CBSE Class 12 Chemistry
Sample paper - 10 (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. Electrolysis is the process in which electrical energy is converted to chemical energy. In electrolytic cell, oxidation takes place at anode and reduction at cathode. Electrode process depends on the electrode taken for electrolysis. Amount of substance liberated at an electrode is directly proportional to hte amount of charge passed through it. The mass of substance liberated at electrode is calculated using the following relation: $m = \frac{ItE}{96500}$
   Here, E represents the equivalent mass and 96500 C is called the Faraday constant. Faraday (96500 C) is the charge of 1 mole electron, i.e., 6.023×10^{23} electrons; it is used to liberate one gram equivalent of the substance.
   Answer the following questions:
   i. The passage of current liberates H_2 at cathode & Cl_2 at the anode. The solution is
      (a) copper chloride in water (b) NaCl in water

ii. What is obtained at the anode on electrolysis of dilute H_2SO_4 using platinum electrodes as a product?

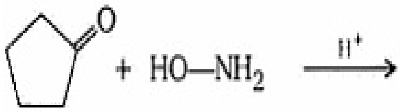
iii. The platinum electrodes were immersed in a solution of cupric sulphate ($CuSO_4$) and the electric current is passed through the solution. After some time, it was observed that the colour of copper sulphate disappeared with the evolution of gas at the electrode. The colourless solution contains ________.

iv. Calculate the volume of gas liberated at the anode at S.T.P. during the electrolysis of a $CuSO_4$ solution by a current of 1 A passed for 16 minutes and 5 seconds.

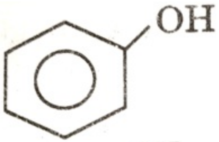
[Hint: At anode: $2OH^- \rightarrow H_2O + 1/2\ O_2 + 2e^-$ (Oxygen gas is evolve) ,Equivalent volume V_e of oxygen = 5.6 litre].

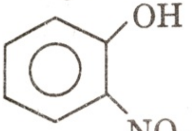
v. What is the change in free energy for a galvanic cell?

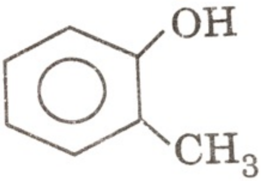
2. Name the method used for refining copper metal.
3. Name the different types of RNA molecules found in the cells of organisms.
4. What are the three components of nucleic acids?
5. Write the structure and one use of urea-formaldehyde resin.
6. Predict the products of the following reaction:



7. Which one of the following compound is most acidic?

a. 

b. 

c. 

d. $Cl\text{-}CH_2\text{-}CH_2\text{-}OH$

8. $ZnCO_3(s) \xrightarrow{\Delta} ZnO(s) + CO_2$;The reaction shows the process of

a. Reduction
b. Smelting

c. Calcination
d. Roasting

9. Which of the following ion has smallest radii?
   a. Ni^{2+}
   b. Ti^{2+}
   c. Mn^{2+}
   d. V^{2+}
10. A complex of platinum, ammonia and chlorine produces four ions per molecule in the solution. The structure consistent with the observation is
    a. $[Pt(NH_3)_2Cl_4]$
    b. $[Pt(NH_3)_5Cl]Cl_3$
    c. $[Pt(NH_3)_4Cl_2]Cl_2$
    d. $[Pt(NH_3)_6]Cl_4$
11. Polystyrene is used
    a. to make rain coats
    b. as an insulator
    c. to make handles of utensils
    d. in paints
12. **Assertion:** Purine base present in DNA are adenine and guanine.
    Reason: The base thymine is present in RNA whereas base uracil is present in DNA.

    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:** The sum of mole fractions of all components of a solution is unity.
    Reason: Mole fraction is independent of temperature.

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:** Ozone is a powerful oxidising agent in comparison to O_2.

    Reason: Ozone is diamagnetic but O_2 is paramagnetic.

    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:** Alcohols have higher boiling points than ethers of comparable molecular masses.
    Reason: Alcohols and ethers are isomeric compounds.

    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:** Aryl halogen undergoes nucleophilic substitution reactions with ease.
    Reason: The carbon halogen bond in aryl halides has partial double bond character.

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. Give example of natural and synthetic polymers.

18. The rate of the chemical reaction doubles for an increase of 10 K in absolute temperature from 298 K. Calculate E_a.

19. Amongst the following compounds, identify which are insoluble, partially soluble and highly soluble in water?

    i. Phenol
    ii. Toluene
    iii. Formic acid
    iv. ethylene glycol
    v. chloroform
    vi. pentanol

20. What are t_{2g} and e_g orbitals?

21. Write the hybridisation, shape and IUPAC name of the complex $[CoF_6]^{3-}$ (Atomic no. of Co = 27)

OR

Using the valence bond approach, predict the shape and magnetic character of $[Fe(CN)_6]^{3-}$ ion.

22. Give the uses of cast iron.

OR

The extraction of gold by leaching with NaCN, involves both oxidation and reduction. Justify giving chemical equations.

23. Write structural formula and give IUPAC name:-
Glycerol

Section C

24. Define the following terms:
    i. Mole fraction
    ii. Molarity

25. In a reaction between A and B, the initial rate of reaction (r_0) was measured for different initial concentrations of A and B as given below:

$A/molL^{-1}$	**0.20**	**0.20**	**0.40**
$B/molL^{-1}$	0.30	0.10	0.05
$r_0/molL^{-1}s^{-1}$	$5.07 \times 10 - 5$	$5.07 \times 10 - 5$	$1.43 \times 10 - 4$

What is the order of the reaction with respect to A and B?

OR

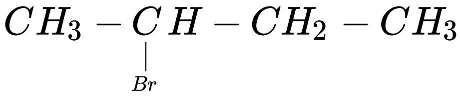
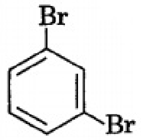
A reaction is first order in A and second order in B.

i. Write the differential rate equation.
ii. How is the rate affected on increasing the concentration of B three times?
iii. How is the rate affected when the concentrations of both A and B are doubled?

26. Write the Nernst equation and calculate the emf of the following cell at 298 K
$Cu(s)|Cu^{2+}(0.130M)||Ag^{+}(1.00 \times 10^{-4}M)|Ag(s)$
Given: $E^0_{Cu^+/cu} = +0.34V$ and $E^0_{Ag^+/Ag} = +0.80V$

27. a. Draw the structural formulae of the following molecules:

    i. $P_4O_{10}(S)$
    ii. $XeO_3(S)$
b. Draw the structural formula of $SF_4(g)$.

28. Give the IUPAC names of the following compounds:
    i. 
    $CH_3-\underset{\underset{Br}{|}}{C}H-CH_2-CH_3$
    ii. 
    iii. $CH_2=CH-CH_2-Cl$

29. Write the steps and conditions involved in the following conversions:
    i. Acetophenone to 2-phenyl-2-butanol
    ii. Propene to acetone

OR

Write one chemical reaction each to exemplify the following:

i. Rosenmund reduction
ii. Tollen's reagent.

30. If water contains dissolved calcium hydrogen carbonate, out of soaps and synthetic detergents which one will you use for cleaning clothes?

Section D

31. a. What is Nickel Cadmium cell? State its one merit over lead storage cell. Write the overall reaction that occurs during discharging of this cell.
    b. Silver is electro deposited on a metallic vessel of total surface area 900 cm^2 by passing a current of 0.5 ampere for 2 hours.

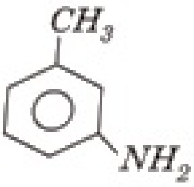
    Calculate the thickness of silver deposited, given its density is $10.5 gcm^{-3}$. (At. mass of Ag = 108 g mol^{-1}).

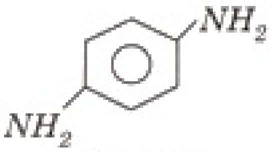
OR

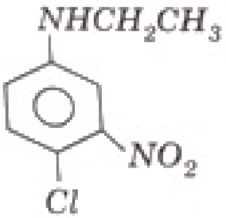
State the products of electrolysis obtained on the cathode and the anode in the following cases:

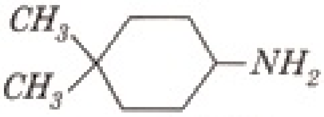
i. A dilute solution of H_2SO_4 with platinum electrodes.
ii. An aqueous solution of $AgNO_3$ with silver electrodes.

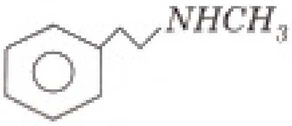
32. Give the IUPAC names of the following compounds

a. 

b. 

c. 

d. 

e. 

OR

i. Write structures of different isomeric amines corresponding to the molecular formula, $C_4H_{11}N$.
ii. Write IUPAC names of all the isomers.
iii. What type of isomerism is exhibited by different pairs of amines?

33. a. Give balanced chemical equations of two reactions in which $KMnO_4$ acts as an oxidizing agent in acidic medium.
b. Give reason:

i. Cr^{2+} is a strong reducing agent whereas Mn^{2+} is not (Cr = 24, Mn = 25)
ii. The transition metal ions such as Cu^{+}, Ag^{+} and Sc^{3+} are colourless
iii. Chemistry of the actinoids is much more complicated than that of the lanthanoids.

OR

For M^{2+}/M and M^{3+}/M systems, the E^{Θ} values for some metals are as follows:

Cr^{2+}/Cr = -0.9 V, Cr^{3+}/Cr = -0.4 V, Mn^{2+}/Mn = -1.2 V,Mn^{3+}/Mn^{2+} = +1.5 V, Fe^{2+}/Fe= -0.4 V, Fe^{3+}/Fe^{2+} = +0.8 V. Use this data to comment upon:

i. The stability of Fe^{3+} in acid solution as compared to that of Cr^{3+} or Mn^{3+}
ii. The ease with which iron can be oxidised as compared to a similar process for either chromium or manganese metal.

Solution

Section A

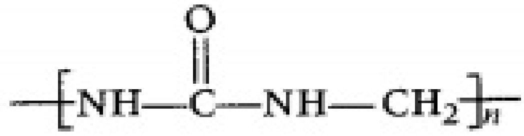
1.
   1. The passage of current liberates H_2 at cathode & Cl_2 at the anode. The solution is (b) NaCl in water.
   2. Oxygen is obtained at the anode on electrolysis of dilute H_2SO_4 using platinum electrodes as a product.
   3. Sulphuric acid
   4. $V = \frac{ItV_e}{96500} = \frac{1\times965\times5.6\times10^3}{96500} = 56mL$
   5. For a galvanic cell, Free energy change decreases i.e., $\Delta G < O$.

2. Electrolytic refining method used for refining copper metal.

3. The different types of RNA molecules are transfer RNA (t-RNA), messenger RNA (m-RNA), ribosomal RNA (r-RNA)

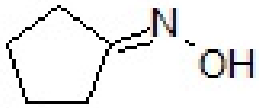
4. The three components of nucleic acid are base, sugar and phosphate group..

5. Structure of urea-formaldehyde resin is given below:

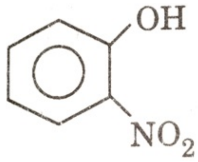


$$-\!\!\left[NH-\overset{\overset{O}{\|}}{C}-NH-CH_2\right]_n\!\!-$$

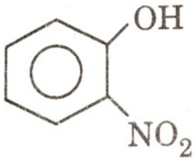
It is used for making unbreakable cups.

6. 

Cyclopentanone oxime

7. (b) 

Explanation:



8. (c) Calcination

   Explanation: In calcination, carbonate ore is heated to a high temperature in the absence of air to decompose the carbonate and give the metal oxide and carbon dioxide.

9. (a) Ni^{2+}

   Explanation: In period, when we move from left to right, atomic radii first decreases till nickel and then starts increasing. Hence Ni^{2+} has smallest radii.

10. (b) $[Pt(NH_3)_5Cl]Cl_3$

    Explanation: On getting ionised this complex gives 3 Cl^- (ions outside the square brackets are ionisable) and a $[Pt(NH_3)_3Cl]^+$ i.e. 4 ions are produced per molecule of the compound.

11. (b) as an insulator

    Explanation: Polystyrene is a thermoplastic polymers which are the linear or slightly branched long chain molecules capable of repeatedly softening on heating and hardening on cooling. It is used as an insulator.

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

    Explanation: Assertion is CORRECT but, reason is INCORRECT.

13. (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.

14. (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.

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

    Explanation: Assertion is INCORRECT but, reason is CORRECT.

Section B

17.
    - Natural polymers: Wool silk and cotton
    - Synthetic polymers: Nylon and Terylene.

18. It is given thatT_1 = 298 K

    Therefore,$T_2 = (298 + 10)K$ = 308 K

    We also know that the rate of the reaction doubles when temperature is increased by 10°

    Therefore, let us take the value of$k_1 = k$ and that of $k_2 = 2k$

    Also, $R = 8.314\, J\, K^{-1}\, mol^{-1}$

    Now, substituting these values in the equation: $\log \frac{k_2}{k_1} = \frac{E_a}{2.303\, R}\left[\frac{T_2 - T_1}{T_1 T_2}\right]$

    We get: $\log \frac{2k}{k} = \frac{E_a}{2.303 \times 8.314}\left[\frac{10}{298 \times 308}\right]$

    $\log 2 = \frac{E_a}{2.303 \times 8.314}\left[\frac{10}{298 \times 308}\right]$

    $E_a = \frac{2.303 \times 8.314 \times 298 \times 308 \times \log 2}{10}$

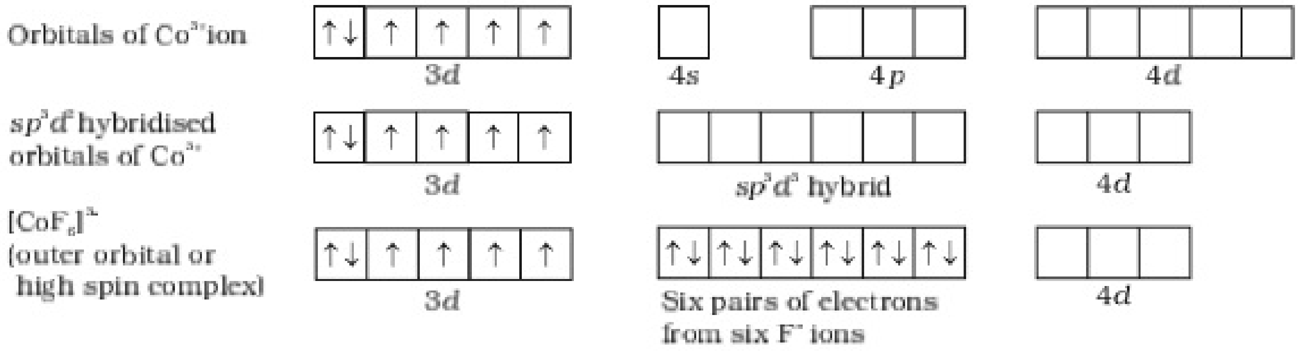
    $= 52897.78\, J\, mol^{-1} = 52.9\, k\, J\, mol^{-1}$

19.
    i. Phenol - Partially soluble in water
    ii. Toluene - Insoluble in water
    iii. Formic acid - Soluble in water
    iv. Ethylene glycol - Soluble in water
    v. $CHCl_3$ - Insoluble in water
    vi. Pentanol - Partially soluble in water

20. In a free transition metal ion the five d-orbital are degenerate, when it forms a complex, the degeneracy is split. In an octahedral field three d-orbitals having lower energy are called t_{2g} orbitals and the remaining two d-orbitals of higher energy are called e_g orbitals.

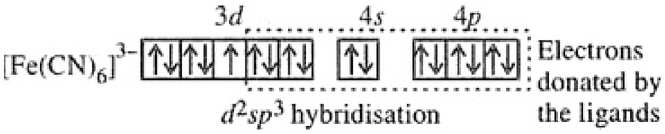
21. **IUPAC name:** hexafluorocobaltate (III) ion

    In $[\mathrm{CoF}_6]^{3-}$, cobalt is in +3 oxidation state. F^- is a weak field ligand. It does not cause pairing. In the formation of this complex outer six orbitals,i.e. one 4s, three 4p and two 4d-orbitals hybridize to give six hybrid orbitals (undergoes sp^3d^2 hybridisation). The complex has octahedral geometry and highly paramagnetic. It is an outer orbital or high spin complex.



OR

Fe(26): [Ar]4^3d6, Fe^{3+} : [Ar]$4s^0 3d^5$



It has octahedral shape and is paramagnetic in nature due to presence of one unpaired electron.

22. **Uses of cast iron:**

    i. Cast iron is used for casting stoves, railway sleepers, gutter pipes and toys etc.
    ii. It is used in the manufacture of wrought iron and steel.

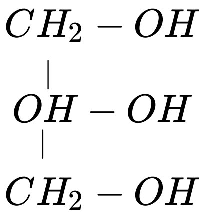
OR

When gold ore is treated with NaCN solution, gold ore is dissolved and impurities remain insoluble. In the extraction of gold, the metal is leached with NaCN or KCN, which is an oxidation reaction. During this process, Au is oxidized to Au^+. The recovery of gold from the solution is done by the displacement method.

$4Au(s) + 8CN^-(aq) + 2H_2O(aq) + O_2(g) \longrightarrow 4[Au(CN)_2]^- (aq) + 4OH^-(aq)$

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

In this reaction, zinc acts as a reducing agent. Thus, extraction of Au by leaching with NaCN involves both oxidation and reduction.

23. 

$$\begin{array}{l} CH_2-OH \\ \quad | \\ OH-OH \\ \quad | \\ CH_2-OH \end{array}$$

Propane - 1, 2, 3 - triol

Section C

24. i. **Mole fraction:** It is the ratio of number of moles of one component to the total number of moles present in the solution.

    If n_1 and n_2 be the no. of moles of solute and solvent, then mole fraction of solute x_1.

    $x_1 = \frac{n_1}{n_1+n_2}$

    ii. Molarity: It is number of moles of solute dissolved per litre of the solution. It is denoted by M.

    $\text{Molarity} = \frac{\text{Moles of solute}}{\text{Volume of solution in litre}}$

    $= \frac{n}{V} \times 1000$ unit is mol/L

25. Let the order of the reaction with respect to A be *x* and with respect to B be *y*.

    Therefore,

    $5.07 \times 10^{-5} = k[0.20]^x[0.30]^y$........(i)

    $[ro = k[A]^x[B]^y]][5.07 \times 10^{-5} = k[0.20]^x[0.10]^y$........(ii)

    $1.43 \times 10^{-4} = k[0.40]^x[0.05]^y$

    $$5.07 \times 10^{-5} = k[0.20]^x[0.30]^y \ldots\ldots..(i)$$

    $$[r_0 = k[A]^x[B]^y]][5.07 \times 10^{-5} = k[0.20]^x[0.10]^y \ldots\ldots(ii)\ \ ]$$

    $$1.43 \times 10^{-4} = k[0.40]^x[0.05]^y \ldots\ldots(iii)$$

    Dividing equation (i) by (ii), we obtain

    $\frac{5.07\times10^{-5}}{5.07\times10^{-5}} = \frac{k[0.20]^x[0.30]^y}{k[0.20]^x[0.10]^y}$

    $1 = \frac{[0.30]^y}{[0.10]^y}$

    $\left(\frac{0.30}{0.10}\right)^0 = \left(\frac{0.30}{0.10}\right)^y$

    y = 0

    Dividing equation (iii) by (ii), we obtain

    $\frac{1.43\times10^{-4}}{5.07\times10^{-5}} = \frac{k[0.40]^x[0.05]^y}{k[0.20]^x[0.30]^y}$

    Since y=0,

$$[0.05]^y = [0.30]^y = 1$$

$\frac{1.43\times10^{-4}}{5.07\times10^{-5}} = \frac{[0.40]^x}{[0.20]^x}$

2.821 = 2^X

log 2.821 = x log 2 (Taking log on both sides)

$$2.821 = 2^x$$

$$\log 2.821 = x\log 2 \quad (Taking \log on\, both\, sides)$$

$x = \frac{\log 2.821}{\log 2}$

= 1.496

= 1.5 (approximately)

Hence, the order of the reaction with respect to A is 1.5 and with respect to B is zero.

OR

1. The differential rate equation will be
   $-\frac{d[R]}{dt} = k[A][B]^2$
2. If the concentration of B is increased three times, then
   $-\frac{d[R]}{dt} = k[A][3B]^2 = 9.k[A][B]^2$
   Therefore, the rate of reaction will increase 9 times.
3. When the concentrations of both A and B are doubled,
   $-\frac{d[R]}{dt} = k[A][B]^2 = k[2A][2B]^2 = 8.k[A][B]^2$
   Therefore, the rate of reaction will increase 8 times.

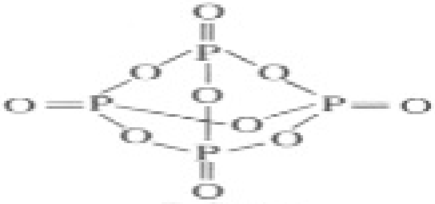
26. cell reaction

$$Cu(s) \to Cu^{2+}(aq) + 2e^-$$
$$2Ag^+(aq) + 2e^- \to 2Ag(s)$$
$$Cu(s) + 2Ag^+(aq) \to Cu^{2+}(aq) + 2Ag(s)$$
$$E_{cell} = E^0_{cell} - \frac{0.0591}{2}\log\frac{[Cu^{2+}]}{[Ag^+]^2}$$
$$= \left[E^0_{Ag^+/Ag} - E^0_{Cu^{2+}/cu}\right] - \frac{0.0591}{2}\log\frac{0.13}{(10^{-4})^2}$$
$$= (0.80V - 0.34V) - \frac{0.0591}{2}\log 1.3\times 10^7$$
$$= 0.46V - \frac{0.0591}{2}\left[\log 1.3 + \log 10^7\right]$$

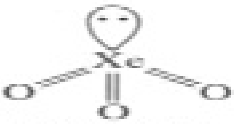
E_{cell} = 0.46V - 0.21V

= 0.25 V

27. a. Structure of the compounds are given below:

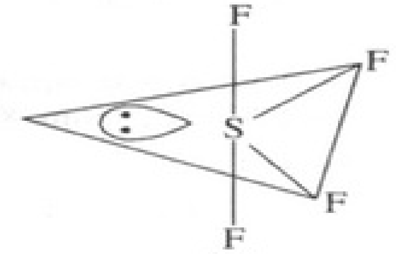
i. 

P_4O_{10}

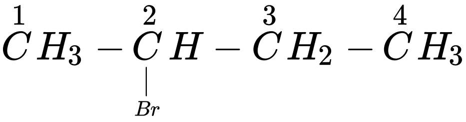
ii. 

Pyramidal

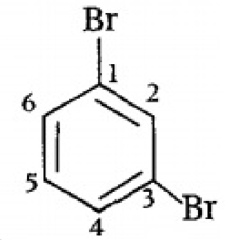
XeO_3

b. 

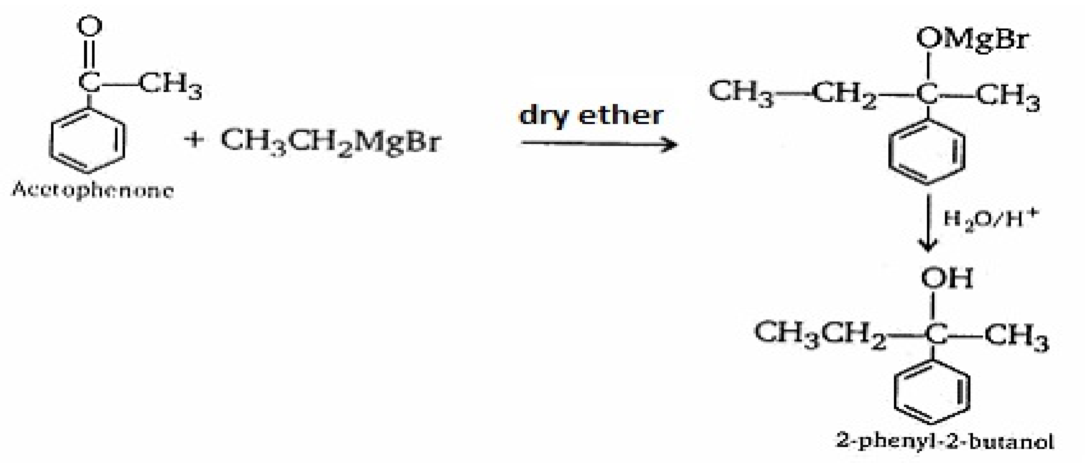
SF_4

28. i. IUPAC name of the compound, 

$\overset{1}{C}H_3-\underset{\underset{Br}{|}}{\overset{2}{C}}H-\overset{3}{C}H_2-\overset{4}{C}H_3$ is 2-bromobutane

ii. IUPAC name of the compound,  is 1,3-dibromobenzene

iii. IUPAC name of the compound, $\overset{1}{C}H_2=\overset{2}{C}H-\overset{3}{C}H_2-Cl$ is 3-chloroprop-1-ene

29. i. 

ii. $\underset{\text{Propene}}{CH_3-CH=CH_2} + H_2O \xrightarrow{H_2SO_4} \underset{2-propanol}{CH_3-\overset{\overset{OH}{|}}{C}H-CH_3} \xrightarrow[573K]{Cu} \underset{Acetone}{CH_3-\overset{\overset{O}{||}}{C}H-}$

OR

1. **Rosenmund reduction:** Acyl chloride is hydrogenated over a catalyst, palladium on barium sulphate. This reaction is called Rosenmund Reaction.

$$\underset{\text{Ethanoyl chloride}}{CH_3-\overset{\overset{O}{||}}{C}-Cl} + H_2 \xrightarrow[quinoline]{Pd-BaSO_4} \underset{Ethanal}{CH_3-\overset{\overset{O}{||}}{C}-H} + HCl$$

2. **Tollen's reagent:** On warming an aldehyde with freshly prepared ammonical silver nitrate solution (Tollen's reagent), a bright silver mirror is produced due to the formation of silver metal. The aldehydes are oxidised to corresponding carboxylate anion. The reaction occurs in alkaline medium.

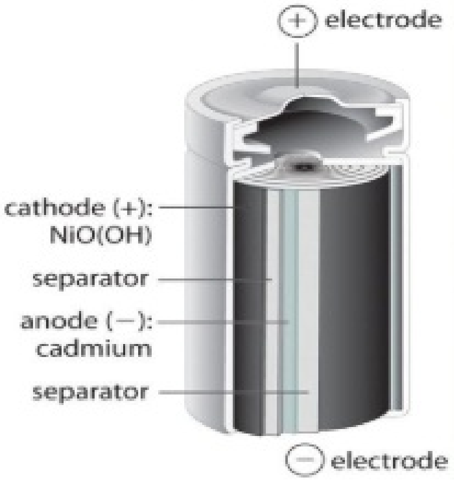
$$RCHO + 2[Ag(NH_3)_2]^+ + 3\,\overset{-}{O}H \rightarrow RCO\overset{-}{O} + 2Ag + 2H_2O + 4$$

30. Synthetic detergents are preferred for cleaning clothes. When soaps are dissolved in water containing calcium ions, these ions form insoluble salts that are of no further use. However, when synthetic detergents are dissolved in water containing calcium ions, these ions form soluble salts that act as cleansing agents.

Section D

31. a. **Nickel Cadmium cell:**

It is a rechargeable cell. It consists of a cadmium anode and a metal grid containing NiO_2 acting as a cathode as shown in the figure. The electrolyte in this cell is KOH. The reaction taking place during discharging and charging are shown in the figure.



1-Ni-Cd (Nickel Cadmium battery)

Battery reactions:

At the negative

$$Cd + 2OH \underset{disch\arg e}{\overset{ch\arg e}{\longleftrightarrow}} Cd(OH)_2 + 2e-$$

At the positive

$$NiOOH + H_2O + 2e- \underset{disch\arg e}{\overset{ch\arg e}{\longleftrightarrow}} Ni(OH)_2 + OH$$

Overall reaction

$$2NiOOH + Cd + 2H_2O \underset{disch\arg e}{\overset{ch\arg e}{\longleftrightarrow}} 2Ni(OH)_2 + Cd(OH)_2$$

In these reactions, there is no formation of gaseous products. The reaction products generally remain sticking to the electrodes and can be reconverted by recharging the cell. The charging process is similar to lead storage battery.

It produces a potential of about 1.4 V. It has longer life than the lead storage cell but more expensive than lead storage battery. However, it has some advantages because it is smaller and lighter. It can be used in portable and cordless appliances.

b. We have,

$$Ag^+(aq) + e^- \rightarrow Ag(s)$$

Thus, quantity of electricity required to deposit 1 mole of Ag(108 g)

$$Q = nF = 1mole \times 96500\,C\,mol^{-1}$$

$$= 96500\,C = 9.65 \times 10^4 C$$

Quantity of electricity actually passed = Current in amperes × Time in seconds

$$= 0.5A \times (2 \times 60 \times 60)\,s$$

= 3600 C

$\therefore$ 3600C of charge produce silver $= \frac{108g}{9.65 \times 10^4 C} \times 3600C \; = 4.03\ g$

Volume of silver deposited $= \frac{\text{Mass}}{\text{Density}} = \left(\frac{4.03g}{10.5\,g\,cm^{-3}}\right) = 0.384\ cm^3$

Therefore,thickness of the silver deposited $= \frac{\text{Volume}}{\text{Surface Area}} = \frac{(0.384\,cm^3)}{(900\,cm^2)}$

$$= 4.27 \times 10^{-4}\ cm$$

OR

i. **At cathode:** $2H^+(aq) + 2e^- \rightarrow H_2(g)$

   At anode: $2OH^-(aq) \rightarrow O_2(g) + 2H^+(aq) + 4e^-$

   $H_2(g)$ is evolved at cathode and $O_2(g)$ is evolved at anode.

ii. **At cathode:** $Ag^+(aq) + e^- \rightarrow Ag(s)$

   At anode: $Ag(s) \rightarrow Ag^+(aq) + e^-$

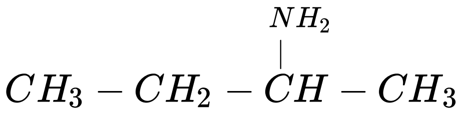
32. a. m-Toluidine or 3-Methylbenzenamine
    b. 1, 4-Benzenediamine
    c. 4-chloro-3-nitro-N-ethyl aniline
    d. 4, 4-Dimethylcyclohexanamine
    e. N-Methyl-2-phenylethanamine

OR

(i), (ii) The structures and IUPAC names of different isomeric amines corresponding to the molecular formula, $C_4H_{11}N$ are given below:

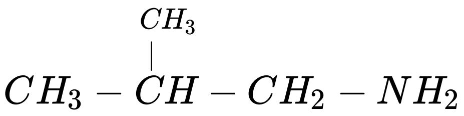
a. $CH_3 - CH_2 - CH_2 - CH_2 - NH_2$

   Butanamine(1°)

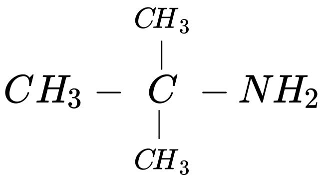
b. 

$$CH_3 - CH_2 - \underset{}{\overset{\overset{NH_2}{|}}{C}H} - CH_3$$

   Butan-2-amine (1°)

c. 
$CH_3 - \overset{\overset{CH_3}{|}}{C}H - CH_2 - NH_2$

2-Methylpropanamine (1°)

d. 
$CH_3 - \overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}} - NH_2$

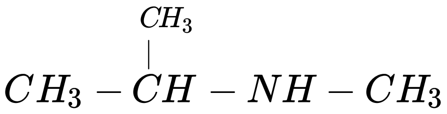
2-Methylpropan-2-amine (1^o)

e. $CH_3 - CH_2 - CH_2 - NH - CH_3$

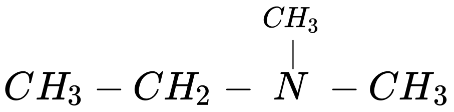
N-Methylpropanamine (2°)

f. $CH_3 - CH_2 - NH - CH_2 - CH_3$

N-Ethylethanamine (2°)

g. 
$CH_3 - \overset{\overset{CH_3}{|}}{C}H - NH - CH_3$

N-Methylpropan-2-amine (2°)

h. 
$CH_3 - CH_2 - \overset{\overset{CH_3}{|}}{N} - CH_3$

N, N- Dimethylethanamine (3°)

(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.

33. a. Acidified permanganate solution act as a strong oxidising agent. $KMnO_4$ oxidises oxalates to carbon dioxide, sulphides to sulphur etc and itself get reduced to Mn^{+2}.

$5C_2O_4^{2-} + 2MnO_4^- + 16H^+ \rightarrow 2Mn^{2+} + 8H_2O + 10CO_2$

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

b. i. Cr^{2+} is less stable than Cr^{3+} therefore it is good reducing agent. Cr^{3+} is stable because outer most electronic configuration of Cr^{3+} is $3d^3$, which makes a stable half filled t_{2g} configuration. Whereas Mn^{2+} has outermost electronic configuration as $3d^5$ which is stable due to half filled d-orbitals therefore it is not reducing agent.

ii. Cu^+, Ag^+, Sc^{3+} are colourless because they do not have unpaired electrons. Due to absence of unpaired electrons in them, no d-d transition occurs.

iii. Actinoids show large number of oxidation states, that is why their chemistry is more complicated. Secondly all of them are radioactive and the earlier members have relatively long half-lives, the latter ones have half-life values ranging from a day to some minutes. The latter members could be prepared only in nanogram quantities. These facts render their study more difficult.

OR

Oxidation potential is measure of tendency of a chemical species to undergo oxidation. More is the tendency of substance to undergo oxidation, more will be its oxidation potential.

Similarly, Reduction potential is a measure of tendency of a chemical species to undergo reduction. More is the tendency of substance to undergo reduction, more will be its reduction potential and lesser will be its oxidation potential.

Oxidation potential = - (Reduction Potential)

The E^{Θ} value (Standard reduction potential value) for Fe^{3+}/Fe^{2+} is higher than that for Cr^{3+}/Cr^{2+} and lower than that for Mn^{3+}/Mn^{2+}.So, the reduction of $Fe^{3+} to\, Fe^{2+}$ is easier than the reduction of $Mn^{3+}\ to\, Mn^{2+}$,but not as easy as the reduction of Cr^{3+} to Cr^{2+}.Hence, Fe^{3+} is more stable than Mn^{3+}, but less stable than Cr^{3+}. The stability of Cr^{3+} is because of presence of half filled t_{2g} configuration in Cr^{3+}. These metal ions can be arranged in the increasing order of their stability as: $Mn^{3+} < Fe^{3+} < Cr^{3+}$

The reduction potentials for the given pairs increase in the following order. $Mn^{2+}/Mn < Cr^{2+}/Cr < Fe^{2+}/Fe$ So, the oxidation of Fe to Fe^{2+} is not as easy as the oxidation of Cr to Cr^{2+} and the oxidation of Mn to Mn^{2+} Thus, these metals can be arranged in the increasing order of their ability to get oxidised as: Fe < Cr < Mn.