

Group B"

1)

Why the oxalic acid is known as primary standard substance?

→ Oxalic acid is known as a primary standard substance because it is highly pure, stable and does not change its concentration with environmental factors.

2) 0.4 g divalent metal (eq.wt = 20) is dissolved in 50cc of 0.64 N HCl solution. If further 10g. 2 cc of NaOH is required to neutralize the resultant solution completely. Determine the strength of NaOH is g/l. Soln,

$$\text{wt. of metal (w)} = 0.4 \text{ g}$$

$$\text{Eq.wt (E)} = 20$$

$$\text{vol. of HCl (V1)} = 50 \text{ cc} = 0.05 \text{ ltr}$$

$$\text{Normality of HCl (N1)} = 0.64 \text{ N}$$

$$\text{Volume of NaOH (V2)} = 10g. 2 \text{ cc} = 0.1092 \text{ ltr}$$

$$\text{Normality of NaOH (N2)} = ?$$

Then, since the acid leftover from reaction of metal & HCl is neutralized by NaOH,

$$n \text{ gm. eq. of metal} + n \text{ gm. eq. of NaOH} = n \text{ gm. eq. of HCl}$$

$$\text{or } \frac{W}{E} + N_2 \times V_2 = N_1 V_1$$

E

$$\therefore N_1 V_1 - \frac{W}{E} = N_2 V_2$$

$$\therefore N_2 = \left(N_1 V_1 - \frac{W}{E} \right) \times \frac{1}{V_2}$$

$$\therefore N_2 = 0.109 \text{ N}_1$$

Now,

$$glt = \frac{N_2}{10} \times \text{Eq.wt}$$

$$= \frac{0.109}{10} \times 20$$

$$= 0.218 \text{ g}$$

OR

- a) Differentiate between order and molecularity of reaction. [3]

Order of reaction

- i) It is determined experimentally.
- ii) It cannot be zero.
- iii) It can have fractional values also.
- iv) It is defined as sum of powers of concentration terms in a rate equation.
- v) It is derived from the rate expression.

Molecularity of reaction

- i) It is a theoretical concept
- ii) It ~~can~~ be zero.
- iii) It ~~can~~ has integral values only.
- iv) It is defined as the total number of species taking part in chemical reaction.
- v) It is derived from the mechanism of reaction.

- b) The rate of first order reaction is $0.6932 \times 10^{-2} \text{ mol L}^{-1} \text{ min}^{-1}$ and the initial concentration of reactant is 0.1 mole. Find its half life period. [2]

Soln,

$$\text{Rate of first order, } rx^n(R) = 0.6923 \times 10^{-2} \text{ mol L}^{-1} \text{ min}^{-1}$$
$$\text{initial concn of reactant (a)} = 0.1 \text{ mol}^{-1}$$

then,

$$\text{Half life } (T_{1/2}) = \frac{0.693}{K}$$

Since,

$$\text{Rate} = K [\text{reactant}]^a$$

$$\therefore 0.6923 \times 10^{-2} = K \times 0.1$$

$$\therefore K = 0.6923 \times 10^{-3} \text{ min}^{-1}$$

So,

$$T_{1/2} = \frac{0.693}{0.6923 \times 10^{-3}}$$

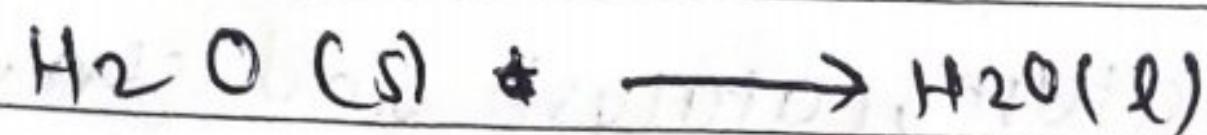
$\approx 10 \text{ min}$

2. Study the following data for melting of ice at 1 atm and at different temperature.



Condition	Temperature (K)	$\Delta H (\text{J})$	$\Delta S (\text{JK}^{-1})$	$T\Delta S (\text{J})$
1	263	5614	20.5	5392
2	273	6006	22.0	6006
3	283	6391	23.4	6622

Soln



a) find the ΔG at condn (1)

for ΔG for condn 1,

$$\begin{aligned}\Delta G &= \Delta H - T\Delta S \\ &= 5614 - 5392 \\ &= 222 \text{ J}\end{aligned}$$

b) At condition 3,

$$\begin{aligned}\Delta G &= \Delta H - T\Delta S \\ &= 6391 - 6622 \\ &= -231 \text{ J} < 0\end{aligned}$$

Since ΔG is $-ve$,

the reaction at condn (3) is spontaneous.

c) For equilibrium,

$$\Delta G = 0$$

$$\text{or } \Delta H - T\Delta S = 0$$

$$\text{or } \Delta H = T\Delta S$$

In condn (2)

$$\Delta H = T\Delta S = 6006$$

So, at 273K, the ice and water are in equilibrium state.

d) Effect of Temperature for spontaneity

⇒ If ΔH is -ve and ΔS is +ve, ΔG would certainly be -ve and the process will be spontaneous at all temperatures.

If both ΔH and ΔS are -ve, ΔG would be -ve if $\Delta H > T\Delta S$

If both ΔH and ΔS are +ve, ΔG would be -ve if $T\Delta S > \Delta H$
If ΔH is +ve and ΔS is -ve, ΔG would be certainly be +ve and the process will be non-spontaneous at all temperatures.

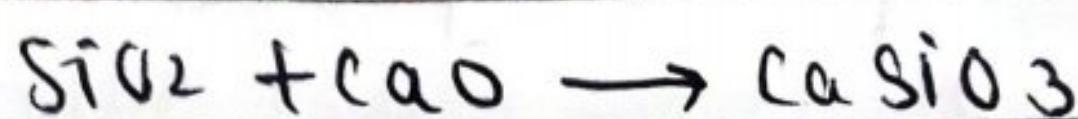
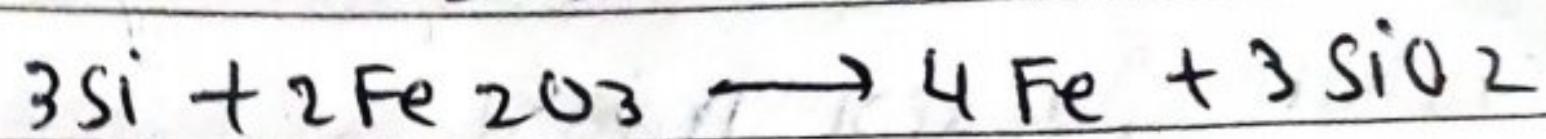
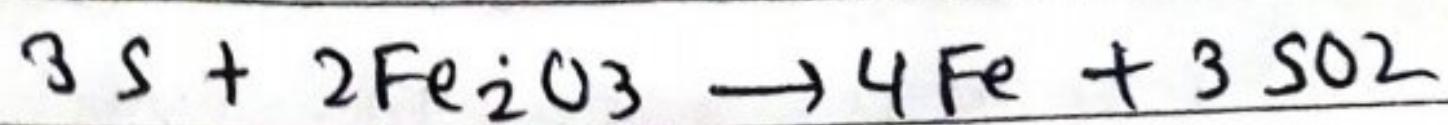
3. a) Write the basic principle for this process with necessary chemical reaction!

→ The above shown figure shows a heat process which is one of the process in manufacturing steel.

The basic principle for this process are:

- i) Impurities present in cast iron are removed by oxidation of by haematite.
- ii) Percentage of carbon is decreased by adding scrap iron.
- iii) Percentage of carbon is maintained by adding required amount of sponge iron.
- iv) Maintenance of high temperature and saving of fuel is done based on a regenerating system of heat economy.

Reactions:



b) what are the advantages of this process?

→ The advantages of this process are:

i) The quality of steel is uniform

ii) This process is easily controllable.

iii) The loss of iron from iron ore is less,

because there is no blast of air is passed.

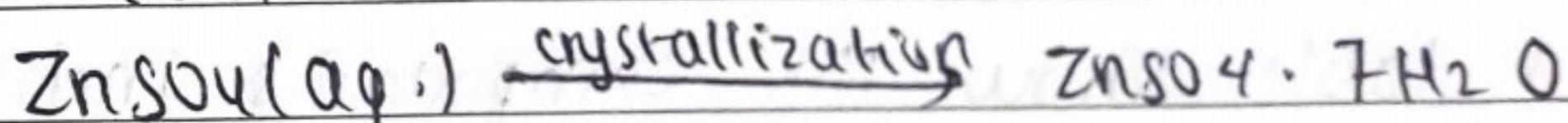
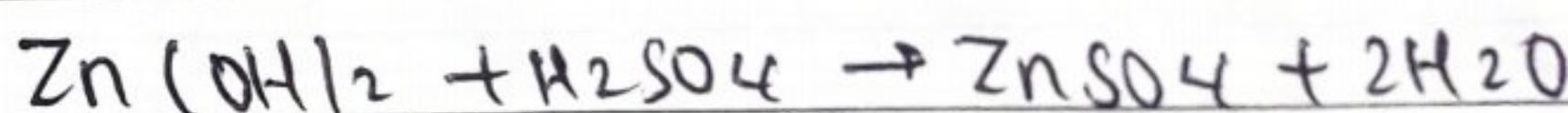
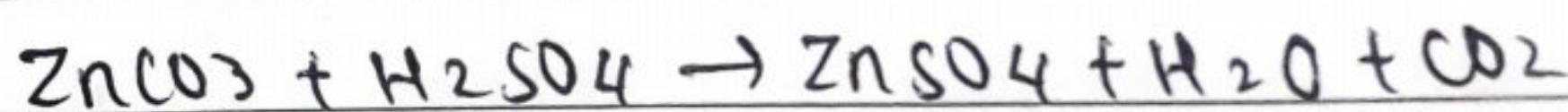
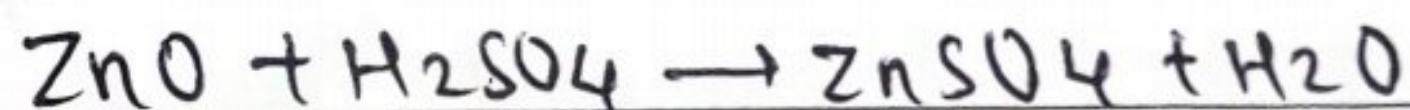
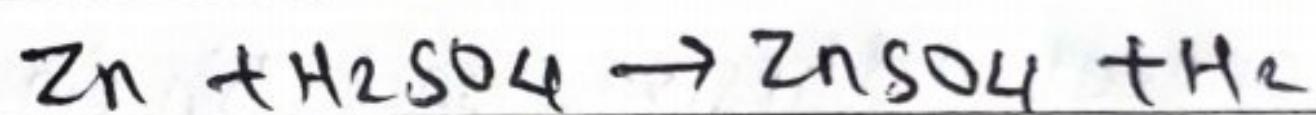
iv) The batch size is very large compared to other processes.

4. Write the preparation, properties and uses of white nitrol? [5]

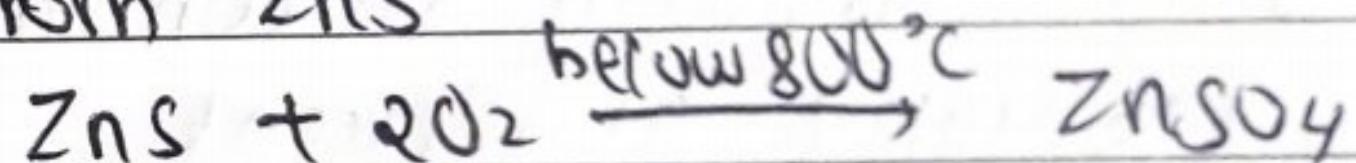
→ Zinc sulphate is commonly known as white nitrol.

Preparation

i) From Zn, ZnO, ZnCO₃, Zn(OH)₂ with dil H₂SO₄



ii) From ZnS



Properties

i) Physical properties

- a) It is a white crystalline solid.
- b) It is highly soluble in water and is hygroscopic.
- c) It is efflorescent and loses water when exposed to air.

ii) Chemical properties

- a) When heated to decomposition, it releases harmful sulphur oxides and zinc oxide fumes.
- b) The solution of white nitrol is acidic in nature.
- c) White nitrol is insoluble in alcohol.
- d) The powdered and granular form of white nitrol lose water to the atmosphere.

Uses

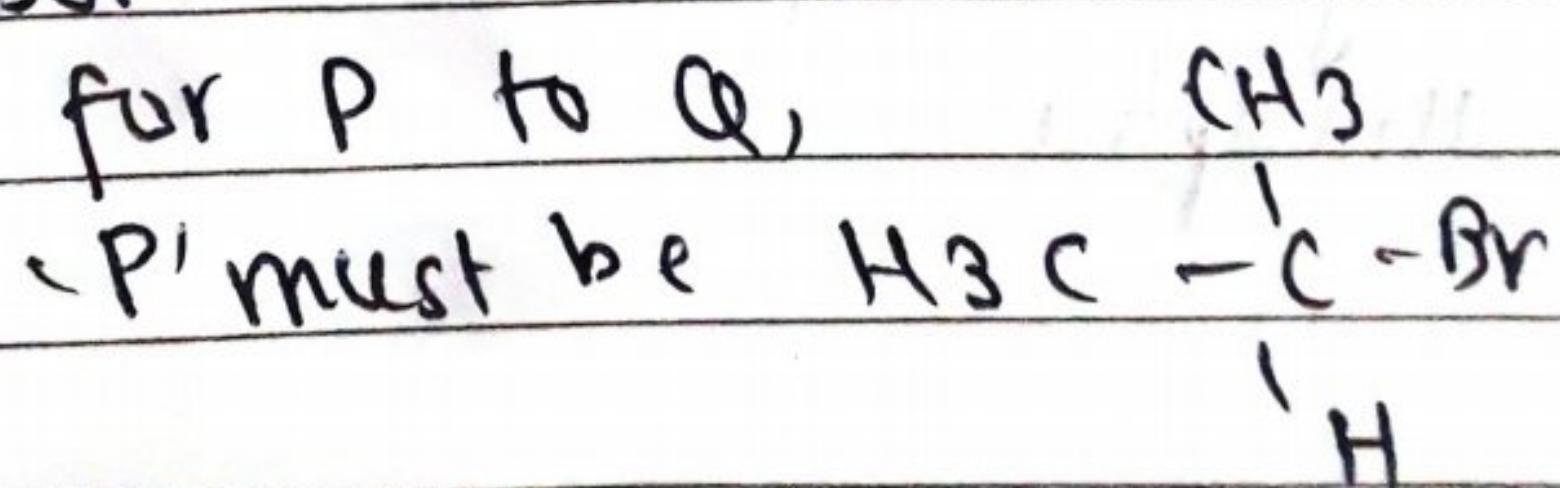
- a) It is used for the synthesis of human drugs.
- b) It is used in making cosmetic products.
- c) It is used in oral care products.
- d) It is used in synthesis of the antibacterial drug.
- e) It is used as an absorbent.
- f) It is also used as a general adhesive and binding agent.

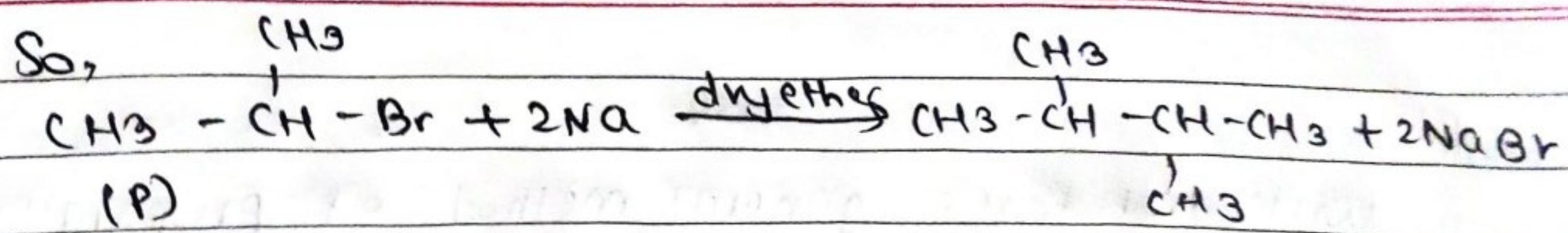
5. The given table shows the compounds and their molecular formula. How can you convert P to Q, where Q is the compound in which two methyl groups are substituted at adjacent carbons? How is P obtained from T where T is a secondary alcohol? Write the reaction involved in the conversion of R to S and R. [5]

Compounds	Molecular formula
P	C ₃ H ₇ Br
Q	C ₆ H ₁₄
R	C ₃ H ₆ O
S	C ₃ H ₆
T	(C ₃ H ₈)O

→ Since Q is the compound in which two methyl groups are substituted at adjacent carbons.

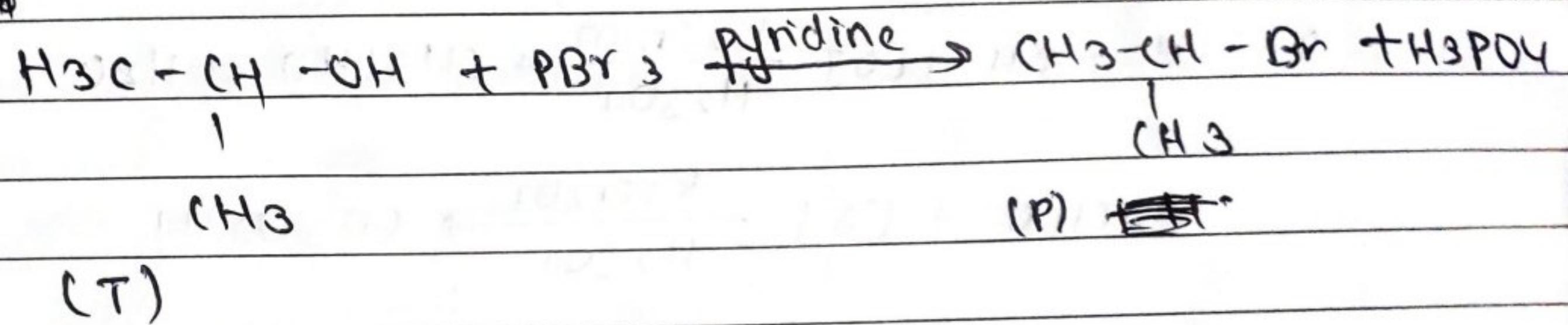
for P to Q,





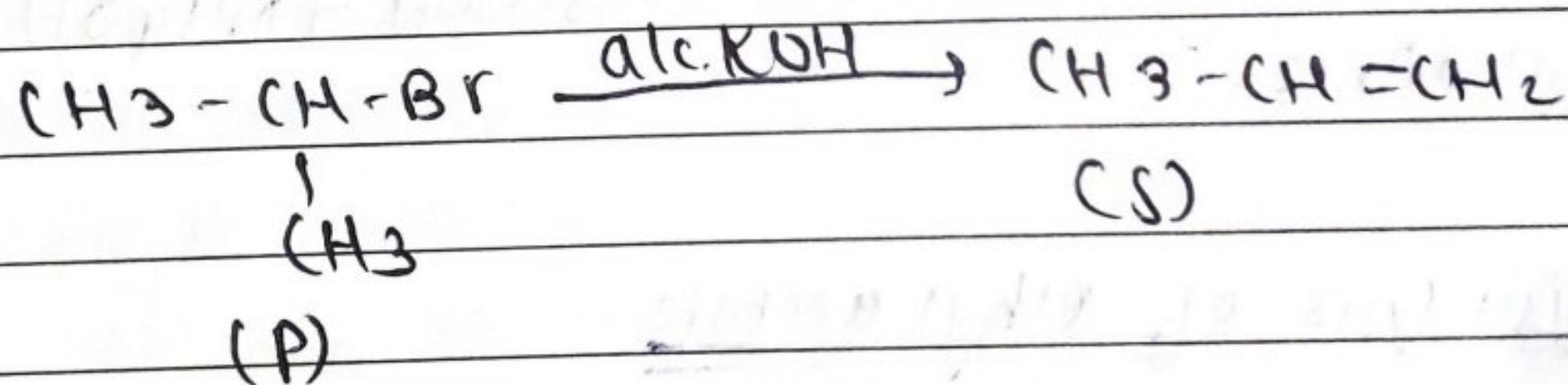
Since, T is secondary alcohol, it must be $\text{H}_3\text{C}-\underset{\text{CH}_3}{\overset{|}{\text{CH}}}-\text{OH}$

for 'T' to 'P'



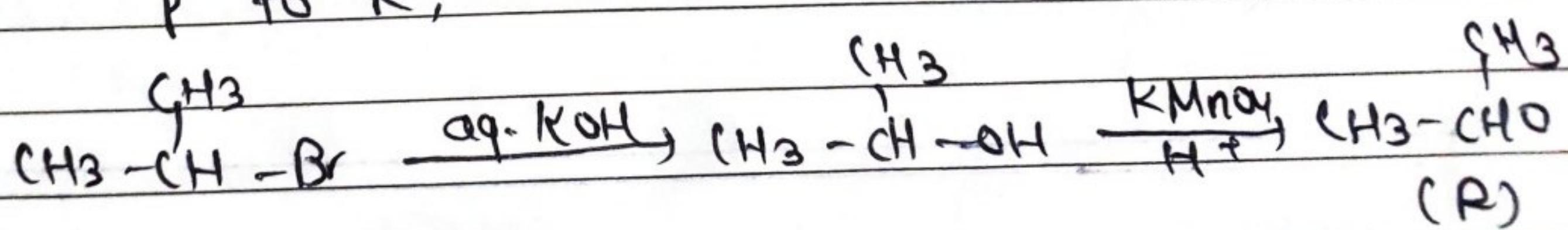
Now,

P to S,



Also,

P to R,



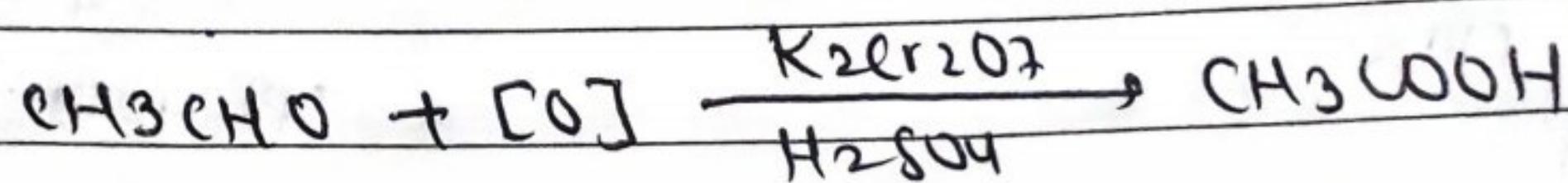
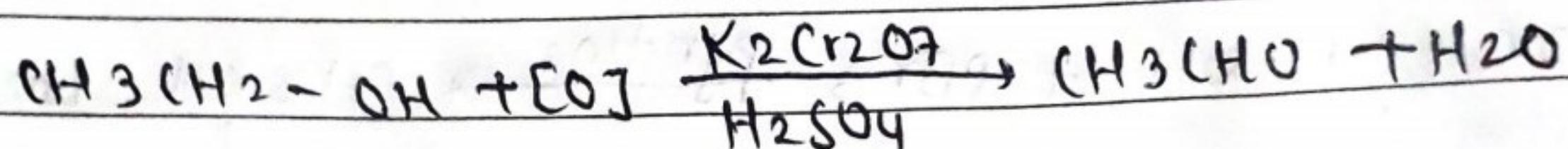
6.

a) Write any three general method of preparation of this compound. [3]

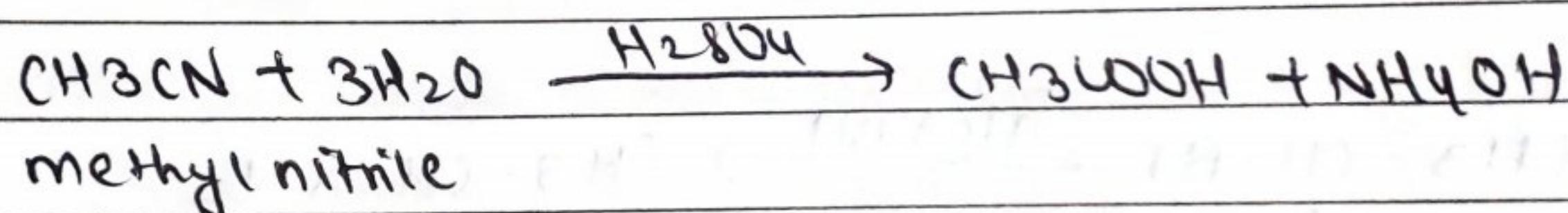
→ The given compound is acetic acid - (C₂H₄O₂)

The methods of preparation are :

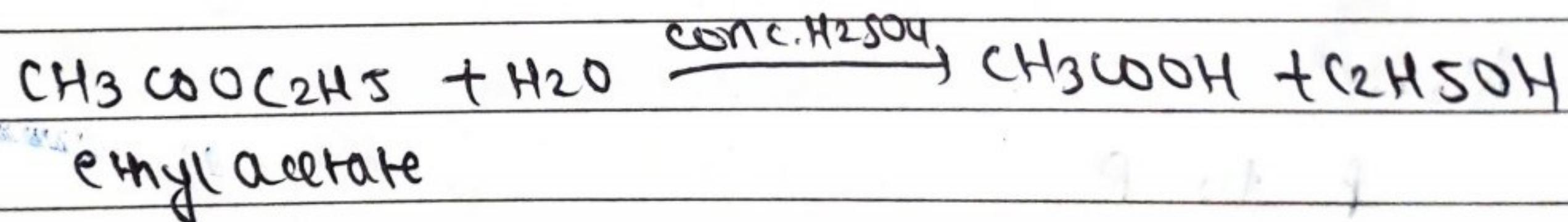
1) By oxidation of ethyl alcohol



2) By hydrolysis of methyl nitrile:

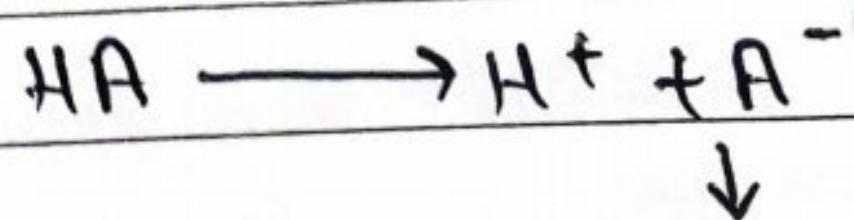


3) By hydrolysis of ethyl acetate



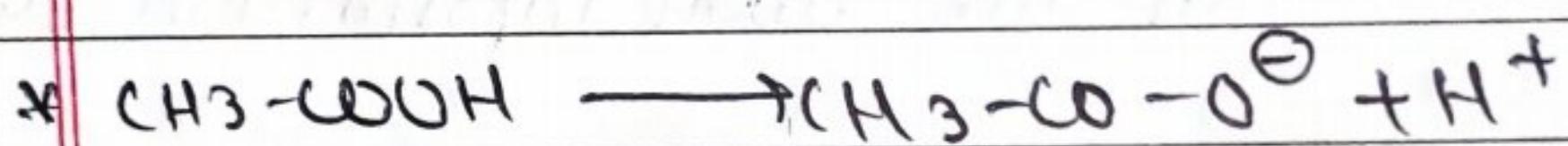
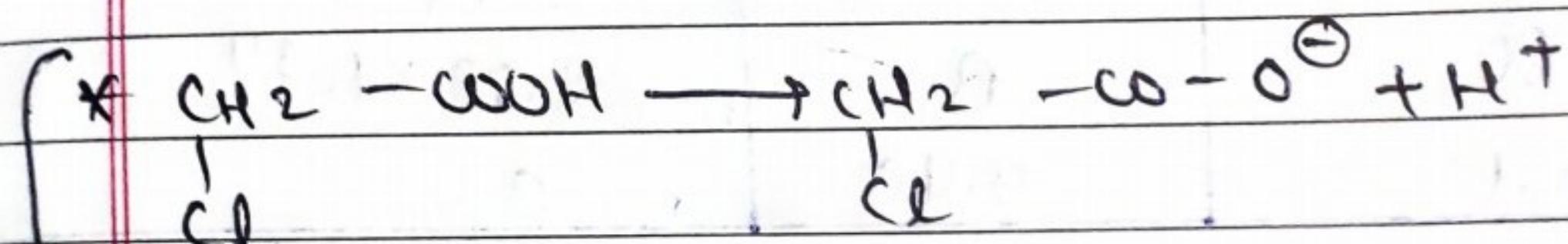
b) Why chloroacetic acid is more stronger than acetic acid? [2]

⇒ If,



If A^- is stable, it is acidic.

For stability of ion \propto Acidity.



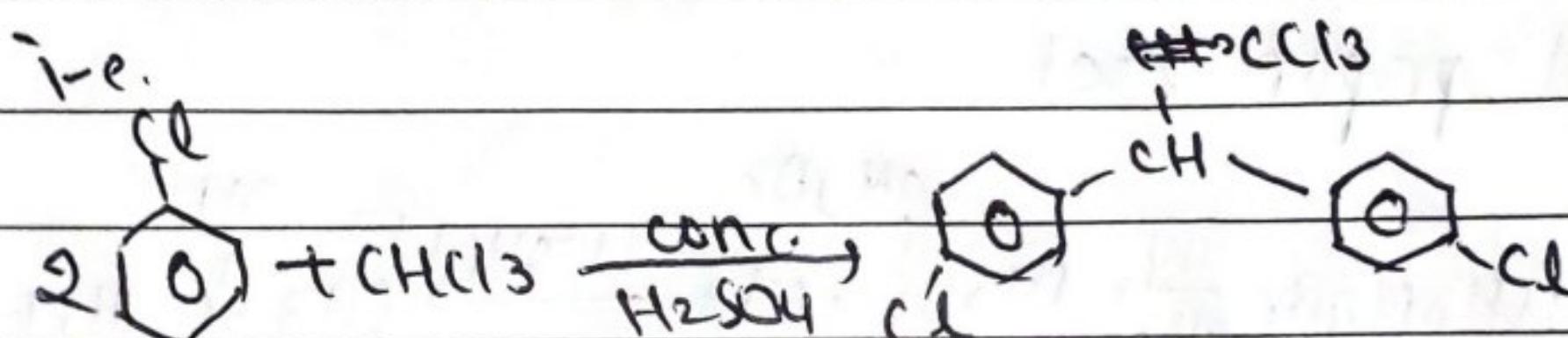
⇒ Due to -I effect (electron withdrawing) of chlorine negative charge density on the oxygen atom is reduced, hence stabilising the conjugate base of chloroacetic acid. While the negative charge on oxygen atom in acetic acid is localized and the conjugate base is less stable. So, that's why chloroacetic acid is stronger than acetic acid.

7) Write the structure and reagent/conditions for the conversion of A to D. If D is treated with 2,2,2-trichloroethanal in presence of conc. H_2SO_4 gives DDT and the compound A is obtained by ammonolysis of benzyl chloride.

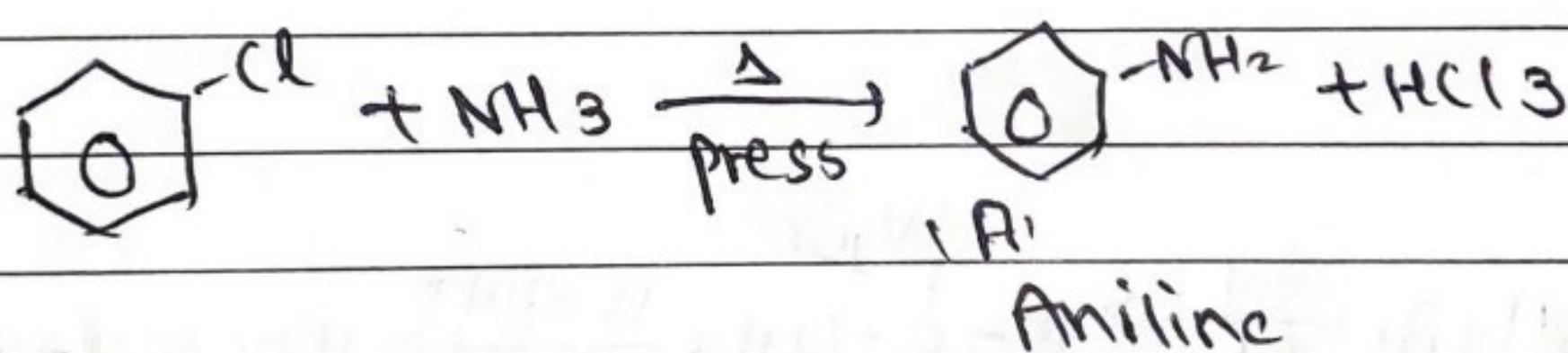
[5] How can you convert D into compound B.

Since 'D' on treatment with 2,2,2-trichloroethanal in the presence of conc. H_2SO_4 gives DDT.

'D' must be chlorobenzene.

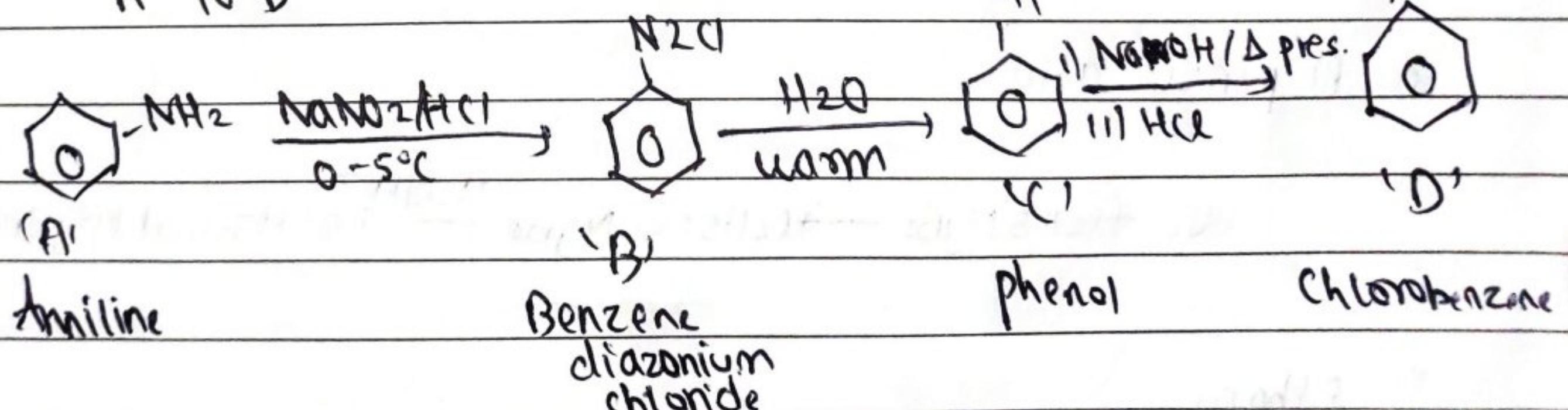


since, compound 'A' is obtained by ammonolysis of benzyl chloride 'A' must be aniline.



Hence

A to D



Hence,

A \rightarrow Aniline

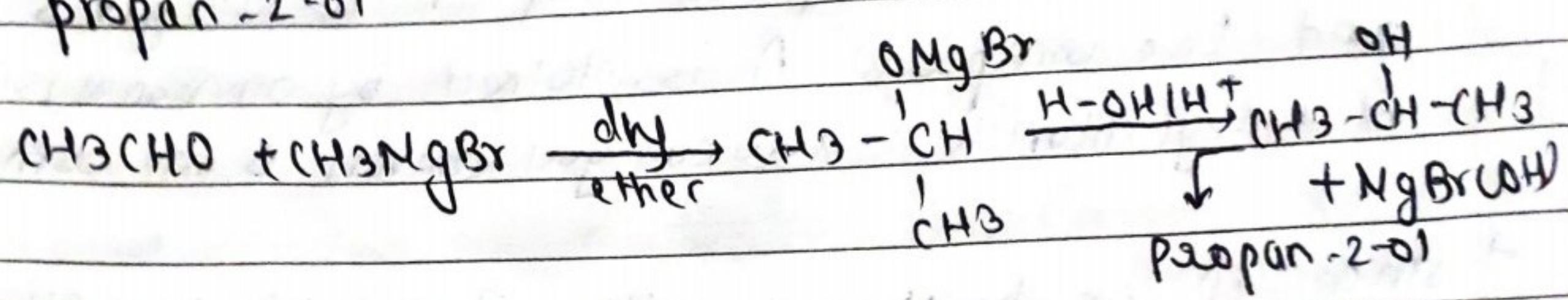
B \rightarrow Benzene diazonium chloride

C \rightarrow Phenol

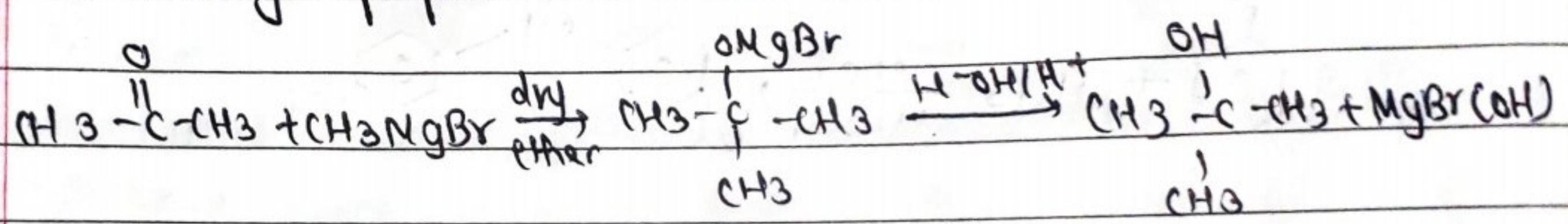
D \rightarrow Chlorobenzene

8. Outline the synthesis for the following compound from Grignard reagent -

a) propan-2-ol

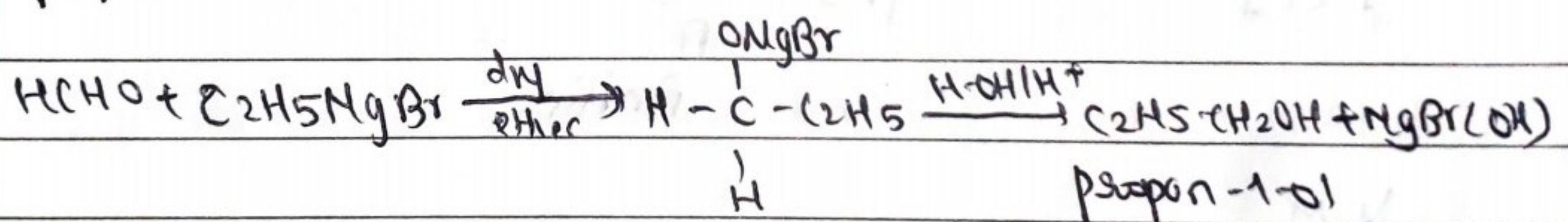


b) 2-methyl propan-2-ol

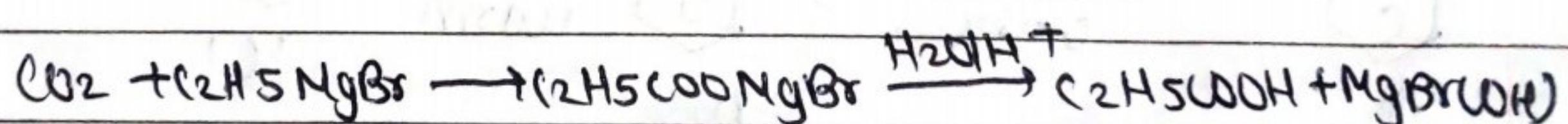


2methylpropan-2-ol.

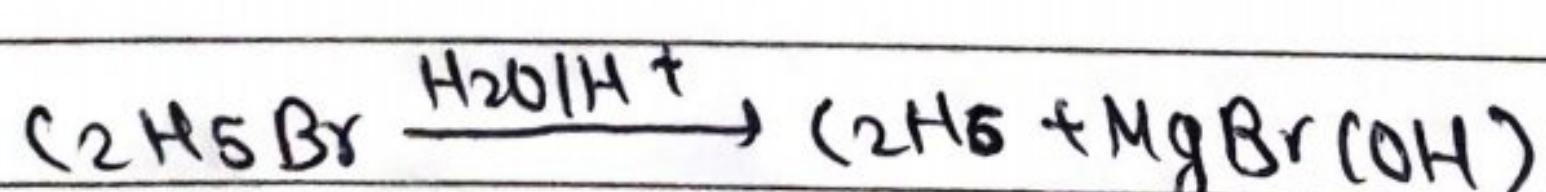
c) propan-1-ol



d) propanoic acid



e) Ethane



Group "C"

1. For a hypothetical reaction $2M + N \rightarrow \text{product}$
 is first order with respect to M and second
 order with respect to N .

Expt no.	$M \text{ mol L}^{-1}$	$N \text{ mol L}^{-1}$	Initial rate $\text{mol L}^{-1}\text{s}^{-1}$
I	0.10	0.20	3×10^2
II	A	0.40	3.6×10^3
III	0.60	B	2.88×10^4
IV	0.10	0.40	C

Identify a, b and c from the above information. [4]

Soln

from I,

$$\text{Rate} = k[M]^1[N]^2$$

$$\text{or}, 3 \times 10^2 = k \times 0.10 \times 0.20$$

$$\Rightarrow k = 1.5 \times 10^4 \text{ mol}^{-2}\text{L}^2\text{s}^{-1}$$

for II,

$$\text{Rate} = k[M]^1[N]^2$$

$$\text{or}, 3.6 \times 10^3 = k \times A \times (0.4)^2$$

$$\text{or}, 3.6 \times 10^3 = 1.5 \times 10^4 \times A \times (0.4)^2$$

$$\Rightarrow A = 1.5 \text{ mol L}^{-1}$$

For III,

$$\text{Rate} = k[M]^1[N]^2$$

$$\text{or}, 2.88 \times 10^4 = k \times 0.60 \times (B)^2$$

$$\text{or}, 2.88 \times 10^4 = 1.5 \times 10^4 \times 0.60 \times B^2$$

$$\text{or}, B^2 = 3.2$$

$$B = 1.7 \text{ mol L}^{-1}$$

For IV,

$$\text{Rate} = K[M]^1[N]^2$$

$$c = 1.5 \times 10^4 \times 0.10 \times (0.40)^2$$

$$c = 0.024 \times 10^4$$

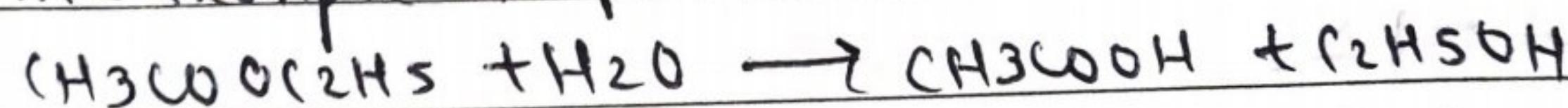
$$c = 240 \text{ mol L}^{-1}\text{s}^{-1}$$

What is the effect of temperature, catalyst and concentration of reactants in rate of reaction. Write the example of pseudo first order reaction.

⇒ The effect of temperature, catalyst and concn of reactants in rate of reaction are:

- i) Effect of temperature → Reaction rate increases with increase in temperature. Temperature increases Average Kinetic energy of the particle increasing the collision frequency of the constituent particles.
- ii) Effect of catalyst ⇒ Rate of reaction increases in presence of a catalyst - A catalyst increases the rate of reaction because it reduces the activation energy some of the collisions have enough energy to react.
- iii) Effect of concn of reactants ⇒ Increasing the concentration of reactants increases the rate of reaction because there are more collisions between the reactant particles.

⇒ The example of pseudo first order reaction is:



Ethyl ethanoate Water

ethanoic acid

Ethanol

1 OR

A) Calculate the heat of formation of methane from the given data-

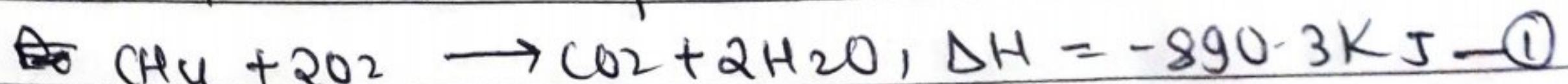
$$\text{Heat of combustion of methane} = -890.3 \text{ KJ}$$

$$\text{Heat of formation of water} = -285.3 \text{ KJ}$$

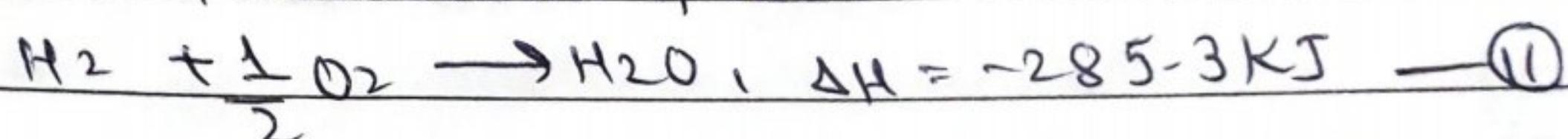
$$\text{Heat of formation of carbon dioxide} = -393.5 \text{ KJ}$$

Soln,

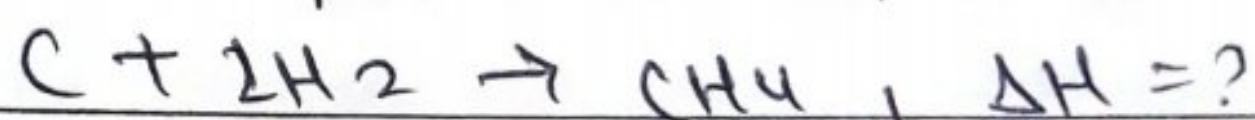
Heat of combustion of water methane



Heat of combustion of water,

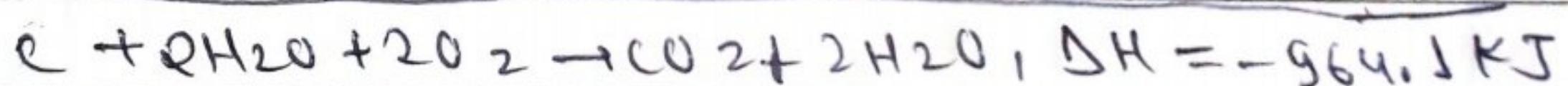


Heat of formation of methane,



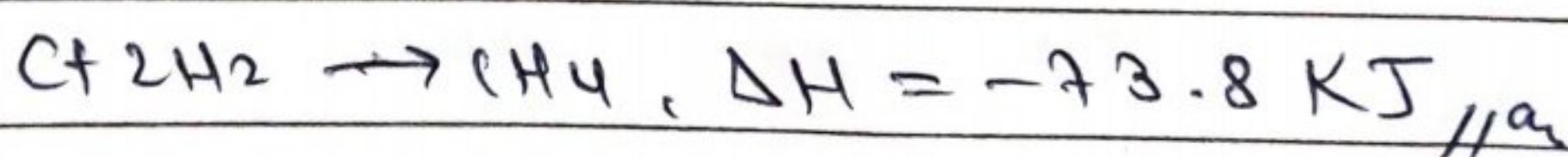
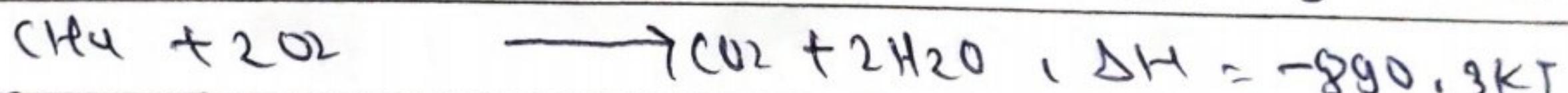
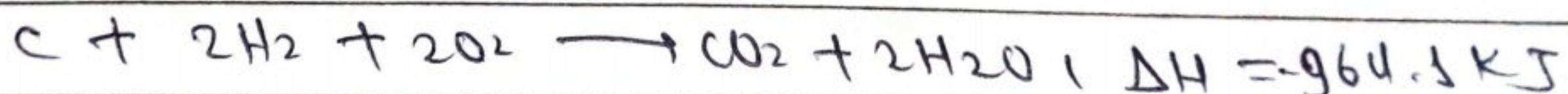
Then

Multiplying eqn (ii) by 2 and adding to eqn (i)



Now

Subtracting eqn (ii) from eqn (i)



(b) Given standard potential of $E^\circ_{\text{Cu}^{+1}/\text{Cu}}$ and $E^\circ_{\text{Ag}^+/\text{Ag}}$ are $+0.34\text{V}$ and 0.80V respectively.

a) Define standard electrode potential.

→ The potential difference setup between the electrode at its ions present in the solution at 25°C and 1atm pressure is standard electrode potential.

b) Write rxn at anode and cathode.

Given,

$$E^\circ_{\text{Cu}^{+1}/\text{Cu}} = +0.34\text{V}$$

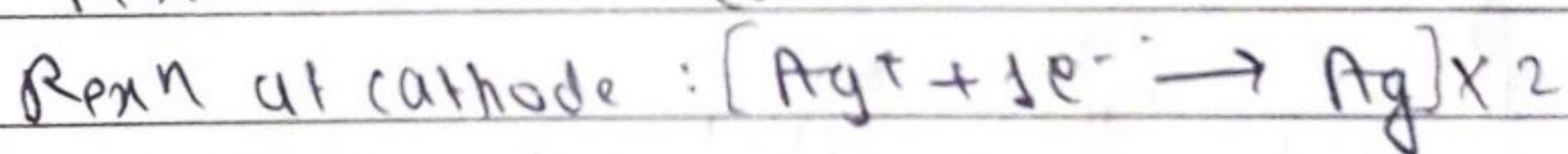
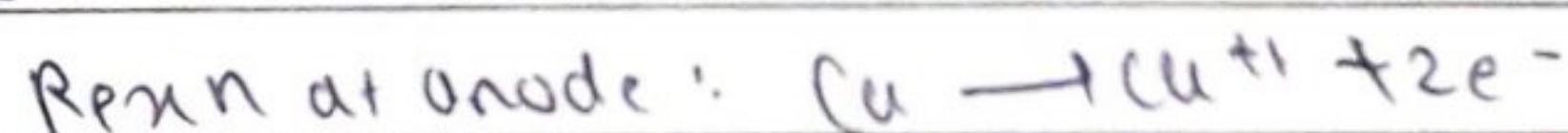
$$E^\circ_{\text{Ag}^+/\text{Ag}} = +0.80\text{V}$$

Then,

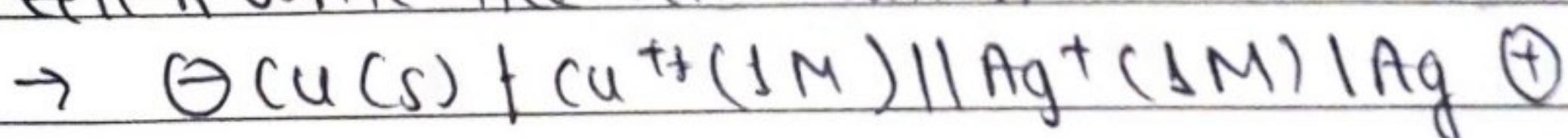
Since $E^\circ_{\text{Ag}^+/\text{Ag}} > E^\circ_{\text{Cu}^{+1}/\text{Cu}}$,

Ag-electrode undergoes redn and is cathode and Cu-electrode is anode.

So,



c) ~~left~~ write the cell notation.



d) calculate the cell potential of 1M solution at 25°C and 1atm pressure.

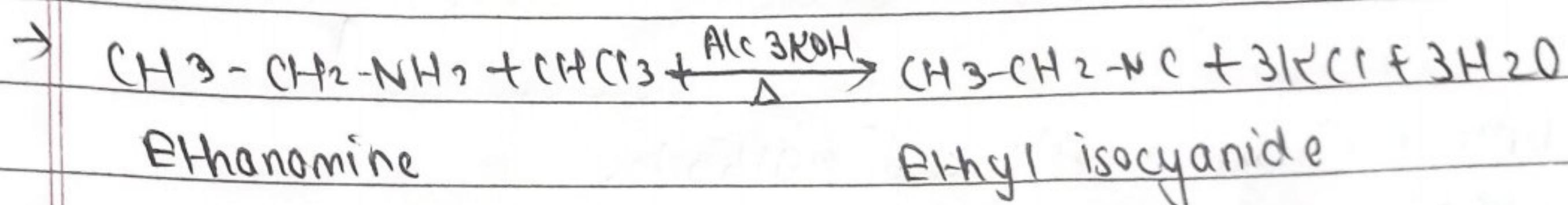
Soln

$$\begin{aligned}\text{Cell potential} &= E^\circ_{\text{cathode}} - E^\circ_{\text{anode}} \\ &= +0.80 - 0.34 \\ &= +0.46\text{V}\end{aligned}$$

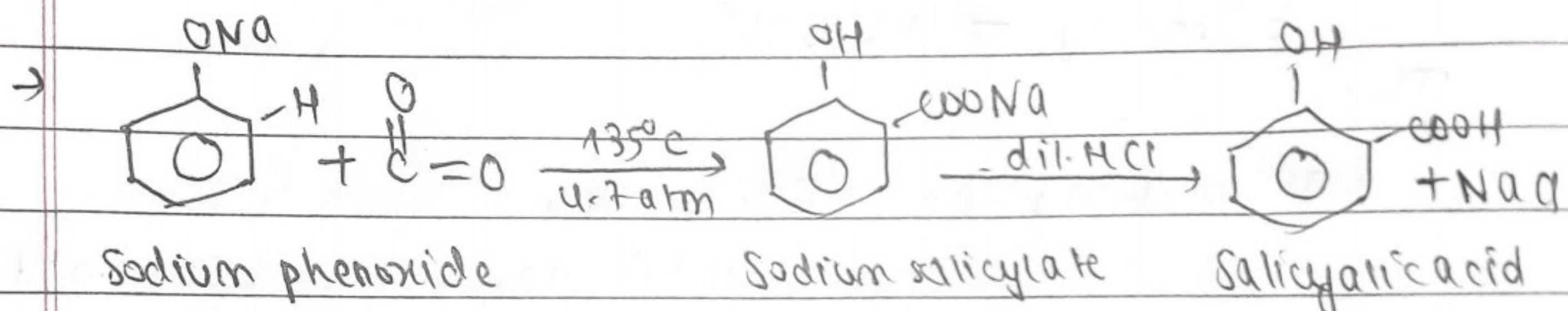
2)

a) Write the example of following name reactions:

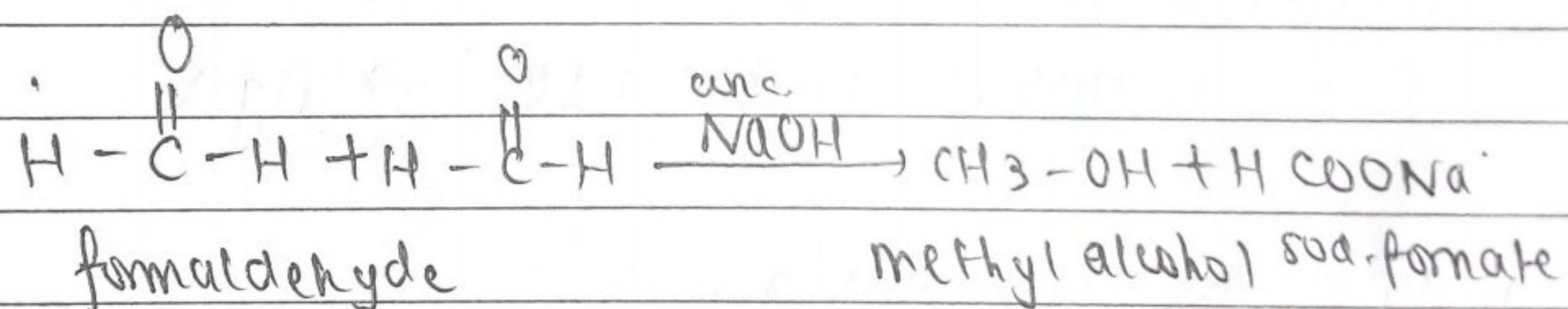
1d Carbylamine reaction



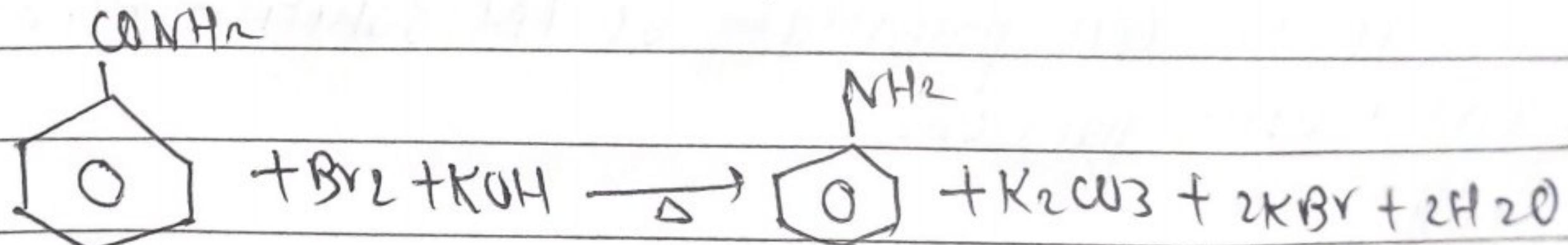
ii) Kolbe's reaction



iii) Cannizaro reaction

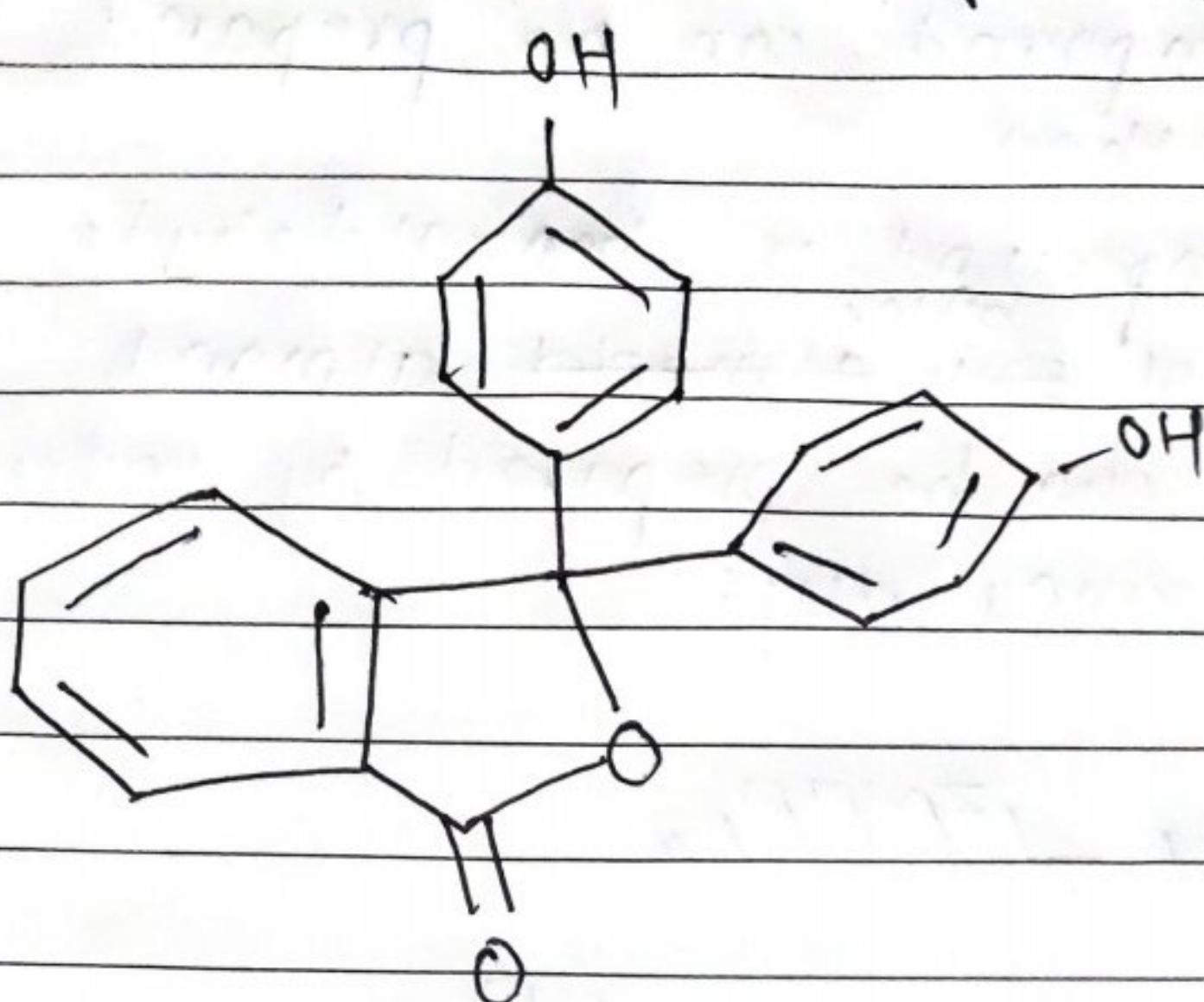


iv) Hoffmann's bromamide degradation reaction



b) Write down the structure of phenolphthalein.

→



c) Write the reaction when compound is treated with phenol.

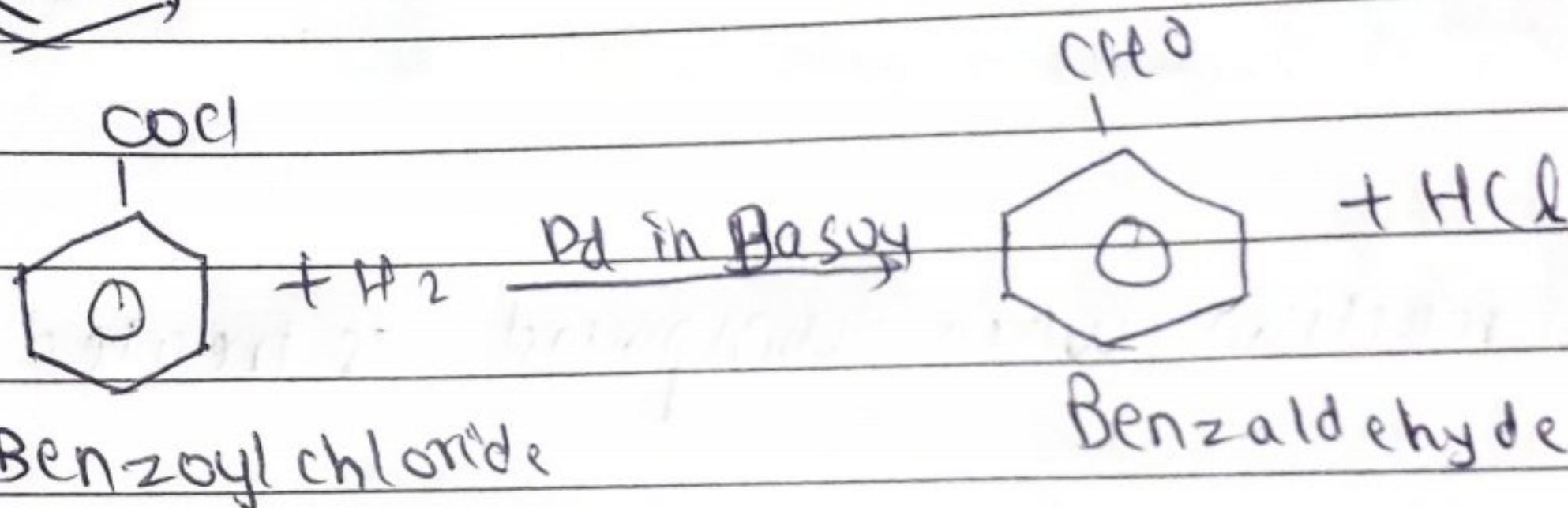
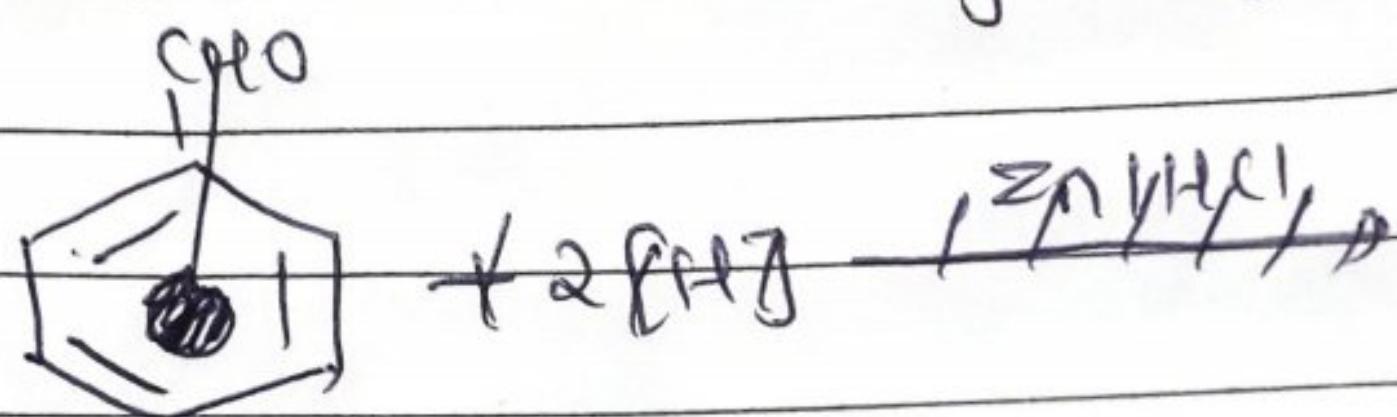
⇒

3y

3y
a) How this compound can be prepared by reduction method?

reduction method
The given compound is benzaldehyde i.e.
having taste of bitter almond

This compound can be prepared by reduction method in following way:



b) How it can be used to prepare Benzene diazonium chloride?