happens when

(a) Phenol reacts with Br_2 in CS_2 at 273 K.

(b) Phenol reacts with conc. HNO_3.

22. Out of acetophenone and benzophenone, which gives a positive iodoform test? Write the reactions involved.

OR

Draw the structures of the following compounds:

(a) 3-methyl butanal

(b) 4-chloropentan-2-one

23. Assign a reason for each of the following statements:

(a) Ammonia is a stronger base than phosphine

(b) Sulphur in the vapour state exhibits paramagnetic behaviour.

24. Chromium crystallises in BCC structure. If its atomic diameter is 245 pm, find its density. (Atomic mass of Cr = 52 amu and $N_A = 6.02 \times 10^{23}\ mol^{-1}$)

25.

(a) Why are deltas formed at places where the river meets the sea?

(b) List two characteristics of catalysts.

Section C

Q. No. 26-30 are short answer type II carrying 3 marks each.

26.

(a) Answer the following questions:

What is meant by chirality of a compound? Give an example.

(b) Which of the following compounds is more easily hydrolysed by KOH and why?

$CH_3CHClCH_2CH_3$ or $CH_3CH_2CH_2Cl$

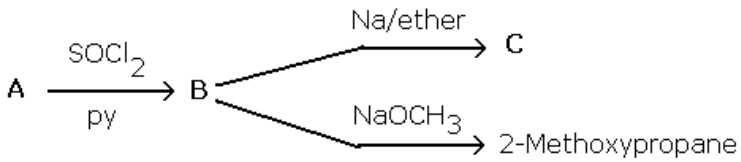
(c) Which one undergoes S_N2 substitution reaction faster and why?

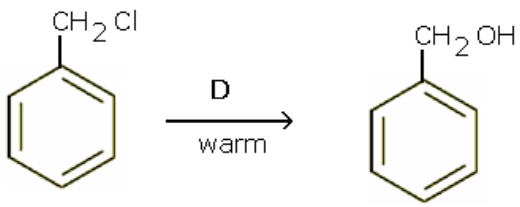
and

OR

(a) Give a chemical test to distinguish between chlorobenzene and benzyl chloride.

(b) Identify A, B, C and D:





27.

(a) Give the equation of the following reactions:

Oxidation of propan-1-ol with alkaline $KMnO_4$ solution

(b) Bromine in CS_2 with phenol

(c) Dilute nitric acid with phenol

28. In the following cases, rearrange the compounds as directed:

(a) In the increasing order of basic strength:

$C_6H_5NH_2$, $C_6H_5N(CH_3)_2$, $(C_2H_5)_2NH$ and CH_3NH_2

(b) In the decreasing order of basic strength:

Aniline, p-nitroaniline and p-toluidine

(c) In the increasing order of pK_b value:

$C_2H_5NH_2$, $C_6H_5NHCH_3$, $(C_2H_5)_2NH$ and $C_6H_5NH_2$

29. Name three fat-soluble vitamins, their source and the diseases caused by their deficiency in the diet.

OR

Explain the following terms:

(a) Peptide linkage

(b) Pyranose structure of glucose

(c) Glycosidic linkage

30. Explain the following observations:

(a) Lyophilic colloid is more stable than lyophobic colloid.

(b) Coagulation takes place when sodium chloride solution is added to a colloidal solution of ferric hydroxide.

(c) The sky appears blue.

Section D

Q. No. 31 to 33 are long answer type carrying 5 marks each.

31.

(a) Name two transition elements which show +1 oxidation state.

(b) Name the transition element which does not exhibit variable oxidation state.

(c) Transition elements show catalytic properties. Why?

(d) Explain why Cu^{+} ion is not stable in aqueous solutions.

OR

(a) Write the steps involved in the preparation of

(i) Na_2CrO_4 from chromite ore

(ii) K_2MnO_4 from pyrolusite ore

(b) What is the effect of increasing pH on $K_2Cr_2O_7$ solution?

(c) Draw the structure of dichromate ion indicating the bond angles and bond lengths.

32. The emf of the cell reaction

$3Sn^{4+} + 2\ Cr \rightarrow 3Sn^{2+} + 2Cr^{3+}$ is 0.89 V.

Calculate:

(a) ΔG^{θ} for the reaction.

(b) Equilibrium constant for the reaction relating to

(i) ΔG^{θ}

(ii) E^{θ} cell

OR

Given:

$Cu^{2+} + 2e^{-} \rightarrow Cu\ E^{\theta} = +0.34$ V

$Ag^{+} + e^{-} \rightarrow Ag\ E^{\theta} = +0.80$ V

(a) Write the cell reaction.

(b) Construct the galvanic cell.

(c) For what concentration of Ag+ ions will the emf of the cell be zero at 25°C if the concentration of Cu^{2+} is 0.01 M?

33.

(a) Ethanol reacts with acetic acid in the presence of conc. H_2SO_4 to give a sweet-smelling substance. Give the equation involved in the reaction.

(b) Write a note on

(i) Rosenmund's reduction

(ii) Hell–Volhard–Zelinsky reaction

OR

(a) Complete the equations:

(i) $CH_3CH_2COOH \xrightarrow{NH_3} A \xrightarrow{Br_2/KOH} B$

(ii) $(CH_3)C=O \xrightarrow{HCN} X \xrightarrow{H_2/Ni} Y$

(iii) $C_6H_5CHO + CH_3COCH_3 \xrightarrow{dil\ OH^-} C + D$

(b) Semicarbazide contains two NH_2 groups, but only one participates in the reaction with carbonyl compounds. Why?

(c) Which of the two—pentan-2-one or pentan-3-one—will give a yellow precipitate with iodine and sodium hydroxide?

CBSE
Class XII Chemistry
Sample Paper 1 - Solution

Section A

1.

(i) (c) Sugar present in DNA is β-D-2-deoxyribose and sugar present in RNA is β-D-ribose.

(ii) (b) RNA molecules are of three types, and they are named messenger RNA (m-RNA), ribosomal RNA (r-RNA) and transfer RNA (t-RNA).

(iii) (b) Hydrogen bonds are present to keep DNA strands complementary to each other.

(iv) (a) DNA contains four bases: adenine (A), guanine (G), cytosine (C) and thymine (T).

2.

(i) (b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
Vegetable tanned leather cannot adsorb a large amount of moisture because tanning reduces its surface area and hence there are less residual charges due to less surface area which causes less adsorption by leather.
Leather is a porous material which can adsorb high amount of moisture due to more surface area. To overcome this tanning is done.
Hence both the statements are true but reason is not the correct statement of the assertion.

(ii) (a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
As already mentioned in the paragraph Tanning occurs due to mutual coagulation of positively charged animal hide with negatively charged tannin material. This tanning provides hardness to leather as the positive and negative charges cancel out each other and no residual charges on surface are left for adsorbing moisture.

(iii) (a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
This is because the adsorption enthalpy is low for physisorption that ranges between 20KJ to 80KJ. Due to the formation of Vander Waal's forces physisorption involves the formation of a multimolecular layer on the surface.

(iv) (a) Assertion and reason both are correct statements and reason is correct explanation for assertion. The vegetable tanning materials have larger surface areas because the capillaries present in leather are reduced to smaller diameters.

OR

(b) Assertion and reason both are correct statements and reason is not a correct explanation for assertion. Leather absorbs different amount of moisture. Some moisture is necessary to prevent cracking of leather.

3. (d) The P-P-P bond angle in a tetrahedral P4 molecule is only 60^{o}.

4. (b) The most common oxidation state for actinoids is +3.

5. (b) $[Pt(NH_3)_4Cl_2]\ Br_2$ and $[Pt(NH_3)_4Br_2]\ Cl_2$ are types of ionisation isomers.

6. (d) 1-phenyl-2-butanone

7. (a) The given carbohydrate is α-D-(-) Fructofuranose. This is because the -OH group is present on the right hand side.

8. (b) Electronic configuration of zinc- [Ar] $3d^{10}\ 4s^2$, zinc is having completely filled d-subshell.

OR

(b) V^{+2} =[Ar] $3d^1\ 4s^0$ (1 unpaired electron)
Sc^{+3} =[Ar] $3d^0\ 4s^0$ (0 unpaired electron)
Cu^{+2}=[Ar] $3d^9\ 4s^0$ (1 unpaired electron)
Mn^{+3}=[Ar] $3d^4\ 4s^0$ (2 unpaired electrons)
So, Sc^{+3} is diamagnetic.

9. (b) Propanamide on reaction with bromine in aqueous solution gives NaOH solution.

OR

(d) When methyl ammine reacts with 2 moles of ethyl chloride it forms N-Ethyl, N-methylethanamine.

10. (a) NO_2^- and SCN^- are unidentate ligands.

OR

(a) $[Co(NH_3)_4(H_2O)Cl]Cl_2$ = Tetraammineaquachloridocobalt(III)

11. V^{+3}, V^{+2}, Fe^{+3} ions have unpaired electrons so they will exhibit specific colors.

12. (c) Assertion is correct, but reason is wrong.

13. (a) Both assertion and reason are correct, and the reason is the correct explanation of the assertion.

14. (d) Assertion is wrong, but reason is correct.

15. (a) Both assertion and reason are correct, and the reason is the correct explanation of the assertion.

16. (d) Assertion is wrong, but reason is correct.

Section B

17. Henry's law: The partial pressure of the gas in the vapour phase (p) is proportional to the mole fraction of the gas (x) in the solution. It is expressed as

$P = K_H x$

where K_H is Henry's constant.

Significance of K_H: Higher the value of Henry's law constant K_H, lower is the solubility of the gas in the liquid.

OR

In dilute solutions, $K_2SO_4 \longrightarrow 2K^+ + SO_4^{2-}$

$$\text{van't Hoff Factor, } i = \frac{\text{No. of moles of particles after dissociation}}{\text{No. of moles of particles before dissociation}} = \frac{3}{1} = 3$$

18.

(a) Alkalinity of the solution prevents the availability of H^+ ions.

(b) A galvanised substance is that which has been coated with a layer of zinc to delay corrosion. Zinc gets corroded instead of the substance.

The outer layer of zinc of any galvanised material reacts with atmospheric oxygen to form zinc oxide (ZnO), which is stronger than zinc. Thus, even if the outer layer of zinc undergoes corrosion, the material is getting coated with a stronger substance (i.e. ZnO) and is thus better able to resist corrosion.

19.

(a) $\text{Order} = \frac{1}{2} + \frac{3}{2} = 2$, i.e., second order

(b) $\text{Order} = \frac{3}{2} + (-1) = \frac{1}{2}$, i.e., half order

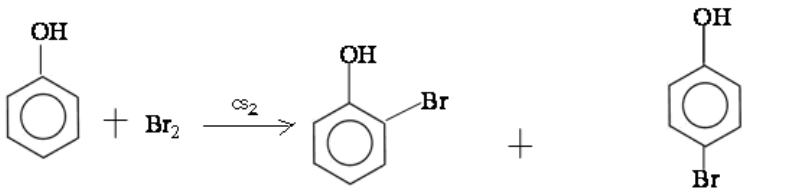
20.

(a) $2XeF_2 + 2H_2O \rightarrow 2Xe + 4HF + O_2$

(b) $2PH_3 + 3HgCl_2 \rightarrow Hg_3P_2 + 6HCl$

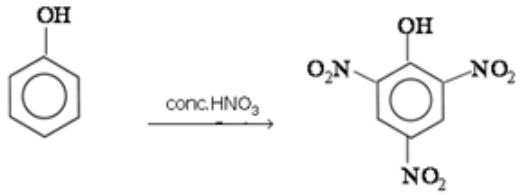
21.

(a) When phenol reacts with Br_2 in CS_2 at 273 K, a mixture of o- and p-bromophenol is formed in which p-bromophenol is the major product.



o - Bromophenol p - Bromophenol

(b) When phenol reacts with conc. HNO_3, 2,4,6-trinitrophenol is formed.



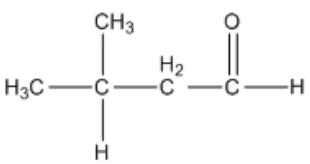
22. Acetophenone ($C_6H_5COCH_3$) contains the group ($-CH_3CO$) and hence gives the iodoform test, while benzophenone does not contain this group and hence does not give the iodoform test:

$$\underset{\text{Acetophenone}}{C_6H_5COCH_3} + 3I_2 + 4NaOH \longrightarrow \underset{\text{Idoform}}{CHI_3} + C_6H_5COONa + 3NaI + 3H_2O$$

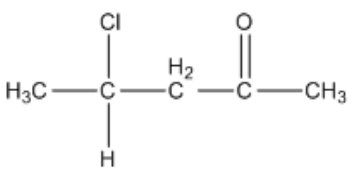
$$\underset{\text{Benzophenone}}{C_6H_5COC_6H_5} + 3I_2 + 4NaOH \longrightarrow \text{No Reaction}$$

OR

(a)



(b)



23.

(a) The lone pair of electrons on the N atom in NH_3 is directed and not diffused/delocalised as it is in PH_3 due to larger size of P/or due to availability of d-orbitals in P.

(b) Under ordinary conditions, sulphur exists as S_8 in the solid state.
In the vapour state, sulphur partly exists as S_2 molecule. The S_2 molecule like O_2 has two unpaired electrons in the anti-bonding P orbital and hence exhibits paramagnetism.

24. Diameter = 245 pm

$$\therefore \text{Radius} = \frac{245}{2}\text{pm} = 122.5\text{ pm}$$

$$\text{In a bcc structure, } r = \frac{\sqrt{3}}{4}a$$

$$\therefore \quad 122.5 = \frac{\sqrt{3}}{4}a$$

$$\therefore \quad a = \frac{122.5 \times 4}{\sqrt{3}} = \frac{490}{1.732} = 282.91\text{ pm}$$

$$d = \frac{z \times M}{a^3 \times N_A} = \frac{2 \times 52}{(282.91 \times 10^{-10})^3 \times 6.02 \times 10^{23}}$$

$$= \frac{104}{2.264 \times 10^{-23} \times 6.02 \times 10^{23}} = \frac{104}{2.264 \times 6.02} = 7.63\ g\ cm^{-3}$$

25.

(a) River water is muddy and contains charged colloidal particles of clay, sand and many other materials. Sea water contains a number of dissolved electrolytes. When sea water and river water come in contact with each other, the electrolytes present in sea water coagulate the suspended colloidal particles which ultimately settle at the point of contact. Thus, a delta is formed at the point where the river meets the sea.

(b) Characteristics of catalysts:

(i) Catalysts are highly selective. A catalyst is able to direct a reaction to give a particular product.

(ii) Catalysts are highly active. A catalyst is able to increase the rate of a chemical reaction.

Section C

26.

(a) Chiral molecules are those molecules which are non-superimposable on their mirror images, and this property is known as chirality. Butan-2-ol is an example of a chiral molecule.

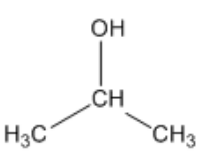
(b) Due to the –I effect of alkyl groups, the secondary carbanion ion $CH_3\text{-}\overset{+}{C}H\text{-}CH_2\text{-}CH_3$ derived from secondary butyl chloride is more stable than the primary carbonium ion $CH_3\text{-}CH\text{-}\overset{+}{C}H_2$ derived from n-propyl chloride. Therefore, secondary butyl chloride gets hydrolysed more easily than n-propyl chloride under S_N1 conditions.

(c) As iodine is a better leaving group because of its large size, it will be released at a faster rate in the presence of incoming nucleophiles.

OR

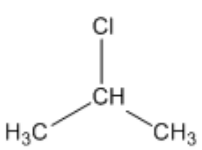
(a) Add a small amount of aqueous KOH to both compounds. Acidify with dil. HNO_3 and add $AgNO_3$. Benzyl chloride gives a white precipitate, while chlorobenzene does not.

(b)



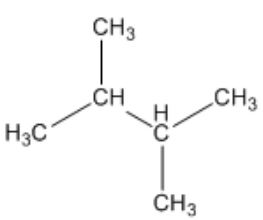
2-propanol

[A]



2-chloropropane

[B]



2,3-dimethylbutane

[C]

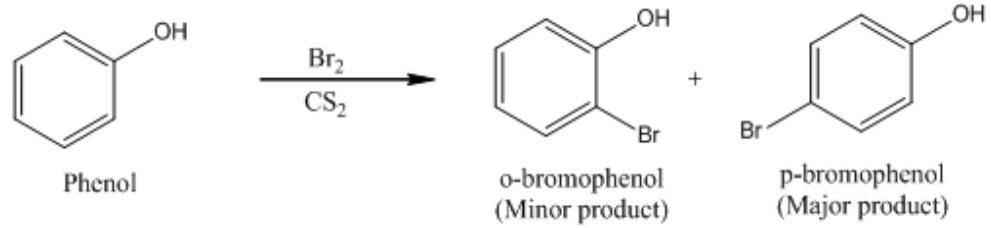
Aq. KOH

[D]

27.

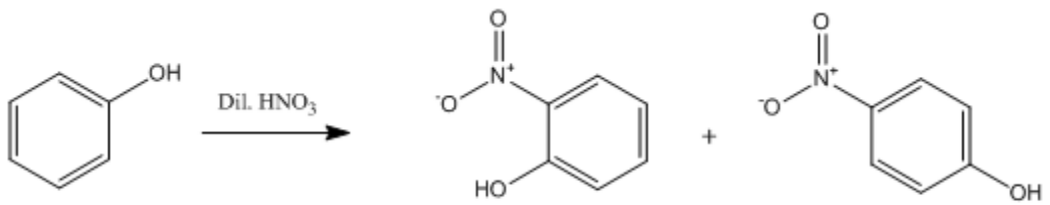
(a) $\underset{\text{Propan-1-ol}}{CH_3CH_2CH_2OH} + 2[O] \xrightarrow[\text{Oxidation}]{\text{Alkaline } KMnO_4} \underset{\text{Propanoic acid}}{CH_3CH_2COOH} + H_2O$

(b)



Phenol — o-bromophenol (Minor product) + p-bromophenol (Major product)

(c)



Phenol — o-nitroPhenol (Major product) + p-nitroPhenol (Minor product)

28.

(a) In the increasing order of basic strength: $C_6H_5NH_2 < C_6H_5N(CH_3)_2 < CH_3NH_2 < (C_2H_5)_2NH$

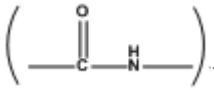
(b) In the decreasing order of basic strength: p-toluidine > Aniline > p-nitroaniline

(c) In the increasing order of pK_b value: $(C_2H_5)_2NH < C_2H_5NH_2 < C_6H_5NHCH_3 < C_6H_5NH_2$

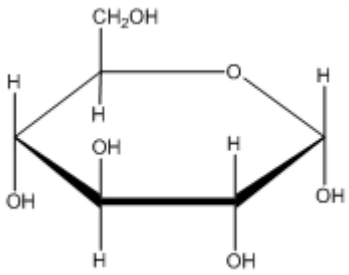
29.

Name of fat-soluble vitamins	Source	Deficiency Diseases
Vitamin A	Fish liver oil, carrots, milk	Xerophthalmia, night blindness
Vitamin D	Exposure to sunlight, fish and egg	Rickets and osteomalacia
Vitamin E	Vegetable oils like wheat germ oil, sunflower oil	Sterility and muscular atrophy

OR

(a) **Peptide linkage**: The  bond formed between two amino acid molecules with loss of water in a polypeptide linkage.

(b) **Pyranose structure of glucose:** The six-membered cyclic structure of glucose is called the pyranose structure (α- or β-), in analogy with the heterocyclic compound pyranose.



α-D-(+)-Glucopyranose

(c) **Glycosidic linkage:** The linkage between two monosaccharide molecules through the oxygen atom in a disaccharide or polysaccharide is known as a glycosidic linkage.

30.

(a) Lyophobic colloids are stable due to the presence of charge on the colloidal particles. Lyophilic colloids are more stable due to the charge as well as solvation of the colloidal particles.

(b) The charge of $Fe(OH)_3$ sol is positive, as the sol is coagulated only by negatively charged Cl^- present in the NaCl solution.

(c) The sky appears blue because of the scattering of light by dust particles. This is known as Tyndall effect.

Section D

31.

(a) Au and Hg can show +1 oxidation state.

(b) Scandium

(c) Transition elements exhibit variable oxidation state and can form complexes.

(d) Due to low charge density, Cu^+ has low enthalpy of hydration. Cu^+ in aqueous solution undergoes disproportionation.

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

The E^θ value for this is positive and the reaction is favourable.

OR

(a)

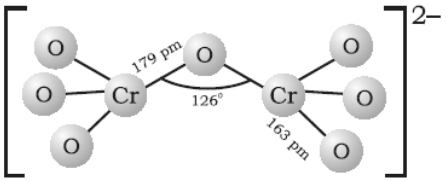
(i) $4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$

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

(b) On increasing pH, the solution turns yellow due to the formation of chromate ion.

$Cr_2O_7^{2-} + 2\ OH^- \rightarrow 2CrO_4^{2-} + H_2O$

(c)



Dichromate ion

32.

(a) The cell reaction is

$3Sn^{4+} + 2Cr \rightarrow 3Sn^{2+} + 2Cr^{3+}$

$\Delta G^{\theta} = -n F E^{\theta}_{cell}$

$E^{\theta}_{cell} = 0.89$ V

n = 6

F =96500 C mol^{-1}

$\Delta G^{\theta} = -(6) \times (96500) \times (0.89)$

$= -5.15 \times 10^5$

$= -5.15 \times 10^5$ J

(b) Calculation of K

(i) $\Delta G^{\theta} = -2.303$ RT log K

$\Delta G^{\theta} = -5.15 \times 10^5$ J , R = 8.314 J mol^{-1} K^{-1}, T = 298 K

$\log K = -\Delta G^{\theta} / 2.303$ RT

$= -(-5.15 \times 10^5 \text{ J}) / (2.303 \times 8.314 \text{ J mol}^{-1} \text{ K}^{-1} \times 298 \text{ K})$

log K = 90.259

$K = 1.8 \times 10^{90}$

(ii) $\log K = n F E^{\theta}_{cell}/2.303$ RT

$= (6) \times (96500 \text{ C mol}^{-1}) \times (0.89 \text{ V})$

$2.303 \times (8.314 \text{ J mol}^{-1} \text{ K}^{-1}) \times (298 \text{ K})$

$= 90.313$

$K = 2.05 \times 10^{90}$

OR

(a) Since the reduction potential of Ag^+/Ag is more than that of Cu^{2+}/Cu,

Ag^+ gets reduced to Ag at the cathode and Cu gets oxidised to Cu^{2+} at the anode.

At the cathode:

$2 Ag^+ + 2 e^- \rightarrow 2 Ag$

At the anode:

$Cu \rightarrow Cu^{2+} + 2 e^-$

Therefore, the net reaction is

$2Ag^+ + Cu \rightarrow 2Ag + Cu^{2+}$

(b) The cell is

$Cu(s) \mid Cu^{2+}(aq) \parallel Ag^+(aq) \mid Ag(s)$

(c) $E^{\theta}_{cell} = E^{\theta}_{Ag^+/Ag} - E^{\theta}_{Cu^{2+}/Cu}$

$= 0.80 - 0.34$

$= 0.46\ V$

$$E_{cell} = E^{\theta}_{cell} - \frac{0.059}{n} \log \frac{[Cu^{2+}]}{[Ag^+]^2}$$

$$E_{cell} = E^{\theta}_{cell} - \frac{0.059}{n} \log \frac{[Cu^{2+}]}{[Ag^+]^2}$$

$$0 = 0.46 - \frac{0.059}{2} \log \frac{0.01}{[Ag^+]^2}$$

$[Ag^+] = 1.59 \times 10^{-9}\ M$

33.

(a) $CH_3CH_2OH + CH_3COOH \xrightarrow{conc.\ H_2SO_4} CH_3COOCH_2CH_3 + H_2O$

(b)

(i) In Rosenmund's reaction, acid chlorides are subjected to catalytic hydrogenation in the presence of Pd supported over $BaSO_4$ to yield the corresponding aldehyde. The catalyst is poisoned by S or quinoline.

$$RCOCl + H_2 \xrightarrow{Pd, BaSO_4} RCHO + HCl$$

(ii) In the Hell–Volhard–Zelinsky reaction, carboxylic acids react with chlorine or bromine in the presence of a small amount of P to give α-halogenated carboxylic acids. The reaction requires the presence of α-hydrogen in the acid.

$$R\text{-}CH_2\text{-}COOH \xrightarrow[(ii)H_2O]{(i)X_2\ /\ Red\ phosphorous} R\text{-}\underset{\displaystyle X}{\underset{|}{CH}}\text{-}COOH$$

α - Halocarboxylic acid

(X = Cl, Br)

OR

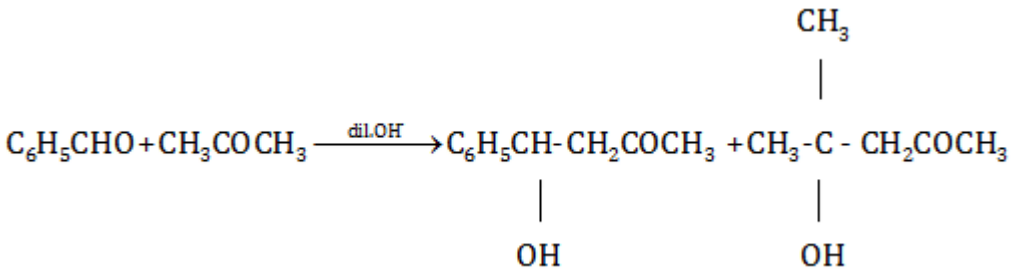
(a)

(i) $CH_3CH_2COOH \xrightarrow{NH_3} CH_3CH_2CONH_2 \xrightarrow{Br_2\ /\ KOH} CH_3CH_2NH_2$

(ii)

$$(CH_3)_2C{=}O \xrightarrow{HCN} \underset{\displaystyle CN}{\underset{|}{(CH_3)_2C\text{-}OH}} \xrightarrow{H_2/Ni} \underset{\displaystyle CH_2NH_2}{\underset{|}{(CH_3)_2C\text{-}OH}}$$

(iii)



(b) $NH_2CONHNH_2$ (semicarbazide) contains two NH_2 groups, but the one next to the CO group is involved in resonance with C=O and is thus not available.

(c) Pentan-2-one will give a yellow precipitate with iodine and sodium hydroxide because it contains the group.