CBSE Class 11 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. When anions and cations approach each other, the valence shell of anions are pulled towards the cation nucleus and thus, the shape of the anion is deformed. The phenomenon of deformation of anion by a cation is known as polarization and the ability of the cation to polarize the anion is called as polarizing power of cation. Due to polarization, sharing of electrons occurs between two ions to some extent and the bond shows some covalent character.
   The magnitude of polarization depends upon a number of factors. These factors were suggested by Fajan and are known as Fajan's rules.

   I. Greater is the polarization in a molecule, more is the covalent character.
   II. As the charge on cation increases, its tendency to polarize the anion increases.
   III. As the size of the cation decreases or the size of the anion increases, the

polarization increases.

IV. The cations with 18 electrons in the outermost shell bring greater polarization of the anion than those with inert gas configuration even both the cations to have same size and same charge.

Answer the following questions

i. Considering $BeCl_2$, $MgCl_2$, $CaCl_2$ and $BaCl_2$, predict which of the following statement is true?
   a. $BeCl_2$ is least ionic out of the given chlorides
   b. Covalent character increases as the atomic number of the metal atom increases
   c. $BeCl_2$ has the highest melting point the given chlorides
   d. All are highly ionic compounds

ii. Out of $AlCl_3$ and AlI_3 which halides show maximum polarization?

iii. Out of $AlCl_3$ and $CaCl_2$ which one is more covalent in nature?

iv. The non-aqueous solvent like ether is added to the mixture of LiCl, NaCl and KCl. Which will be extracted into the ether?

v. Out of CaF_2 and CaI_2 which one has a minimum melting point?

2. What is common between d_{xy} and $^{d}x^2 - y^2$ orbitals?

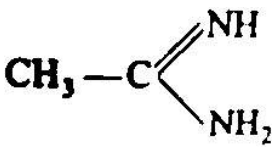
3. Why Li and Mg show resemblance in chemical behaviour?

4. Predict the change in internal energy for an isolated system at constant volume.

5. What is light soda ash? Why is it called so?

6. Name the two strong acids present in the acid rain?

7. The correct order of basicities of the given compounds is:

i. 

ii. $CH_3^- CH_2 NH_2$

iii. $(CH_3)_2NH$

iv. $CH_3 - \overset{O}{\overset{||}{C}} - NH_2$

a. i > iii > ii > iv

b. i > ii > iii > iv

c. ii > i > iii > iv

d. iii > i > ii > iv

8. The oxidation number of hydrogen in LiH, NaH and CaH_7 is

a. -1

b. -2

c. 1and 2

d. -1 and -2

9. Which of the following property of water can be used to explain the spherical shape of rain droplets?
   a. critical phenomena
   b. viscosity
   c. surface tension
   d. pressure

10. In the decomposition of lead (II) nitrate to give lead (II) oxide, nitrogen dioxide and oxygen gas, the coefficient of nitrogen dioxide (in the balanced equation) is

a. 1

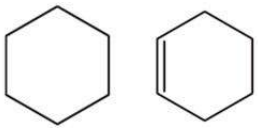
b. 2

c. 3

d. 4

11. Compounds containing carbon atoms joined together in the form of a ring as

following are:



a. Aliphatic compounds

b. Heterocyclic compounds

c. Alicyclic compounds

d. Aromatic compounds

12. **Assertion:** Graphite is good conductor of heat and electricity.
Reason: Graphite has π-electrons which are mobile.

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:** Empirical and molecular formula of Na_2CO_3 is same.
Reason: Na_2CO_3 does not form hydrate.

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:** Oxidation number of C in HCHO is zero.

Reason: Formaldehyde is a covalent compound.

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:** Nitration of nitrobenzene gives mainly m-dinitrobenzene.
Reason: -NO group is electron donation 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:** The kinetic energy of 8 gram of methane is equal to the kinetic energy of 16 gram of oxygen.
Reason: The total heat change in a reaction is the same whether the chemical reaction takes place in one single step or in several steps.

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. What do you mean by Dipole moment? Draw the dipole diagram of H_2O.

18. Arrange the following in order of increasing O.N. of iodine:
l_2, Hl, HlO_2, KlO_3, LCl.

19. Why is LiF almost insoluble in water whereas LiCl soluble not only in water but also in acetone?

20. Rotation around carbon-carbon single bond of ethane is not completely free. Justify the Statement.

21. Calculate the pH of a buffer solution containing 0.1 mole of acetic acid and 0.15 mole of sodium acetate. Ionisation constant for acetic acid is 1.75×10^{-5}.

OR

What is the total number of sigma and pi bonds in the following molecules

i. CH_2Cl_2
ii. C_2H_4

22. What is meant by reaction mechanism?

OR

Find out the value of the equilibrium constant for the following reaction at 298 K.
$2\mathrm{NH_3(g)} + \mathrm{CO_2}\,(g) \rightleftharpoons \mathrm{NH_2CONH_2}(aq) + \mathrm{H_2O(l)}$
Standard Gibbs energy change, $\Delta G^{\ominus}$ at the given temperature, is - 13.6 kJ mol^{-1}.

23. On converting benzene to toluene, state whether there will be a rise or fall in the melting point.

Section C

24. 221.4J is needed to heat 30g of ethanol from 15^0C to 18^0C. Calculate (a) specific heat capacity, and (b) molar heat capacity of ethanol.

25. Indicate the type of bonds present in NH_4NO_3 and state the mode of hybridisation of two N-atoms.

OR

The solubility of $Sr(OH)_2$ at 298 K is 19.23 g/L of solution. Calculate the concentration of strontium and hydroxyl ions and the pH of the solution. (Atomic mass of Sr = 87.6)

26. Balance the following equations in a basic medium by ion-electron method and oxidation number methods and identify the oxidizing agent and the reducing agent.

    i. $\mathbf{P_4(s) + OH^-(aq) \longrightarrow PH_3(g) + HPO_2^-(aq)}$
    ii. $N_2H_4(l) + ClO_3^-(aq) \longrightarrow NO(g) + Cl^-(g)$
    iii. $Cl_2O_7(g) + H_2O_2(aq) \longrightarrow ClO_2^-(aq) + O_2(g) + H^+$

27. A 5L vessel contains 1.4 g of nitrogen. When heated to 1800 K, 30% of molecules are dissociated into atoms. Calculate the pressure of the gas at 1800 K.

28. A solution contains 25 % water, 25 % ethanol and 50 % acetic by mass. Calculate the mole fraction of each component.

29. The first ionization enthalpy of carbon atom is greater than that of boron whereas the reverse is true for the second ionization enthalpy. Explain.

OR

Discuss briefly the various factors on which ionization enthalpy depends.

30. What do you mean by ozone hole? What are its consequences?

Section D

31. Predict the products of electrolysis in each of the following:

    i. An aqueous solution of $AgNO_3$ with silver electrodes.
    ii. An aqueous solution of $CuCl_2$ with platinum electrodes.

OR

Give ion-electron equations for the following reactions:

i. Oxidation of ferrous ions to ferric ions by hydrogen peroxide both in acidic and basic media.
ii. Oxidation of iodide ion to iodine by hydrogen peroxide in acidic medium.
iii. Reduction of acidified permanganate ion by hydrogen peroxide.
iv. Reduction of alkaline ferricyanide ions to ferrocyanide ions.
v. Oxidation of ferrocyanide ions to ferricyanide ions in acidic medium.

32. Assign structures for the following:

i. An alkyne (X) has a molecular formula C_5H_8. It reacts neither with sodamide nor with ammoniacal cuprous chloride.
ii. A hydrocarbon 'Y' decolourises bromine water. On ozonolysis, it gives 3-methyl butanal and formaldehyde. Give the name of the compound.
iii. A hydrocarbon (Z) has molecular formula C_8H_{10}. It does not decolourise bromine water and is oxidised to benzoic acid on heating with $K_2Cr_2O_7$. It can also have three other isomers A, B and C. Write the structures of Z, A, B and C.

OR

i. Addition of HBr to propene yields 2-bromopropane, while in the presence of benzoyl peroxide, the same reaction yields 1-bromopropane. Explain and give mechanism.
ii. Write down the products of ozonolysis of 1, 2-dimethylbenzene (o-xylene). How does the results support the Kekule structure of benzene?

33. a.
    i. An atomic orbital has n = 3. What are the possible values of I and m_I?
    ii. List the quantum numbers (mI and I) of electrons for 3d orbital.
    iii. Which of the following orbitals are possible?
    1p, 2s, 2p and 3f
    b. An atom of an element contains 29 electrons and 35 neutrons. Deduce
    i. The number of protons and
    ii. The electronic configurations of the element

OR

i. How are 0.50 m $NaCO_3$ and 0.50 M $NaCO_3$ different?

ii. Calculate the amount of carbon dioxide that could be produced when
   a. 1 mol of carbon is burnt in air
   b. 1 mol of carbon is burnt in 16 g dioxygen
   c. 2 mol of carbon is burnt in 16 g of dioxygen

CBSE Class 11 Chemistry
Sample Paper 08 (2019-20)

Solution

Section A

1. i. $BeCl_2$ is least ionic out of the given chlorides
   ii. AlI_3 halides show maximum polarization.
   iii. $AlCl_3$ is more covalent in nature.
   iv. LiCl will be extracted into the ether.
   v. CaI_2 has a minimum melting point.

2. Both have identical shape, consisting of four lobes.

3. Due to diagonal relationship both Li and Mg show same chemical properties as:
   i. Both has small atomic size
   ii. Both are harder and have high melting point than other elements in their respective groups.
   iii. Hydroxides of both Li and Mg are weak alkalies.

4. For an isolated system at constant volume, there is no transfer of energy in the form of heat or work.
   So, $\Delta U = q + W$
   $\Rightarrow \Delta U = 0 + 0$
   $\Rightarrow \Delta U = 0$

5. Light soda ash is known as sodium carbonate.
   Formula of light soda ash is $\mathrm{Na_2CO_3}$.
   It is called so because it is fluffy solid with a low packing density of about 0.5 g cm^{-3}.

6. Sulphuric acid (H_2SO_4) and nitric acid (HNO_3) are the two strong acids present in the acid rain.

7. (a) i > iii > ii > iv

Explanation: i > iii > ii > iv

8. (a) -1
   Explanation: This is according to the rules of assigning oxidation number i.e. Metal hydrides, such as NaH, LiH, etc., in which the oxidation state for H is -1.
9. (c) surface tension
   Explanation: Due to surface tension, the water droplet tends to acquire minimum surface area, hence water droplet attains spherical shape.
10. (d) 4
    Explanation: 4
11. (c) Alicyclic compounds
    Explanation: An alicyclic compound is an organic compound that is both aliphatic and cyclic. They contain one or more all-carbon rings which may be either saturated or unsaturated, but do not have aromatic character.
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. (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. (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.

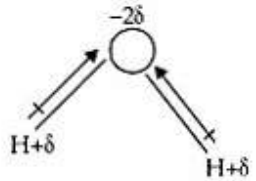
Section B

17. The product of the magnitude of charges Q (+ve, or -ve) and the distance between them is called dipole moment.
    It is usually denoted by μ

$\mu = Q \times d$

Its SI unit is Debyes (coulomb-meter).

The dipole moment of H_2O is:- 1.84 D



M = 1.8 4 D

18. The increasing order of oxidation numbers of iodine in the given compounds is,
$HI < I_2 < ICl < HIO_2 < KIO_3$

The oxidation numbers of iodine in the given compounds are tabulated as below in their increasing order -

HI	-1
I_2	0
ICl	+1
HIO_2	+3
KIO_3	+5

$\therefore$ the increasing order of O.N. of iodine is,
$HI < I_2 < ICl < HIO_2 < KIO_3$

19. The low solubility of LiF in water is due to its high lattice energy which could not be compensated by hydration energy. LiCl is soluble in water,acetone and ethanol as well , it is because of its hydration energy which compensates the low lattice energy.

20. Ethane contains carbon-carbon sigma (σ) bond and electron distribution of sigma molecular orbital is symmetrical around the internuclear axis of the C-C bond which is not distributed due to rotation about its axis and permits free rotation around C-C bond. However, the rotation around C—C single bond is not completely free due to repulsion between electron clouds of C-H bonds on adjacent carbon atoms. Such type of repulsive interaction is called torsional strain.

21. We have, Henderson's equation

pH = pK_a + log $\frac{[Salt]}{[Acid]}$

pH = -log K_a + log $\frac{[Sodium\ acetate]}{[Acetic\ acid]}$

pH = - log (1.75×10^{-5}) + log $\frac{0.15}{0.10}$

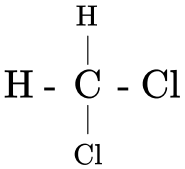
or, pH = - log 1.75 - log 10^{-5} + log 1.5

= -0.243 + 5 + 0.176 = 4.933

OR

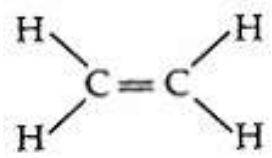
i. σ bond = 4

π bond = 0



ii. σ bond = 5

π bond = 1



22. A sequential account of each step, describing details of electron movement, energetics during bond cleavage and bond formation, and the rates of transformation of reactants into products (kinetics) is referred to as reaction mechanism.

OR

According to the question, T = 298 K, Standard Gibbs energy change = $\Delta G^{\ominus}$ = - 13.6 kJ mol^{-1}.

Reaction:

$2NH_3(g) + CO_2(g) \rightleftharpoons NH_2CONH_2(aq) + H_2O(l)$

We know that, $\log K = \frac{-\Delta_r G^{\ominus}}{2.303RT}$

$\Rightarrow \log K = \frac{-(-13.6)}{2.303 \times 8.314 \times 298}$

$\Rightarrow \log K = 2.38$

$\Rightarrow K =$ antilog (2.38)

$\Rightarrow K = 2.4 \times 10^2$

23. On converting benzene to toluene, there is a fall in the melting point although toluene has a higher molecular mass. This is because benzene is more symmetrical structure than toluene and due to its planar structure, molecules of benzene can pack more closely in the crystal lattice and the cohesive forces are strong, whereas the methyl group in toluene prevents such close packing and it has weaker intermolecular forces.

Section C

24. According to the question, 221.4 J is needed to heat 30 g of ethanol from 15^0C to 18^0C.

    a. We know that, Specific heat capacity = C = $\frac{\text{Heat absorbed by the substance}}{Mass \text{ of the substance} \times \text{Rise in temp.}}$

    $= \frac{221.4J}{30g(18^0C - 15^0C)}$

    $= \frac{221.4}{30 \times 3} \text{Jg}^{-1} \circ C^{-1}$

    = 2.46 Jg^{-1} $^oC^{-1}$

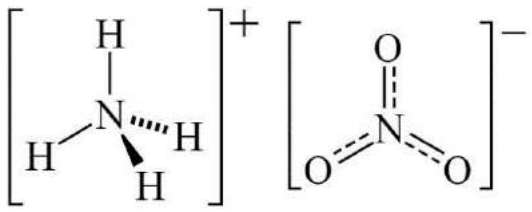
    b. Molar heat capacity, C_m = specific heat $\times$ molar mass

    = 2.46 $\times$ 46

    = 113.2 $Jmol^{-1}$ $^oC^{-1}$

    The molar heat capacity of ethanol is 113.2 J mol^{-1} $^oC^{-1}$.

25. The structure of the compound NH_4NO_3 can be represented as:



It is evident from the structure that NH_4^+ ion contains covalent bonds and NO_3^- also contains covalent bonds. Also, the structure clearly indicates that NH_4^+ is a cation and NO_3^- is an anion and hence the bond between them is ionic. It has coordinate bond also as the lone pair of electron on nitrogen is donated to H. All type of bonds are present in it.

The N of NH_4^+ ion is sp^3 hybridised and is tetrahedral and the N of NO_3^- ion is

sp^2 hybridised and is planar.

OR

Molar mass of $Sr(OH)_2$ = 87.6 + 34 = 121.6 g mol^{-1}

Molarity of $Sr(OH)_2$ in moles $L^{-1} = \frac{19.23g\ L^{-1}}{121.6g\ mol^{-1}} = 0.1581\ M$

Assuming complete dissociation, $Sr(OH)_2 \rightarrow Sr^{2+} + 2OH^-$

$\therefore$ [Sr^{2+}] = 0.1581 M, $\left[OH^-\right] = 2 \times 0.1581$ = 0.3162 M

pOH = -log 0.3162 = 0.5, $\therefore$ pH = 14 - 0.5 = 13.5

26. Please try yourself. The balanced equations are :

i. $\mathrm{P_4}(s) + 6\mathrm{OH^-}(aq) \longrightarrow \mathrm{PH_3}(g) + 3\mathrm{H_2PO_2^-}(aq)$

ii. $3\mathrm{N_2H_4}(l) + 4\mathrm{ClO_3^-}(aq) \longrightarrow 6\mathrm{NO}(g) + 4\mathrm{Cl^-}(aq) + 6\mathrm{H_2O}(l)$

iii. $\mathrm{Cl_2O_7}(g) + 4\mathrm{H_2O_2}(aq) + 2\mathrm{OH^-}(aq) \longrightarrow$
$2\mathrm{ClO_2} - (aq) + 4\mathrm{O_2}(g) + 5\mathrm{H_2O}(l)$

27. According to the question, V = 5L, T = 1800 K

Reaction:

$N_2 \rightleftharpoons 2N$

Initial moles of N_2 = $\frac{1.4}{28}$ = 0.050

Initial moles of 2N = 0

Moles of N_2 after heating = 0.05 - $\frac{30}{100} \times$ 0.05 = 0.035

Moles of 2N after heating = 2$\times$ $\frac{30}{100} \times$ 0.05 = 0.03

Dissociation of N_2 = 0.035

Dissociation of 2N = 0.03

$\therefore$ Total number of moles, n = 0.035 + 0.03 = 0.065

We know that,

pV = nRT

$\Rightarrow$p = $\frac{nRT}{V}$

$\Rightarrow$p = $\frac{0.065\ mol \times 0.0821\ L\ \mathrm{atm\ K^{-1}mol^{-1}} \times 1800\ \mathrm{K}}{5\ L}$

$\Rightarrow p = 1.92\ atm$

28. We know that, Mole fraction = $\frac{Number\ of\ moles\ of\ one\ component}{Total\ number\ of\ moles\ of\ all\ components}$

Let the total mass of solution = 100 g
Here, Mass of water = 25 g

Mass of ethanol = 25 g
Mass of acetic acid = (100-25-25) = 50 g

Now, Moles of water = $\frac{25}{18} = 1.388$ (Molar Mass of H_2O= 18 g/mol)
Also, Moles of ethanol = 25 / 46 = 0.543 (Molar Mass of C_2H_5OH = 46 g/mol)
And, Moles of acetic acid = 50 / 60 = 0.833 (Molar Mass of CH_3COOH = 60 g/mol)
Total number of moles of all components in a solution = 1.388 + 0.543 + 0.833 = 2.764

i. Mole fraction of water (H_2O)= $\frac{1.388}{2.764} = 0.502$
ii. Mole fraction of ethanol, (C_2H_5OH) = $\frac{0.543}{2.764} = 0.196$
iii. Mole fraction of acetic acid (CH_3COOH) = $\frac{0.833}{2.764} = 0.302$

29. The electronic configuration of C is $1s^2\ 2s^2\ 2p^2$ and that of B is $1s^2\ 2s^2\ 2p^1$. The nuclear charge is more in C than in B. As a result, first ionization enthalpy of C is higher than that of B. After the removal of the first electron, the second electron to be removed from C atom is from 2p ($2p^2$) and whereas that from B atom is form 2s ($2\ s^2$). Now, 2s orbital is more penetrating and hence is more strongly attracted by the nucleus. As a result, the second I.E. of B is higher than that of C.

OR

The important factors which affect ionisation enthalpy are:
a) **Atomic size:** greater the atomic size (atomic radius), smaller will be the ionisation enthalpy.

b) **Nuclear charge:** The value of ionisation enthalpy increases with increase in the effective nuclear charge for the valence electrons.

c) **Shielding effect:** As the shielding effect increases, the electrons can easily be removed and so the ionisation enthalpy decreases.

d) **Stability of electronic configurations:** Pesence of half-filled or completely filled orbitals increases ionisation enthalpy.

e) **Penetration effect of orbitals:** The order of energy required to remove electron from s, p, d and f-orbitals of a shell is s>p>d>f. This is because of the distance of the electron from the nucleus increases.

30. Depletion of ozone layer creates some sort of holes in the blanket of ozone which surround as. This is known as ozone hole.
(i) With the depletion of the ozone layer UV radiation filters into the troposphere which leads to aging of skin, cataract, sunburn, skin cancer etc.
(ii) By killing many of the phytoplanktons it can damage the fish productivity.
(iii) Evaporation rate increases through the surface and stomata of leaves which can decrease the moisture content of the soil.

Section D

31. i. An aqueous solution, $AgNO_3$ ionises to give Ag^+ (aq) and $NO\overline{3}$(aq) ions.

$AgNO_{3(}aq) \longrightarrow Ag^+(aq) + NO\overline{3}(aq)$

Thus, when an electric current is passed through $AgNO_3$ solution,

Ag^+(aq) ions move towards the cathode
and
$NO\overline{3}$(aq) ions move towards the anode.

∴ at the cathode, either Ag^+(aq) ions or H_2O molecules may get reduced.

Which of these will actually get discharged would depend upon their electrode potentials given as below:

$Ag^+(aq) + e^- \longrightarrow Ag(s)$; $E^O = + 0.80$ V

$2H_2O(l) + 2e^- \longrightarrow H_2(g) + 2OH^-(aq)$; $E^O = -0.83$ V

Since the reduction electrode potential of Ag^+ (aq) ions is higher than that of H_2O molecules, therefore, at the cathode, Ag^+ (aq) ions (rather than H_2O molecules) are reduced/discharged.

Similarly, at the anode, either Ag metal of the anode or H_2O molecules may be

oxidised.

Their reduction electrode potentials are:

$Ag(s) \longrightarrow Ag^{+}(aq) + e^{-}; E^{o} = -0.80\ V$

$2H_2O(l) \longrightarrow O_2(g) + 4H^{+}(aq) + 4e^{-}; E^{o} = -1.23\ V$

Since the electrode potential of Ag is much higher than that of H_2O,

$\therefore$ the anode metal (ie. Ag) gets oxidized and (not the H_2O molecule).

It may, however, be mentioned here that the oxidation potential of $NO\overline{3}$ ions is even lower than that of H_2O since more bonds are to broken during the reduction of $NO\overline{3}$ ions than those in H_2O.

Thus, when an aqueous solution of $AgNO_3$ is electrolysed, Ag from Ag anode dissolves while Ag^{+} (aq) ions present in the solution get reduced and get deposited on the cathode,

ii. In aqueous solution, $CuCl_2$ ionises as follows:

$CuCl2(aq) \longrightarrow Cu^{2+}(aq) + 2Cl^{-}(aq)$

On passing electric current, $Cu^{2+}(aq)$ ions move towards the cathode and $Cl^{-}(aq)$ ions move towards anode.

Thus, at the cathode, either $Cu^{2+}(aq)$ or H_2O molecules can get reduced.

Their electrode potential are:

$Cu^{2+}(aq) + 2e^{-} \longrightarrow Cu(s); E^{o} = +0.34\ V$

$H_2O(l) + 2e^{-} \longrightarrow H_2(g) + 2OH^{-}; E^{o} = -0.83\ V$

Since the electrode potential of $Cu^{2+}(aq)$ ions is much higher than that of H_2O,at the cathode, $Cu^{2+}(aq)$ ions are reduced(and not H_2O molecules.)

Similarly, at the anode either $Cl^{-}(aq)$ ions or H_2O molecules are oxidized.

Their oxidation potentials are:

$2Cl^{-}(aq) \longrightarrow Cl_2(g) + 2E^{-}; \Delta E^{o} = -1.36\ V$

$2H_2O(l) \longrightarrow O_2(g) + 4H^{+}(aq) + 4e^{-}; \Delta E^{o} = -1.23\ v$

OR

i. a. In acidic medium

$2Fe^{2+}(aq) + 2H^{+}(aq) + H_2O_2(aq) \longrightarrow 2Fe^{3+}(aq) + 2H_2O(l)$

b. In basic medium

$2Fe^{2+}(aq) + H_2O_2(aq) \longrightarrow 2Fe^{3+}(aq) + 2OH^{-}(aq)$

ii. $2I^{-} + H_2O_2 + 2H^{+} \longrightarrow I_2 + 2H_2O$

iii. $2MnO_4^{-} + 6H^{+} + 5H_2O_2 \longrightarrow 2Mn^{2+} + 8H_2O + 5O_2$

iv. $2K_3[Fe(CN)_6] + 2KOH + H_2O_2 \longrightarrow K_4[Fe(CN)_6] + 2H_2O + O_2$

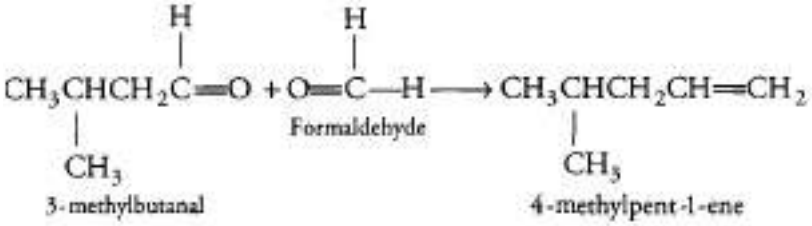
v. $2K_4[Fe(CN)_6] + H_2SO_4 + H_2O_2 \longrightarrow 2K_3[Fe(CN)_6] + K_2SO_4 + 2H_2O$

32. i. Since the given alkyne (X) does not react with sodamide or ammoniacal cuprous chloride, thus, in Alkyne C_5H_8, the triple bond cannot be terminal.

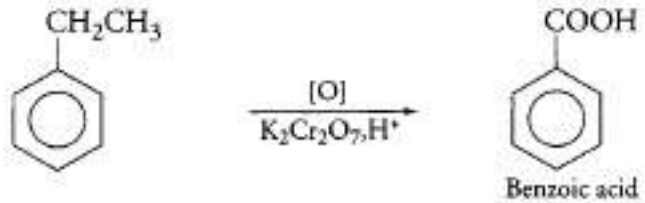
$\therefore X = CH_3CH_2C \equiv CCH_3$

Pent-2-yne

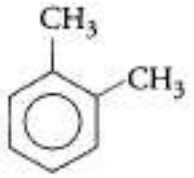
ii. Hydrocarbon 'Y' is alkene (unsaturated hydrocarbon) because it decolourises bromine water. From the products of ozonolysis, the structure of alkene can be predicted.



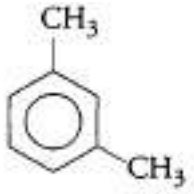
iii. The given compound (Z) is arene (Ethylbenzene) as it does not decolourise bromine water.



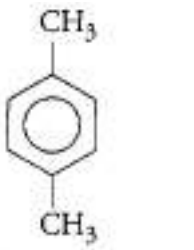
The other three isomers of Ethylbenzene are:



1, 2-dimethylbenzene
(*o*-xylene)



1, 3-dimethylbenzene
(*m*-xylene)



1, 4-dimethyl benzene
(*p*-xylene)

OR

i. Addition of HBr to propene is an ionic electrophilic addition reaction which follows Markonikov rule. In this case H^+ adds to alkene to give a more stable 2° carbocation. This is rapidly attacked by nucleophile Br^- ion to give 2-bromo propane.

$$H-Br \rightleftharpoons H^+ + Br^-$$

$$CH_3 - CH = CH_2 + H^+ \xrightarrow{Slow} \begin{matrix} CH_3 - CH^+ - CH_3 \\ 2^\circ - \text{Carbocation} \\ \text{(more stable)} \end{matrix}$$

$$CH_3 - CH^+ - CH_3 + Br^- \xrightarrow{Fast} \begin{matrix} CH_3 - CH - CH_3 \\ Br \\ 2- \text{ Bromopropane} \end{matrix}$$

In the presence of benzoyl peroxide, the reaction follows free radical addition. In this case $\dot{B}r$ free radical acts as electrophile which is obtained from the action of benzoyl peroxide on HBr.

$$C_6H_5CO - O - O - COC_6H_5 \xrightarrow[Heat]{Homolytic\ fission}$$

$$2C_6H_5COO \longrightarrow 2C_6\dot{H}_5 + 2CO_2$$

Phenyl free radical

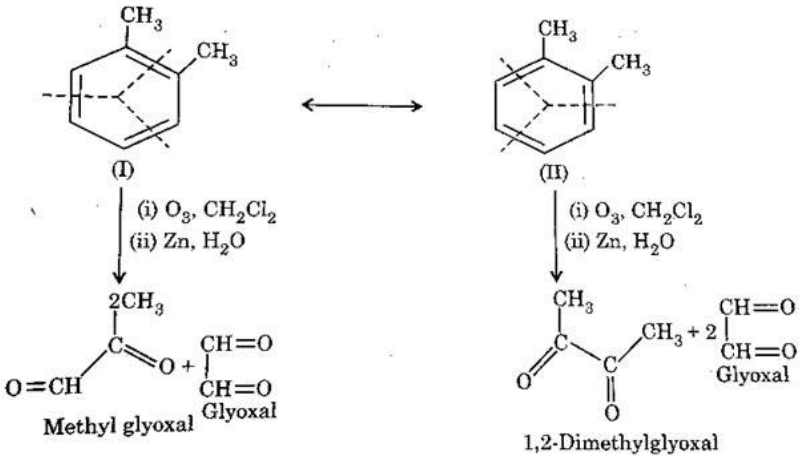
$$C_6\dot{H}_5 + HBr \longrightarrow \underset{Benzene}{C_6H_6} + Br$$

$\dot{B}r$ free radical attacks propene in such a way to generate a more stable 2° free radical. This free radical obtained rapidly abstracts a hydrogen atom of BHr to give 1-Bromopropane.

$$CH_3 - CH = CH_2 + \dot{B}r \xrightarrow{\text{Slow}} \underset{2^\circ - \text{ Free radical}}{CH_3 - CH - CH_2Br}$$

$$CH_3 - CH - CH_2Br + H - Br^\bullet \xrightarrow{Fast} \underset{1 - \text{ Bromopropane}}{\underset{\text{(stable)}}{CH_3CH_2CH_2Br}} + Br^\bullet$$

ii. o-xylene may be regarded as a resonance hybrid of the following structures. Ozonolysis of each one of these gives two products shows as ahead:



Therefore, only three products are formed. Since all the three products cannot be obtained from anyone of the two Kekule structures, this shows that o-xylene is a resonance hybrid of two Kekule structures (I) and (II).

33. a.

i. For n = 3, I = 0, 1, 2

When I = 0, m_I = 0

When I = 1, m_I = -1, 0, + 1

When I = 2, m_l = -2, -1, 0, +1, + 2

ii. n =3, I = 2 and for I = -2, -1, 0, +1, +2

iii. 2s, 2p are possible.

b. An atom of an element contains 29 electrons and 35 neutrons

i. No. of protons = 29

ii. Atomic number = 29

Electronic configuration : $[Ar]^{18}\ 3d^{10}4s^1$.

OR

i. 0.50 m Na_2CO_3 means that 0.50 moles of Na_2CO_3 are dissolved in 1000 g of water. 0.50 M Na_2CO_3 solution means that 0.50 moles of na2CO3 are dissolved in 1000 mL of solution.

ii. $C + O_2 \longrightarrow CO_2$

1 Mol of carbon reacts with 1 mole of oxygen to form 1 mole of CO_2.

a. 1 mol of CO_2 or 44 g of CO_2

b. since 16 g of dioxygen i.e. 0.5 mol of O_2 are present, it is a limiting reagent. 0.5 mol of O_2 will form 0.5 mol of CO_2 i.e. 22 g

c. 16 g or 0.5 mol O_2 is limiting reagent 0.5 mol of O_2 will form 0.5 mol of CO_2 i.e. 22 g