

NEB - GRADE XII

2077 (2020)

Chemistry

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Time: 1:30 hrs.

Full Marks (Condense): 30

Group 'A'

Attempt any five questions.

5x2=10

1. What are hybrid orbitals? Draw hybrid structure of methane.
2. What do you mean by normality of a solution is 1N?
3. Distinguish between electrochemical equivalent and chemical equivalent.
4. On what factors the Rate of reaction depends?
5. Write the chemical formula of Green Vitriol.
6. Give an example of Coupling reaction.
7. Draw the structure of Glucose and fructose.

Group 'B'

Attempt any two questions.

2x5=10

1. Define the terms;
 - i. Titration error
 - ii. Standard solution
 Calculate the volume of 1M NaOH required to neutralize 200cc of 2M HCl. What mass of sodium chloride are produced from the neutralized reaction?
2. Name a primary reference electrode and mention its one important use.
For a cell;
 $\text{Mg(s)}/\text{Mg}^{++}(\text{1M})//\text{Cu}^{++}(\text{1M})/\text{Cu(s)}$
 $E^\circ \text{Mg(s)}/\text{Mg}^{++} = 2.37 \text{ V}$ and $E^\circ \text{Cu}^{++}/\text{Cu} = +0.34 \text{ V}$
 - i. Indicate cathode and anode
 - ii. Write the reaction taking place at electrode.
 - iii. Calculate the emf at 1M solution of its ions.
3. How would you separate 1°, 2°, 3° amines from their mixture by Hoffmann's method?

Group 'A'

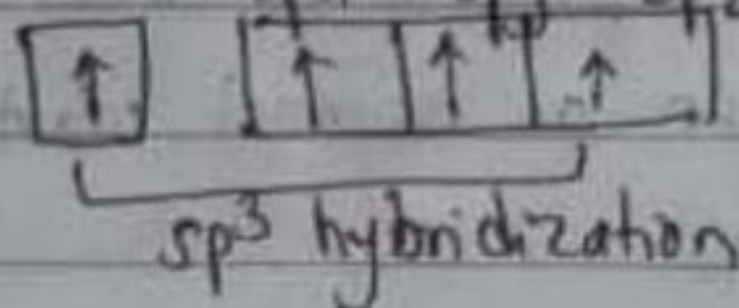
1). What are hybrid orbitals? Draw hybrid structure of methane?

Ans. The process of mixing of dissimilar atomic orbitals of same atom giving rise to equal number of a new set of orbitals having same energy is known as hybridization and new orbital is called hybrid orbitals.

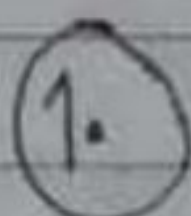
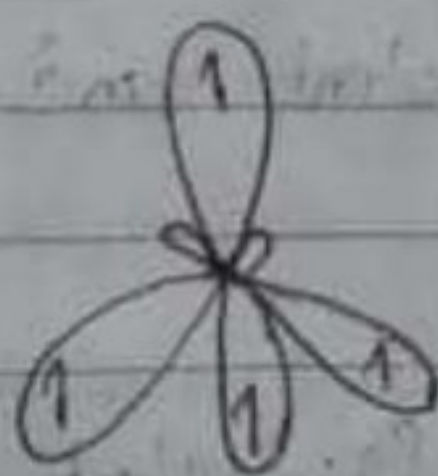
Methane (CH_4)

egs = $1s^2 2s^2 2p^2$

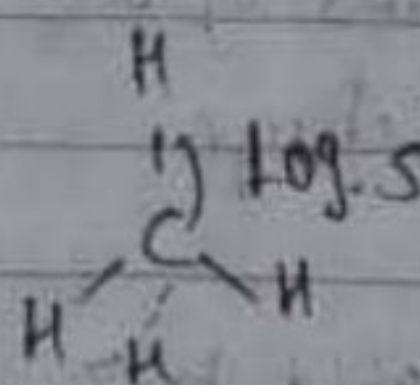
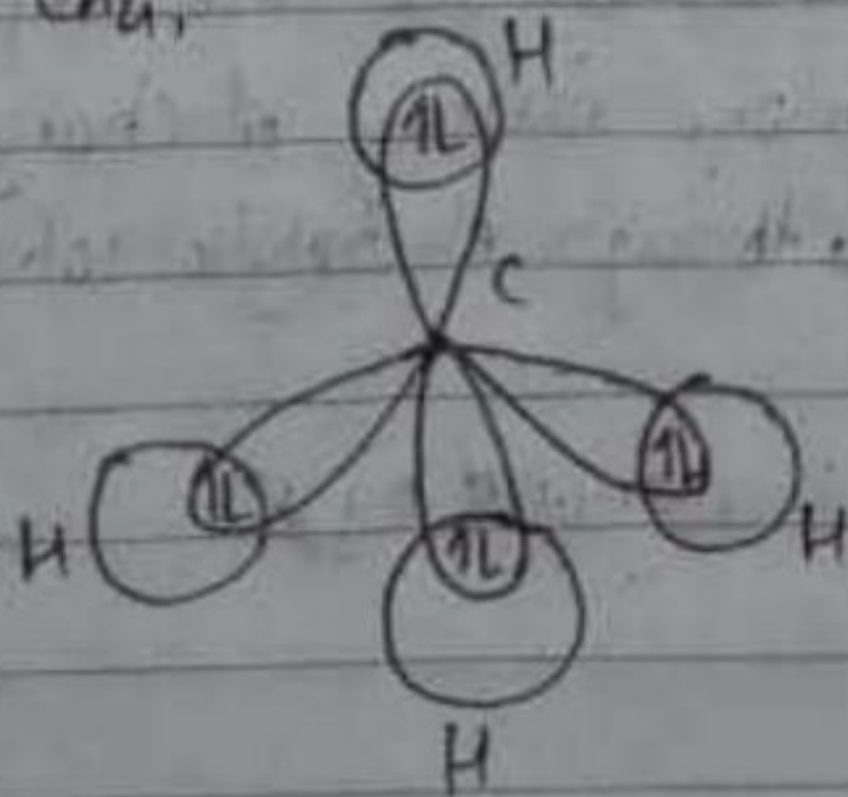
Cs = $1s^2 2s^2 2p^2 2p_x^1 2p_y^1 2p_z^1$



for C,



for CH_4 ,



Q) What do you mean by normality of a solution is 1N?

Ans:

Normality is defined as the number of gram equivalent of solute present in one litre of solution. It is denoted by N.

$$\text{Normality} = \frac{\text{no of gram equivalent of solute}}{\text{volume of solution in litre}}$$

Normality of a solution is 1 N means that one gram equivalent of substance is present in one litre of its solution. It is also known as normal solution.

Q) Distinguish between electrochemical equivalent and chemical equivalent.

Ans.	Electrochemical equivalent	Chemical Equivalent
1.	The mass of substance deposited or liberated by one coulomb of charge.	The mass of substance deposited when one faraday of charge is passed through electrolytic solution.
2.	It is denoted by Z.	It is denoted by E.

4) On what factors the Rate of reaction depends?

Ans Rate of reaction is defined as the change in concentration of reactants or products per unit time. It depends upon the following factors:

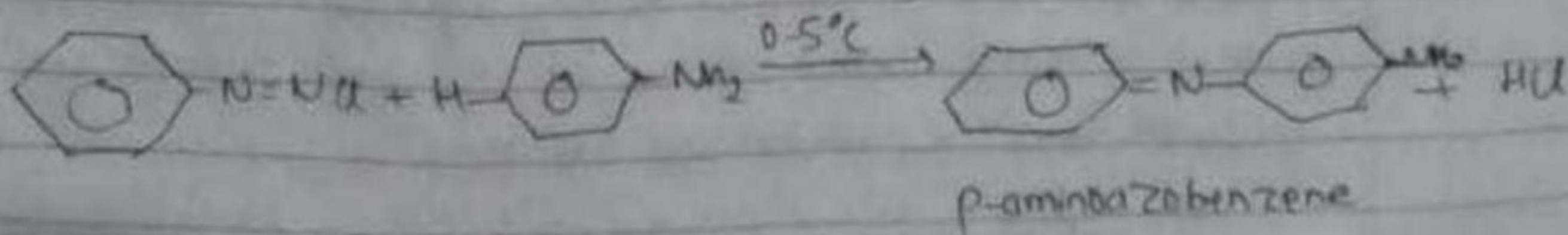
- i) Nature of reactant
- ii) Concentration of reactants
- iii) Temperature
- iv) Catalyst
- v) Surface area of reactants
- vi) Light

5) Write the chemical formula of green vitriol.

Ans Ferrous sulphate heptahydrate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) is the chemical formula of green vitriol.

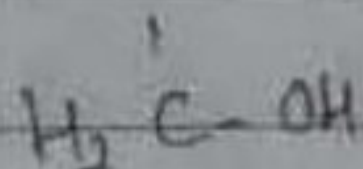
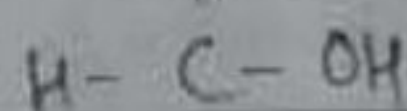
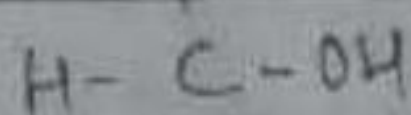
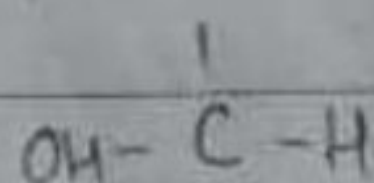
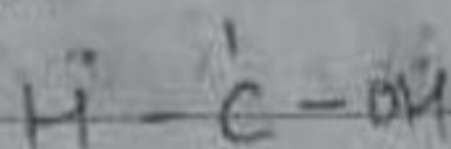
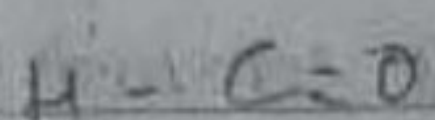
6) Give an example of Coupling reaction.

Ans When aniline is treated with benzene diazonium chloride, p-aminodiphenylamine is obtained. This reaction is known as coupling reaction.

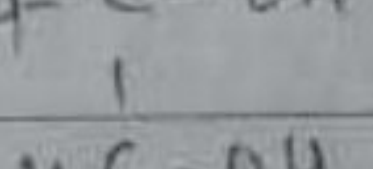
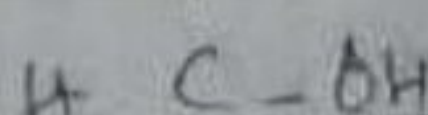
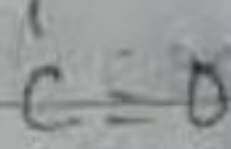
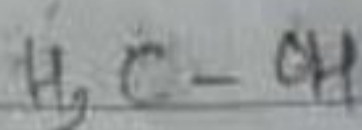


7. Draw the structure of Glucose and fructose.

Ans:



Glucose (aldohexose)



fructose (ketohexose)

Group 'B'

1. Define the terms:

i. Titration error: The difference between the equivalence point and end point is called titration error.

ii. Standard Solution: The solution whose concentration is known is called standard solution.

Calculate the volume of 1M NaOH required to neutralize 200cc of 2M HCl. What volume of sodium chloride are produced from the neutralized reaction.

Soln.

$$V_1 = ?$$

$$N_1 = M_1 = 1N$$

$$V_2 = 200\text{cc}$$

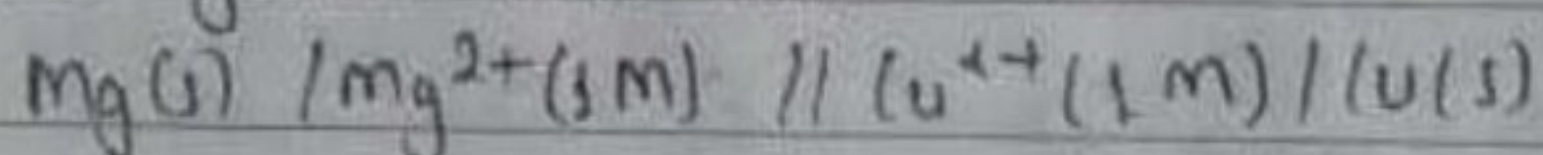
$$N_2 = 2M = 2N$$

Q. Name a primary reference electrode and mention its important use.

Ans: A primary reference electrode is an electrode which has a stable and well-known electrode potential. Standard Hydrogen Electrode is an example of primary reference electrode. Its potential is assumed to be zero and used to calculate cell potential using different electrodes.

Numerical:

The given cell notation is as:



Anode

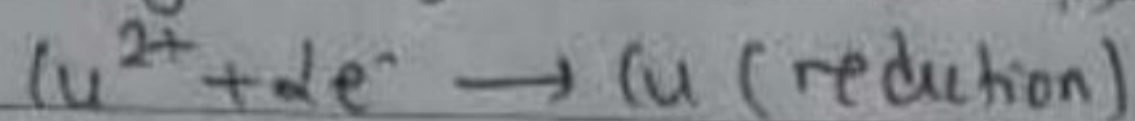
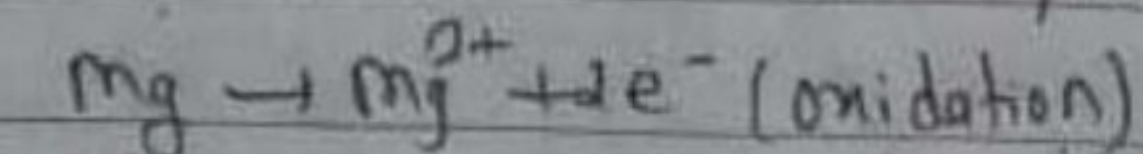
Cathode

-2.37V

+0.34V

i. $\text{Mg(s)} / \text{Mg}^{2+}$ is anode and $\text{Cu}^{2+} / \text{Cu(s)}$ is cathode.

ii. Mg acts as anode which undergoes oxidation and Cu acts as cathode where reduction takes place.



iii. E_{cell} of cell

$$E^\circ_{\text{cell}} = E^\circ_{\text{red (cathode)}} - E^\circ_{\text{red (anode)}}$$

$$= +0.34 - (-2.37)$$

$$= +2.71 \text{ V}$$

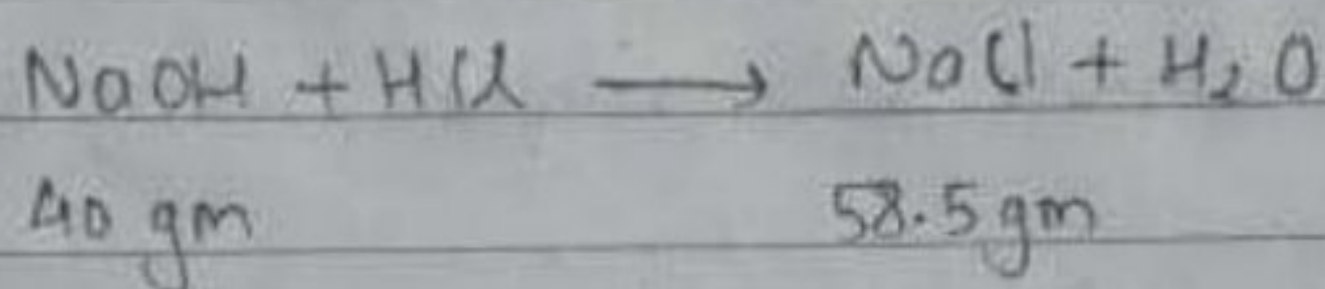
from the normality eqⁿ

$$N_1 V_1 = N_2 V_2$$

or, $1 \times V_1 = 200 \times 2$

$\Rightarrow V_1 = 400 \text{ cc}$

Now,



for NaOH,

$$w = \frac{NEV}{1000} = \frac{1 \times 400 \times 40}{1000} = 16 \text{ gm}$$

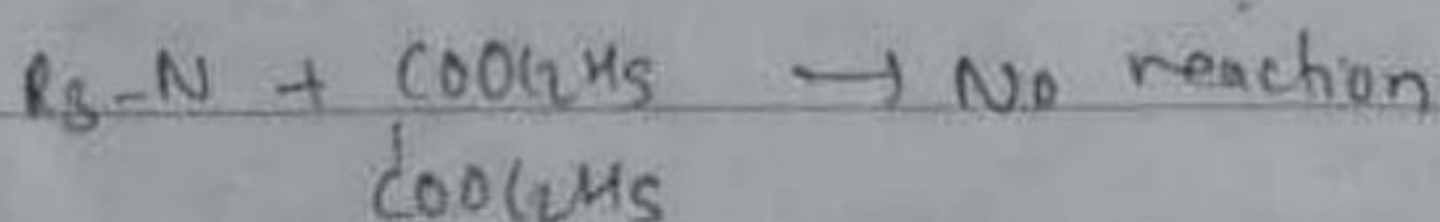
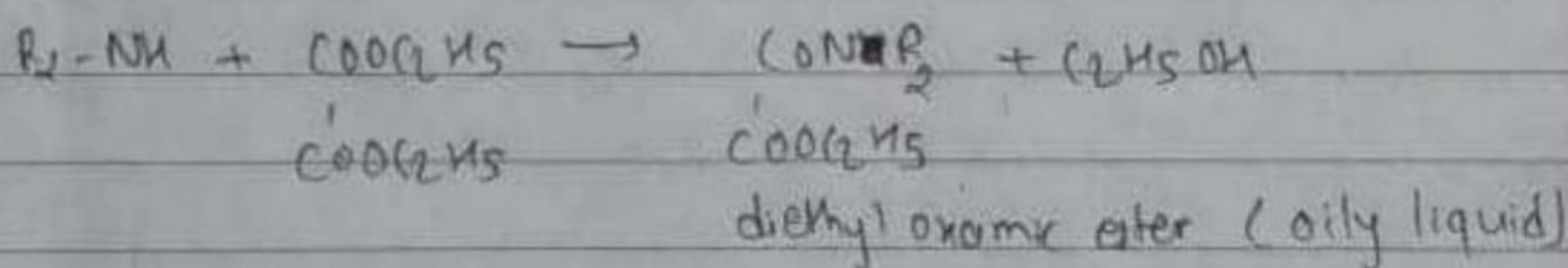
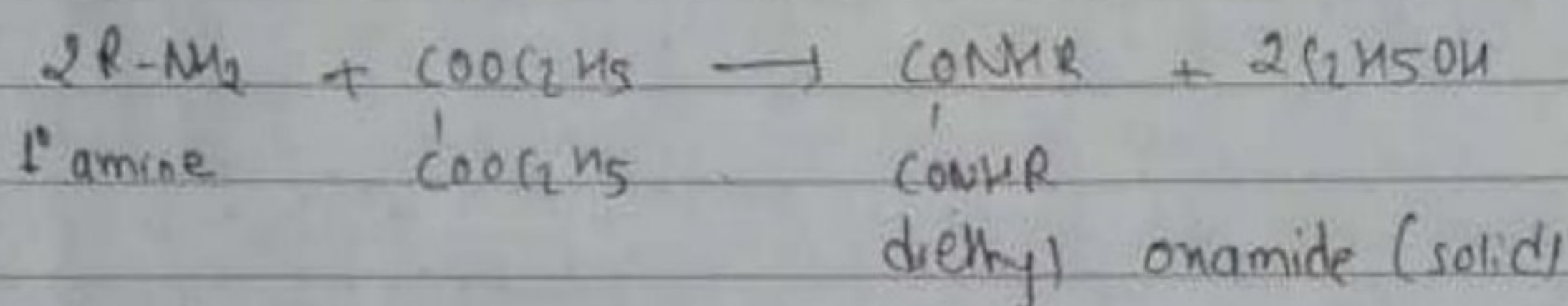
5) 40 gm of NaOH gives 58.5 gm of NaCl

16 gm of NaOH gives $\left(\frac{58.5}{40} \times 16 \right)$ gm of NaCl

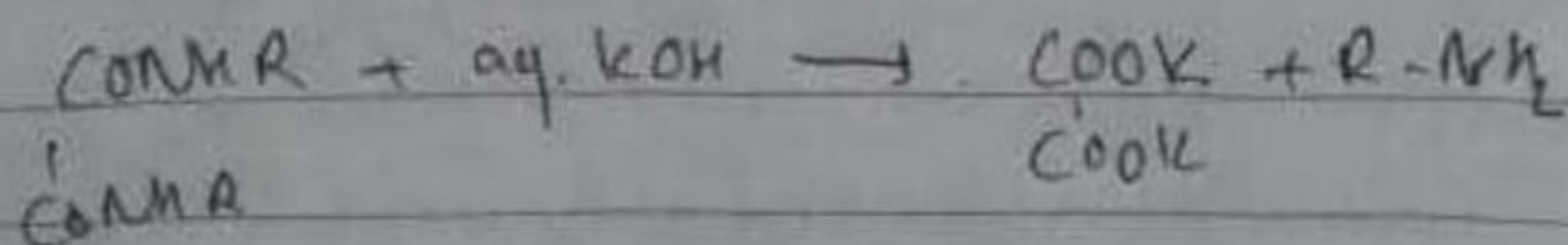
$$= 23.4 \text{ gm of NaCl}$$

3. How would you separate 1°, 2°, 3° amines from their mixture by Hoffmann's method?

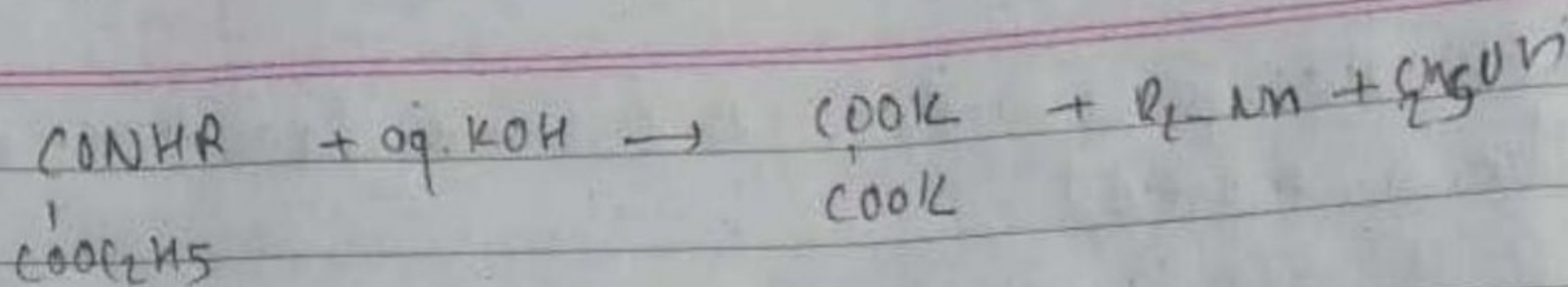
Ans. The mixture of 1°, 2° and 3° amines can be separated by treating it with Hoffmann's reagent i.e. diethyl oxalate.



Now the mixture containing diethyl oxamide, diethyl oxamic ester, tertiary amine and alcohol are subjected to filtration. The diethyl oxamide is obtained as residue and is treated with aq. KOH to obtain primary amine.



Now the mixture containing diethyl oxamic ester, ethanol and tertiary amine is subjected to fractional distillation.



In this way, 1°, 2° and 3° amines are separated.

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Time: 1:30 hrs.

Full Marks (Condense): 30

Group 'A'

Attempt any five questions.

5x2=10

1. What is the mode of hybridization of B in BF_3 ? Write any two important features of this hybridization.
2. Distinguish between end point and equivalence point of reaction.
3. What is meant by single electrode potential? How is it measured?
4. Define enthalpy of formation giving an example of it.
5. Give the balanced chemical reaction for the preparation of black oxide from blue vitriol. How is black oxide converted into red oxide?
6. What is Williamson's etherification reaction?
7. A primary haloalkane (X), if allowed to react with KCN yields a compound (Y), which on acidic hydrolysis gave propanoic acid. Identify (X) and (Y).

Group 'B'

Attempt any two questions.

2x5=10

8. Are all standard solutions, primary standard solutions or not? Give reason. 1 g of a divalent metal was dissolved in 25mL of 2N H_2SO_4 ($f = 1.01$). The excess acid required 15.1mL of 1N NaOH ($f = 0.8$) for complete neutralization. Find the atomic weight of the metal.
9. What is meant by enthalpy of formation? Calculate the enthalpy of formation of ethane at 298 K, if the enthalpies of combustion of C, H and C_2H_6 are - 94.14, - 68.47 and - 373.3 KCal respectively.
10. An Organic Compound (A) reacts with PBr_3 to give (B). Compound B produces (C) when heated with alc. KOH. The compound (C) undergoes ozonolysis to yield ethanal and methanal as major products. The compound A responses iodoform test. Identify A, B, C and write reactions involved. How is (A) obtained from CH_3MgBr ?

Contd...

212 'D'

(2)
Group 'C'

Attempt any **one** question.

1x10=10

11. Give a suitable chemical reaction for the laboratory preparation of trichloromethane. What happens when trichloromethane reacts with

i. Phenol

ii. Nitric acid

iii. Silver powder

iv. Atmospheric air.

12. Define the terms (i) activation energy (ii) order of reaction (iii) molecularity of reaction (iv) effective collision (v) rate law equation.

Why does powder sugar dissolve faster than grain sugar?

The following data were obtained for a hypothetical reaction



Expt	[x] mol L ⁻¹	[y] mol L ⁻¹	Formation of z mol L ⁻¹ S ⁻¹
1	0.20	0.20	3x10 ⁻³
2	0.40	0.20	1.2x10 ⁻²
3	0.60	0.40	6x10 ⁻³
4	0.80	0.20	9x10 ⁻³

Group 'A'

Attempt any five questions.

5X2=10

4-)

1-→ The mode of hybridization of B in BF_3 is sp^2 hybridization.

① The important feature of this hybridization are :

② The bond angle of sp^2 hybridization orbital is 120° and triangular shape.

③ sp^2 hybridization poses 33.3% of s character and 66.7% of p character.

2-→ Endpoint/Neutral point

The point in a titration at which reaction betⁿ 2 solution is just completed and at which indicator can show sharp colour change is called end point.

equivalence point

The point in a titration in which equivalent quantity of titrant is just completely neutralized by titrand is called equivalence point.

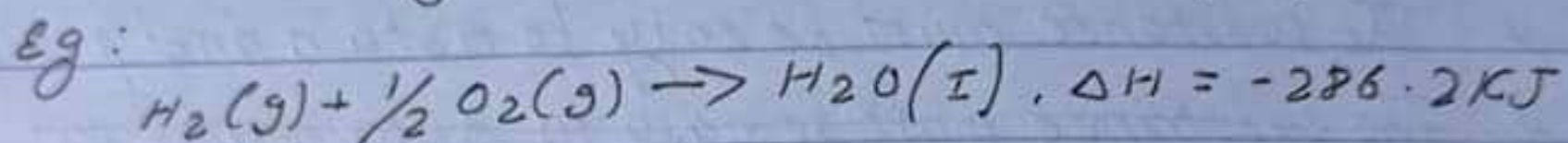
3-→ Single electrode potential : When a metal is dipped into a solution containing its own ion, a potential is developed betⁿ them. This is called single electrode potential. It is measured by the separation of charges betⁿ the metal electrode and its solution. example :

When zinc metal rod is immersed into the zinc sulphate solution, zinc metal loses electron and zinc

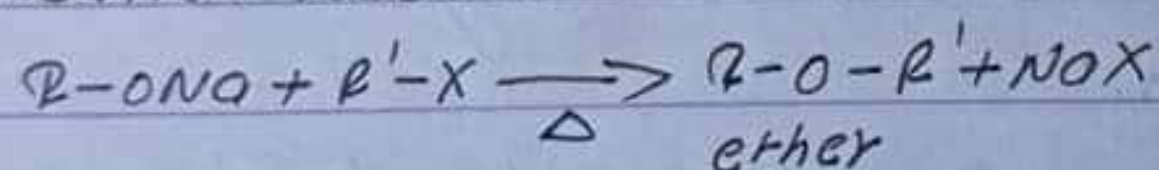
Write 2 in
h. or.

ion is formed. The zinc ion passes into the solution keeping leaving behind the electrons in the metal surface.

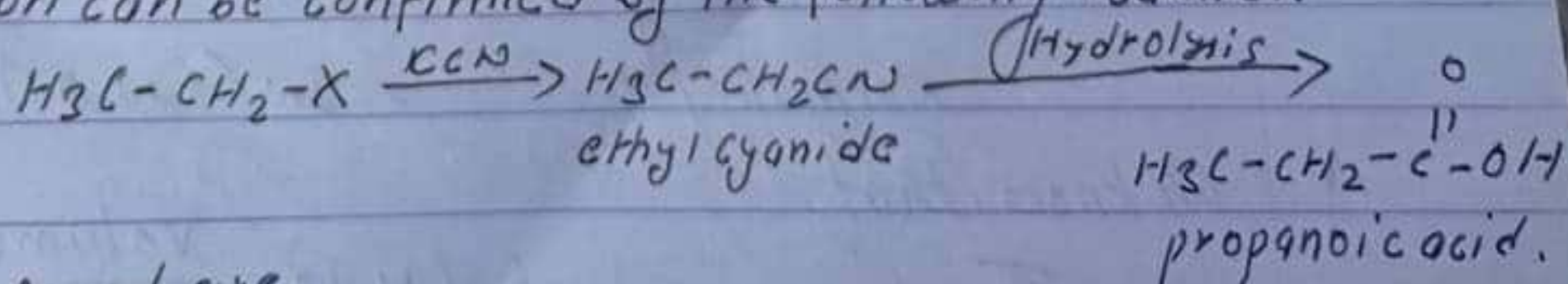
4) The heat change when one mole of substance is formed from its own elements in their ~~neutra~~ natural state is called heat of formation or enthalpy of formation.



6) The reaction in which alkyl halide and sod. or pot. alkoxide are reacted to form ether is known as Williamson's etherification reaction.



7) The compound (Y) is obtained from the compound (X) on treatment with KCN solution which on hydrolysis gives propanoic acid. The compound (Y) must be $\text{CH}_3\text{CH}_2\text{CN}$. The compound (Y) is obtained from (X) with KCN. So, the compound (X) must be $\text{CH}_3\text{CH}_2\text{-X}$. This conversion can be confirmed by the following reaction.



The compound are,

X = haloethane

Y = ethyl cyanide

Group 'B'

2x5=10

Attempt any two question

8-> Not, all standard solution are not primary standard solution.

To be a primary standard, a substance must fulfill the

following criteria:

1. The substance must be easy to obtain and purity.
2. ~~The substance must be easy to obtain and pu~~
2. The substance must not be hygroscopic or efflorescent or deliquescent.
3. The composition should not change during storage or weighing.
4. The substance should be readily soluble under the employed condition.
5. The substance should have high molecular mass

Numerical:

Given,

The wt of the metal = 1g

The valency of metal = 2

for acid:

Volume of acid (H_2SO_4) = 25ml

Normality " " = 2N (f=1.01)

We know that,

$$\begin{aligned}\text{The gm-equivalent of } H_2SO_4 &= \frac{\text{Volume} \times \text{Normality}}{1000} \\ &= \frac{25 \times 2 \times 1.01}{1000} \\ &= 0.505\end{aligned}$$

For base :

$$\text{Volume of base (NaOH)} = 15.4 \text{ ml}$$

$$\text{Normality of acid} = 1 \text{ N (f} = 0.8)$$

We know that,

$$\begin{aligned} \text{The gm equivalent of NaOH} &= \frac{\text{Volume} \times \text{Normality}}{1000} \\ &= \frac{15.4 \times 1 \times 0.8}{1000} \\ &= 0.01208 \end{aligned}$$

For metal

$$\begin{aligned} \text{The gm. equivalent of metal} &= \frac{\text{Weight of metal}}{\text{Eq. wt. of metal}} = \frac{15.4 \times 1 \times 0.8}{1000} \\ &= 0.01208 \\ \Rightarrow \frac{\text{wt of metal}}{\text{Eq. wt. of metal}} &= \frac{1}{\text{Eq. wt. of metal}} \end{aligned}$$

We know that

$$\begin{aligned} \text{The gm equivalent of metal} &= \text{The gm. equivalent of} \\ \text{H}_2\text{SO}_4 &- \text{The gm. equivalent of NaOH} \end{aligned}$$

$$\frac{1}{\text{Eq. wt. of metal}} = (0.0505 - 0.01208) = 0.03842$$

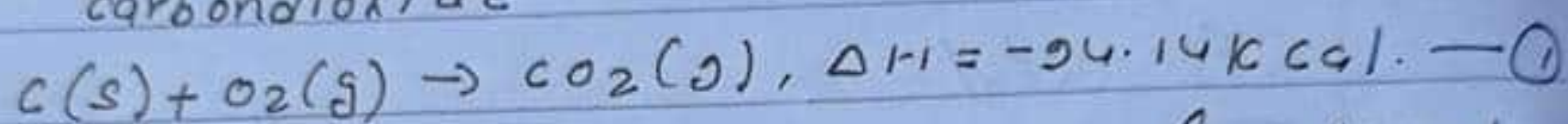
$$\text{or, Eq. wt of metal} = 26.02$$

$$\begin{aligned} \text{Hence, the atomic wt. of metal} &= \text{Eq. wt.} \times \text{Valency} = \\ &26.02 \times 2 = 52.05 \text{ amu} // \end{aligned}$$

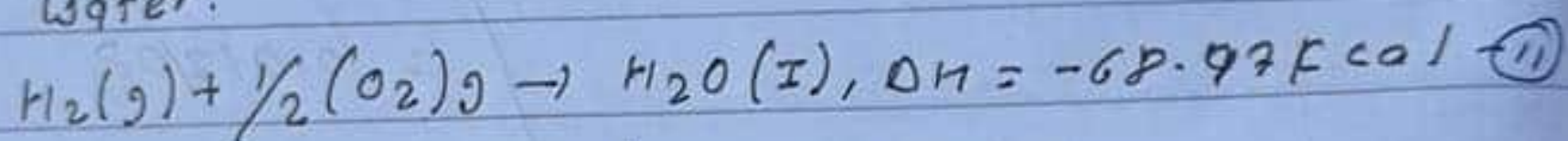
9-> Enthalpy of formation: The quantity of heat change is involved when one mole of chemical substance is formed from its constituent element is known as enthalpy of formation. It is denoted by ΔH Numerical.

Given:

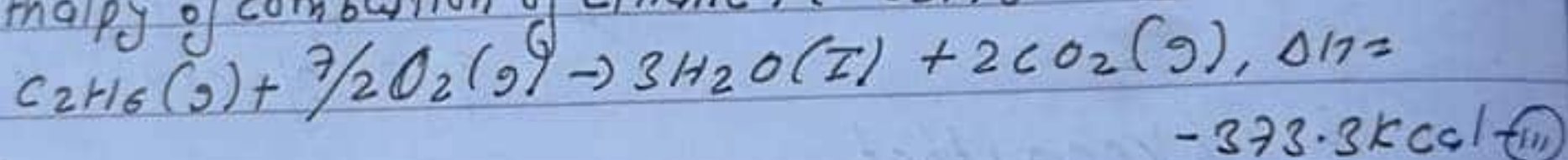
Enthalpy of combustion of carbon i.e. formation of carbon dioxide



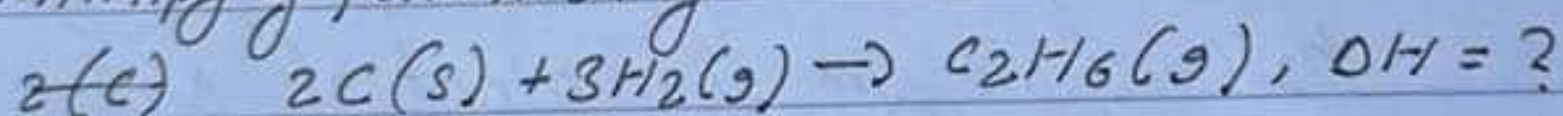
Enthalpy of combustion of hydrogen i.e. formation of water.



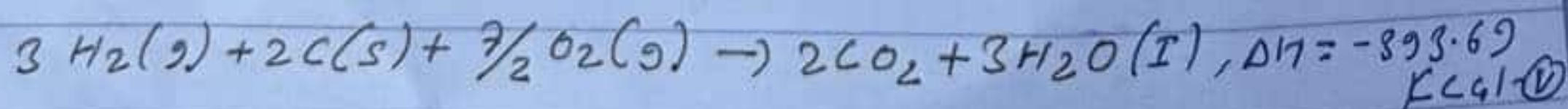
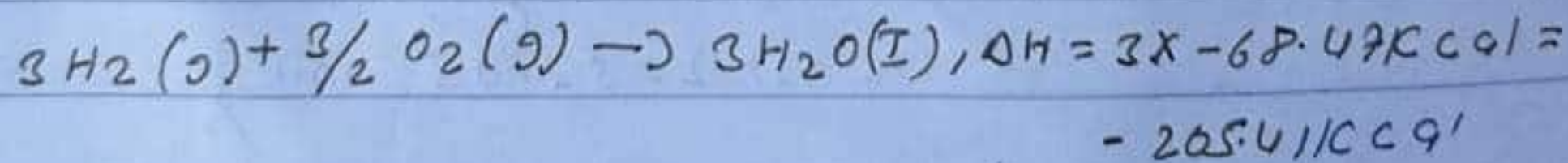
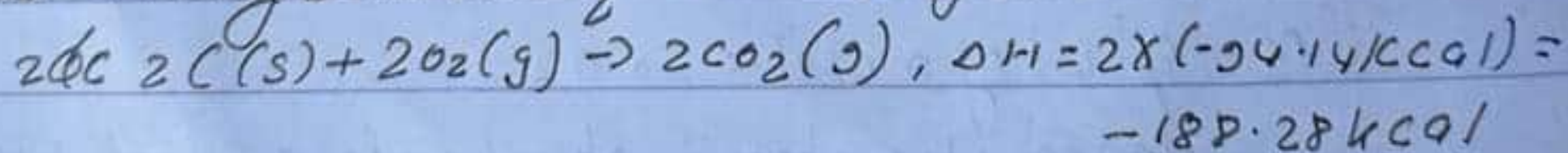
Enthalpy of combustion of ethane i.e. C_2H_6



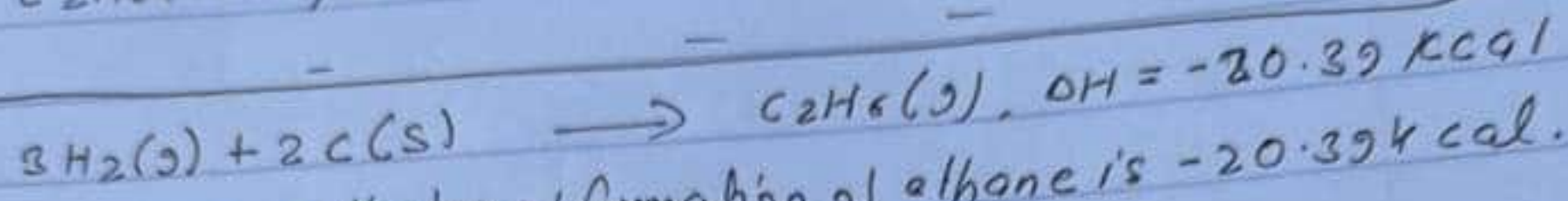
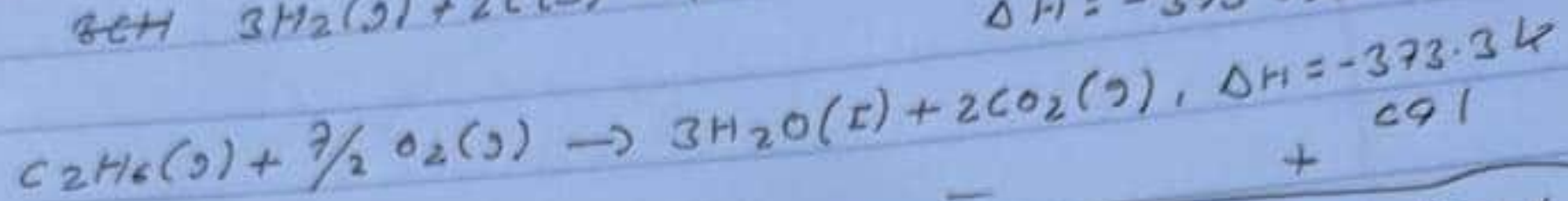
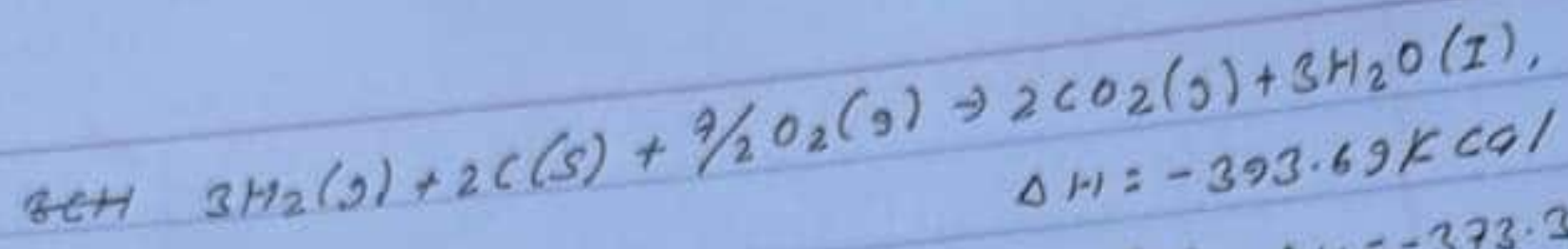
Enthalpy of formation of ethane



Eq. (i) is multiplied 2 and Eq. (ii) is multiplied by 3 and adding both the eqⁿ then we get,



Subtracting eqⁿ (iii) from eqⁿ (iv) we get



Hence, enthalpy of formation of ethane is -20.39 Kcal .

Group 'C'

11- Guide ko. p.g. no. 211

12- Guide ko. p.g. no. 167