

CBSE Class 12 Chemistry
Sample paper - 08 (2019-20)

Maximum Marks: 70

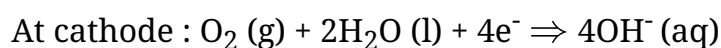
Time Allowed: 3 hours

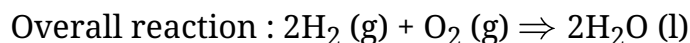
General Instructions:

- a. All questions are compulsory.
- b. Section A: Q.no. 1 to 16 are very short answer questions (objective type) and carry 1 mark each.
- c. Section B: Q.no. 17 to 23 are short answer questions and carry 2 marks each.
- d. Section C: Q.no. 24 to 30 are long answer questions and carry 3 marks each.
- e. Section D: Q.no. 31 to 33 are also long answer questions and carry 5 marks each.
- f. There is no overall choice. However an internal choice has been provided in two questions of two marks, two 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.
- g. Use log tables if necessary, use of calculators is not allowed.

Section A

1. Fuel cells convert the energy produced during the combustion of fuels directly into electrical energy. Probably the most successful fuel cell so far is a hydrogen-oxygen fuel cell, which has been used in spacecraft. The electrodes consist of porous screens of titanium coated with a layer of a platinum catalyst. Concentrated KOH or NaOH solution is placed between the electrodes to serve as the electrolyte. Hydrogen and oxygen gases are bubbled through the porous electrodes into the electrolyte solution. The following electrode reaction occur:





In this cell, the gaseous materials are consumed and continuously supplied. The thermodynamic properties of fuel cell reaction at 25°C are:

$$\Delta H^\circ = -285.8 \text{ kJ mol}^{-1}, \Delta G^\circ = -237.2 \text{ kJ mol}^{-1}, E^\circ = 1.23 \text{ V}$$

- i. What is the value of ΔS° for the fuel cell reaction at 25°C ?
 - ii. If the potential of the half cell reaction at cathode is $E^\circ = 0.41$, then what is the value of E° for the half cell reaction at the anode?
 - iii. If the concentrations of OH^- ions in the cell are doubled then what would happen to the cell potential?
 - iv. Calculate the thermodynamic efficiency of $\text{H}_2\text{-O}_2$ fuel cell
[Hint : $\frac{\Delta G}{\Delta H} = \frac{\Delta FE}{\Delta H}$]
 - v. The amount of a substance deposited by the passage by 1 amp of current for 1 second. This is equivalent to what?
2. Give the formula of:
- i. Haematite
 - ii. Magnetite.
3. What is the basic unit of proteins?
4. Write the sequence of bases in the complementary strand of the given strand - A G G C T T A A C C T.
5. Are proteins natural or synthetic polymers?
6. How does $> \text{C} = \text{C} <$ differ from $> \text{C} = \text{O}$ group in chemical reaction?
7. Victor Meyer test is not given by
- a. $(\text{CH}_3)_3\text{COH}$
 - b. $(\text{CH}_3)_2\text{CHOH}$
 - c. $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$

d. C_2H_5OH

8. Which among the following ores are not found on earth's crust?

a. Halides

b. Nitrides

c. Oxides

d. Sulphides

9. $KMnO_4$ is the oxo salt of

a. Mn_2O_3

b. MnO_3

c. Mn_2O_7

d. MnO_2

10. A group of atoms can function as a ligand only when

a. It is a small molecule

b. It is a compound

c. It is capable of acting as donor of electron pair

d. It is a positively charged ion

11. A large number of polymer applications in different fields depend on

a. elasticity

b. tensile strength

c. All of these

d. toughness

12. **Assertion:** Fats and oils are one of the main sources of food for all living organisms.

Reason: Lipids act as energy reserves.

- a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
- b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
- c. Assertion is CORRECT but, reason is INCORRECT.
- d. Assertion is INCORRECT but, reason is CORRECT.

13. **Assertion:** Camphor is usually used in molecular mass determination.

Reason: Camphor has low cryoscopic constant and therefore, causes greater depression in freezing point.

- a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
- b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
- c. Assertion is CORRECT but, reason is INCORRECT.
- d. Assertion is INCORRECT but, reason is CORRECT.

14. **Assertion:** Graphite is a good conductor of heat and electricity.

Reason: Free electrons are spread out in the structure of graphite.

- a. Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
- b. Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
- c. Assertion is CORRECT but, reason is INCORRECT.
- d. Assertion is INCORRECT but, reason is CORRECT.

15. **Assertion:** Tert. butyl methyl ether is not prepared by the reaction of tert. butyl bromide with sodium methoxide.

Reason: Sodium methoxide is a strong nucleophile.

- Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
- Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
- Assertion is CORRECT but, reason is INCORRECT.
- Assertion is INCORRECT but, reason is CORRECT.

16. **Assertion:** Addition of Br_2 to trans-2-butene yields meso-2,3-dibromobutane.

Reason: Bromine addition to an alkene is an electrophilic addition reaction.

- Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
- Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.
- Assertion is CORRECT but, reason is INCORRECT.
- Assertion is INCORRECT but, reason is CORRECT.

Section B

17. Write equation for the synthesis of Glyptal.

18. If the activation energy of a reaction is zero, will the rate of reaction still depend on temperature?

19. 45 g of ethylene glycol ($\text{C}_2\text{H}_6\text{O}_2$) is mixed with 600 g of water. Calculate

- the freezing point depression and
- the freezing point of the solution.

(Given, K_f of water = $1.86 \text{ K kg mol}^{-1}$)

20. Explain the role of complexes in metallurgy with an example.
21. Using IUPAC norms, write the formulae for the following complexes:
- Hexa aqua chromium (III) chloride
 - Sodium tri oxalato ferrate

OR

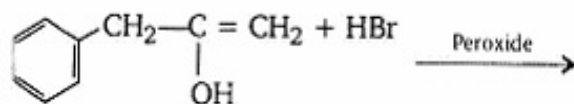
When a coordination compound $\text{CoCl}_3 \cdot 6\text{NH}_3$ is mixed with AgNO_3 , 3 moles of AgCl are precipitated per mole of the compound. Write

- structural formula of the complex.
 - IUPAC name of the complex.
22. i. Give an example of zone refining of metals.
ii. What is the role of cryolite in the metallurgy of aluminium?

OR

Describe the principle involved in each of the following processes:

- Mond's process for refining of nickel.
 - Column chromatography for purification of rare elements.
23. Write the product of the following reaction:



Section C

24. Calculate the mole fraction of benzene in solution containing 30% by mass in carbon tetrachloride.
25. Calculate the half-life of a first order reaction from their rate constants given below:
(i) 200 s^{-1} (ii) 2 min^{-1} (iii) 4 years^{-1}

OR

List the various important factors which affects the rate of reaction.

26. Three electrolytic cells A, B and C containing electrolytes of zinc sulphate, silver nitrate and copper sulphate respectively are connected in series. A steady current of 1.50 amperes was passed through them until 1.45 g of silver deposited at the cathode of cell B. How long did the current flow? What weight of copper and zinc get deposited? (Atomic weight: Cu=63.5 g mol⁻¹, Ag=108 g mol⁻¹ and Zn=65.3 g mol⁻¹)
27. Explain why NH₃ is basic while BiH₃ is only feebly basic.
28. Why is sulphuric acid not used during the reaction of alcohols with KI?
29. An aliphatic compound 'A' with a molecular formula of C₃H₆O reacts with phenylhydrazine to give compound 'B'. Reaction of 'A' with I₂ in alkaline medium on warming gives yellow precipitate 'C'. Identify the compounds A, B and C.

OR

Write the steps for the conversion of ethyl alcohol to acetone.

30. Low level of noradrenaline is the cause of depression. What type of drugs are needed to cure this problem? Name two drugs.

Section D

31. The resistance of a conductivity cell, when filled with 0.05 M solution of an electrolytes X, is 100 ohms at 40°C. The same conductivity cell filled with 0.01 M solution of electrolyte Y has a resistance of 50 ohms. The conductivity of 0.05 M solution of electrolyte X is $1.0 \times 10^{-4} S cm^{-1}$ calculate.
- Cell constant
 - Conductivity of 0.01 MY solution
 - Molar conductivity of 0.01 MY solution.

OR

Explain with an example how weak and strong electrolytes can be distinguished.

32. i. Write the structure of main products when aniline reacts with the following reagents :
- Br_2 water
 - HCl
 - $(\text{CH}_3\text{CO})_2\text{O}$ /pyridine
- ii. Arrange the following in the increasing order of their boiling point: $\text{C}_2\text{H}_5\text{NH}_2$, $\text{C}_2\text{H}_5\text{OH}$, $(\text{CH}_3)_3\text{N}$
- iii. Give a simple chemical test to distinguish between the following pair of compounds : $(\text{CH}_3)_2\text{NH}$ and $(\text{CH}_3)_3\text{N}$.

OR

- i. Write structures of different isomeric amines corresponding to the molecular formula, $\text{C}_4\text{H}_{11}\text{N}$.
- ii. Write IUPAC names of all the isomers.
- iii. What type of isomerism is exhibited by different pairs of amines?
33. i. Complete the following equations:
- $\text{Cr}_2\text{O}_7^{2-} + 2\text{OH}^- \longrightarrow$
 - $\text{MnO}_4^- + 4\text{H}^+ + 3\text{e}^- \longrightarrow$
- ii. Account the following:
- Zn is not considered as a transition element.
 - Transition metals form a large number of complexes.
 - The E^0 value for the $\text{Mn}^{3+}/\text{Mn}^{2+}$ couple is much more positive than that for $\text{Cr}^{3+}/\text{Cr}^{2+}$ couple.

OR

Give examples and suggest reasons for the following features of the transition metal chemistry:

- The lowest oxide of transition metal is basic, the highest is amphoteric/acidic.
- A transition metal exhibits highest oxidation state in oxides and fluorides.
- The highest oxidation state is exhibited in oxyanions of a metal.

CBSE Class 12 Chemistry
Sample paper - 08 (2019-20)

Answer
Section A

1. i. $\Delta G = \Delta H - T\Delta S$

$$\Delta S = \frac{\Delta G - \Delta H}{T}$$
$$= \frac{-273.2(-285.8)}{298}$$

$$= 163 \text{ JK}^{-1}\text{mol}^{-1}.$$

ii. $E_{\text{Cell}}^{\circ} = E_{\text{cathode}}^{\circ} - E_{\text{anode}}^{\circ}$

$$1.23 = 0.41 - E_{\text{cathode}}^{\circ}$$

$$\therefore E_{\text{anode}}^{\circ} = -0.82 \text{ V}$$

iii. Cell potential remains unchanged because the cell reaction doesn't involve OH⁻ ions concentration.

iv. $\frac{\Delta G}{\Delta H} = \frac{-nFE}{\Delta H}$

$$= \frac{-2 \times 96500 \times 1.23}{-285.8 \times 10^3} = 0.83 \text{ or } 83\%$$

v. It is equivalent to electrochemical equivalent.



3. The basic unit of all proteins is - amino acids.

4. The sequence of bases in the complementary sequence is - T C C G A A T T G G A

5. Proteins are natural polymers.

6. The ethylenic double bond differs from the carbonyl group in the following ways:

i. Halogen, halogen acids and H₂SO₄ undergo addition reactions, with ethylenic double bond but not with a carbonyl group.

ii. Ethylenic double bond undergoes electrophilic addition reactions while > C = O bond undergoes nucleophilic addition reactions.



Explanation: Victor Meyer's test: This test consists of the following steps.

- The given alcohol is first converted into its alkyl iodide by treating it with HI
- The alkyl iodide is then treated with silver nitrite (AgNO_2) to convert it into the corresponding nitroalkane.
- The nitroalkane is then treated with nitrous acid (HNO_2), i.e., $\text{NaNO}_2 + \text{HCl}$.
- The resulting solution is finally made alkaline with aqueous NaOH or KOH.

If blood red colouration appears it is a primary alcohol.

If blue colouration appears it is a secondary alcohol.

If the solution remains colorless, it indicates a tertiary alcohol.

8. (b) Nitrides

Explanation: Nitride ores not found in earth's crust.

9. (c) Mn_2O_7

Explanation: In Mn_2O_7 , each Mn is tetrahedrally surrounded by oxygen including Mn-O-Mn bridge.

10. (c) It is capable of acting as donor of electron pair

Explanation: Ligands are the ions/molecules bound to the central metal atom/ion in a coordination entity. These may be simple ions like Cl^- , small molecules like NH_3 , large molecules like ethane-1,2-diamine or even macromolecules like proteins. A ligand must be able to donate a pair of electrons to the central metal atom/ion and thus they act as Lewis bases.

11. (c) All of these

Explanation: A large number of polymer applications in different fields depend on their unique mechanical properties like tensile strength, elasticity, toughness, etc. These mechanical properties are governed by intermolecular forces, e.g., van der Waals forces and hydrogen bonds, present in the polymer.

12. (a) Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

Explanation: Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

13. (c) Assertion is CORRECT but, reason is INCORRECT.

Explanation: Assertion is CORRECT but, reason is INCORRECT.

14. (a) Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

Explanation: Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

15. (b) Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

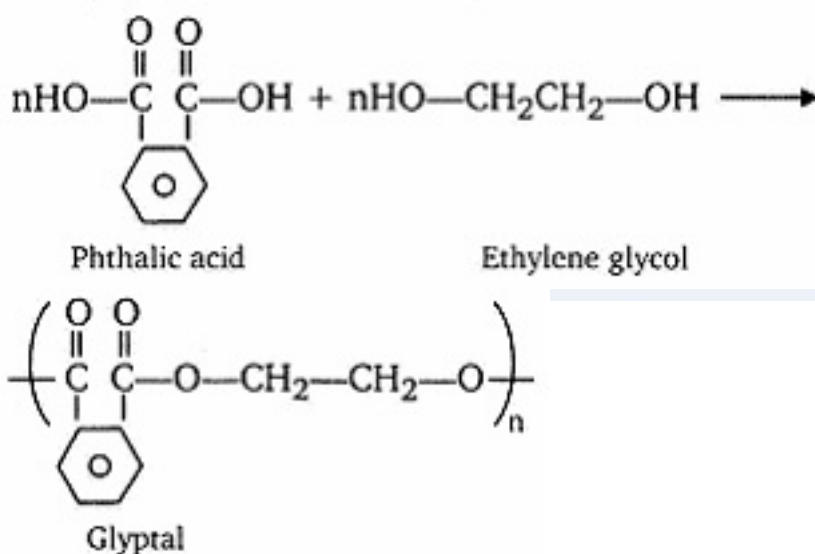
Explanation: Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

16. (b) Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

Explanation: Both assertion and reason are CORRECT but, reason is NOT THE CORRECT explanation of the assertion.

Section B

17. **Glyptal.** It is prepared by condensation of ethylene glycol and phthalic acid.



18. Rate of reaction will not depend upon the temperature if activation energy is zero. Mathematically,

$$k = Ae^{-E_a/RT}$$

When $E_a = 0$

$$k = Ae^{-0/RT}$$

or,

$k = A$, where A is Arrhenius factor or the frequency factor. It is a constant specific to a particular reaction.

19. Given, $W_1 = 600 \text{ g}$, $K_f = 1.86 \text{ K kg mol}^{-1}$

$W_2 = 45 \text{ g}$, $M_2 = 62.0 \text{ g mol}^{-1}$

T_f^o (water) = 273 k

$$\begin{aligned} \text{i. } \Delta T_f &= \frac{K_f \times W_2 \times 1000}{M_2 \times W_1} \\ &= \frac{1.86 \text{ K kg mol}^{-1} \times 45 \text{ g} \times 1000}{62 \text{ g mol}^{-1} \times 600 \text{ g}} \end{aligned}$$

$$\Delta T_f = 2.25 \text{ k}$$

$$\text{ii. } \Delta T_f = T_f^o - T_f$$

$$T_f = 273 \text{ K} - 2.25 \text{ K} = 270.75 \text{ K}$$

20. Some extraction processes make use of complex formation e.g. during metallurgy of Gold, it combines with cyanide in the presence of oxygen and water to form the complex $[\text{Au}(\text{CN})_2]^-$ in aqueous solution by addition of zinc.

21. i. Formula of Hexa aqua chromium (III) chloride is $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$

ii. Formula of Sodium tri oxalato ferrate is $\text{Na}_3[\text{Fe}(\text{ox})_3]$

OR

i. When one mole of $\text{CoCl}_3 \cdot 6\text{NH}_3$ is mixed with AgNO_3 , three moles of AgCl are precipitated which indicates that three ionisable chloride ions in the complex are present. Hence, its structural formula is $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$.

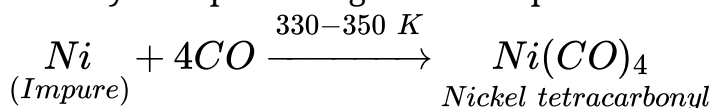
ii. IUPAC name of the complex $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ is Hexa ammine cobalt (III) chloride.

22. i. Zone-refining method is used for the production of semiconductors and various other metals of high purity. e.g. silicon, boron, germanium, gallium and indium.

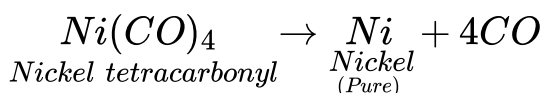
ii. Cryolite is added to alumina to lower its melting point and to make it more conducting.

OR

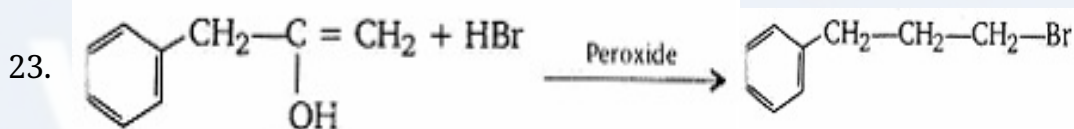
- i. Mond's process for refining of nickel (vapour phase refining) is based upon the principle that Ni (impure) is passed through the discharge of CO at 330 to 350K to form nickel tetracarbonyl which is of volatile nature. The vapours of the metal carbonyl escape leaving behind impurities.



Then, the obtained nickel tetracarbonyl is decomposed by subjecting it to a higher temperature (450 - 470 K) to obtain pure nickel metal.



- ii. **Column chromatography** is based on the principle that different components of a mixture are differently adsorbed on an adsorbent. In it, there are two phases, the mobile phase and stationary phase. The stationary phase is immobile and immiscible. The mobile phase may be a gas, liquid or supercritical fluid in which the sample extract is dissolved. The adsorbed components are then removed (eluted) by using a suitable solvent (eluant).



Section C

24. Let the total mass of the solution be 100 g and the mass of benzene be 30 g.

$$\therefore \text{Mass of carbon tetrachloride} = (100 - 30) \text{ g}$$

$$= 70 \text{ g}$$

$$\text{Molar mass of benzene (C}_6\text{H}_6) = (6 \times 12 + 6) \text{ g mol}^{-1}$$

$$= 78 \text{ g mol}^{-1}$$

$$\therefore \text{Number of moles of C}_6\text{H}_6 = \frac{30}{78} \text{ mol}$$

$$= 0.3846 \text{ mol}$$

$$\text{Molar mass of carbon tetrachloride (CCl}_4) = 1 \times 12 + 4 \times 35.5$$

$$= 154 \text{ g mol}^{-1}$$

$$\therefore \text{Number of moles of CCl}_4 = \frac{70}{154} \text{ mol}$$

$$= 0.4545 \text{ mol}$$

Thus, the mole fraction of C₆H₆ is given as:

$$\frac{\text{Number of moles of } C_6H_6}{\text{Number of moles of } C_6H_6 + \text{Number of moles of } CCl_4}$$

$$= \frac{0.3846}{0.3846 + 0.4545}$$

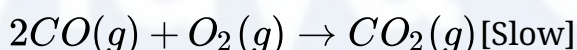
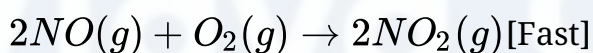
$$= 0.458$$

25. i. Half life, $t_{1/2} = \frac{0.693}{k}$
 $= \frac{0.693}{200 \text{ min}^{-1}} = 3.4 \times 10^{-3} \text{ min (approximately)}$
- ii. Half life, $t_{1/2} = \frac{0.693}{k}$
 $= \frac{0.693}{2 \text{ min}^{-1}}$
 $= 0.35 \text{ min (approximately)}$
- iii. Half life, $t_{1/2} = \frac{0.693}{k}$
 $= \frac{0.693}{4 \text{ years}^{-1}}$
 $= 0.173 \text{ years (approximately)}$

OR

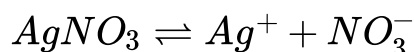
The important factors that effect the rate of reaction are:

- i. **Nature of reactants:** Since the bond energies of the different reactants are different, which affects the rate of reaction.



- ii. **Concentration of reactants:** Rate of reaction is directly proportional concentration of the reactants.
- iii. **Temperature:** Generally, reaction rate increases with increase in temperature due to provision of thermal energy which enhances collision of the reactants.
- iv. **Presence of catalyst:** The presence of catalyst increases the rate of reaction by decreasing the activation energy of reaction and without affecting the equilibrium constant.

26. Cell B contains $AgNO_3$ and reaction may be represented as:



According to the equation,

1 mol or 108 g of silver is deposited by 96500 C

$$1.45 \text{ g silver is deposited by} = \frac{96500 \times 1.45}{108}$$

$$= 1295.6 \text{ C}$$

$$\text{Now, } Q = I \times t$$

$$1295.6 = 1.5 \times t$$

$$\therefore t = \frac{1295.6}{1.5} = 863 \text{ s}$$

The weights of copper and zinc can be calculated by using Faraday's second law of electrolysis.

In cell A, the electrode reaction is

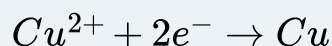


2 mol of electrons or $2 \times 96500 \text{ C}$ of current produce 1 mol or 65.3 g of Zn so that

$2 \times 96500 \text{ C}$ of electricity deposit Zn = 65.3 g

$$1295.6 \text{ C of electricity deposit Zn} = \frac{65.3 \times 1295.6}{2 \times 96500} = 0.438 \text{ g}$$

In cell C, The electrode reaction is



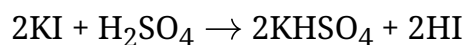
2 mol of electrons or $2 \times 96500 \text{ C}$ of current produce 1 mol or 63.5 g of Cu so that

$2 \times 96500 \text{ C}$ of current deposit Cu = 63.5 g

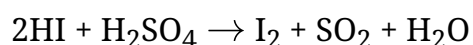
$$1295.6 \text{ C of current deposit Cu} = \frac{63.5 \times 1295.6}{2 \times 96500} = 0.426 \text{ g}$$

27. NH_3 is distinctly basic while BiH_3 is feebly basic. Nitrogen has a small size due to which the lone pair of electrons is concentrated in a small region. This means that the charge density per unit volume is high. On moving down a group, the size of the central atom increases and the charge gets distributed over a large area decreasing the electron density. Hence, the electron donating capacity of group 15 element hydrides decreases on moving down the group.

28. In the presence of sulphuric acid (H_2SO_4), KI produces HI



Since H_2SO_4 is an oxidizing agent, it oxidizes HI (produced in the reaction to I_2).



As a result, the reaction between alcohol and HI to produce alkyl iodide cannot occur. Therefore, sulphuric acid is not used during the reaction of alcohols with KI. Instead, a non-oxidizing acid such as H_3PO_4 is used.

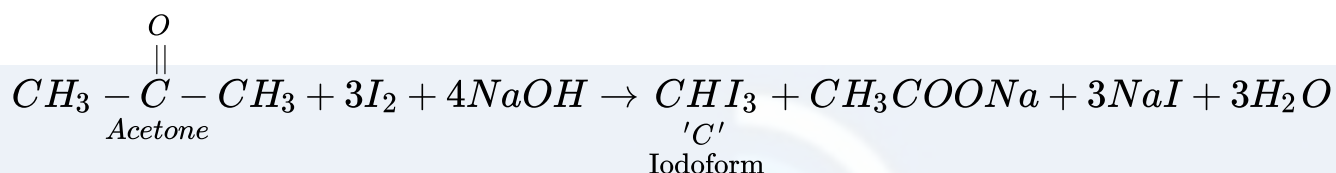
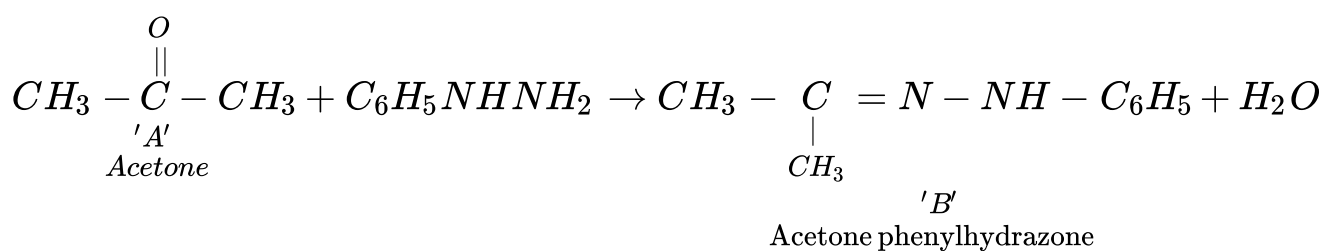
29. A, B and C are:

A = Acetone

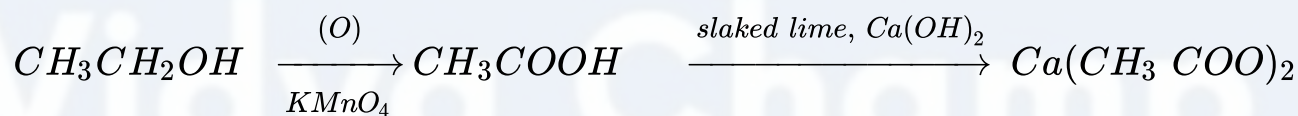
B = Acetone Phenylhydrazone

C = Iodoform

Completed reactions are given below:



OR



30. If the level of noradrenaline is low for some reason, the signal sending activity becomes low, and the person suffers from depression. In such situations and depressant drugs are required.

'Iproniazid and phenelzine' are two such drugs, these drugs inhibit the enzymes which catalyse the degradation of noradrenaline.

Section D

31. For electrolyte X

Molarity = 0.05 M

Resistance = 100Ω

Conductivity = $1.0 \times 10^{-4} \text{S cm}^{-1}$

For electrolyte Y

Molarity = 0.01 M

Resistance = 50Ω

Conductivity = ?

i. Cell constant = Conductivity (K) \times Resistance (R)

$$G^* = 1.0 \times 10^{-4} \times 100$$

$$= 10^{-2} \text{cm}^{-1}$$

ii. Conductivity of solution Y is

$$K = \frac{G^*}{R} = \frac{10^{-2}}{50}$$

$$= 0.02 \times 10^{-2}$$

$$= 2 \times 10^{-4} \text{S cm}^{-1}$$

iii. Concentration C = 0.01 M

$$= 0.01 \text{ mol L}^{-1}$$

$$= 0.01 \times 1000 \text{ mol ml}^{-3}$$

$$= 10 \text{ mol cm}^{-3}$$

\therefore Molar concentration

$$\lambda_m = \frac{K}{C} = \frac{2 \times 10^{-4}}{10}$$

$$= 0.2 \times 10^{-4} \text{S cm}^2 \text{mol}^{-1}$$

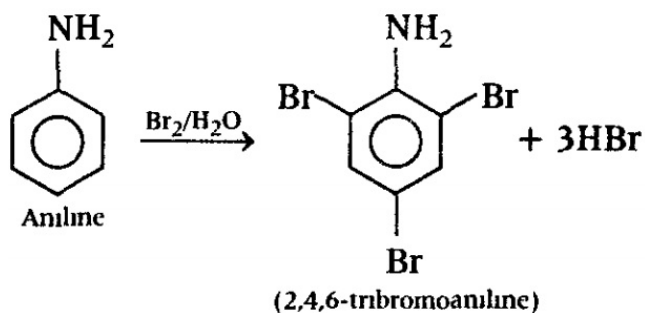
OR

Strong electrolysis: Those electrolytes which dissociate into ions completely into aqueous solution are called strong electrolytes. for example:

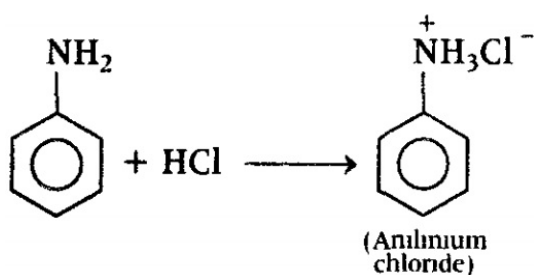
KCl, NaOH, H₂SO₄

Weak electrolytes: Those electrolytes which do not dissociate into ions completely into aqueous solution are weak electrolytes. for example: CH₃COOH, NH₄Cl

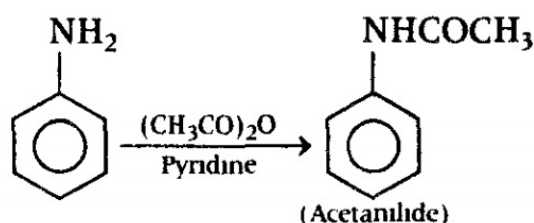
32. i. a.



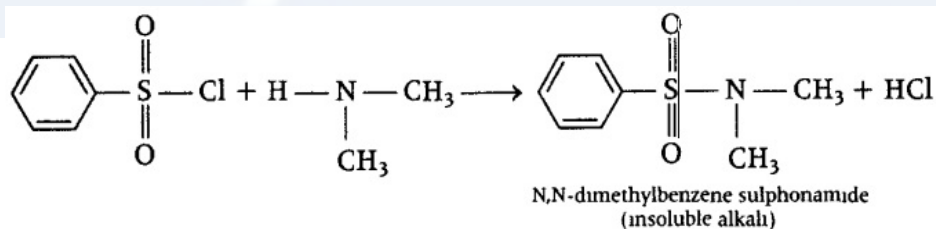
b.



c.

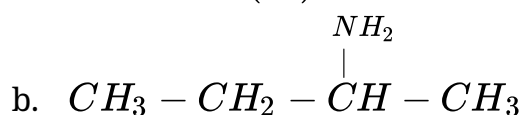
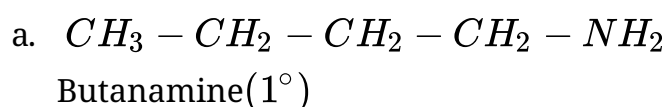


- ii. Increasing order of boiling point $(\text{CH}_3)_3\text{N} < \text{C}_2\text{H}_5\text{NH}_2 < \text{C}_2\text{H}_5\text{OH}$ Alcohols have a higher boiling point as compared to that of amines because oxygen being more electronegative forms stronger hydrogen bond as compared to that of nitrogen. In tertiary amine, there is no hydrogen bond formation due to the absence of H-atoms and hence, has the lowest boiling point.
- iii. $(\text{CH}_3)_2\text{NH}$ and $(\text{CH}_3)_3\text{N}$ are secondary and tertiary amines respectively. These are distinguished by Hinsberg's reagent which gives sulphonamide with secondary amines and no reaction with tertiary amines. $(\text{CH}_3)_2\text{NH}$ reacts with benzene sulphonyl chloride to give N, N-dimethyl benzene sulphonamide, which is insoluble in alkali. The reaction is as follows:

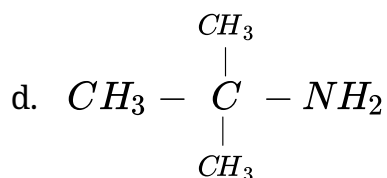
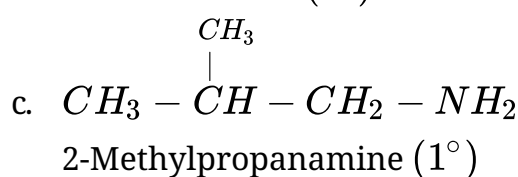


OR

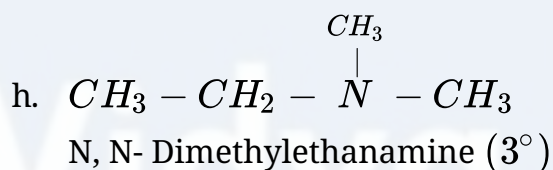
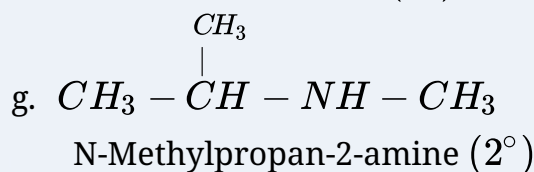
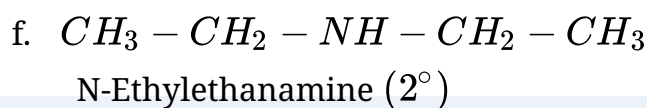
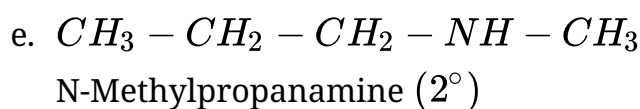
(i), (ii) The structures and IUPAC names of different isomeric amines corresponding to the molecular formula, $\text{C}_4\text{H}_{11}\text{N}$ are given below:



Butan-2-amine (1°)



2-Methylpropan-2-amine (1°)

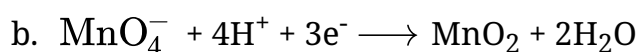


(iii) The pairs (a) and (b) and (e) and (g) exhibit position isomerism.

The pairs (a) and (c); (a) and (d); (b) and (c); (b) and (d) exhibit chain isomerism.

The pairs (e) and (f) and (f) and (g) exhibit metamerism.

All primary amines exhibit functional isomerism with secondary and tertiary amines and vice-versa.



ii. a. Zn ($3d^{10}4s^2$) has completely filled d-orbitals in its atomic as well as in its common oxidation state (Zn^{2+} state). Therefore, it is not regarded as a transition element.

b. Transition metals form a large number of complex compounds due to the

comparatively smaller size of the metal ions, high ionic charges and the availability of vacant d-orbitals for bond formation.

- c. The comparatively high E^0 value for Mn^{3+}/Mn^{2+} is due to the fact that $Mn^{2+}(d^5)$ is quite stable, while the electronic configuration of Mn^{3+} is $3d^4$ which is less stable than $3d^5$ hence, the conversion from $3+$ to $2+$ is very feasible whereas comparatively low value for Cr^{3+}/Cr^{2+} is because of the extra stability of $Cr^{3+}(3d^5)$ than Cr^{2+} . Therefore, Cr^{3+} cannot be reduced to Cr^{2+} easily.

OR

- i. In the case of a lower oxide of a transition metal, the metal atom has a low oxidation state. This means that some of the valence electrons of the metal atom are not involved in bonding. As a result, it can donate electrons and behave as a base.

On the other hand, in the case of a higher oxide of a transition metal, the metal atom has a high oxidation state. This means that the valence electrons are involved in bonding and so, they are unavailable. There is also a high effective nuclear charge. As a result, it can accept electrons and behave as an acid.

For example, $Mn^{II}O$ is basic and $Mn^{VII}O_7$ is acidic.

- ii. Oxygen and fluorine act as strong oxidising agents because of their high electronegativities and small sizes. Hence, they can oxidise any metal to its higher oxidation state. In other words, a transition metal exhibits higher oxidation states in oxides and fluorides. For example, in OsF_6 and V_2O_5 , the oxidation states of Os and V are +6 and +5 respectively.
- iii. Oxygen is a strong oxidising agent due to its high electronegativity and small size. So, oxo-anions of a metal have the highest oxidation state. For example, in MnO_4^- , the oxidation state of Mn is +7.