Previous IPE

SOLVED PAPERS

MARCH -2026(AP)

PREVIOUS PAPERS

IPE: MARCH-2026 (AP)

JR. CHEMISTRY

Time : 3 Hours Max.Marks : 85

SECTION-A

I. Answer ALL the following questions. $9 \times 1 = 9$

1. The drug Azidothymidine (AZT) is used in the treatment of
   1) Cancer 2) AIDS 3) Bronchitis 4) Ulcer
2. Which of the following is ionic ?
   1) KI 2) CH_4 3) Diamond 4) H_2
3. The oxidation number of Sulphur in $Na_2S_4O_6$ is
   1) 2.5 2) 1.5 3) 2 4) 3
4. Splitting of spectral lines in electric field is called_____
5. For an isolated system, $\Delta U = 0$ the value of ΔS will be_____
6. Ethyl alcohol and methyl alcohol can be separated by _____
7. What is diagonal relationship?
8. What is the value of K_w at 25°C?
9. What is Lindlar's catalyst?

SECTION-B

II. Answer ALL the following questions. $14 \times 2 = 28$

10. What is Aufbau principle?
11. What is a black body ?
12. The empirical formula of a compound is CH_2O. Its molecular weight is 90. Calculate the molecular formula of the compound.
13. How many number of moles of glucose are present in 540 grams of glucose.
14. Name any two bridge elements.
15. State the third law of thermodynamics.
16. What is heterogeneous equilibrium? Give two examples.
17. Write the bond order and magnetic behaviour of H_2.
18. State Octet rule.
19. What is Wurtz'reaction? Give one example.
20. What is Friedel -Crafts alkylation?
21. How many σ and π bonds are present in each of the following molecules?
    (a) $HC \equiv CCH = CHCH_3$, (b) $CH_2 = C = CHCH_3$
22. What is carbocation? Give example.
23. Write the formulae for the following compounds.
    a) Nickel(II) sulphate b) Thallium(I) sulphate

SECTION-C

III. Answer ANY EIGHT of the following questions. **8 × 4 = 32**

24. Give any four characteristic properties of transition elements.
25. A carbon compound contains 12.8% carbon, 2.1% hydrogen, 85.1% bromine. The molecular weight of the compound is 187.9. Calculate the molecular formula.
26. Explain the difference between Orbit and Orbital.
27. What are σ -and π bonds? Specify the differences between them.
28. Explain the hybridisation involved in PCl_5 molecule.
29. State Le-Chatelier's principle. Discuss the application of Le-Chatelier's principle for the industrial synthesis of Ammonia by Haber's process.
30. The species : $\mathbf{H_2O, HCO_3^-, HSO_4^-}$ and NH_3 can act both as Bronsted acids and bases. For each case give the corresponding conjugate acid and conjugate base.
31. What are open, closed and isolated systems? Give one example for each?
32. State and explain the Hess's law of constant Heat summation.
33. Complete the following reaction and name the products A, B and C.

$$\mathbf{CaC_2 \xrightarrow{H_2O} A \xrightarrow{\text{hot metal tube}} B \xrightarrow{AlCl_3+CH_3Cl} C}$$

34. Balance the following redox equation in acidic medium by ion-electron method:

$$\mathbf{Cr_2O_{7(aq)}^{2-} + Fe_{(aq)}^{2+} \rightarrow Cr_{(aq)}^{3+} + Fe_{(aq)}^{3+}}$$

35. What is position isomerism and functional isomerism? Give one example for each.

SECTION-D

IV. Answer ANY TWO of the following questions. **2 × 8 = 16**

36. What are quantum numbers? Explain the significance of quantum numbers.
37. Define IE_1 and IE_2. Why is $IE_2$is always greater than IE_1 for a given atom? Discuss the factors that effect IE of an element.
38. Describe two methods of preparation of ethylene. How does it reacts with the following. Give equations.a)Ozone b) Cold and dil.alk. $KMnO_4$ c) Br_2

IPE AP MARCH - 2026
SOLUTIONS

SECTION-A

1. The drug Azidothymidine (AZT) is used in the treatment of [MAR-26] [2]

1) Cancer **2) AIDS** 3) Bronchitis 4) Ulcer

2. Which of the following is ionic ? [MAR-26] [1]

1) KI 2) CH_4 3) Diamond 4) H_2

3. The oxidation number of Sulphur in $Na_2S_4O_6$ is

✓ **1)2.5** 2) 1.5 3) 2 4) 3

4. Splitting of spectral lines in electric field is called **Stark effect**.

5. For an isolated system, $\Delta U = 0$ the value of ΔS will be $\geq$ **0(zero)** .

6. Ethyl alcohol and methyl alcohol can be separated by **Fractional distillation**. **[BMP1]**

---

7. What is diagonal relationship? [MAR-26]

A: Diagonal relationship: The elements of 2nd period have certain similarities with the elements situated diagonally in the third period .

II period : Li Be B C

III period: Na Mg Al Si

Ex: (Li→ Mg); (Be→Al); (B→ Si)

---

8. What is the value of K_w at 25°C? [BMP1]

A: $K_w = 1.0 \times 10^{-14}$ mol^2/L^2, at 25°C,

---

9. What is Lindlar's catalyst?

A: Lindlar's catalyst is **Pd-C/ $BaSO_4$**

SECTION-B

10. What is Aufbau principle?

A: **Auf bau principle:** 'In the ground state of the atoms, the orbitals are filled with electrons, in their increasing order of energies'.

---

11. What is a black body ?

A: **Black body** is an ideal body which **absorbs and emits all frequencies of radiation** .
Ex: A hollow sphere coated inside with platinum black and having a small hole in its walls .

---

12. The empirical formula of a compound is CH_2O.Its molecular weight is 90. Calculate the molecular formula of the compound.

A: Given molecular weight = 90
Empirical formula weight of CH_2O = 12 + 2 + 16 = 30

$$n = \frac{\text{Molecular weight}}{\text{Empirical formula weight}} = \frac{90}{30} = 3$$

Molecular formula = $(\text{Empirical formula})_n = (CH_2O)_3 = C_3H_6O_3$

---

13. How many number of moles of glucose are present in 540 grams of glucose.

A: Given weight of glucose W = 540 g
Known GMW of glucose ($C_6H_{12}O_6$) = 180 g

Number of moles $n = \frac{W}{GMW} = \frac{540}{180} = 3$ moles.

---

14. Name any two bridge elements

A: **Bridge elements** (Elements of 2nd period) **Ex:** Li, Be

---

15. State the third law of thermodynamics.

A: **Third law of thermodynamics :**
The entropy of a pure and perfectly crystalline substance approaches zero when the temperature approaches absolute zero. Mathematically, $S_T = \int_0^T \frac{Cp}{T}.dT$

---

16. What is heterogeneous equilibrium? Give two examples.

A: When the reactants and products are in different physical states then the equilibrium is said to be heterogeneous equilibrium.

Ex 1: $CO_{2(g)} + C_{(s)} \rightleftharpoons 2CO_{(g)}$ **Ex 2:** $CaCO_{3(s)} \overset{\Delta}{\rightleftharpoons} CaO_{(s)} + CO_{2(g)}$

17. Write the bond order and magnetic behaviour of H_2.

A: **Bondorder : 1**

Magnetic behaviour is **diamagnetic.**

---

18. State Octet rule.

A: **Octet rule:** Atoms show a tendency, to have eight electrons in their outermost shell by losing, gaining or sharing electrons.

---

19. What is Wurtz'reaction? Give one example.

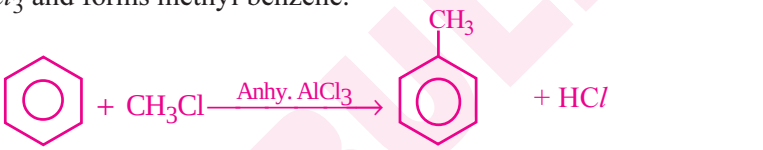
A: **Wurtz reaction:** Ethane is prepared by **heating methyl iodide** with **sodium** metal in the presence of dry ether.

$$2CH_3\ I + 2Na \xrightarrow{\text{dry ether}} C_2H_6 + 2NaI$$

---

20. What is Friedel -Crafts alkylation?

A: **Friedel - Craft's alkylation :** Benzene reacts with methyl chloride in the presence of anhy. $AlCl_3$ and forms methyl benzene.



Methyl Benzene (Toluene)

---

21. How many σ and π bonds are present in each of the following molecules?

(a) $HC\equiv CCH=CHCH_3$, (b) $CH_3=C=CHCH_3$

A: a) σ_{C-C} : 4; σ_{C-H} : 6; $\pi_{C=C}$: 1; $\pi_{C\equiv C}$: 2 b) σ_{C-C} : 3; σ_{C-H} : 6; $\pi_{C=C}$: 2

---

22. What is carbocation? Give example.

A: A species having carbon atom with positive charge and sixtet of electrons.

Ex : CH_3^+ (Methyl carbocation) , $CH_3-\overset{+}{C}H-CH_3$ (Secondary carbocation)

---

23. Write the formulae for the following compounds.

a) Nickel(II) sulphate b) Thallium(I) sulphate

A: a) $NiSO_4$ b) Tl_2SO_4

SECTION-C

24. Give any four characteristic properties of transition elements.

A: Properties of transition elements :

1) They are all hard metals with high B.P and M.P.
2) They are good conductors of heat and electricity.
3) They form coloured ions.
4) They exhibit variable valency oxidation states.
5) They possess paramagnetic nature.
6) They form complex compounds.
7) They act as catalysts.

---

25. A carbon compound contains 12.8% carbon, 2.1% hydrogen, 85.1% bromine. The molecular weight of the compound is 187.9. Calculate the molecular formula.

A:

S.No	Element	% by weight	$\frac{\%\text{ by weight}}{\text{At.wt}}$	Simple ratio
1)	Carbon (C)	12.8	$\frac{12.8}{12}=1.067$	$\frac{1.067}{1.063}=1$
2)	Hydrogen(H)	2.1	$\frac{2.1}{1}=2.1$	$\frac{2.1}{1.063}=2$
3)	Bromine(Br)	85.1	$\frac{85.1}{80}=1.063$	$\frac{1.063}{1.063}=1$

Ratio of C:H:Br= 1:2:1. Hence Empirical formula = CH_2Br

$\therefore$ Empirical formula weight = $12 + (2 \times 1) + 80 = 94$.

Given molecular formula weight = 187.9

$$n = \frac{\text{Molecular formula weight}}{\text{Empirical formula weight}} = \frac{187.9}{94} = 2$$

$\therefore$ Molecular formula = $(\text{Empirical formula})_n = (CH_2Br)_2 = C_2H_4Br_2$

26. Write the difference between Orbit and Orbital.

A:

Orbit	Orbital
1) Orbit is a well defined circular path of a revolving electron around the nucleus.	1) Orbital is the 3-dimensional spaced around the nucleus where the probability of finding an electron is maximum.
2) It represents 2- dimensional planar motion of an electron.	2) It represents three dimensional motion of an electron.
3) The maximum number of electrons in an orbit is $2n^2$, where 'n' is no. of the orbit.	3) The maximum number of electrons in an orbital is 2.
4) Orbits are circular in shape.	4) Shape of s-orbital is spherical, shape of p-orbital is dumb bell.
5) Orbits are non - directional. They cannot explain shape of molecules.	5) Orbitals (except s-orbital) are directional. They account for shapes of molecules.
6) Concept of well-defined orbit is against to Heisenberg's principle.	6) Concept of orbital is in accordance with Heisenberg's principle.

---

27. What are σ -and π bonds? Specify the differences between them.

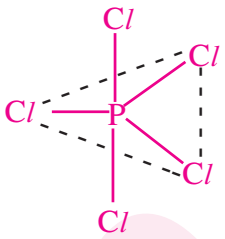
A:

σ - bond	π - bond
1) σ-bond is a covalent bond formed by the axial overlapping of orbitals.	1) π -bond is a covalent bond formed by the side wise overlapping of orbitals.
2) σ -bond is a strong bond.	2) π -bond is a weak bond.
3) It allows free rotation of atoms.	3) It restricts the free rotation of atoms.
4) σ -bonds determine the shape of the molecules.	4) The shape of the molecules is not influenced by π bonds
5) It forms independently.	5) π bond always follows σ-bond.
6) There can be only one σ- bond between two atoms.	6) There can be one or two π-bonds between two atoms.

28. Explain the hybridisation involved in PCl_5 molecule

A: I) sp^3d hybridisation : One s-orbital, three p-orbitals and one d-orbital mix together to form five sp^3d hybrid orbitals .

II) Structure of PCl_5 molecule:



1) In PCl_5, the central atom is P(15).
2) It's ground state E.C = $[Ne]3s^23p^3$
   It's excited state E.C = $[Ne]\,3s^1 3p_x^1 3p_y^1 3p_z^1 3d^1$
3) In its excited state, the central P atom undergoes sp^3d hybridisation.
4) Central P forms 'five sp^3d hybrid orbitals', and each sp^3d orbital contains one electron.
5) 'Five sp^3d hybrid orbitals' of P, overlap axially with $3p_z$ orbital of five Cl atoms to form five σ bonds.
6) **Shape** of PCl_5 is **Trigonal bipyramid** and the bond angles are 120°,90°.

---

29. State Le-Chatelier's principle. Discuss the application of Le-Chatelier's principle for the industrial synthesis of Ammonia by Haber's process.

A: I) Le-Chatelier's principle : If a **chemical reaction at equilibrium,** is subjected to **'a change'** in temperature, pressure or concentration, then the equilibrium shifts in the direction, which nullifies the change .

II) Synthesis of Ammonia - Haber's process :

1) **Formation of Ammonia:** N_2 and H_2 are synthesized directly in the ratio 1:3 to produce NH_3.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g);\ \Delta H = -92kJ$$

2) This reaction is reversible and exothermic. Also it leads to a **decrease in volume**.
3) So, **Le-Chatelier principle** is applicable.
4) **Effect of Temperature:** As the reaction is exothermic, low temperature is favoured.
5) **Effect of Pressure:** As the reaction leads to decrease in volume, high pressure is favoured.
6) **Optimum Conditions:**
   (a) Low Temperature : **725-775 K**
   (b) High Pressure : **200-300 atm**
   (c) High concentrations: **Pure N_2 and H_2** .
7) Catalyst : **Finely divided iron**
8) Promoter : **Mo**

30. The species : H_2O, HCO_3^-, HSO_4^- and NH_3 can act both as Bronsted acids and bases. For each case give the corresponding conjugate acid and conjugate base.

Sol:

Species	Conjugate acid	Conjugate base
H_2O	H_3O^+	OH^-
HCO_3^-	H_2CO_3	CO_3^{2-}
HSO_4^-	H_2SO_4	SO_4^{2-}
NH_3	NH_4^+	NH_2^-

---

31. What are open, closed and isolated systems? Give one example for each.

A: **a) Open system:** A system which can exchange both matter and energy with its surroundings is an open system

Ex: A cup of tea in a saucer.

Here the system can exchange both matter and heat with its surroundings.

b) Closed system: A system which can exchange energy but not matter with its surroundings is a closed system.

Ex: Chilled sealed drink bottle.

Here the system can exchange only energy heat with the surroundings.

c) Isolated system: A system in which neither matter nor energy is exchanged with the surroundings is an isolated system

Ex: Hot Coffee in a thermos flask.

In this system there is no exchange of either matter (or) heat with the surroundings.

32. State and explain "Hess law of constant heat summation" with example.

A: **1) Hess Law:** 'The total heat change in a chemical reaction is the same, whether the chemical reaction takes place in one step or several steps'.

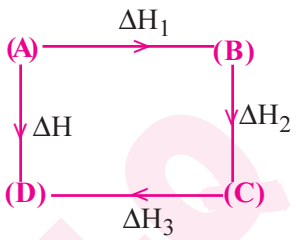
2) Suppose that D is formed from A in two different paths.

Path - I: $A \rightarrow D, \Delta H$

Path - II: $A \rightarrow B, \Delta H_1$

$B \rightarrow C, \Delta H_2$

$C \rightarrow D, \Delta H_3$



Total heat change in path - II= $\Delta H_1+\Delta H_2+\Delta H_3$

Total heat change in path - I $= \Delta H$

From Hess law, $\Delta H = \Delta H_1+\Delta H_2+\Delta H_3$

3) Example: CO_2 can be obtained from $C_{(graphite)}$ and $O_{2(g)}$ in two different ways.

Path - I : $C_{(graphite)} + O_{2(g)} \rightarrow CO_{2(g)}$; $\Delta H = -393.5$ KJ

Path - II : $C_{(graphite)} + 1/2\ O_{2(g)} \rightarrow CO_{(g)}$; $\Delta H_1 = -110.5$ KJ

$CO_{(g)} + 1/2O_{2(g)} \rightarrow CO_{2(g)}$; $\Delta H_2 = -283.02$ KJ

4) Total heat change in path-II = $\Delta H_1+\Delta H_2 = (-110.5)+(-283.02) = -393.52$ KJ.

Total heat change in path-I $= \Delta H = -393.5$ KJ.

Thus $\Delta H \simeq \Delta H_1+\Delta H_2$. Hence the Hess law is proved.

---

33. Complete the following reaction and name the products A, B and C.

$$CaC_2 \xrightarrow{H_2O} A \xrightarrow{\text{hot metal tube}} B \xrightarrow{AlCl_3+CH_3Cl} C$$

A: $CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$ $\quad \therefore A = C_2H_2$ (Acetylene)

$3C_2H_2 \xrightarrow{\text{red hot Cu tube}} C_6H_6$ $\quad \therefore B = C_6H_6$ (Benzene)

$C_6H_6 \xrightarrow[\text{Anhyd. } AlCl_3]{CH_3Cl} C_6H_5CH_3 + HCl$ $\quad \therefore C = C_6H_5CH_3$ (Methyl benzene)

34. Balance the following redox equation in acidic medium by ion-electron method:

$$Cr_2O_{7(aq)}^{2-} + Fe_{(aq)}^{2+} \rightarrow Cr_{(aq)}^{3+} + Fe_{(aq)}^{3+}$$

A: 1) Skeleton ionic equation:

RHR (+6) OHR

$$Cr_2O_7^{-2} + Fe^{+2} + \rightarrow Cr^{+3} + Fe^{+3}$$

	Oxidation half reaction	Reduction half reaction
	$Fe^{+2} \rightarrow Fe^{+3}$	$Cr_2O_7^{-2} \rightarrow Cr^{+3}$
3)	Balancing other than 'O' & 'H' atoms	Balancing other than 'O' & 'H' atoms
	$Fe^{+2} \rightarrow Fe^{+3}$	$Cr_2O_7^{-2} \rightarrow 2Cr^{+3}$
4)	Balancing oxygen atoms	Balancing oxygen atoms
	$Fe^{+2} \rightarrow Fe^{+3}$	$Cr_2O_7^{-2} \rightarrow 2Cr^{+3} + 7H_2O$
5)	Balancing hydrogen atoms	Balancing hydrogen atoms
	$Fe^{+2} \rightarrow Fe^{+3}$	$Cr_2O_7^{-2} + 14H^+ \rightarrow 2Cr^{+3} + 7H_2O$
6)	Balancing charges	Balancing charges
	$Fe^{+2} \rightarrow Fe^{+3} + 1e^-$	$Cr_2O_7^{-2} + 14H^+ + 6e^- \rightarrow 2Cr^{+3} + 7H_2O$
7)	Equalizing of electrons	Equalizing of electrons
	$6(Fe^{+2} \rightarrow Fe^{+3} + 1e^-)$	$1(Cr_2O_7^{-2} + 14H^+ + 6e^- \rightarrow 2Cr^{+3} + 7H_2O)$
	$6Fe^{+2} \rightarrow 6Fe^{+3} + 6e^-$ .....(1)	$Cr_2O_7^{-2} + 14H^+ + 6e^- \rightarrow 2Cr^{+3} + 7H_2O$ .....(2)

8) Adding the two half reactions

$$6Fe^{+2} \rightarrow 6Fe^{+3} + 6e^-$$
$$Cr_2O_7^{-2} + 14H^+ + 6e^- \rightarrow 2Cr^{+3} + 7H_2O$$

$$6Fe^{+2} + Cr_2O_7^{-2} + 14H^+ \rightarrow 6Fe^{+3} + 2Cr^{+3} + 7H_2O$$

---

35. What is position isomerism and functional isomerism? Give one example for each.

A: **Position Isomerism** is due to difference in the position of a substituent or functional group.

Ex: $CH_3CH_2CH_2OH$ — 1- propanol

$CH_3\underset{\displaystyle OH}{\underset{|}{C}}HCH_3$ — 2- propanol

Functional isomerism is due to difference in the functional group in the molecules.

Ex: CH_3CH_2OH — Ethyl alcohol

CH_3OCH_3 — Dimethyl ether

SECTION-D

36. How are the quantum numbers n, l and m_l arrived at? Explain the significance of these quantum numbers.

A: The quantum numbers n, l, m_l are arrived by solving Schrodinger wave equation. They explain

i) The position of electron

ii) Size of the orbit, shape and orientation of orbitals.

1) Principal quantum number (n) :

i) It was proposed by **Bohr.**

ii) It is denoted by '**n**'.

iii) The values of 'n' are **1,2,3,4**.....(or) **K,L,M,N**.....

iv) Significance: 'n' denotes

(a) **size** of the orbit (r_n) (b) **energy** of the orbit (E_n)

(v) The maximum number of electrons in n^{th} orbit = $2n^2$.

2) Azimuthal quantum number (l) :

i) It was proposed by **Sommerfeld**.

ii) It is denoted by 'l'.

iii) The values of 'l' are **0, 1, 2,**....,(n–1).

iv) Significance: 'l' denotes

a)**shape** of the orbitals b) number of subshells in a main shell

(v) The 'l' values 0,1, 2, 3 correspond to the sub shells s, p, d, f respectively.

3) Magnetic quantum number (m):

i) It was proposed by **Lande**.

ii) It is denoted by '**m**'(or) m_l.

iii) For a given value of l, we have, $m = 2l + 1$

iv) Significance: 'm' denotes

(a) '**orientation**' of the orbital in **space.** (b) number of orbitals in a subshell

v) It explains the Zeeman and Stark effect.

4) Spin Quantum number (s):

i) It was proposed by Uhlenbeck and Goudsmith..

ii) It is denoted by '**s**'.

iii) The values of 's' are $+\frac{1}{2}$ (clockwise spin) and $-\frac{1}{2}$ (anti-clockwise spin).

iv) Significance: 's' signifies direction of spin of electrons.

37. Define IE_1 and IE_2. Why is $IE_2 > IE_1$ for a given atom? Discuss the factors that effect IE of an element.

A: **1) First Ionisation Enthalpy (IE_1):** It is the **minimum** amount of energy required to remove a valence electron from an **isolated, neutral**, **gaseous atom(X)**.

$$X(g) \xrightarrow{IE_1} X^+(g) + e^-$$

2) Second Ionisation Enthalpy (IE_2): It is the minimum amount of energy required to remove the valence electron from the **unipositive gaseous ion(X^+).**

$$X^+(g) \xrightarrow{IE_2} X^{2+}(g) + e^-$$

3) $IE_2 > IE_1$:

Reason: When compared to the parent atom X, the unipositive ion X^+ contains more protons than electrons. So its positive nuclear charge increase. Hence, the force of attraction on the valence electrons increases. So more energy is required to remove the electron in the second case. Hence, IE_2 is greater than IE_1.

4) Factors that effect IE :

i) Atomic Radius(AR) : As atomic radius decreases, the nuclear force of attraction on the valence electrons increases.
So, IE value also increases.

ii) Nuclear Charge(NC): When the 'effective nuclear charge' increases, the force of attraction on the valence electrons increases. So, IE value also increases.

iii) Electronic Configuration(EC): Atoms with completely filled (or) half-filled sub-shells are more **stable** than the others. So, IE values are more for stable atoms.

iv) Screening Effect(SE): The electrons present in the 'inner orbits', act as a 'screen' between nucleus and valance electrons. When the number of electrons in the inner orbits increases, the screening effect also increases. This screening effect reduces the effective nuclear charge. So, IE value decreases.

v) Penetrating Effect (PE): In a given shell ,the penetrating power of the 'valence electrons' decreases in the order of s > p > d > f. So, IE value decreases in the same order.

38. Describe two methods of preparation of ethylene. How does it reacts with the following. Give equations.

a) Ozone b) Cold and dil.alk. $KMnO_4$ c) Br_2

A: a) Preparation of Ethylene(C_2H_4):

1) Dehydration: Ethyl alcohol is heated with conc. sulphuric acid at 170°C to form ethylene.

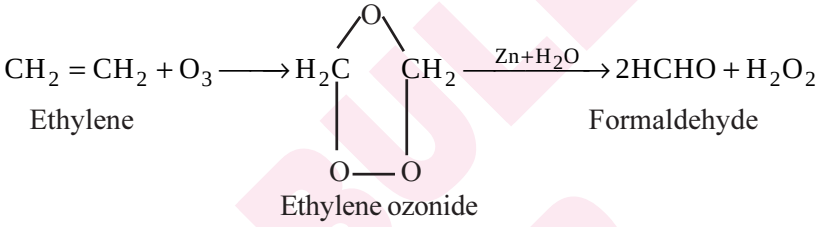
$$\underset{\text{Ethyl alcohol}}{CH_3CH_2OH} \xrightarrow[170^0C]{\text{Conc } H_2SO_4} \underset{\text{Ethylene}}{C_2H_4} + H_2O$$

2) Dehydrohalogenation: Ethyl chloride is heated with alcoholic potassium hydroxide to form ethylene.

$$\underset{\text{Ethyl chloride}}{CH_3CH_2Cl} + KOH(alc) \xrightarrow{\Delta} \underset{\text{Ethylene}}{C_2H_4} + KCl + H_2O$$

b) Chemical Properties of Ethylene:

i) Action with Ozone (Ozonolysis): Ethylene reacts with ozone to form unstable ozonide. This undergoes hydrolysis in the presence of Zinc to form Formaldehyde.



ii) Action with cold dil. alk. $KMnO_4$: Ethylene reacts with cold dil .alk.$KMnO_4$ (Baeyer 's reagent) at 273K to form Ethylene glycol.

$$\underset{\text{Ethylene}}{CH_2 = CH_2} \xrightarrow[\text{alk.}KMnO_4]{\text{Cold.dil}} \underset{\text{Ethylene glycol}}{CH_2OH - CH_2OH}$$

iii) Action with Br_2:

Ethylene reacts with bromine in the presence of CCl_4 to form 1,2- dibromoethane.

$$\underset{\text{Ethylene}}{CH_2 = CH_2} + Br_2 \xrightarrow{CCl_4} \underset{\text{1,2-dibromoethane.}}{CH_2Br - CH_2Br}$$