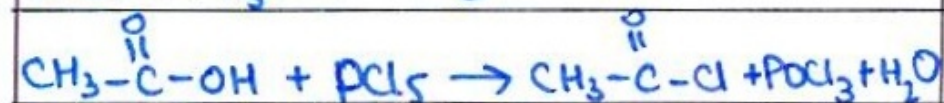


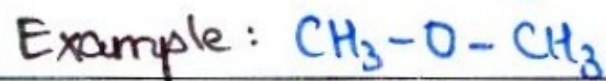
Q. No. 2 Part (i) **ACID HALIDES**

Acid Halides have $R-\overset{\overset{O}{\parallel}}{C}-X$ functional group that is formed by the reaction of Carboxylic acids and PX_5 or PX_3 .



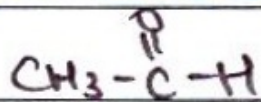
Ethers

Ethers or epoxyalkanes contains $R-O-R$ functional group.



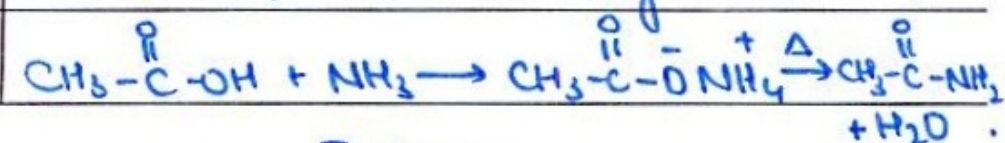
Aldehydes

Aldehydes contains $-\overset{\overset{O}{\parallel}}{C}-H$ formyl group with at least one H bonded to carbonyl carbon.



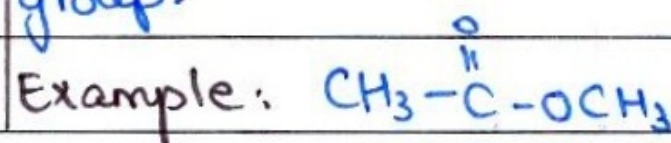
ACID AMIDES.

Acid Amides have $R-\overset{\overset{O}{\parallel}}{C}-NH_2$ functional group that is formed when carboxylic acid is treated with NH_3 . It is not formed directly.



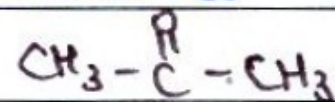
Esters

Esters contain $R-\overset{\overset{O}{\parallel}}{C}-OR$ functional group.



ketones

Ketones contain $-\overset{\overset{O}{\parallel}}{C}-$ group with both Carbons bonded to carbonyl Carbon.



Q. No. 2 Part (ii)

COORDINATION NO. 6: For coordination no. 6, the geometry of complexes is a regular octahedron in which six ligands are attached to central metal.

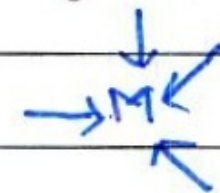
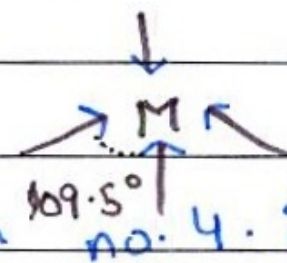
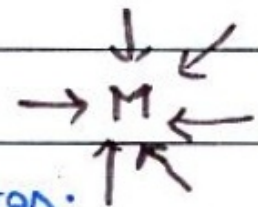
Example: $K_4[Fe(CN)_6]$ Potassium hexacyano Ferrate (II)

COORDINATION NO. 4:

Coordination No. 4 can show two types of structures.

sp^3 : In sp^3 , the geometry of complex is tetrahedral which has bond angle 109.5° .

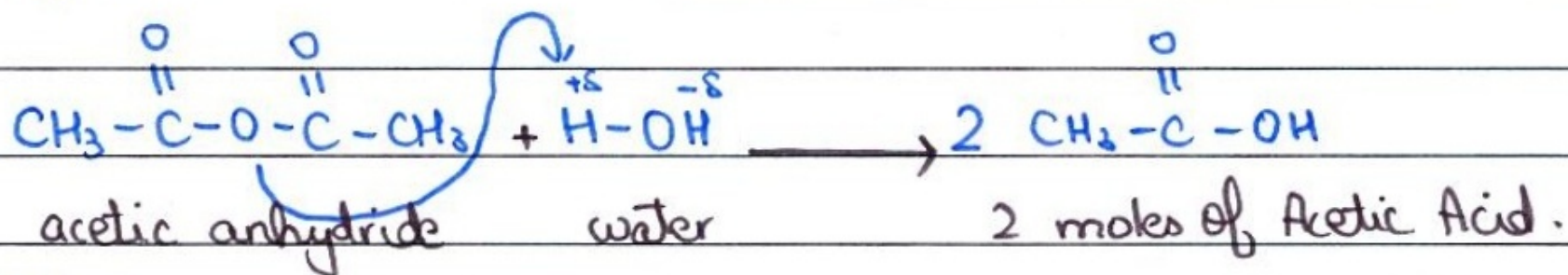
dsp^2 : dsp^2 is also shown by coordination no. 4. In it, the geometry of complex is Trigonal bipyramidal with angles 90° .



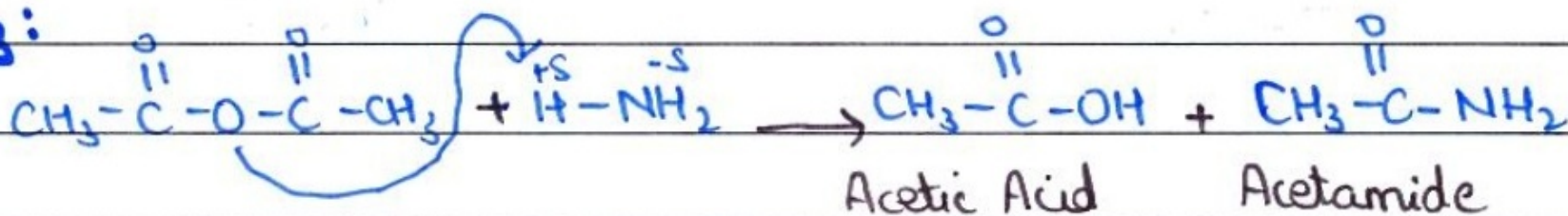
Q. No. 2 Part (iii)

Acetic Anhydride.

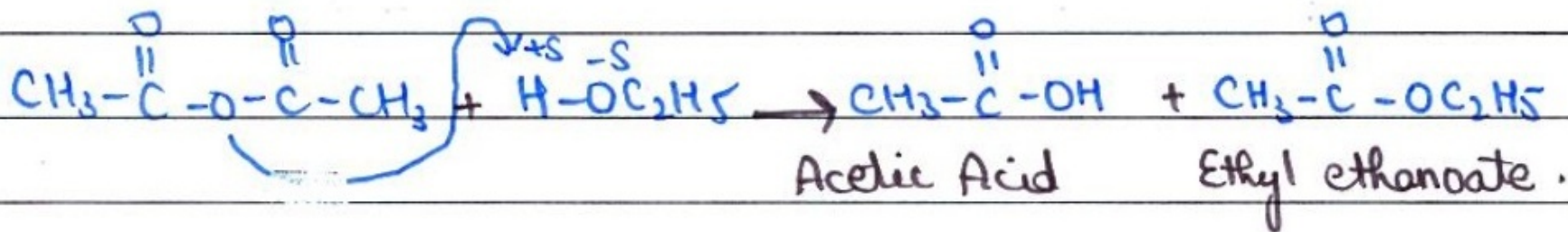
(a) H_2O :



(b) NH_3 :



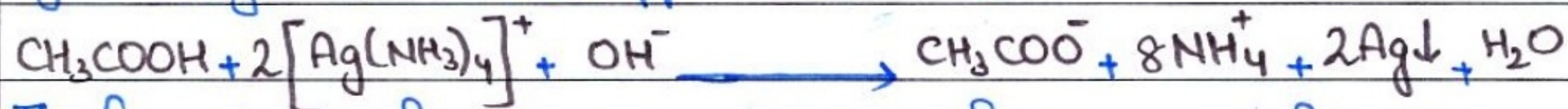
(c) C_2H_5OH :



Q. No. 2 Part (iv)

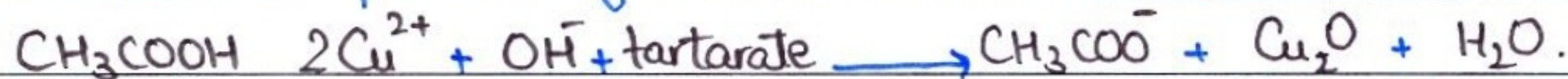
DIFFERENTIATION.

Tollen's Reagent: Tollen's Reagent or Silver mirror test is used to differentiate between Aldehydes and Ketones. This reaction is shown by Aldehydes and white ppt. are formed.



The formation of white precipitates confirm white ppt. presence of Aldehyde (Formyl compound).

Fehling's Solution Test: Fehling Solution Test is positive for Aldehyde i.e. formation of brick red ppt. when Cu^{2+} ions are reduced to Cu^+ ions in presence of alkaline medium and tartarate ions.



No Nitroprusside Test:

Sodium Nitroprusside Test is shown by Ketones only i.e. formation of orange or wine red colour.

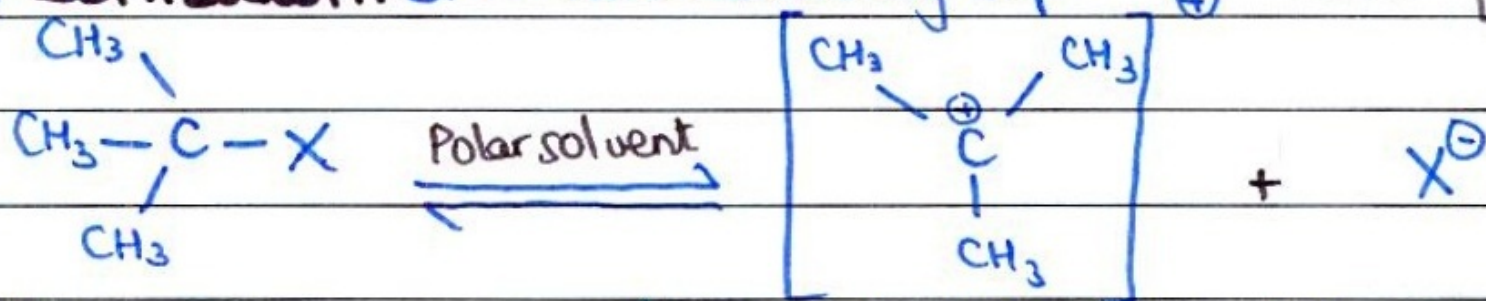
brick red ppt.

Q. No. 2 Part (v)

S_N1 mechanism.

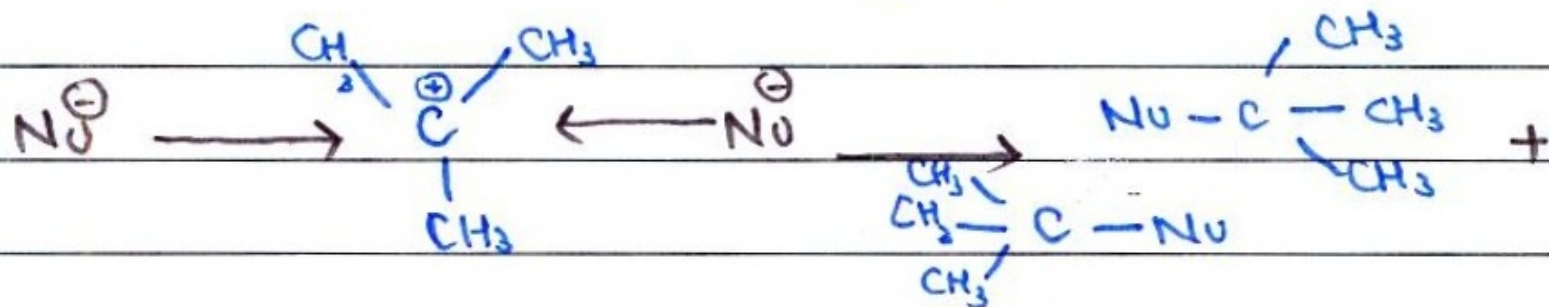
The S_N1 reaction is a unimolecular reaction. It occurs in two steps and usually preferred by 3° Alkyl Halides due to stability of Carbocation.

Step 1: Ionization: It is rate determining step. $\text{Rate} = [A-H]^1$



Alkyl halide ionizes in presence of polar solvent to give Carbocation.

Step 2: Attack of Nucleophile: Nu^- can attack from both sides to give 50% inversion and 50% retention of configuration.



Q. No. 2 Part (vi)

ENZYME INHIBITION.

In presence of certain substances, the activity of enzymes decrease. This is called enzyme inhibition and the substances that decrease the enzyme activity are called inhibitors.

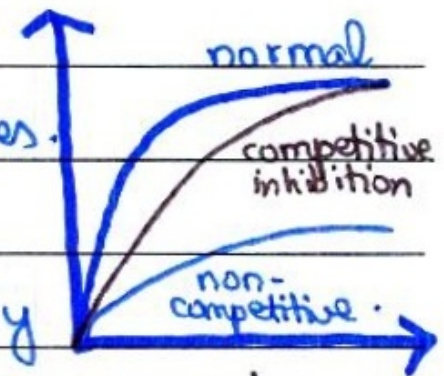
Types: There are two types of enzyme inhibition.

•) **Irreversible inhibition:** In it, the inhibitor forms covalent bond with the active site of enzyme and thus hinders its activity. It is irreversible.

•) **Reversible inhibition:** Reversible inhibition is of two types.

- **Competitive inhibition:** The inhibitor resembles the substrate and binds to active site. This can be reduced by increasing substrate concentration. Malonic acid inhibits succinic acid.

- **Non-Competitive:** The inhibitor binds to site other than active site and changes shape of enzyme (denaturation).

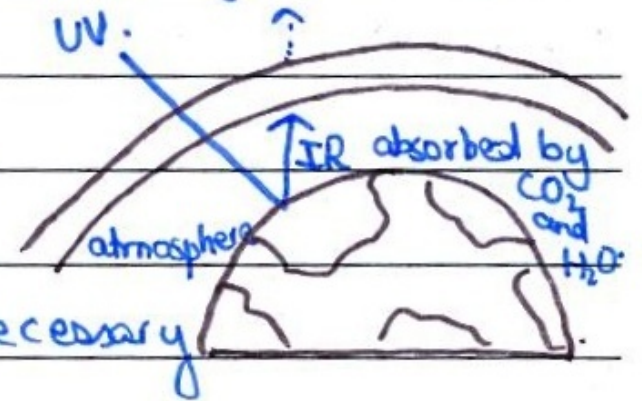


Q. No. 2 Part (vii)

GREEN HOUSE EFFECT.

"The absorption of radiations (infrared radiation of longer wavelength) causes increase in temperature of Earth's atmosphere by CO_2 and H_2O vapours. This phenomenon is called green house effect."

The radiation that reach earth are of shorter wavelength. When they strike Earth, they are converted into longer wavelength. The CO_2 and H_2O vapours absorb these radiation which are necessary for maintenance of temperature.

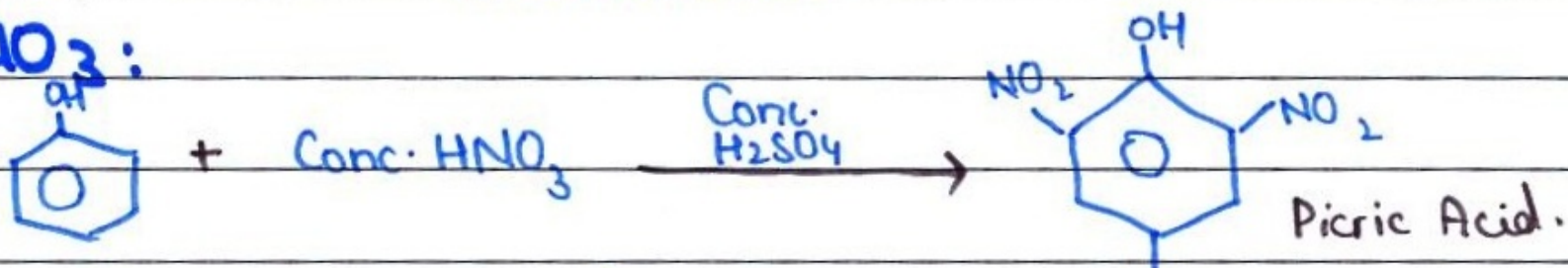


Global Warming: Water vapours are present in higher amounts, so are responsible for more increase. Concentration of CO_2 is 330 ppm in atmosphere. An increase in conc. to 440 ppm increases temperature to 1°C . The normal Earth temperature due to green house effect is 15°C . Global warming because of human activities causes melting of glaciers.

Q. No. 2 Part (viii)

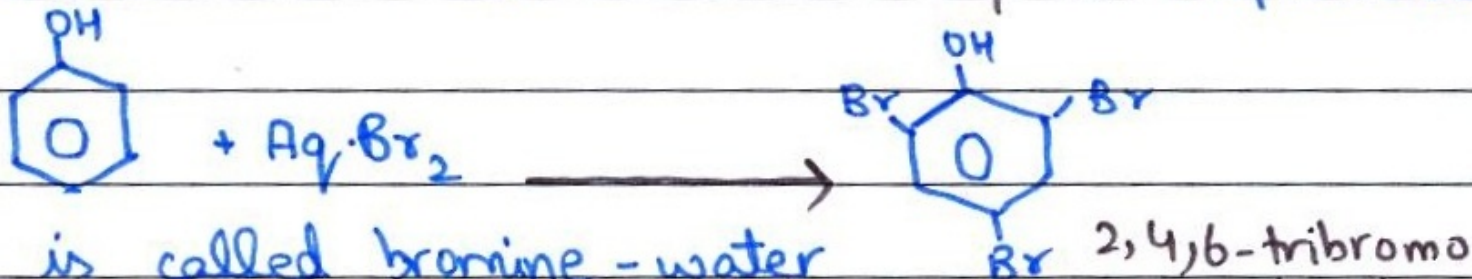
PHENOL.

Conc. HNO_3 :



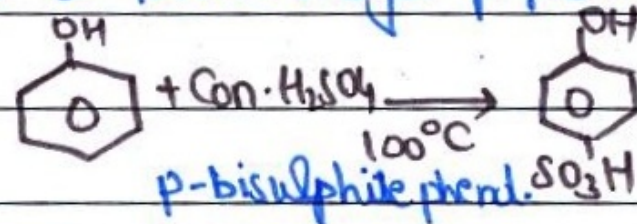
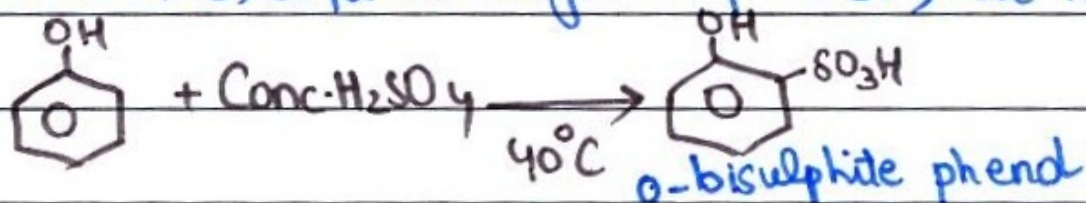
Phenol reacts with conc. HNO_3 to form 2,4,6-Trinitro phenol or picric acid.

aq. Br_2 :



This reaction is called bromine-water test and is used to differentiate between benzene and phenol.

conc. H_2SO_4 : Phenol gives different products at different temperatures. At $20^\circ\text{--}40^\circ\text{C}$, it forms major o-product, at 100°C it forms major p-product.



Q. No. 2 Part (ix) E_2 reactions

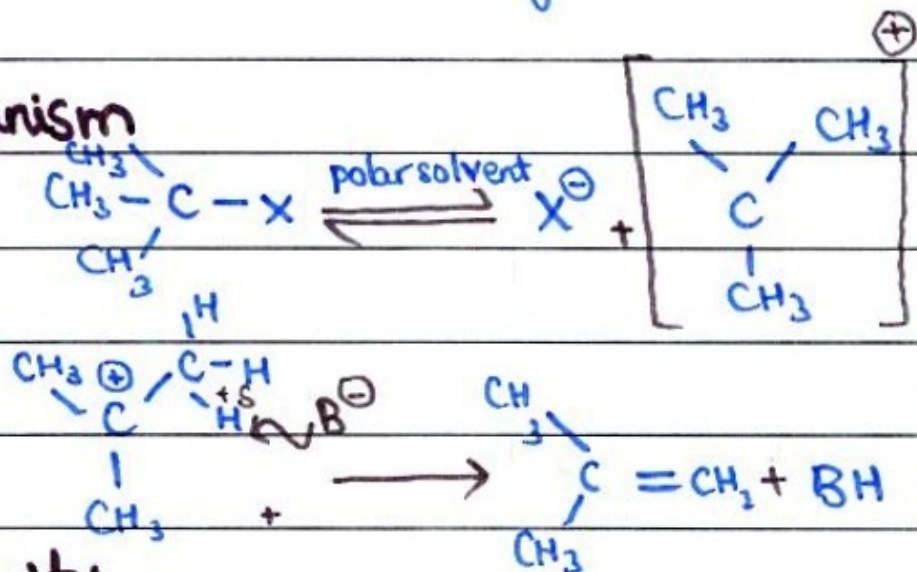
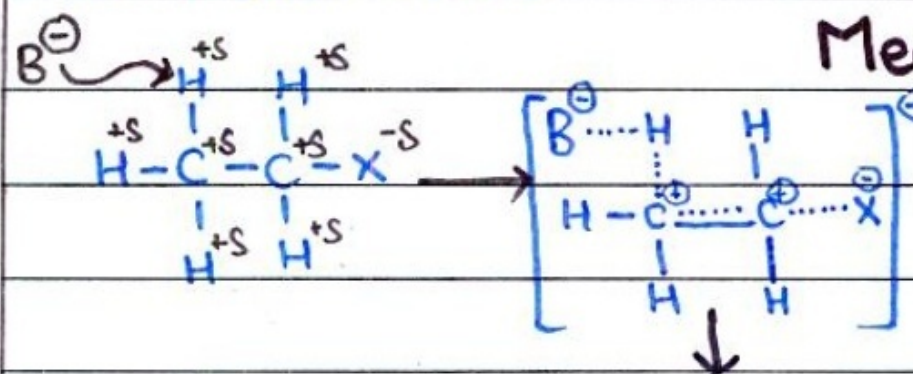
E_1 reactions.

E_2 reactions are bimolecular reactions

E_1 reactions are unimolecular

having molecularity = 2. It occurs in one step with formation of transmission state.

reactions and occur in two steps. (Molecularity = 1)



Reactivity.

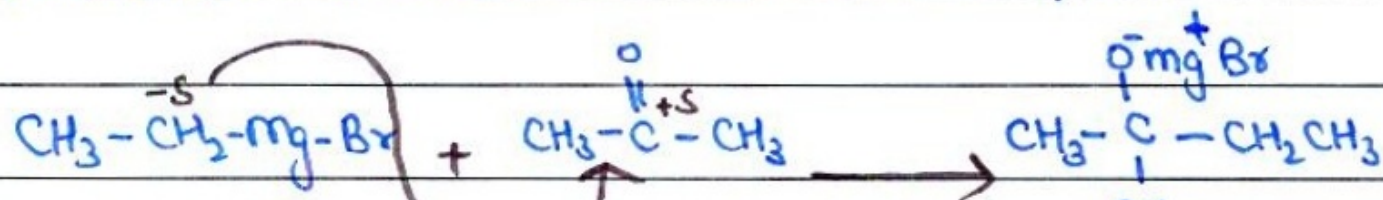
- Order of Rxn = 2 Rate = $[A \cdot H]^1 [B]^1$
- It is preferred by $1^{\circ} A \cdot H$ $1^{\circ} > 2^{\circ} > 3^{\circ}$
- It occurs in presence of non-polar solvent.

- Order of rxn = 1 Rate = $[A \cdot H]^1$
- It is preferred by $3^{\circ} A \cdot H$. $3^{\circ} > 2^{\circ} > 1^{\circ}$
- It occurs in presence of polar solvent.

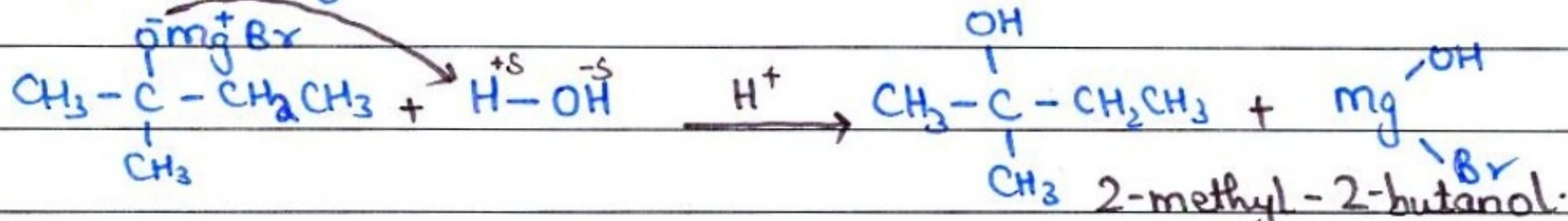
Q. No. 2 Part (x)

GRIGNARD REAGENT.

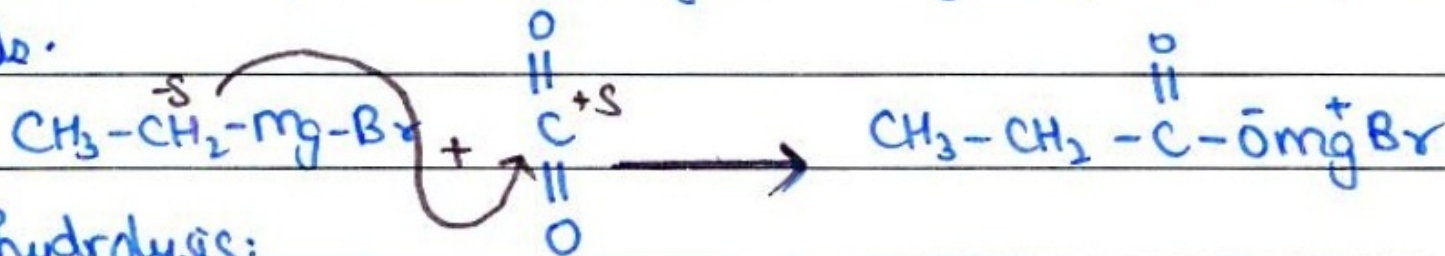
a) **Acetone:** It reacts with acetone to form 2° Alcohols.



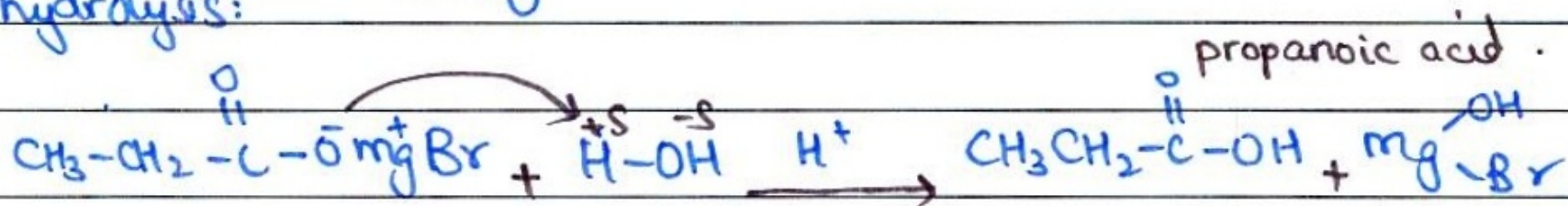
Acid hydrolysis of the intermediate occurs:



b) **CO₂:** Carboxylation of Grignard Reagent produces Carboxylic Acids.



Acid hydrolysis:



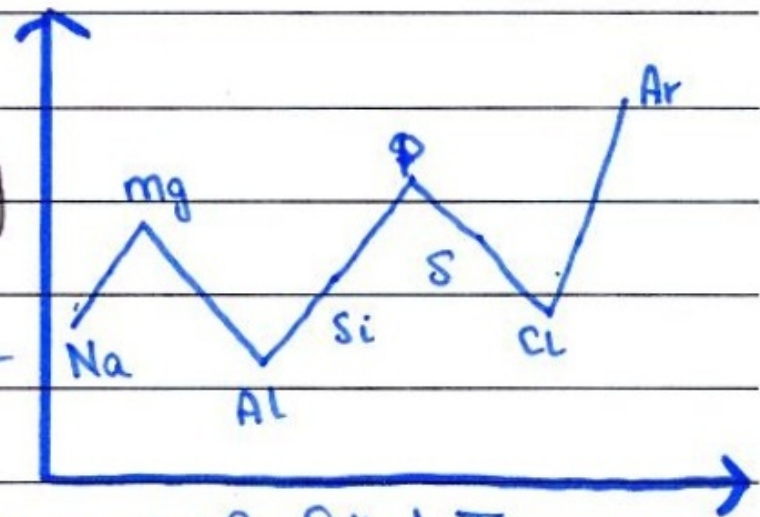
Q. No. 2 Part (xi)

IONIZATION ENERGY.

Ionization energy is the amount of energy required to remove an electron from isolated gaseous neutral atom to produce ions. It generally increases from left to right in a group due to decrease in atomic size and increase in effective nuclear charge.

Anomalous Trends:

Ionization energy depends on stability of electronic configuration. In Period 3, Mg and P show more ionization energy than Al and S respectively.



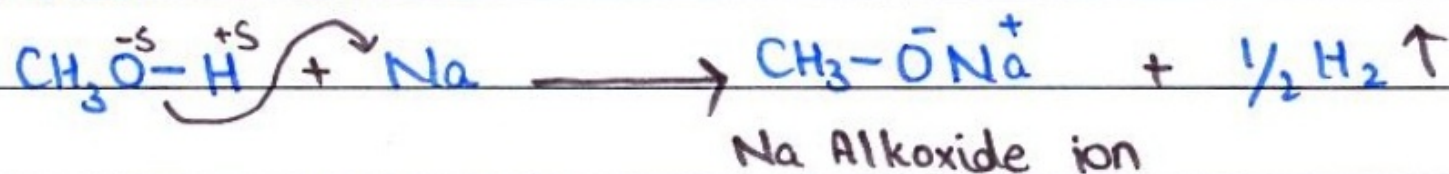
Mg and Al: Mg has $3s^2$ orbital i.e. very stable completely filled. Thus, more energy is required to remove an e^- from Mg than Al i.e. $3s^2, 3p^1$ partially filled with low energy. **P and S:** P has p^3 half-filled orbital which is more stable than p^4 partially filled of S.

Q. No. 2 Part (xii)

O-H BOND BREAKAGE.

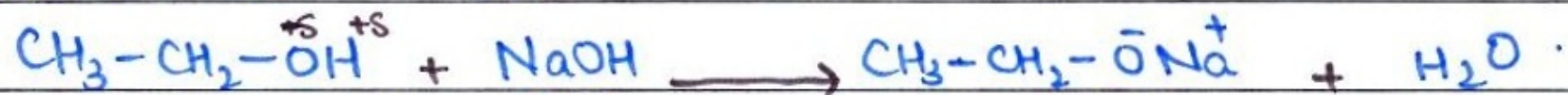
The O-H bond of alcohols break in the presence of electrophilic attack.

Reaction with Na metal:



This reaction is used to detect impurities in petrol.

Reaction with NaOH:



Alcohols reacts with alkalis to form salts with release of H_2O .

Reactivity:

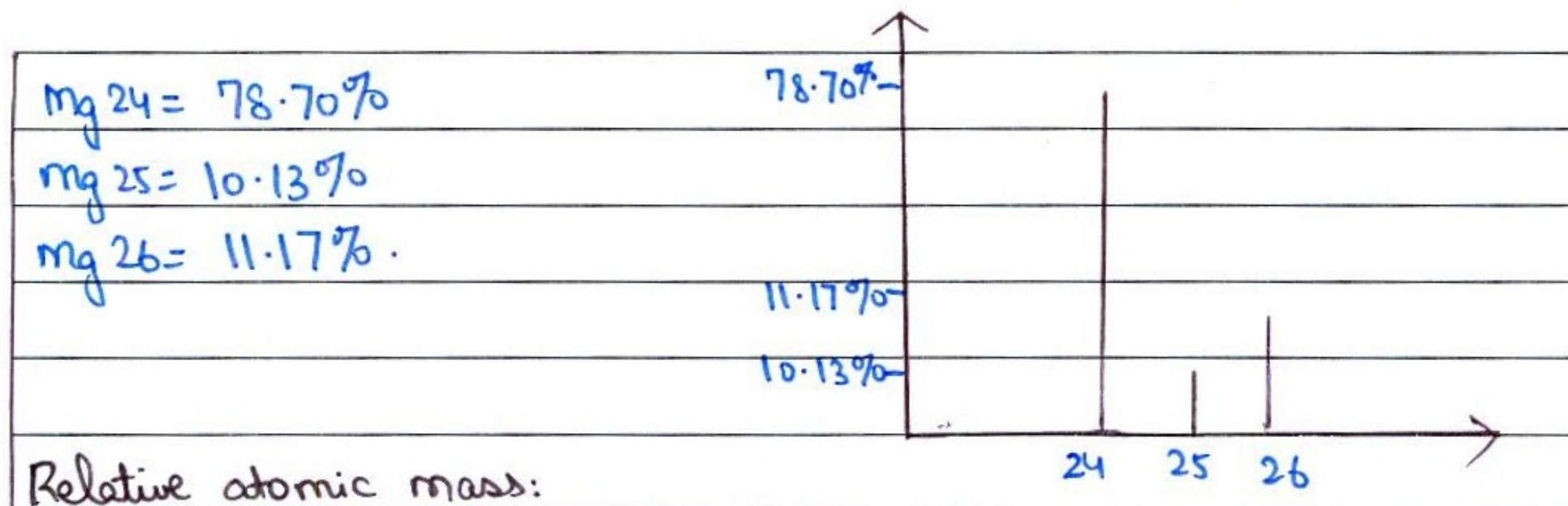
For these reactions, the relative order of reactivity is CH_3OH

1° Alcohol $>$ 2° Alcohol $>$ 3° Alcohol.

It is due to reduction of electron density at -OH bond.

Q. No. 2 Part (xiii)

RELATIVE ATOMIC MASS.



$$M_g = \frac{(78.70 \times 24) + (10.13 \times 25) + (11.17 \times 26)}{100}$$

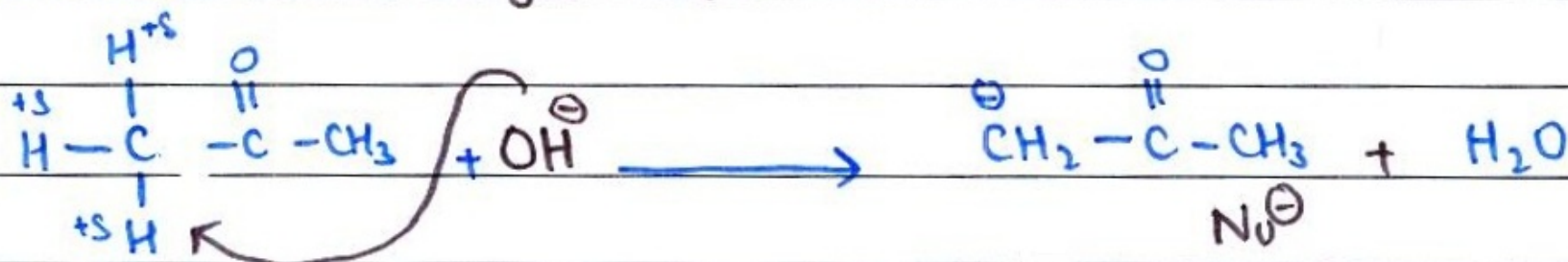
$$= \frac{2432.47}{100}$$

$$M_g = 24.3247 \text{ amu}$$

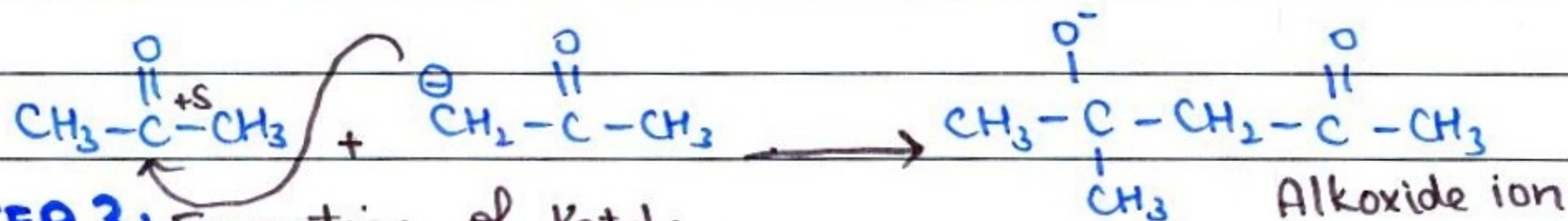
Q. No. 2 Part (xiv)

ACETONE MECHANISM.

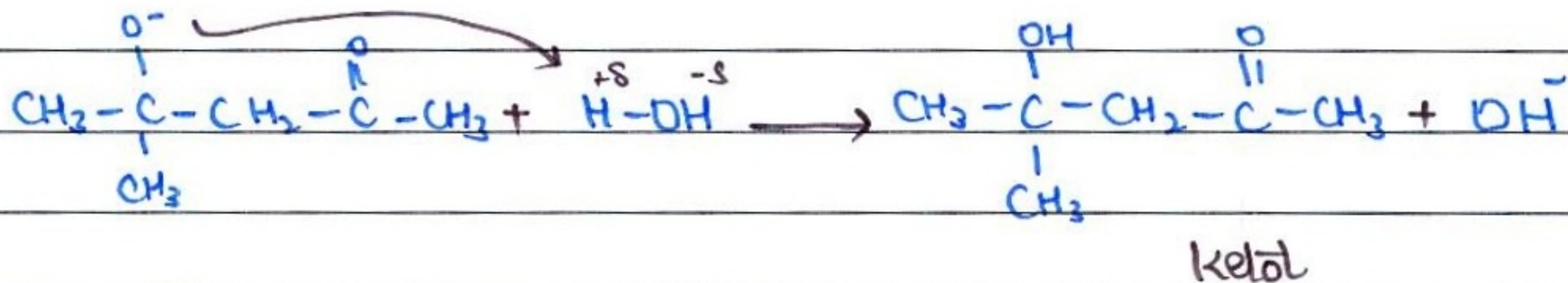
STEP 1: Formation of Nucleophile.



STEP 2: Formation of Alkoxide ion.



STEP 3: Formation of Ketol:



Refining of Crude oil

REFINING: Refining of Crude oil or Petroleum is the separation of different compounds that are present in it.

CARRIED OUT: Refining of Crude oil is carried out on the basis of fractional distillation.

Fractional distillation:

Fractional distillation is the separation of compounds on the basis of their boiling points.

PRINCIPLE OF FRACTIONAL DISTILLATION.

Different molecules are present in the crude oil. They have different boiling points. Refining is carried out on the basis of boiling points.

Low B.P:

Liquids having low Boiling points and highly volatile boil out first and are collected from the top of the chamber.

High B.P:

Liquids having high boiling points and low volatility boil out later and are collected from the bottom of the chamber.

In this way, different liquids are collected which are used for different purposes.

INDUSTRIAL PROCESS.

In industry, the fractional distillation occurs in large chambers called distillation chamber.

• Addition of Crude oil:

Crude oil or petroleum is added in the chamber from the bottom.

• Heat:

The chamber is heated upto 350°C - 400°C .

• Evaporation:

High boiling points i.e. residue that boil at 400°C are collected from the bottom of chamber.

• Low B.P:

Liquids having low boiling points start evaporating and go to top of chamber due to their high volatile nature.

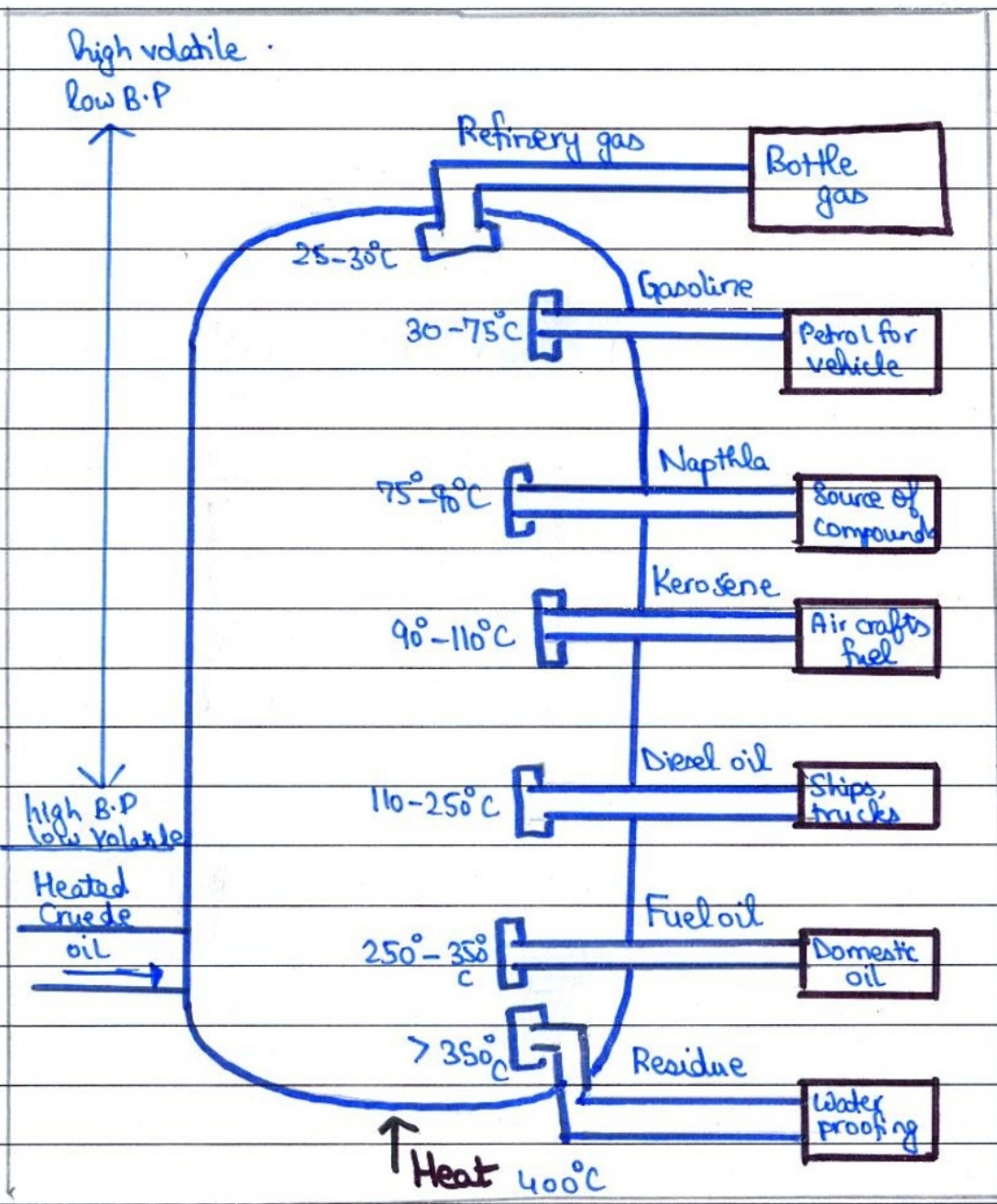
• Condensation and Collection:

High boiling points liquids condense out first and are collected from bottom of chamber. Similarly, liquids having different boiling points condense at different areas in the chamber and are collected accordingly.

	Carbon	B.P	Uses.
Refinery gas	$\text{C}_1 - \text{C}_4$	$25^{\circ} - 30^{\circ}\text{C}$	domestic fuel
Gasoline	$\text{C}_4 - \text{C}_7$	$30^{\circ} - 75^{\circ}\text{C}$	petrol in vehicles
Naphthla	$\text{C}_6 - \text{C}_{10}$	$75^{\circ} - 90^{\circ}$	source of organic comp.
Kerosene	$\text{C}_{10} - \text{C}_{16}$	$90^{\circ} - 110^{\circ}$	air craft fuel
Diesel oil	$\text{C}_{14} - \text{C}_{20}$	$110^{\circ} - 250^{\circ}$	higher vehicles

Q. No. 3 (Page 3)

First oil	$> C_{20} \approx C_{30}$	$250^{\circ} - 350^{\circ}$	domestic oil
Residue	$> C_{30}$	$> 350^{\circ}$	bituminous, water proofing.



Molecular Orbital Concept

OLD CONCEPT:

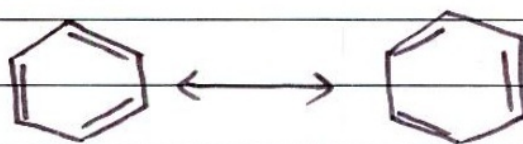
According to the old concept, benzene has 12 C-C bonds and it is a planar, regular structure.

Kekule's structures:

Kekule proposed that benzene has alternative double and single bonds of equal length.

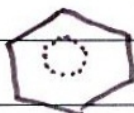
But, he was unable to explain:

- Same C-C bond length.
- Low heat of formation
- Dual nature of benzene.
- Stability.



Robinson's Structure:

Instead of alternative double and single bonds, pi-electrons of benzene can be shown.



X-Ray Analysis:

X-Ray Analysis of benzene shows that it has C-C bond length of 1.39 \AA and C-H bond length of 1.09 \AA . It has C-C-C bond angle of 120° and C-H-C bond angle of 120° .

MODERN THEORY:

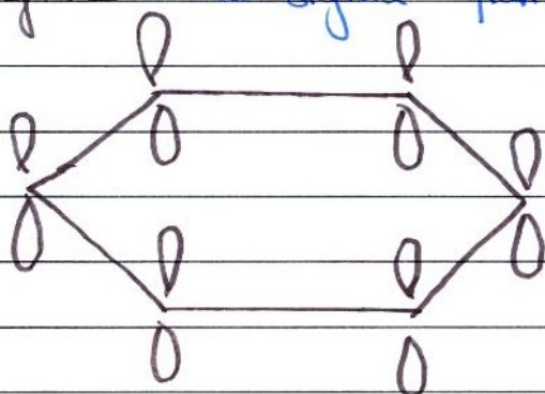
The molecular orbital theory proposes that each C of benzene is sp^2 hybridized as it forms three sp^2 hybrid orbitals and one π -bond.

σ -bonds:

- sp^2-sp^2 : Each carbon forms two sp^2-sp^2 σ bonds with two of its neighbouring carbons.
- sp^2-s : Each carbon atom forms one sp^2-s σ bond with s orbital of hydrogen.

Geometry:

In this way, each carbon has tetrahedral geometry and the overall structure of benzene is hexagonal. This sigma framework is:



STABILITY OF BENZENE

The pi-electrons of each atom are present perpendicular to sigma framework. These orbitals overlap in parallel manner.

Delocalisation: The delocalised pi-electrons form a sheath of negative charges over the layer of benzene nuclei. In such a way that the electrons are sandwiched between them. Due to this benzene becomes highly stability.

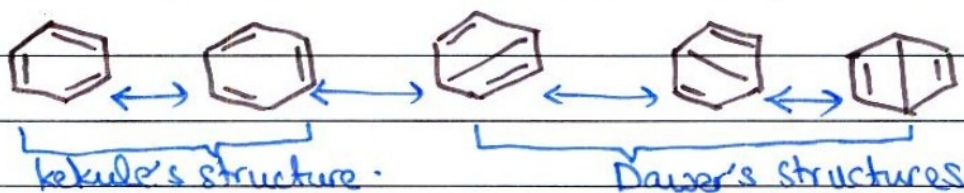
RESONANCE

The formation of different structures of a compound due to stabilization is called resonance.

Benzene has 5 resonance structures i.e. 2 Kekule.

Q. No. 4 (Page 3)

(contributing 80%) and 3 Dower's (contributing 20%).

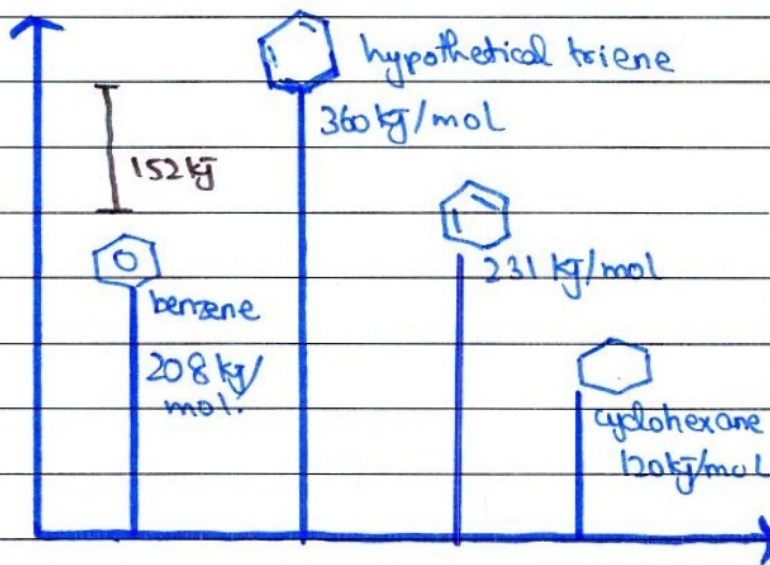


Resonance Energy:

The difference in actual heat of hydrogenation and hypothetical heat of hydrogenation is called resonance energy.

Benzene has resonance energy of 152 kJ/mol or 36 kcal/mol .

Benzene has heat of hydrogenation of 208 kJ/mol which is very small than hypothetical triene, showing its stability.

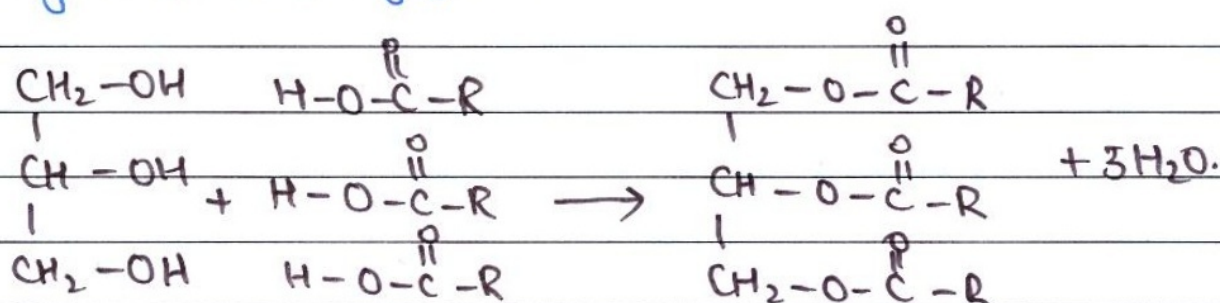


Electrophillic Substitution Reactions

The π -electrons of benzene are extensively delocalised making benzene highly stable. Due to its high stability, benzene prefers substitution over addition which requires a lot of energy to break the ring.

Lipids

Lipids belong to a large class of organic compounds in which the molecules are described on basis of their solubility. The lipids are generally insoluble in H_2O and formed by reaction of fatty acids and glycerol.



Triglycerides.

Essential Lipids

Polyunsaturated fatty acids are called essential lipids.

They are not produced by the body and are necessary for proper functioning of different body metabolism.

Omega-3 and Omega-6 are essential lipids.

Omega-3 is obtained from fish liver oil.

Non-essential lipids.

Monosaturated fatty acids are non-essential lipids.

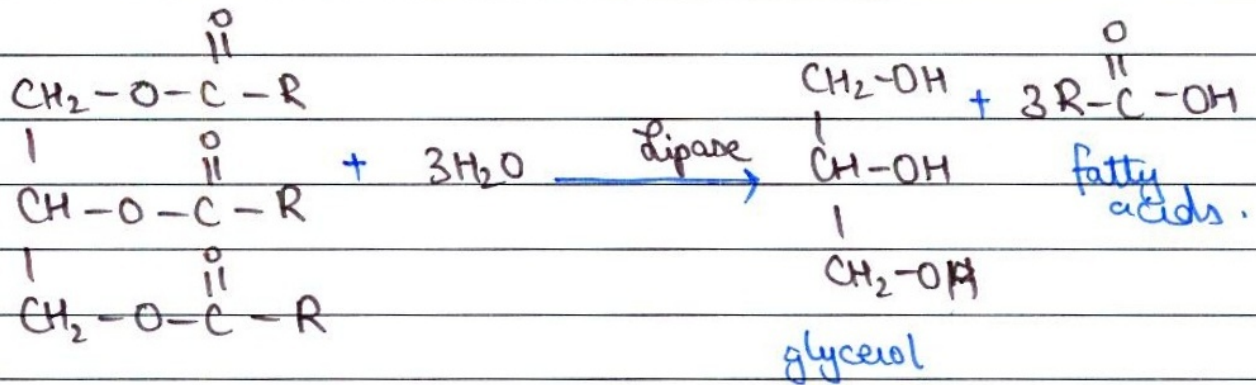
They are produced by the body and are toxic at high level.

They include saturated lipids from plants, animals fat, trans lipids and cholesterol.

Hydrolysis

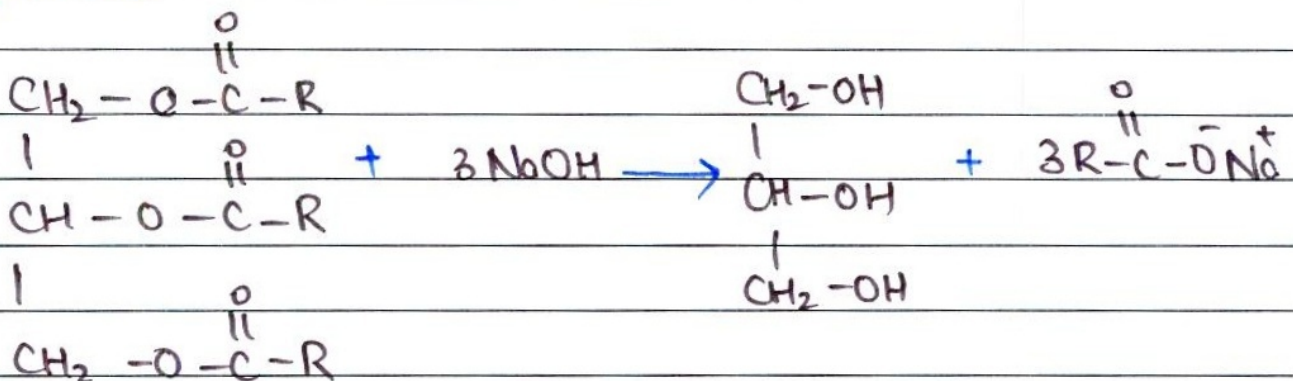
Hydrolysis is the addition of water.

Hydrolysis of a triglyceride produces a glycerol molecule and fatty acid. It occurs in presence of enzymes. These enzymes are called lipases.



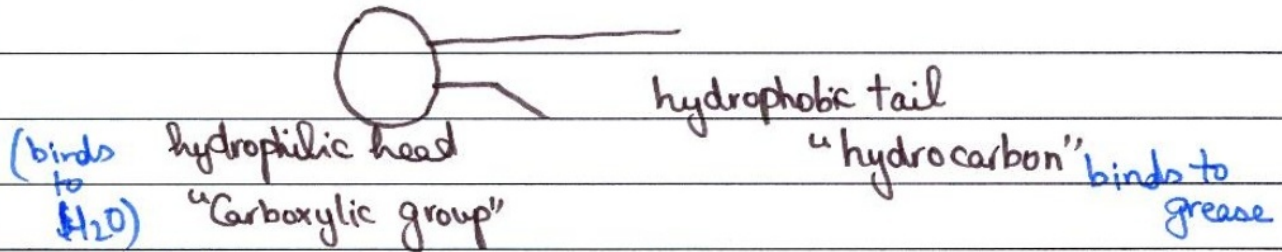
Saponification

Saponification is the reaction of triglycerides with NaOH to produce glycerol and sodium salts of fatty acids. These salts are used in soap formation.



SOLUBILITY OF LIPIDS.

Lipids are described in terms of their solubility.



This helps them in stain removing. Used in soaps

FUNCTION:

- Regulate metabolism.
- Immune function
- Maintain cell membrane
- Hormonal role.
- Proper function of skin.
- Nervous coordination.

PHYSICAL PROPERTIES.

- They are liquids (oils) or waxy solids (fats).
- Generally colourless and odourless.
- Colour is due to other compounds
Yellow colour of butter is due to keratin.
- Lighter than H_2O .
- Insoluble in H_2O .

Mass Spectrometry

Mass Spectrometry is a technique that is used to identify number of isotopes, structure of organic compound and abundance of isotopes.

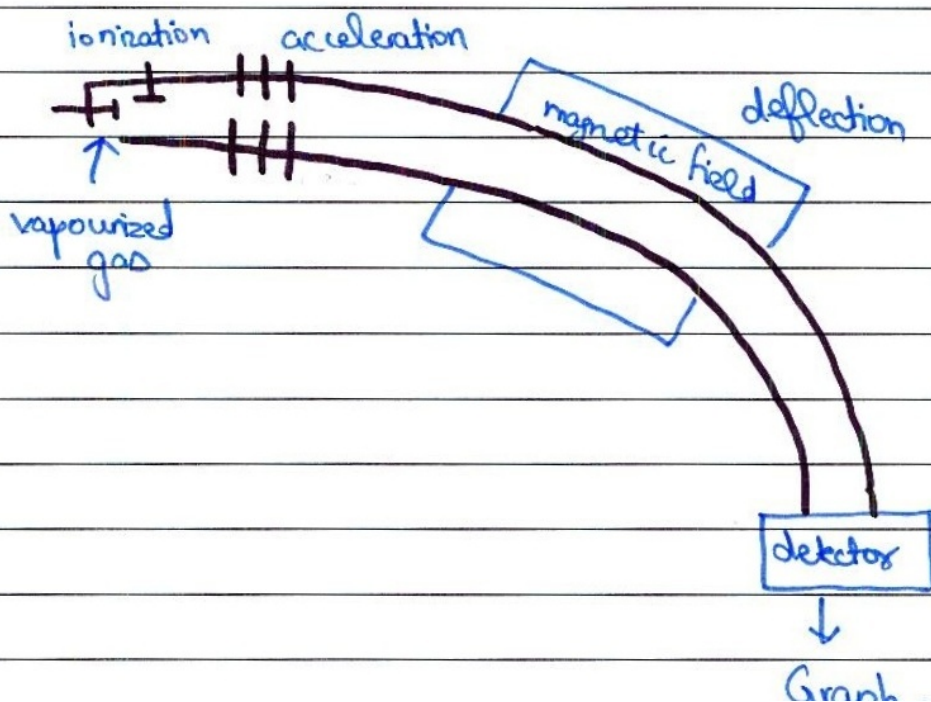
PRINCIPLE:

Mass Spectrometry consists the production of isotopes, their separation according to their mass over charge ratio and their detection. The positive ions m/e ratio is inversely proportional to their deflection angle

CONSTRUCTION.

It consists of a structure that has a

- Electron source: To ionize electrons
- Accelerator: To accelerate electrons
- Magnetic field: For deflection
- Detector: For detection.



Working

• VAPOURIZATION:

Any sample of gas can be used in mass spectrometry. For solids and liquids, they are first vapourized.

• IONIZATION:

The vapourized gaseous molecules are ionized by bombarding electron (70keV). These gas molecules change into ions (positive ions).

• ACCELERATION:

The ions are accelerated by providing electric field to 500 to 2000 V.

• DEFLECTION:

A magnetic field is given to deflect the ~~electrons~~ positive ions. The deflection of positive ions depends on their m/e ratio. The angle of deflection is inversely proportional to mass over charge ratio.

• DETECTION:

A detector is present to detect the positive ions. The detector does not move from its position. Rather the magnetic field deflects ions towards detector which are collected as current and

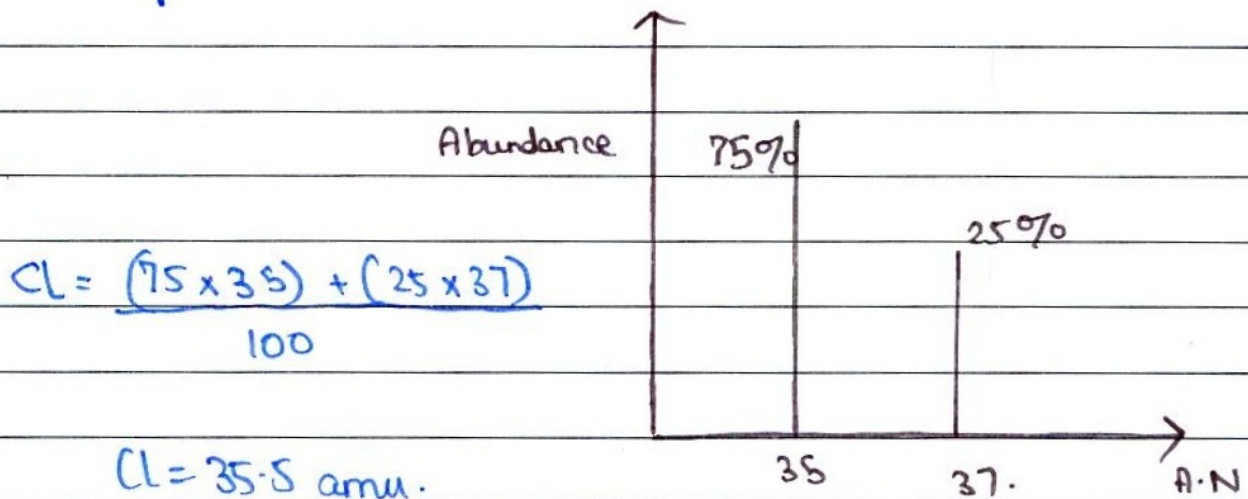
Q. No. 6 (Page 3)

shown by graph.

GRAPH

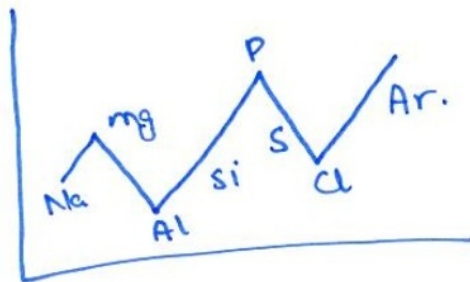
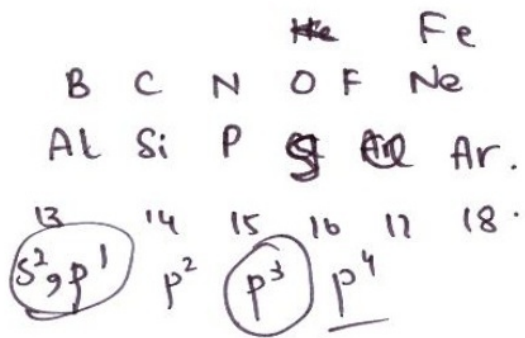
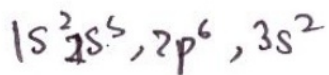
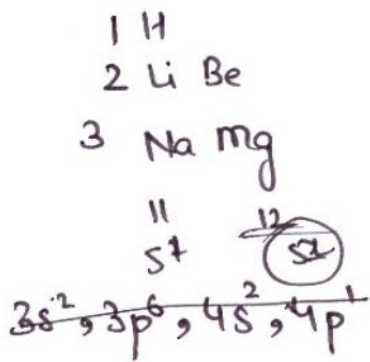
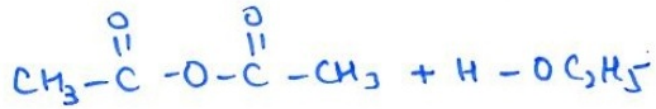
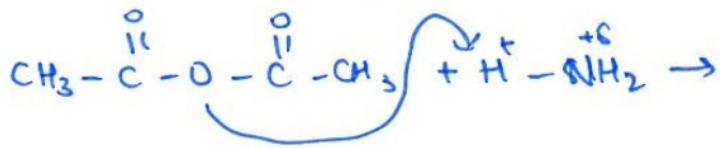
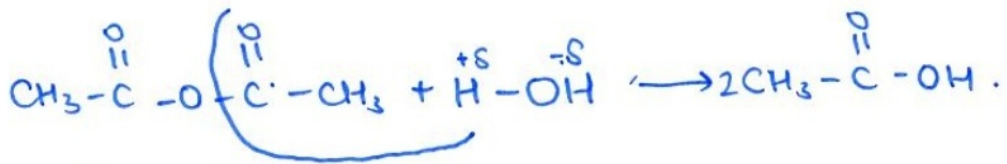
The graph of mass spectrometry shows isotopes. The number of lines of graph shows number of isotopes and the peaks show relative abundance. Relative atomic mass can be calculated.

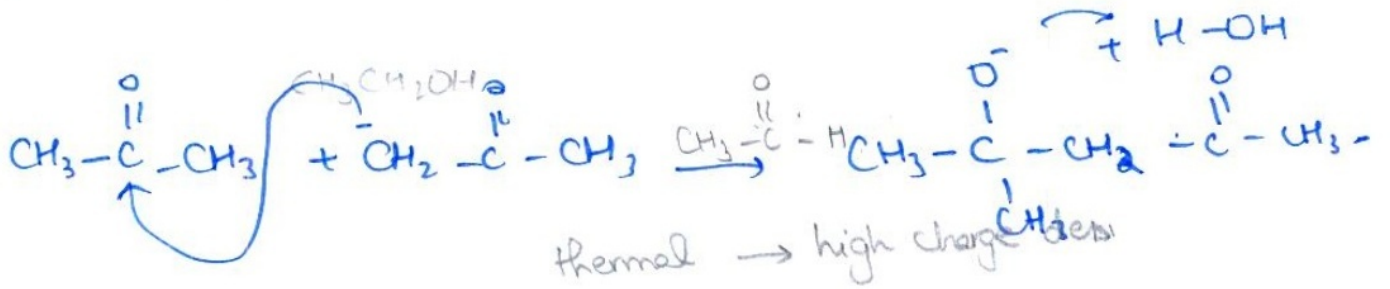
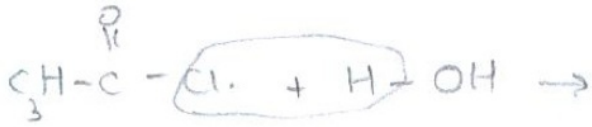
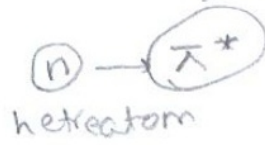
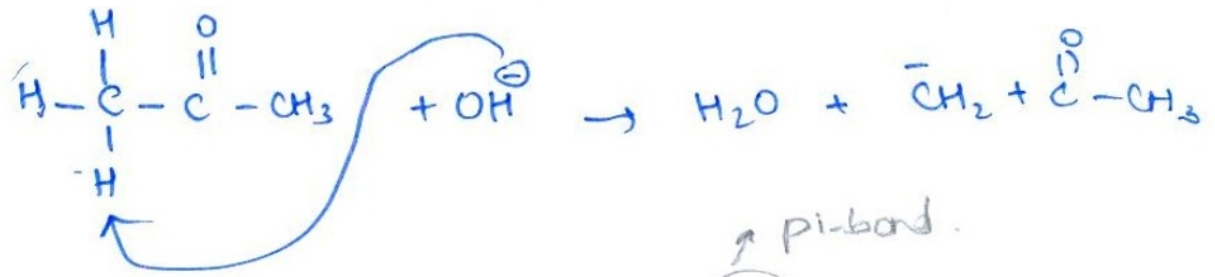
RAM of Chlorine.



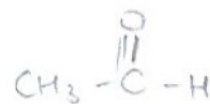
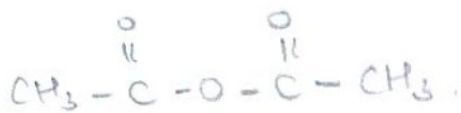
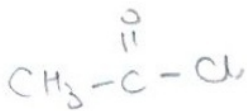
$$CL = \frac{(75 \times 35) + (25 \times 37)}{100}$$

$$CL = 35.5 \text{ amu.}$$

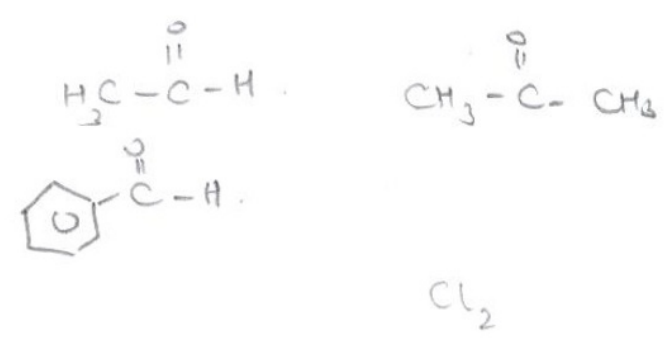




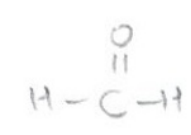
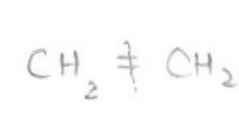
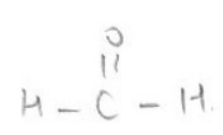
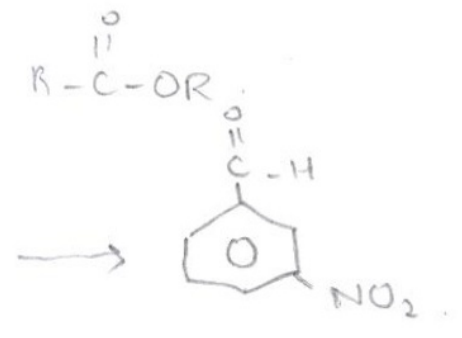
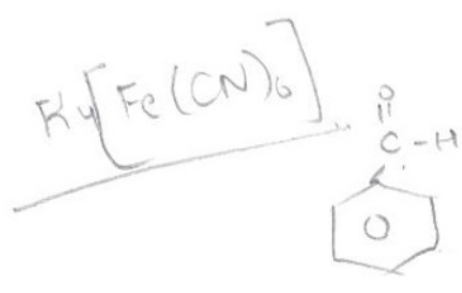
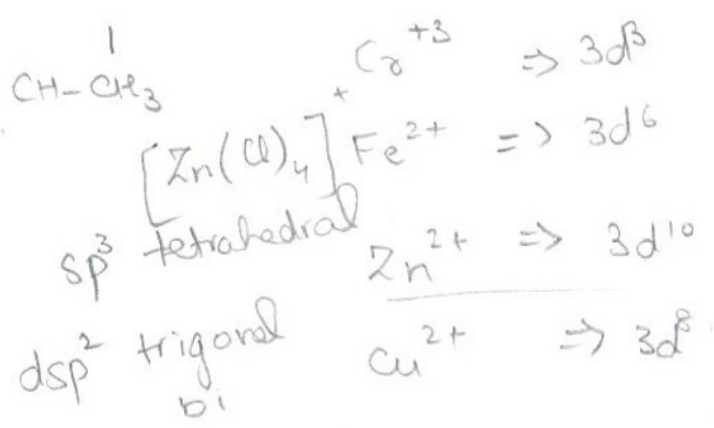
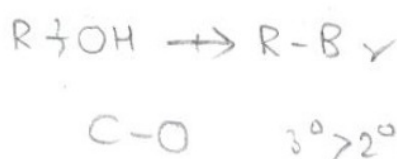
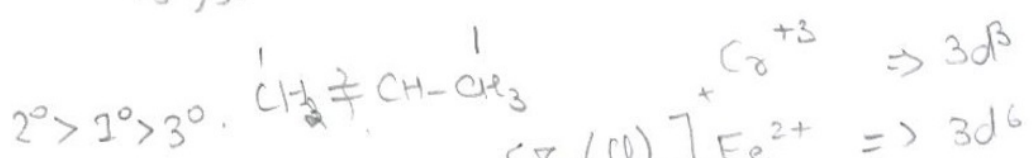
\uparrow charge ↑ size.
 \uparrow size.
 Mg^{+2}



21 Sc	4s ² , 3d ¹
22 Ti	3d ²
23 V	3d ³
24 Cr	4s ¹ , 3d ⁵
25 Mn	4s ² , 3d ⁵
26 Fe	3d ⁶
27 Co	3d ⁷
28 Ni	3d ⁸
29 Cu	4s ¹ , 3d ⁹
30 Zn	4s ² , 3d ¹⁰



$\lambda \propto \text{T.P.P} \propto \frac{\text{charge}}{\text{Size}}$



$\propto \uparrow \text{polarising power} = \frac{\text{charge}}{\text{size}}$

$+2 - 6 = -4$