

CBSE Class 12 Chemistry
Sample paper - 07 (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.
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Section A

1. Conductors allow the passage of electric current through them. Metallic and electrolytic are the two types of conductors. Current carriers in metallic and electrolytic conductors are free electrons and free ions respectively. Specific conductance or conductivity of the electrolyte solution is given by the following relation: $k = c \times \frac{l}{A}$

where $c = 1/R$ is the conductance and l/A is the cell constant. Molar conductance (Λ_m) and equivalence conductance (Λ_e) of an electrolyte solution are calculated using the following similar relations:

$$\Lambda_m = k \times \frac{1000}{M}$$

$$\Lambda_e = k \times \frac{1000}{N}$$

where M and N are the molarity and normality of the solution respectively. Molar conductance of strong electrolyte depends on concentration:

$$\Lambda_m = \Lambda_m^\circ - b\sqrt{c}$$

where Λ_m° = molar conductance at infinite dilution

c = concentration of the solution

b = constant

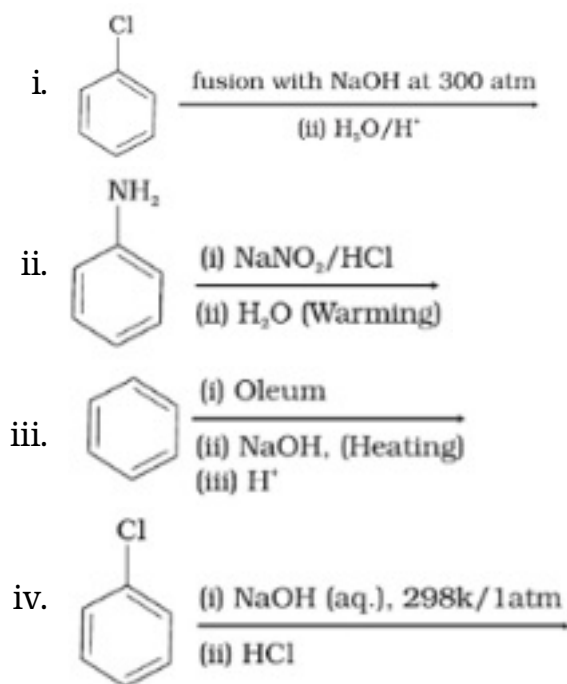
The degrees of dissociation of weak electrolytes are calculated as:

$$\alpha = \frac{\Lambda_m}{\Lambda_m^\circ} = \frac{\Lambda_e}{\Lambda_e^\circ}$$

Answer the following questions:

- i. Out of specific conductance and molar conductance, which one of the following decreases on dilution of electrolyte solution?
 - ii. What is the correct order of equivalent conductance at infinite dilution for LiCl, NaCl & KCl?
 - iii. Out of BaCl_2 and KCl for which electrolyte solutions Λ_m and Λ_e are equal?
 - iv. Which one of the following equality holds good for the strong electrolyte?
(a) $\Lambda = \Lambda^\circ$ as $c \rightarrow 1$ (b) $\Lambda = \Lambda^\circ$ as $c \rightarrow 0$
 - v. What is equal to the cell constant of the conductivity cell when the conductance of a solution of an electrolyte is equal to that of its specific conductance?
2. Predict the conditions under which Al might be expected to reduce MgO.
 3. What is the function of enzyme present in the liver?
 4. Name the various sugars present in RNA & DNA.
 5. Which of the following is a natural polymer?
Buna-S, proteins, PVC
 6. Give IUPAC name of the compound

$$\text{CH}_3 - \text{CH}_2 - \begin{array}{c} \text{CH}_3 \\ | \\ \text{C} \\ | \\ \text{COOH} \end{array} - \text{CH}_2 - \text{CH}_3$$
 7. Which of the following reactions will yield phenol?



- i, iii, iv
 - ii, iii, iv
 - i, ii, iii
 - i, ii, iv
8. The impurity that is added externally to remove the impurity already present in the ore is known as
- Flux
 - Matrix
 - Slag
 - Gangue
9. Ni^{2+} in traces can be tested using
- Dimethylglyoxime
 - Potassium ferrocyanide
 - Ammonium sulphocyanide
 - Sodium nitroprusside
10. The octahedral complex, trioxalatochromate(III) will show
- Structural isomerism
 - Optical isomerism
 - Linkage isomerism
 - Geometrical isomerism
11. Polythene is not one of the following

-
- a. Linear polymer
 - b. Semi – synthetic polymer
 - c. Synthetic polymer
 - d. Branched chain polymer

12. **Assertion:** A solution of sucrose in water is dextrorotatory but on hydrolysis in presence of little hydrochloric acid it becomes laevorotatory.

Reason: Sucrose on hydrolysis gives unequal amounts of glucose and fructose as a result of which change in sign of rotation is observed.

- 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:** A solution having greater vapour pressure has a higher boiling point.

Reason: Elevation in boiling point is directly proportional to the lowering of vapour pressure.

- 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:** The acidity of alcohols follows the order $1^\circ > 2^\circ > 3^\circ$.

Reason: The +I effect of alkyl groups ($3^\circ > 2^\circ > 1^\circ$) favours the dissociation of -OH group.

- 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.

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.

- 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.

Section B

17. Why are the numbers 6, 6 and 6 put in the names of Nylon 6, 6 and Nylon 6?

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18. Determine the overall order of a reaction which has the rate law $R = k[A]^{5/2}[B]^{3/2}$
19. a. Write two poisonous gases prepared from chlorine gas.
b. Why does Cu^{2+} solution give blue colour on reaction with ammonia?
20. Using IUPAC norms, write the formulae for the following complexes:
a. Hexa aqua chromium (III) chloride
b. Sodium tri oxalato ferrate
21. Explain the synergic bonding in metal carbonyls.

OR

Write the formula of the following complexes: (i) Pentaamminechlorocobalt (III) ion
(ii) Lithium tetrahydro aluminate (III)

22. Mention the conditions at which, Mg can reduce SiO_2 and Si can reduce MgO ?

OR

How is 'cast iron' different from 'pig iron'?

23. Explain the fact that in aryl alkyl ethers
i. The alkoxy group activates the benzene ring towards electrophilic substitution and
ii. It directs the incoming substituents to ortho and para positions in benzene ring.

Section C

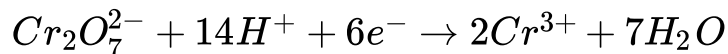
24. Henry's law constant for the solubility of methane in benzene at 298 K is 4.27×10^5 mm Hg. Calculate the solubility of methane in benzene at 298 K under 760 mm Hg.
25. Define the zero order reaction. Give its unit.

OR

For the reaction: $2A + B \rightarrow A_2B$, the rate $= k[A][B]^2$ with $k = 2.0 \times 10^{-6} \text{ mol}^{-2} \text{ L}^2 \text{ s}^{-1}$. Calculate the initial rate of the reaction when

$[A] = 0.1 \text{ mol L}^{-1}$, $[B] = 0.2 \text{ mol L}^{-1}$. Calculate the rate of reaction after $[A]$ is reduced to 0.06 mol L^{-1} .

26. Consider the reaction:



What is the quantity of electricity in coulombs needed to reduce 1 mol of $\text{Cr}_2\text{O}_7^{2-}$?

27. List the uses of Neon and argon gases.

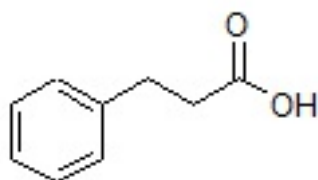
28. A hydrocarbon C_5H_{10} does not react with chlorine in dark but gives a single monochloro compound $\text{C}_5\text{H}_9\text{Cl}$ in bright sunlight. Identify the hydrocarbon.

29. Acetic acid can be halogenated in the presence of red P and Cl_2 but formic acid cannot be halogenated in the same way. Why?

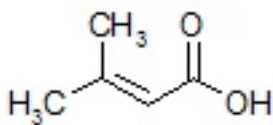
OR

Give the IUPAC names of the following compounds:

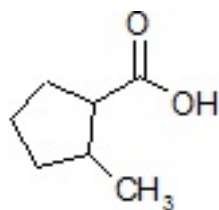
i.



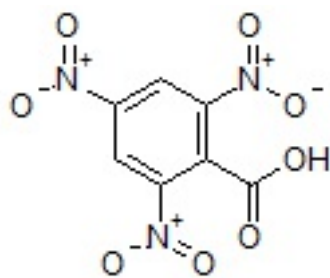
ii.



iii.



iv.



30. Answer the following questions:

- i. Give two examples of macromolecules that are chosen as drug targets.
- ii. What are antiseptics? Give an example.
- iii. Why is use of aspartame limited to cold foods and soft drinks?

Section D

31. Conductivity of 0.00241 M acetic acid is $7.896 \times 10^{-5} \text{ S cm}^{-1}$. Calculate its molar conductivity and if for acetic acid is $390.5 \text{ S cm}^2 \text{ mol}^{-1}$, what is its dissociation constant?

OR

- a. What is electrochemical equivalent?
 - b. Calculate the cell emf and ΔG° for the cell reaction at 25°C . $\text{Zn} / \text{Zn}^{+2}(0.1\text{M}) // \text{Cu}^{+2}(0.01\text{M}) / \text{Cu}$ electrode potential for Zn is - 0.403 volt and for Cu is -0.763 volt
32. A. For the following conversion reactions write the chemical equations:
- i. Ethyl isocyanide to ethylamine
 - ii. Aniline to N-phenylethanamide
- B. Two isomeric compounds A and B having molecular formula $\text{C}_4\text{H}_{11}\text{N}$, both lose N_2 on treatment with HNO_2 and gives compound C and D, respectively. C is resistant to oxidation but immediately responds to Lucas reagent, whereas 'D' responds to Lucas reagent after 5 minutes and gives a positive iodoform test. Identify A and B.

OR

How will you convert

- i. Ethanoic acid into methanamine
- ii. Hexanenitrile into 1-aminopentane

- iii. Ethanamine into methanamine
- iv. Nitromethane into dimethylamine
- v. Propanoic acid into ethanoic acid

33. Assign reason for the following:

- i. The enthalpies of atomization of transition metals are high.
- ii. The transition metals and many of their compounds act as catalysts.
- iii. From element to element, the actinoid contraction is greater than lanthanoid contraction.
- iv. The E^0 value for Mn^{3+}/Mn^{2+} couple is much more positive than that for Cr^{3+}/Cr^{2+}
- v. Scandium ($Z = 21$) does not exhibit variable oxidation states and yet it is regarded as a transition element.

OR

- i. Complete the following chemical equations:
 - a. $Cr_2O_7^{2-}(aq) + H_2S(g) + H^+(aq) \longrightarrow$
 - b. $Cu^{2+}(aq) + I^-(aq) \longrightarrow$
- ii. How would you account for the following?
 - a. The oxidising power of oxoanions are in the order
 $VO_2^+ < Cr_2O_7^{2-} < MnO_4^-$
 - b. The third ionisation enthalpy of manganese ($Z = 25$) is exceptionally high.
 - c. Cr^{2+} is a stronger reducing agent than Fe^{2+} .

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Solution

Section A

1.
 - i. Specific conductance decreases on dilution of electrolyte solution.
 - ii. The correct order of equivalent conductance at infinite dilution is $\text{KCl} > \text{NaCl} > \text{LiCl}$
 - iii. In KCl electrolyte solution Λ_m and Λ_e are equal.
 - iv. (b) $\Lambda = \Lambda^\circ$ as $c \rightarrow 0$ equality holds good for a strong electrolyte.
 - v. The conductance of a solution of an electrolyte is equal to that of its specific conductance. The cell constant of the conductivity cell is equal to the Unity
2. Above 1350°C , the standard Gibbs free energy of formation of Al_2O_3 from Al is less than that of MgO from Mg. Therefore, above 1350°C , Al can reduce MgO.
3. The enzyme present in liver converts galactose to glucose.
4. The various sugars present in nucleic acids are Ribose in RNA and deoxyribose in DNA.
5. Proteins are natural polymers.
6. 2-Ethyl-2-methylbutanoic acid
7. (c) i, ii, iii

Explanation:

- **Preparation of phenols from haloarenes:** Chlorobenzene is an example of haloarenes which is formed by monosubstitution of the benzene ring. When chlorobenzene is fused with sodium hydroxide at 623K and 320 atm sodium phenoxide is produced. Finally, sodium phenoxide on acidification gives phenols.
- **Preparation of phenols from diazonium salts:** When an aromatic primary amine is treated with nitrous ($\text{NaNO}_2 + \text{HCl}$) acid at 273 - 278 K, diazonium salts are obtained. These diazonium salts are highly reactive in nature. Upon warming with water, these diazonium salts finally hydrolyse to phenols.

Phenols can also be obtained from diazonium salts by treating it with dilute acids.

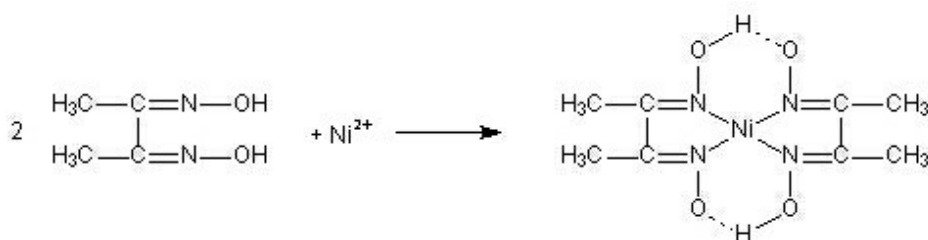
- **Preparation of phenols from benzene sulphonic acid:** Benzenesulphonic acid can be obtained from benzene by reacting it with oleum. Benzenesulphonic acid thus formed is treated with molten sodium hydroxide at high temperature which leads to the formation of sodium phenoxide. Finally, sodium phenoxide on acidification gives phenols.

8. (a) Flux

Explanation: Flux is externally added substance to an ore, which combines with impurities in the ore to form Slag which can be easily separated.

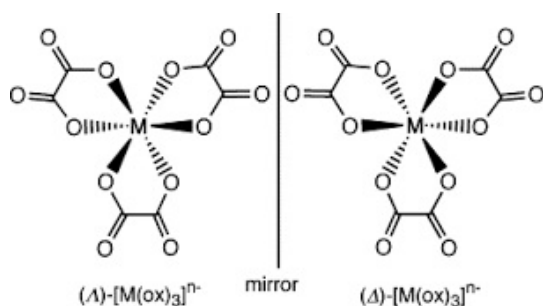
9. (a) Dimethylglyoxime

Explanation: Ni^{2+} forms complex with DMG which is red in colour.



10. (b) Optical isomerism

Explanation: This complex has non-superimposable mirror images as shown.



where $\text{M}=\text{Cr}$, $n=3$

Thus, this complex shows optical isomerism

11. (b) Semi – synthetic polymer

Explanation: Polythene is not semi-synthetic. Semi-synthetic polymers are derived from natural substances like cellulose. Polythene is synthetic, high density polythene is linear polymer whereas low density polythene is branched polymer.

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

Explanation: Assertion is CORRECT but, reason is INCORRECT.

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

Explanation: Assertion is INCORRECT but, reason is CORRECT

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

Explanation: Assertion is CORRECT but, reason is INCORRECT.

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. **Nylon-6, 6** is a polymer of adipic acid and hexamethylene dianine, i.e. both the monomers have 6 carbon atoms each. **Nylon-6** is a polymer of caprolactam which contains 6 carbon atoms.

18. $Rate = k[A]^x[B]^y$

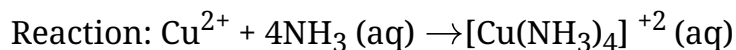
Order = $x + y$

so, order = $\frac{5}{2} + \frac{3}{2} = 4$.

i.e; reaction is fourth order reaction.

19. a. Mustard gas, tear gas, phosgene are poisonous gases prepared from chlorine gas.

- b. Because it forms blue coloured complex $[Cu(NH_3)_4]^{+2}(aq)$

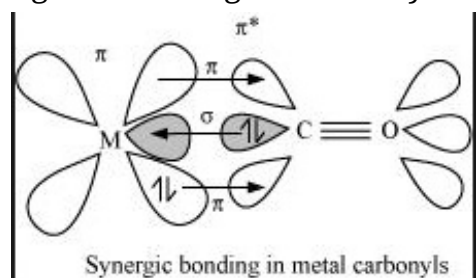


20. i. Formula of Hexa aqua chromium (III) chloride is $[Cr(H_2O)_6]Cl_3$

- ii. Formula of Sodium tri oxalato ferrate is $Na_3[Fe(ox)_3]$

21. The metal – carbon bond in metal carbonyls has both s & P- character. The M - C σ bond is formed by donation of lone pair of electrons of carbonyl carbon into a vacant orbital of metal. The M - C π bond is formed by the donation of a pair of electron from a filled d- orbital of metal to the vacant π orbital of carbon monoxide. The metal to

ligand bonding creates a synergic effect that strengthens the bond.



OR



22. $\text{Mg}_{(s)} + \frac{1}{2}\text{O}_{(g)} \rightarrow \text{MgO}_{(s)} [\Delta G_{(\text{Mg}, \text{MgO})}]$
 $\text{Si}_{(s)} + \text{O}_{2(g)} \rightarrow \text{SiO}_{2} [\Delta G_{(\text{Si}, \text{SiO}_2)}]$ The temperature range in which $\Delta G_{(\text{Mg}, \text{MgO})}$ is lesser than $\Delta G_{(\text{Si}, \text{SiO}_2)}$ Mg can reduce SiO_2 to Si.
 $2\text{Mg} + \text{SiO}_2 \rightarrow 2\text{MgO} + \text{Si}; \Delta G^\ominus = -ve$ On the other hand, the temperature range in which $\Delta G_{(\text{Si}, \text{SiO}_2)}$ is less than $\Delta G_{(\text{Mg}, \text{MgO})}$, Si can reduce MgO to Mg.
 $\text{SiO}_2 + 2\text{Mg} \rightarrow \text{SiO}_2 + 2\text{Mg}; \Delta G^\ominus = -ve$ The temperature at which $\Delta_f G$ curves of these two substances intersect is 1966 K. Thus, at temperature less than 1966 K, Mg can reduce SiO_2 and above 1966 K, Si can reduce MgO.

OR

The iron obtained from blast furnaces is known as pig iron. It contains around 4% carbon and many impurities such as S, P, Si, Mn in smaller amounts. Cast iron is obtained by melting pig iron and coke using a hot air blast. It contains a lower amount of carbon (3%) than pig iron. Unlike pig iron, cast iron is extremely hard and brittle.

23. i. In aryl alkyl ethers, due to the +R effect of the alkoxy group, the electron density in the benzene ring increases as shown in the following resonance structure.
 Thus, benzene is activated towards electrophilic substitution by the alkoxy group.
 ii. It can also be observed from the resonance structures that the electron density increases more at the ortho and para positions than at the meta position. As a result, the incoming substituents are directed to the ortho and para positions in

the benzene ring.

Section C

24. Here $K_H = 4.27 \times 10^5$ mm Hg

$$P = 760 \text{ mm Hg}$$

Applying Henry's law

$$P = K_H x$$

$$x = \frac{P}{K_H} \\ = \frac{760 \text{ mmHg}}{4.27 \times 10^5 \text{ mmHg}} = 1.78 \times 10^{-3}$$

i.e. mole fraction of methane in benzene = 1.78×10^{-3} .

25. **Zero order reaction:** The reactions in which the rate of reaction is independent of the concentration of the reactants is called zero order reaction. The rate law for a zero order reaction is $\text{Rate} = k [A]^0$, where k is rate constant, with the units $\text{mol L}^{-1} \text{s}^{-1}$. Zero order reactions are relatively uncommon but they occur under special conditions. Some enzyme catalysed reactions and reactions which occur on metal surfaces are a few examples of zero order reactions.

OR

The initial rate of the reaction is:

$$\begin{aligned} \text{Rate} &= k[A][B]^2 \\ &= (2.0 \times 10^{-6} \text{ mol}^{-2} \text{ L}^2 \text{ s}^{-1}) (0.1 \text{ mol L}^{-1}) \\ &\quad (0.2 \text{ mol L}^{-1})^2 = 8.0 \times 10^{-9} \text{ mol}^{-2} \text{ L}^2 \text{ s}^{-1} \end{aligned}$$

When $[A]$ is reduced from 0.1 mol L^{-1} to 0.06 mol L^{-1} , the concentration of A reacted = $(0.1 - 0.06) \text{ mol L}^{-1} = 0.04 \text{ mol L}^{-1}$

Therefore, concentration of B reacted = $\frac{1}{2} \times 0.04 \text{ mol L}^{-1} = 0.02 \text{ mol L}^{-1}$

Then, concentration of B available, $[B] = (0.2 - 0.02) \text{ mol L}^{-1}$
 $= 0.18 \text{ mol L}^{-1}$

After $[A]$ is reduced to 0.06 mol L^{-1} , the rate of the reaction is given by,

$$\begin{aligned} \text{Rate} &= k[A][B]^2 \\ &= (2.0 \times 10^{-6} \text{ mol}^{-2} \text{ L}^2 \text{ s}^{-1}) (0.06 \text{ mol L}^{-1}) \\ &= 6 \times 10^{-8} \text{ mol}^{-1} \text{ L}^{-1} \text{ s}^{-1} \end{aligned}$$

26. From the given reaction

1 mol of $\text{Cr}_2\text{O}_7^{2-}$ ions requires

$$6F = 6 \times 96500 \text{ C}$$

= 579000 C of electricity for reduction of Cr^{3+} .

27. ◦ **Uses of neon gas:**

- i. It is mixed with helium to protect electrical equipments from high voltage.
- ii. It is filled in discharge tubes with characteristic colours.
- iii. It is used in beacon lights.

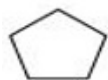
◦ **Uses of Argon gas:**

- i. Argon along with nitrogen is used in gas-filled electric lamps. This is because Ar is more inert than N.
- ii. It is usually used to provide an inert temperature in a high metallurgical process.
- iii. It is also used in laboratories to handle air-sensitive substances.

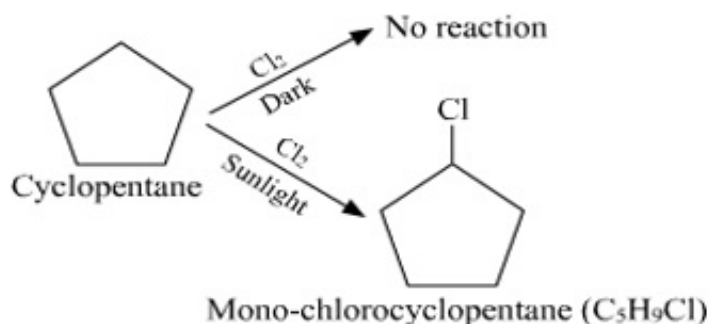
28. A hydrocarbon with the molecular formula, C_5H_{10} belongs to the group with a general molecular formula C_nH_{2n} . Therefore, it may either be an alkene or a cycloalkane.

Since hydrocarbon does not react with chlorine in the dark, it cannot be an alkene.

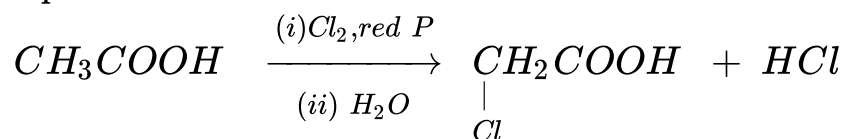
Thus, it should be a cycloalkane. Further, the hydrocarbon gives a single monochloro compound, $\text{C}_5\text{H}_9\text{Cl}$ by reacting with chlorine in bright sunlight. Since a single monochloro compound is formed, the hydrocarbon must contain H-atoms that are all equivalent. Also, as all H-atoms of a cycloalkane are equivalent, the hydrocarbon must be a cycloalkane. Hence, the said compound is cyclopentane.



Cyclopentane (C_5H_{10}) The reactions involved in the question are:



29. Acetic acid is halogenated in the presence of red P in which substitution occurs at alpha-carbon atom. This is known as **Hell-Volhard-Zelinsky reaction**:



However, formic acid (HCOOH) has no alpha-hydrogen atom and therefore, cannot undergo **Hell-Volhard-Zelinsky** reaction.

OR

- i. 3-Phenylpropanoic acid
 - ii. 3-Methylbut-2-enoic acid
 - iii. 2-Methylcyclopentanecarboxylic acid
 - iv. 2,4,6-Trinitrobenzoic acid
30. i. Carbohydrates, lipids, proteins, enzymes nucleic acids (any two)
- ii. Antiseptics are the chemical substances which are used to kill or prevent the growth of microbes, e.g., Dettol, iodoform, boric acid.
- iii. Because aspartame is unstable at cooking temperature.

Section D

31. Given that, $\kappa = 7.896 \times 10^{-5} \text{ S m}^{-1}$

$$C=M= 0.00241 \text{ mol L}^{-1}$$

The formula of molar conductivity,

$$\Lambda_m = (\kappa \times 1000)/M$$

Plug the value we get

$$\Lambda_m = \frac{(7.896 \times 10^{-5} \times 1000)}{0.00241}$$

$$= 32.76 \text{ S cm}^2 \text{ mol}^{-1}$$

The formula of degree of dissociation

$$\alpha = \Lambda_m / \Lambda_{om}$$

Plug the value we get

$$\alpha = 32.76 \text{ S} / 390.5$$

$$= 0.084$$

The formula of dissociation constant

$$K = C\alpha/(1 - \alpha)$$

Plug the values we get

$$K = 0.00241 \times 0.084/(1 - 0.084)$$

$$= 1.86 \times 10^{-5} \text{ mol L}^{-1}$$

OR

a. The electrochemical equivalent is the mass of ions deposited or liberated on an electrode during the electrolysis, when 1C of charge is passed through it.

$$\text{b. } E_{\text{cell}}^{\ominus} = E_{\text{right}}^{\ominus} - E_{\text{left}}^{\ominus}$$

$$= -0.403 - (-0.763\text{V})$$

$$= 0.36\text{V}$$

$$E_{\text{cell}} = E_{\text{cell}}^{\ominus} - \frac{0.059}{n} \log \frac{[Zn^{2+}]}{[Cu^{2+}]}$$

$$E_{\text{cell}} = 0.36 - \frac{0.059}{n} \log \frac{0.1}{0.01} [\because n = 2]$$

$$E_{\text{cell}} = 0.36 - 0.0295 \log 10$$

$$= 0.36 - 0.0295 \times 1$$

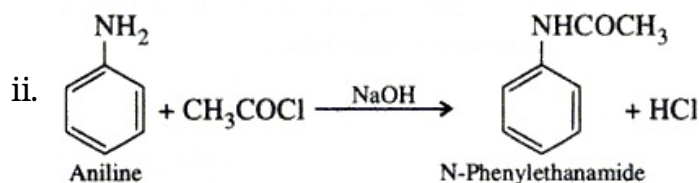
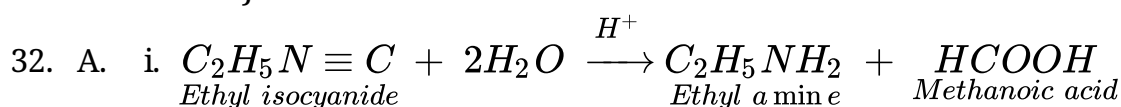
$$= 0.3305\text{V}$$

$$\Delta G^{\ominus} = -nFE_{\text{cell}}^{\ominus}$$

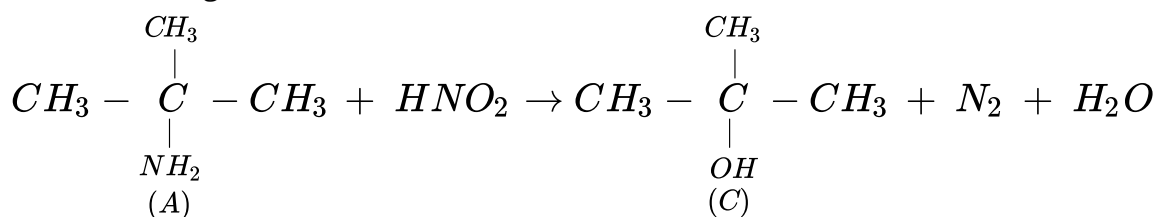
$$= -2 \times 96500 \times 0.36$$

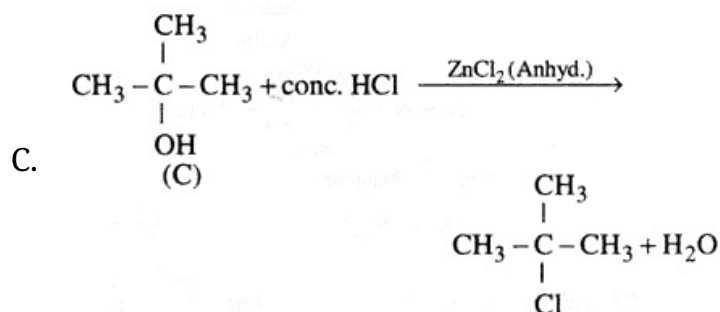
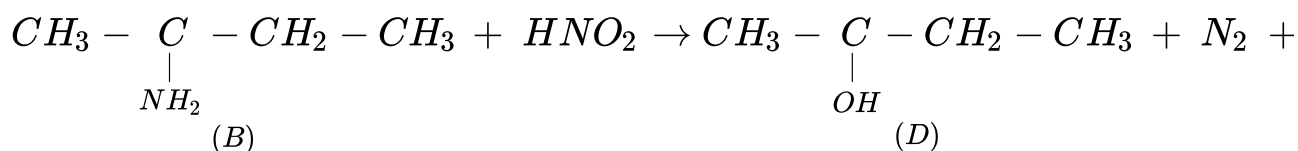
$$\Delta G^{\ominus} = 69480 \text{ J mol}^{-1}$$

$$= 69.48 \text{ J mol}^{-1}$$

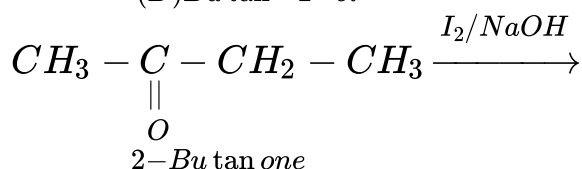
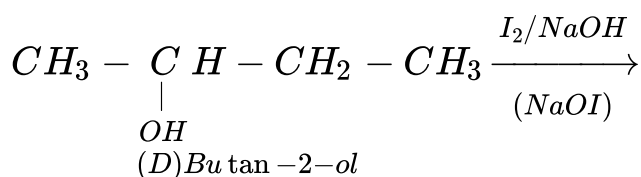
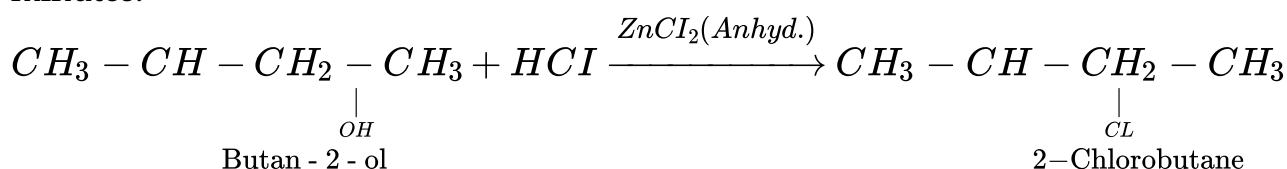


B. The following reactions lead to the identification of A and B:

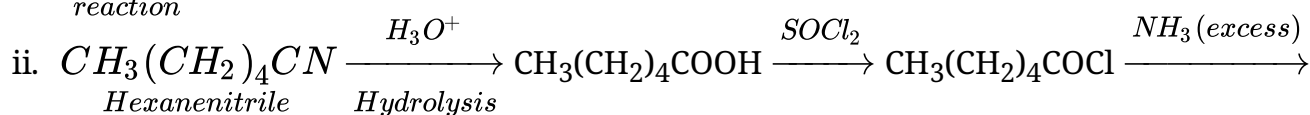
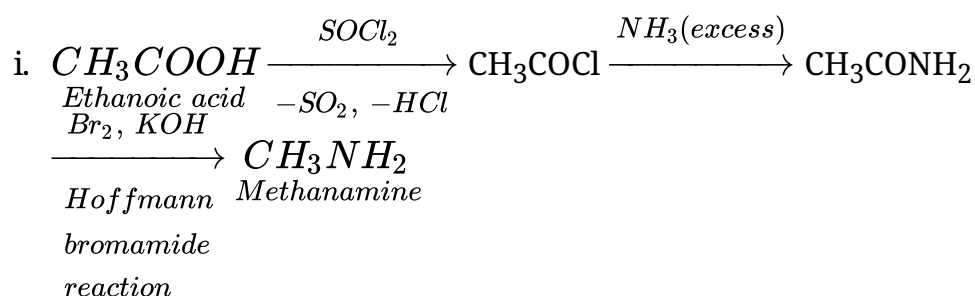


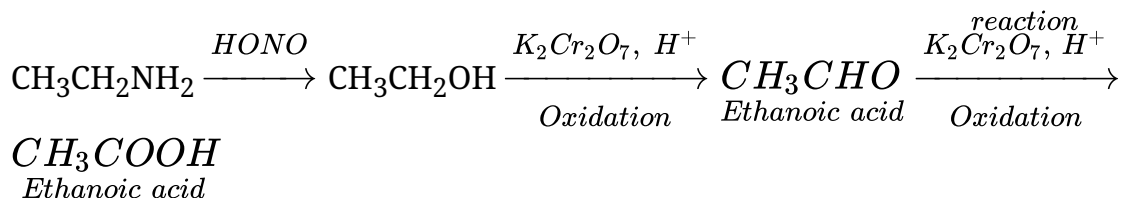
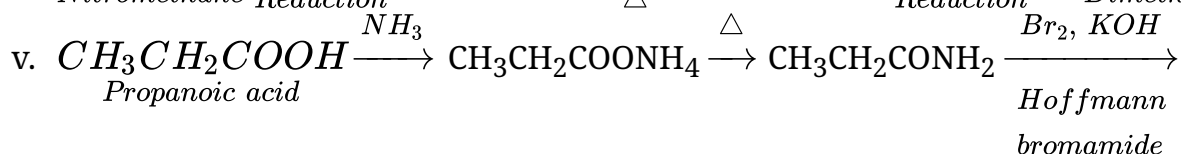
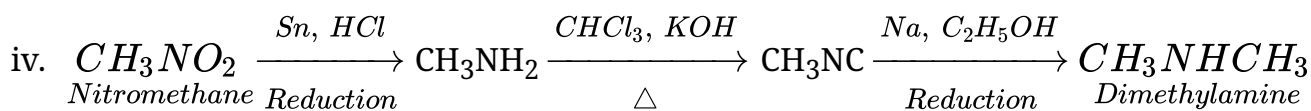
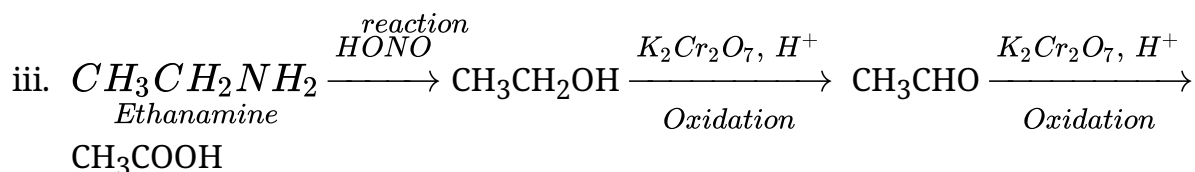
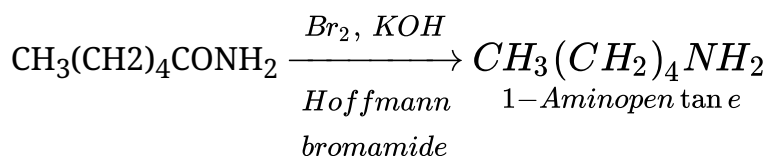


'C' is resistant to oxidation because tertiary alcohols do not undergo oxidation. It gives turbidity immediately with Lucas reagent. 'D' responds to Lucas reagent within 5 minutes because it is secondary alcohol and turbidity appears after 5 minutes.



OR





33. i. High enthalpies of atomization of transition elements are attributed to the involvement of (n - 1)d electrons in addition to ns electrons in the interatomic metallic bonding. In, general , greater the number of valence electrons, stronger is the resultant bonding and higher will be enthalpy of atomization.
- ii. The molecules of the reactants form unstable intermediates with the surface of transition metals due to presence of unpaired d- electrons. The unstable intermediates then decompose to give the products and hence transition metal act as catalyst.
- iii. Actinoid contraction from element to element, is greater than lanthanoid contraction because the 5f electrons, have more poor shielding effect compared to 4f electrons. Because of poor shielding effect, effective nuclear charge increases and size decreases.
- iv. One of the factors that contributes to the more positive value of reduction potential E^0 is the stable oxidation state of the metal. Mn shows +2 as stable oxidation state, as Mn^{+2} has $3d^5$ configuration which is stable due to half filled configuration. On the other hand Cr has +3 as stable oxidation state because Cr^{+3} has half filled t_{2g} configuration.
- v. In Sc, has ground state electronic configuration as $3d^1 4s^2$. So, it has incompletely

filled d orbital in its ground state. Therefore, it is regarded as a transition element.

OR

- i. a. $\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + 3\text{H}_2\text{S}(\text{g}) + 8\text{H}^+(\text{aq}) \longrightarrow 2\text{Cr}^{3+}(\text{aq}) + 3\text{S} + 7\text{H}_2\text{O}(\text{l})$
b. $2\text{Cu}^{2+}(\text{aq}) + 4\text{I}^-(\text{aq}) \longrightarrow \text{Cu}_2\text{I}_2 + \text{I}_2(\text{g})$
- ii. a. It is because V in the lower oxidation state is less stable than Cr which in turn is less stable than Mn. Thus, MnO_4^- has a great tendency to get reduced and hence, behave as a good oxidising agent. Similarly, VO_2^+ has the least oxidising power.
b. The third ionisation enthalpy of Mn is very high because the third electron has to be removed from stable half-filled $3d^5$ -configuration.
c. The electrode reduction potential values are:
 $E_{\text{Cr}^{3+}/\text{Cr}}^o = -0.74\text{V}$ and $E_{\text{Fe}^{2+}/\text{Fe}}^o = -0.44\text{V}$
As we know, the more negative the electrode potential, the greater is the reducing power of the electrode. The highest oxidation state for Cr is +6, therefore, it can lose 3 more electrons, whereas Fe needs to lose only 1 electron to achieve its highest oxidation state of +3. Thus, Cr^{3+} is more reducing than Fe^{2+} .