

Hydrocarbon

Q# WHAT ARE HYDROCARBON & HOW THEY ARE CLASSIFIED?

Hydrocarbon: Compounds containing carbon and hydrogen only are called Hydrocarbon.

Catenation:-

"The self-linking ability of element to form long chains is catenation".

Carbon has more catenation property than silicon?

- Carbon exhibits smaller size than silicon which makes more strong bond.
- Carbon-carbon bond strength is greater.
- Carbon is more electronegative than H making more protic H while silicon has lower electronegativity resulting more hydridic H.

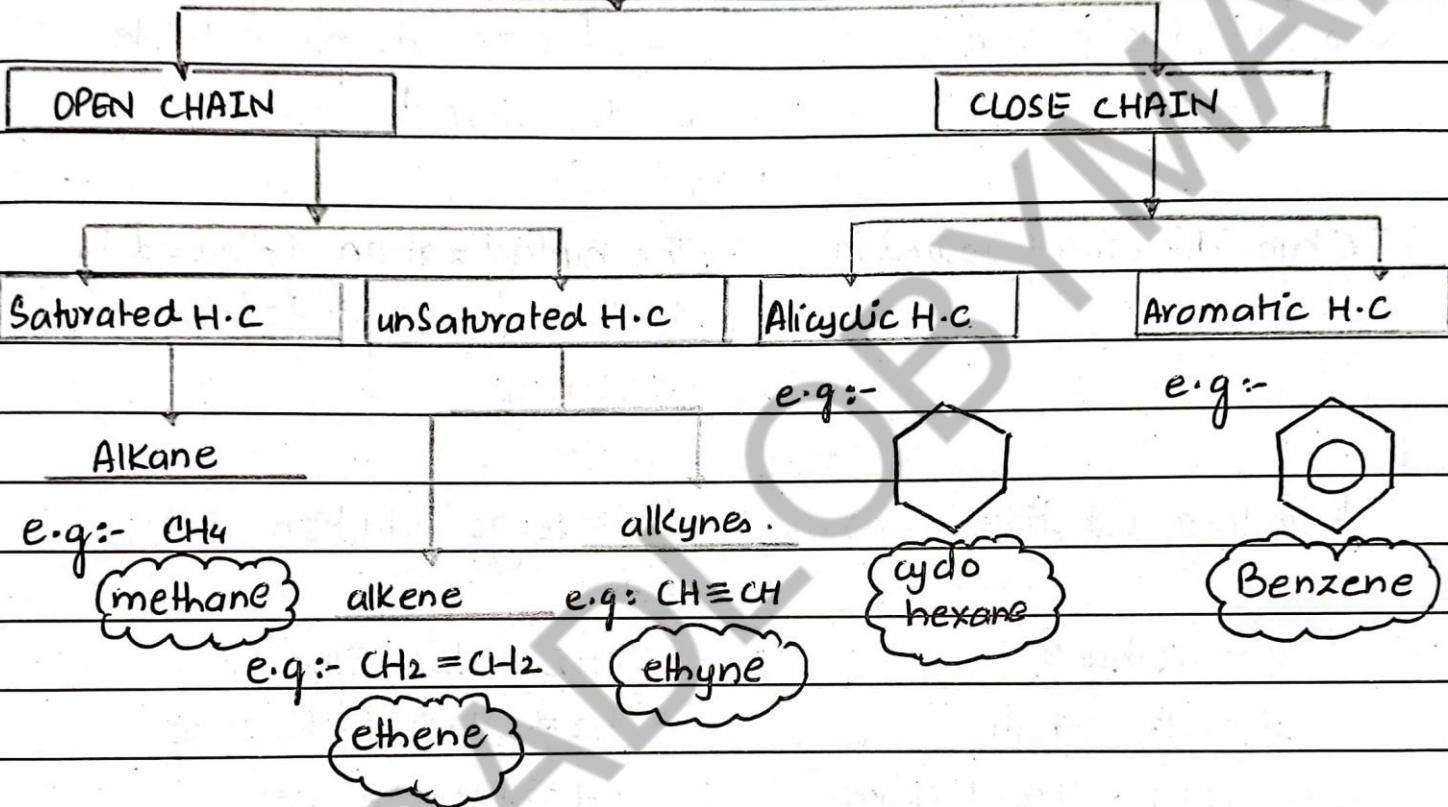
GET **ADMISSION** IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Flow Chart :-

∴ Hydrocarbons :-



OPEN CHAIN H.C :-

- ∴ Also known as Aliphatic and Acyclic hydrocarbon.
- ∴ Hydrocarbon in which carbon are attached to get-to form open chains are called open chain.

Types :-

1. Saturated
2. Unsaturated

GET ADMISSION IN OUR ONLINE INSTITUTE
SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353



Saturated Hydrocarb Unsaturated Hydrocarb

Definition

The hydrocarbon in which C-C single bond is present.

The hydrocarbon in which C=C & C≡C double & triple bond is present.

Hybridization

The hybridization followed in sp^3 .

The hybridization followed in double bond is sp^2 & in triple is sp .

type of reaction

It undergo substitution rxn.

It undergo addition rxn.

examples:

CH₄ - Methane

CH₂=CH₂ - Ethene.

CH₃-CH₃ - Ethane

CH₂=CH-CH₃ - Propene

CH₃-CH₂-CH₃ - Propane.

CH≡CH - Ethyne.

CLOSED CHAIN H.C:-

- Also known as cyclic and ring H.C.
- H.C in which C-atom are attached with each other to form ring.

Types:

- Alicyclic
- Aromatic

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Alicyclic H.C (non-aromatic) Aromatic H.C

Definition	
A close chain H.C without benzene ring.	A close chain H.C containing atleast one benzene ring.

Alternative name

Non-benzoid

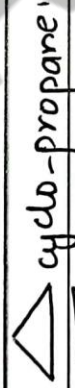
Benzoid

Huckel Rule

Do not obey.

Obey.

example



cyclo-propane



cyclobutane



cyclopentane



cyclohexane



benzene



toluene



naphthalene



anthracene

Trick hybridization

Group	Hybridization
-------	---------------

1 s

2 sp

3 sp²

4 sp³

CH₃ ≡ CH = sp

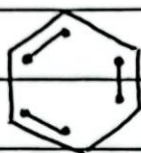
CH₄ = sp³

* = 2 are considered 1 group.

* lone pair is counted as 1 group.

Huckel rule

- If a aromatic compound follows :- $4n+2 = \pi e^-$
 $n=1, 2, 3, \dots$ whole number
- It verifies that it's a aromatic compound.



$$\rightarrow 4n+2 = 6e^-$$

$$4n = 6 - 2$$

$$4n = 4$$

$$n = 1 \text{ (Huckel rule } \checkmark)$$

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Q# Why benzene is aromatic?

Originally benzene was considered aromatic becoz of its 'aromatic' odour. But later it was verified that it follows Huckel rule.

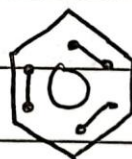
$$\rightarrow 4n+2 = \pi e^-$$

$$4n+2 = 6e^-$$

$$4n = 6 - 2$$

$$4n = 4$$

$$n = 1 \text{ (✓) (Huckel Rule proved)}$$

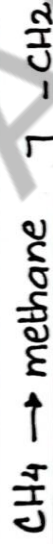


Date: 19 July 24

Homologous series

Series of organic compounds in which two adjacent member differ by $-CH_2$ group.

example



representation

Structural line representation of alkane can be done as :-

- | | | | | | | |
|-------------------|--|---------|--|---------|--|---------|
| 1. C_2H_6 | | ethane | | ethene | | ethyne |
| 2. C_3H_8 | | propane | | propene | | propyne |
| 3. C_4H_{10} | | butane | | butene | | butyne |
| 4. C_5H_{12} | | pentane | | pentene | | pentyne |
| 5. C_6H_{14} | | hexane | | hexene | | hexyne |
| 6. C_7H_{16} | | heptane | | heptene | | heptyne |
| 7. C_8H_{18} | | Octane | | Octene | | Octyne |
| 8. C_9H_{20} | | nonane | | nonene | | |
| | | nonyne | | | | |
| 9. $C_{10}H_{22}$ | | decane | | decene | | |
| | | decyne | | | | |

Page #



Teacher's Signature: _____

Date: _____

alkyl radical (-R)

When one H is removed from any alkane group form is called alkyl radical.

Donate:

-R

Name rule:

ane $\rightarrow$ yl (methane $\rightarrow$ methyl)

formula:



GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

homologue series of -R

NAME	M.F	Abbreviation	$\rightarrow$ used instead of drawing structure
Methyl	-CH ₃	Me	
Ethyl	-C ₂ H ₅	Et	
butyl	-C ₄ H ₉	Bu	
Propyl	-C ₃ H ₇	Pr	
Pentyl	-C ₅ H ₁₁	Pe	
Hexyle	-C ₆ H ₁₃	Hex	
Hephyle	-C ₇ H ₁₅	Hep	
Octyle	-C ₈ H ₁₇	Oc	
Nonyle	-C ₉ H ₁₉	No	
Decyle	-C ₁₀ H ₂₁	De	

Page #



Teacher's Signature: _____

Date: _____

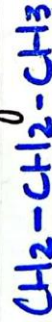
difference

Alkane	Alkene	Alkyne
• Paraffins (inert)	• Olefins (oil making)	-
• C-C	• C=C	• C≡C
• Saturated	• Unsaturated	• Unsaturated
• Substitution rxn	• Addition rxn	• Addition rxn
• Hexane	• Hexene	• Hexyne
• C_nH_{2n+2}	• C_nH_{2n}	• C_nH_{2n-2}

alkyl group common name

→ n, 1°, Primary

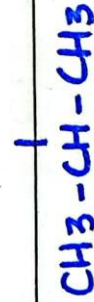
When following structure is straight only or when carbon connected to only 1 C.



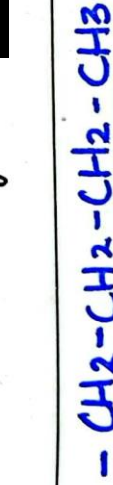
n-Propyl

→ secondary, 2°, iso

When the following carbon from which H has been removed is connected with 2 carbons, or when branch is one 2 C.

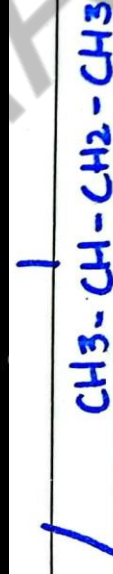


iso-Propyl



n-butyl

1° butyl



iso-butyl

2° butyl

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Page #

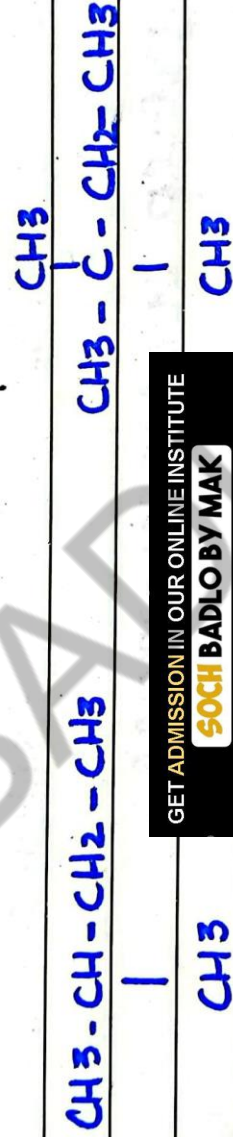
Teacher's Signature: _____

Date: _____

→ When following carbon from which H is removed is connected with 3C.

Common name of alkane

- CH_4 — marsh gas
- iso- • When branch is one 2nd carbon
- neo- • When two branches are present on 2nd carbon



iso-pentane

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

CH_3

neo-pentane

n- • When an alkane is present in the form of straight chain.



n-pentane.

WIPAC

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Rules in easy words

1. Consider a long chain taking it as straight or branch that is not substituent by counting no. of C atoms.
2. Two equal chains of same length, consider chain containing more branches.
3. ~~Name~~ Start numbering from the end closer to substituent.
4. When 2 identical substituent at equal distance is present, consider number by adding C-no at which branch is present.
5. The position of substituent indicated by considering the number of Carbon at which it's present.

number - alkyl group

6. Name of alkyl group written in alphabetical order.
7. If common alkyl group is present 2, 3 times then use :-

2(di), 3(tri), 4(tetra)

8. If two -R group present on same C-atoms name is written by adding (,).

ethyl, methyl

- - number - R group Parent chain
- - number - (di, tri, tetra) R - group Parent chain
- - number - R group
- - number, number - R group parent chain.

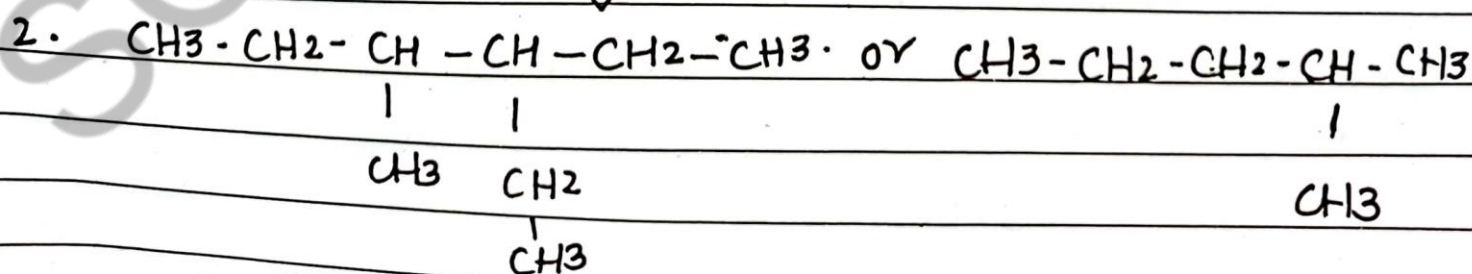
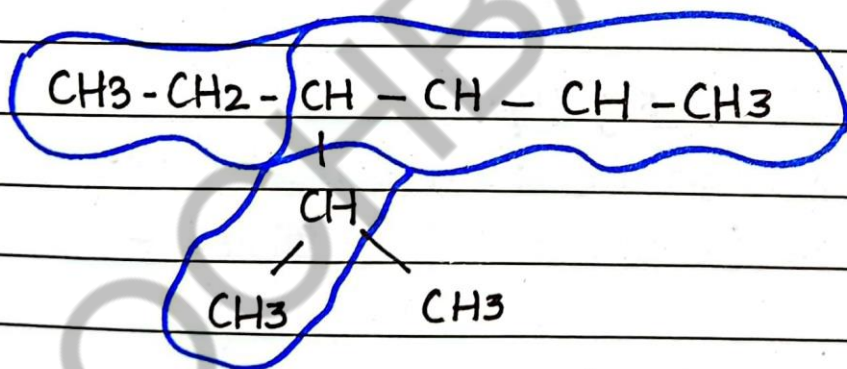
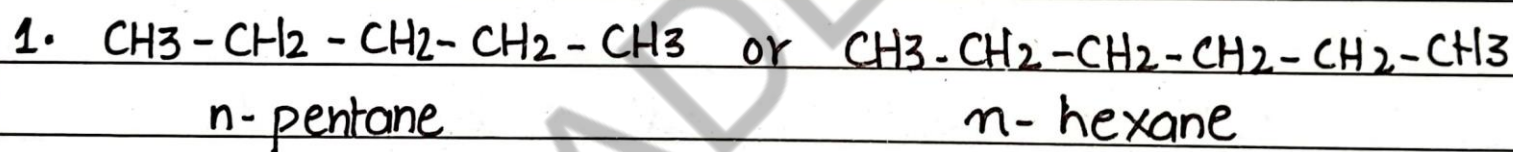
GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

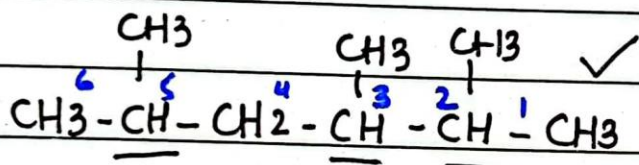
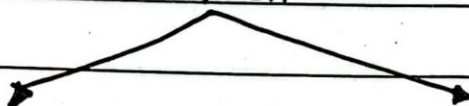
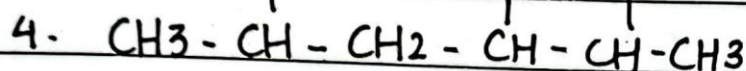
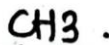
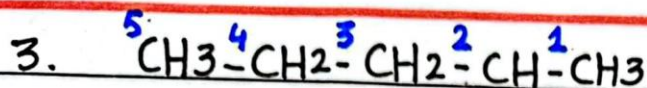
Contact WhatsApp Number: +92 331 5014353

applied form

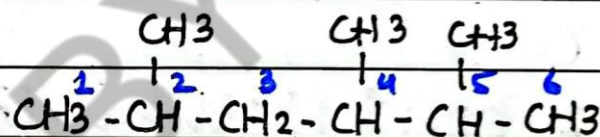
Substituent is a type of branch that can't be straightened to form the part of continuous long chain.



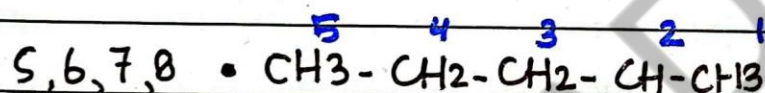
Date: _____



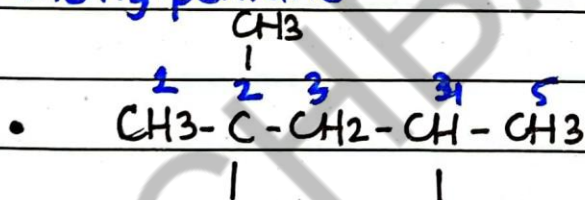
$2+3+5 = 10 \rightarrow \text{min.}$



$2+4+5 = 11 \rightarrow \text{max.}$



2-Methylpentane

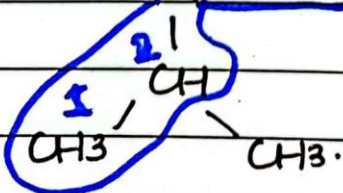
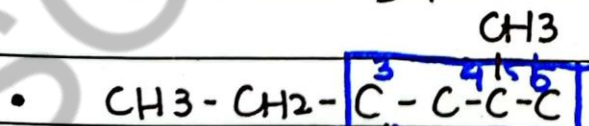


GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

2, 2, 4 - TriMethyl pentane.



3-Ethyl-2,5Methylhexane

Physical Properties

State

- 1 - C_4 = colorless, odourless gases
- 5 - C_{17} = colorless, odourless liquids
- 18 - C_n = waxy solids (colorless, odourless).

Solubility

Non-polar Linkages or weakly polar due to functional groups are soluble in polar solvents (water) and soluble in non-polar solvents (benzene, ether, CCl_4 etc).

M.P and B.P

The M.P, B.P and density etc increases with increase in C-atom.

Solubility decreases with increase in mass. ($\uparrow$ non-polar content)

The boiling point of branch chain is lower because: $\downarrow$ Van's waal forces & reduce in point of contact).

isomerism

"The compounds having molecular formula but different structural formula."

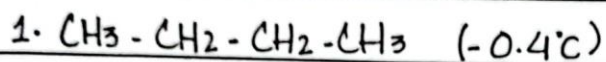
IMP:-

methane, ethane, propane has no isomers because they have only 1 possible structure.

Date: _____

Butane

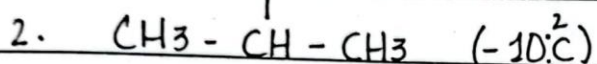
B.P:-



n-butane

CH_3

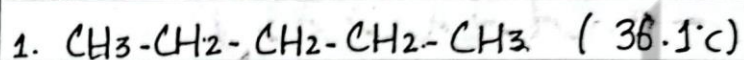
B.P:



(C.N: iso-butane)

(IUPAC: 2-Methyl propane).

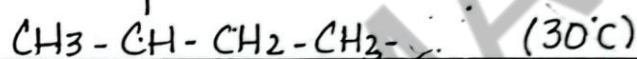
Pentane



n-Pentane

2.

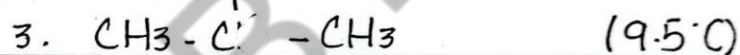
CH_3



(C.N: iso-Pentane)

(IUPAC:- 2-Methyl Butane)

CH_3



(C.N: neo-Pentane)

(IUPAC: 2,2-Dimethyl propane)

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Activity

Question 1

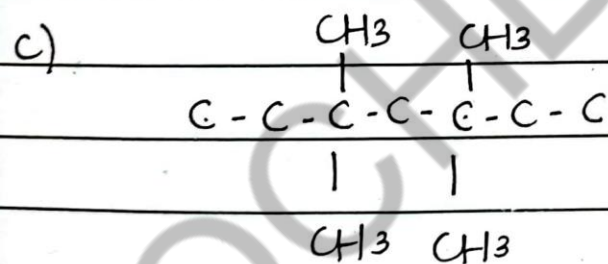
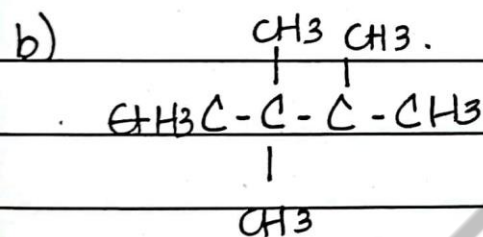
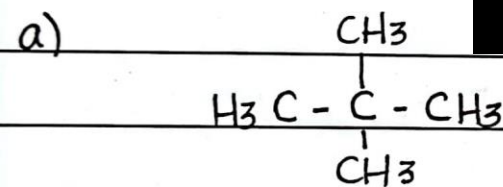
- 2,5-Dimethylhexane
- 2,2,4-Trimethylpentane
- 2,4-Dimethylhexane
- 3-Methylpentane

GET ADMISSION IN OUR ONLINE INSTITUTE

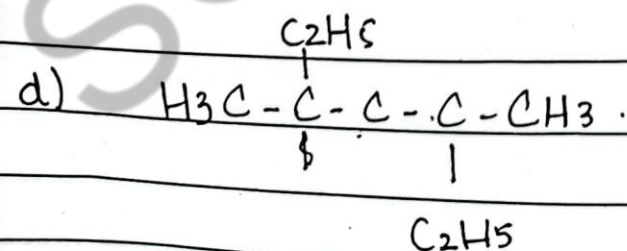
SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

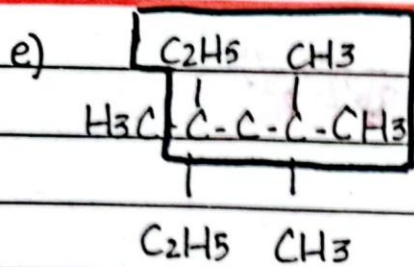
Question 2



3,3,5,5-tetramethylheptane



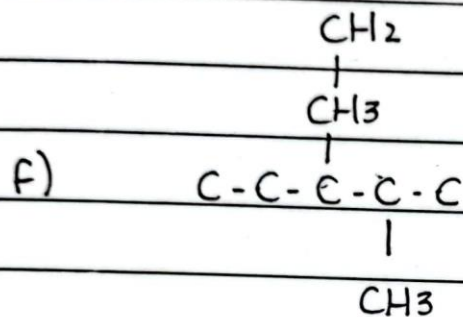
Date: _____



GET ADMISSION IN OUR ONLINE INSTITUTE

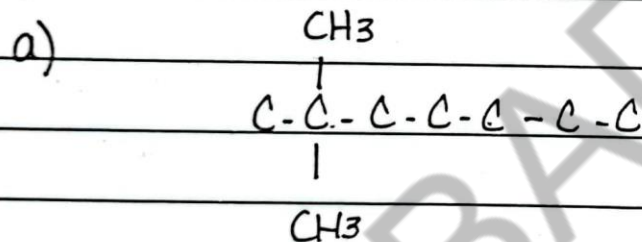
SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

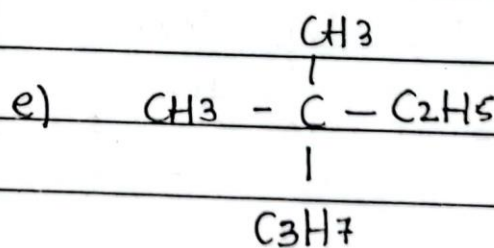
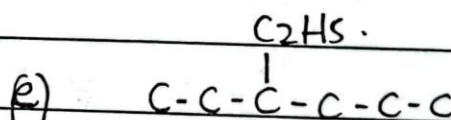
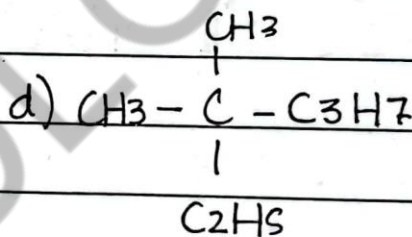
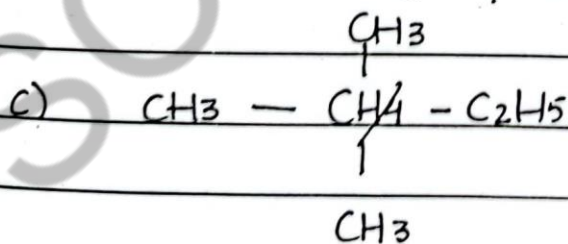
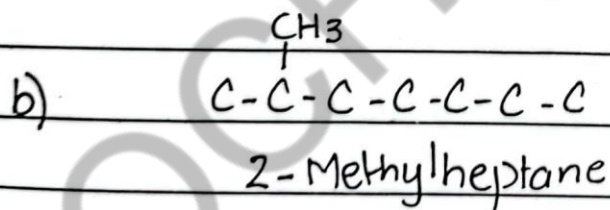


3-Ethyl-4-Methylpentane

Question 3

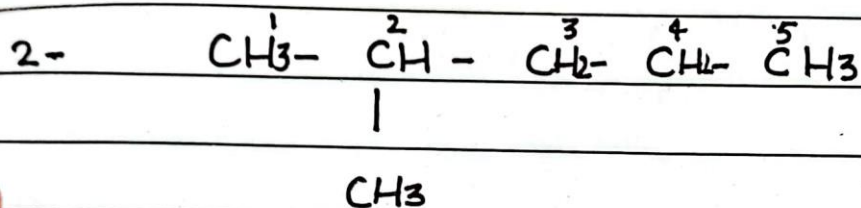
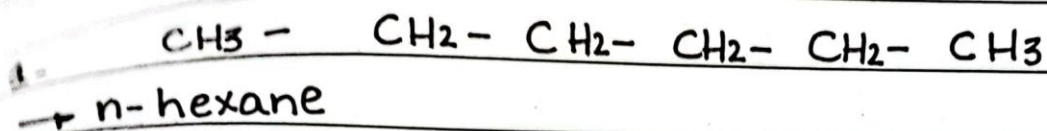


2,2-Dimethylheptane.

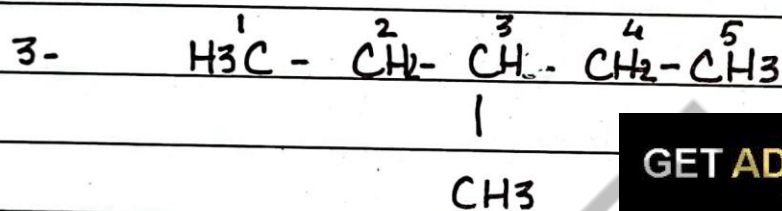


Date: _____

Isomers of hexane (5)



→ 2-Methylpentane.

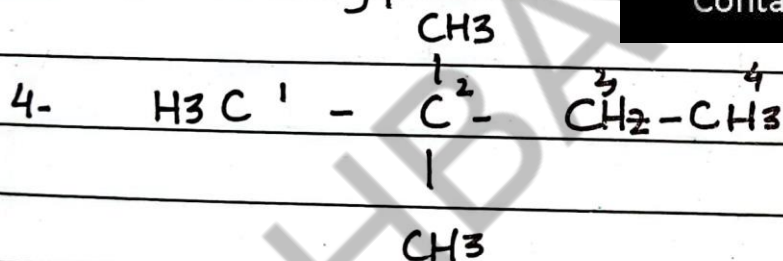


→ 3-Methylpentane.

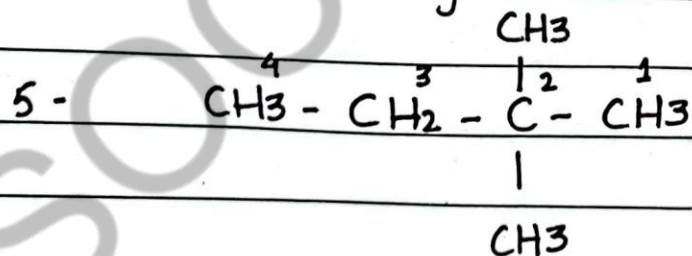
GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353



→ 2,2-Dimethylbutane.



3,3-Dimethylbutane.

Page #



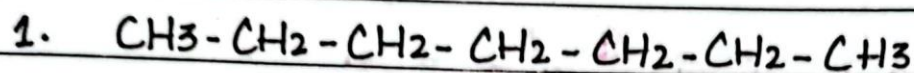
Teacher's Signature: _____

heptane

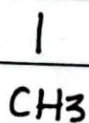
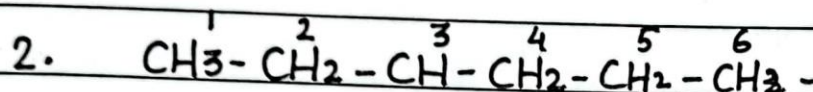
GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

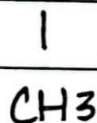
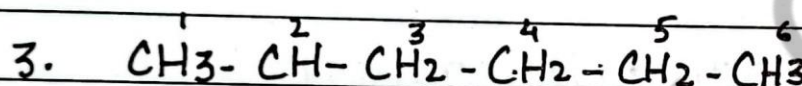
Contact WhatsApp Number: +92 331 5014353



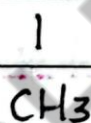
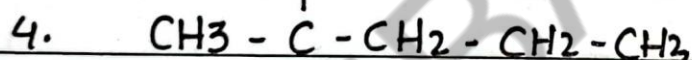
• n-heptane



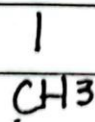
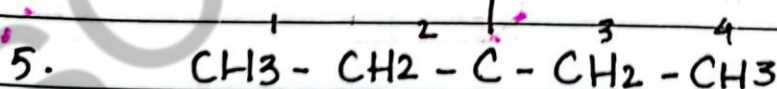
• 3-Methylhexane.



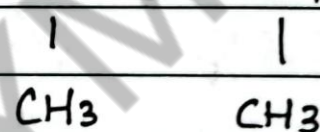
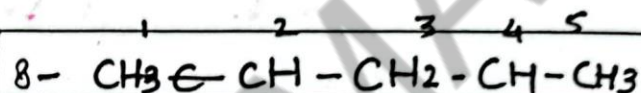
• 2-Methylhexane.



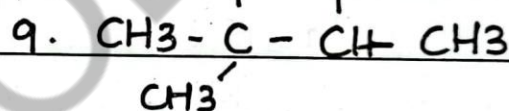
• 2,2-Dimethylpentane.



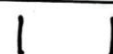
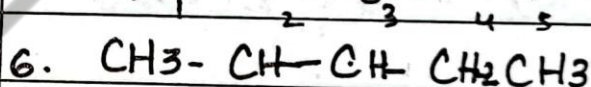
• 3,3-Dimethylpentane.



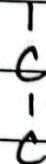
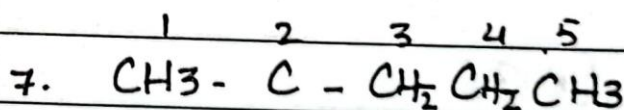
2,4-Dimethylpentane.



2,3-Trimethylbutane.



• 2,3-Dimethylpentane.



• 2-Ethylpentane.

Radical Substitution

Halogenation

Replacement of H-atom by a halogen is called halogenation.
(X, Cl, Br, F, I)

Conditions

- Halogenation take place :
- presence of Sunlight
- UV radiation
- high temperature

Reactivity order



Chlorine $\rightarrow$ Chlorination

Bromine $\rightarrow$ Bromination

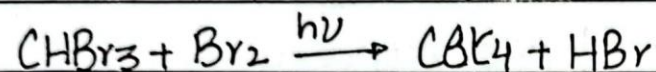
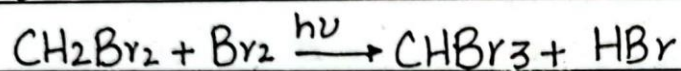
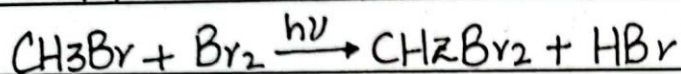
Steps

- Initiation $\rightarrow$ formation of radical
- Propagation $\rightarrow$ both side radical (R.P)
- termination $\rightarrow$ reactant radical

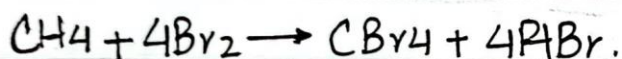
for halogenation, F_2 is not suitable bec it's very violent causing blast & produce large heat.

for halogenation, I_2 is not suitable bec it's very slow & reversible.

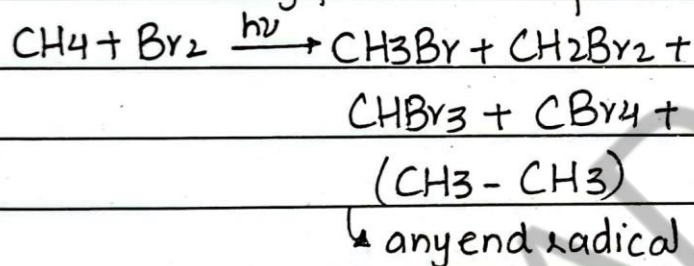


normal rxn

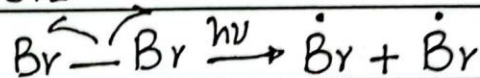
↓
carbon tetra bromide

overall rxn**Sol**

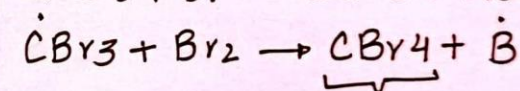
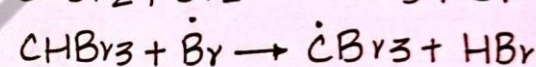
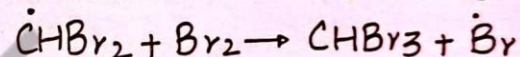
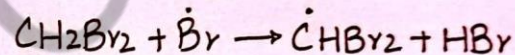
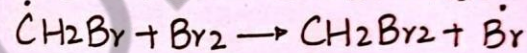
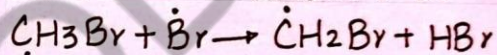
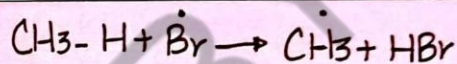
Q# how many products are possible?

initiation - 1

• $h\nu$ causes homolytic catalses of Br_2 .

Propogation - 2

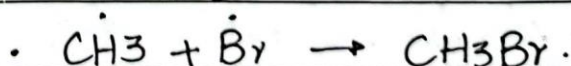
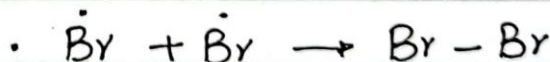
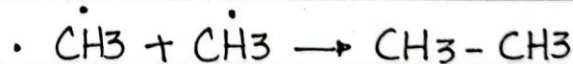
• $\dot{\text{Br}}$ attacks of H of CH_4 producing $\text{HBr} + \dot{\text{CH}}_3\text{Br}$ radical and a chain rxn starts.



Carbon
tetra
Bromide.

termination - 3

At end, free radical are terminated



GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Structural isomerism

Date: 25-7-24

Different compounds having same molecular formula but different structures are called Structural Isomers and phenomena is called structural isomers.

Types

- Chain isomerism
 - Position isomerism
 - Functional group isomerism
 - Metamerism
 - tautomerism
- } Short Q/s

GET ADMISSION IN OUR ONLINE INSTITUTE

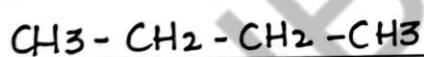
SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

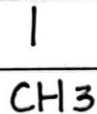
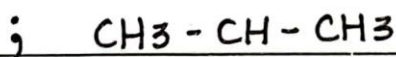
1- Chain isomerism

Different compounds having same molecular formula but different Carbon chains.

examples:



n-butane.



iso-butane / 2-Methylpropane

2- Position isomerism

Different compounds having same molecular formula but different arrangement of functional groups.

Page #



Teacher's Signature: _____

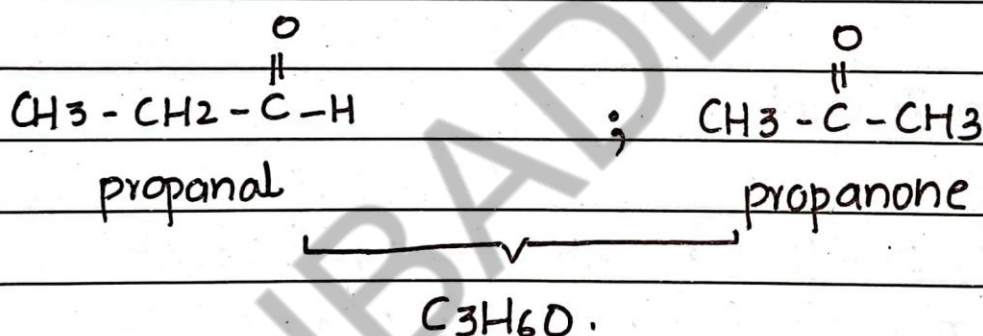
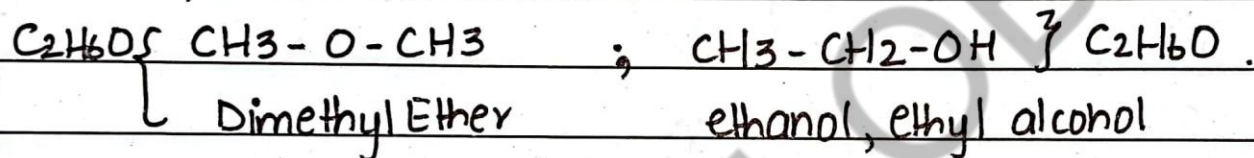
example:

- $\text{CH}_3 - \text{CH}_2 - \text{CH} = \text{CH}_2$; $\text{CH}_2\text{Cl} - \text{CH}_2 - \text{CH}_3$
 1-butene . 1-chloropropane
- $\text{CH}_3 - \text{CH} = \text{CH} - \text{CH}_3$; $\text{CH}_3 - \text{CHCl} - \text{CH}_3$
 2-butene 2-chloropropane.

3. Functional group

Different compounds having same molecular formula but different functional groups.

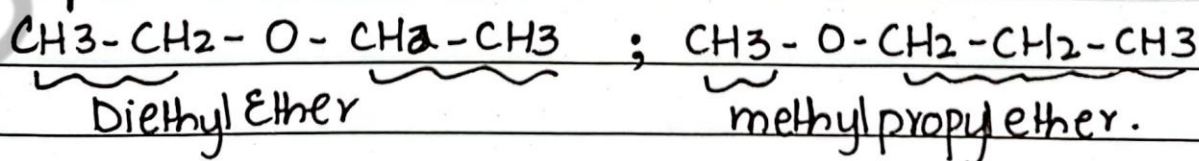
example:



4 Metamerism

Different compounds having same Molecular formula but unequal distribution of carbon atom on either side of functional group.

example:



Date: 26-07-24

Stereoisomerism

Different compounds having same Molecular formula but different arrangement or orientation of atoms or groups in the 3D space are called stereoisomerism.

Types

- 1- Geometrical Stereoisomerisms (cis-trans)
- 2- Optical stereoisomerism.

Geometrical isomers

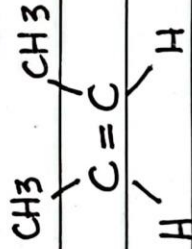
Diff- compounds having same Molecular formula. but different position of identical groups in space.

- restricts rotation about double or single in cyclic comps.
- cis & trans form.

Cis-form: when 2 identical groups lie on same side of = bond.

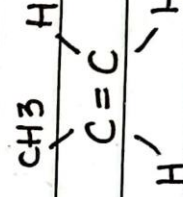
trans-form: When 2 identical groups lie on opp side of = bond.

example: 2-butene



cis-2-butene

$$\mu \neq 0$$



trans-2-butene

$$\mu = 0$$

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Page #

Tanaka, G.

Date: _____

Stability

The trans isomers are more stable than cis-isomers.

Because:-

Two bulky groups lie on opp side of = bond.

Causing a decrease in steric repulsion.

Hence less energy, more stability. (dipole moment $\mu=0$)

But in cis:-

Two bulky groups lie on same side of = bond.

• Increase in steric repulsion.

• More energy, less stability. ($\mu \neq 0$).

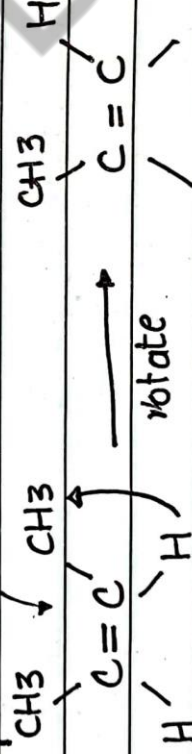
Inter-conversion

• The cis is inter-convertible to trans or vice versa.

→ Heating bond or giving sunlight, breaks π bond.

→ This causes rotation about sigma bond.

example: $h\nu$



cis trans

Conditions

• Two groups attached with C-atom must be diff.

• Carbon-carbon bond should not rotate around its axis.

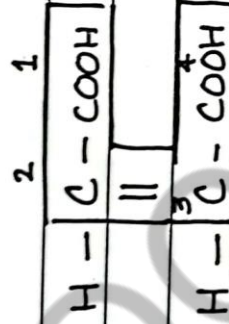
GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

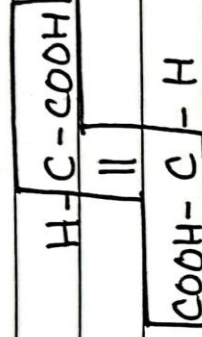
Date: _____

example:



Cis - 2-butene - 1,4-dioic acid

Maleic acid.



trans - 2-butene - 1,4-dioic acid

Fumaric acid.

Optical Isomerism

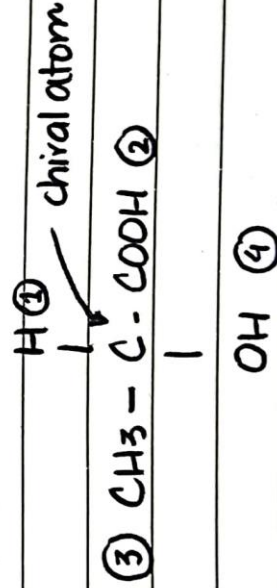
Those compounds which are optically active and exist in 2 isomeric forms possess the optical isomerism.

Conditions

- Atom should have chiral carbon.
- Atom or Compound should not have plane of symmetry.

1- Chiral centre or chiral carbon asymmetric carbon

Carbon atom which is bonded with 4 different groups or atom is called chiral carbon.



GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Page #

Teacher's Signature: _____

Date: _____

2- Plane of Symmetry

- Plane which divides an obj into symmetric halves is called plane of symmetry.

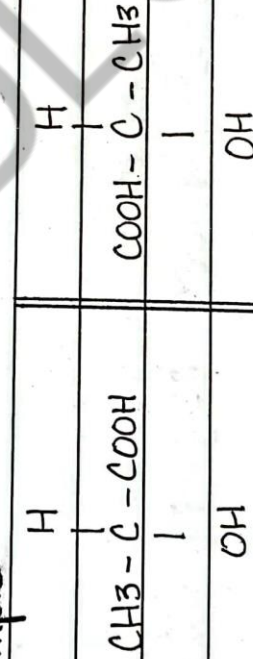
example:

- A person has plane of symmetry
- A glove lacks symmetry.

Conditions for Chiral molecule

- has atleast an asymmetric Carbon
- does not have plane of symmetry
- are not superimposable on their mirror images

example:



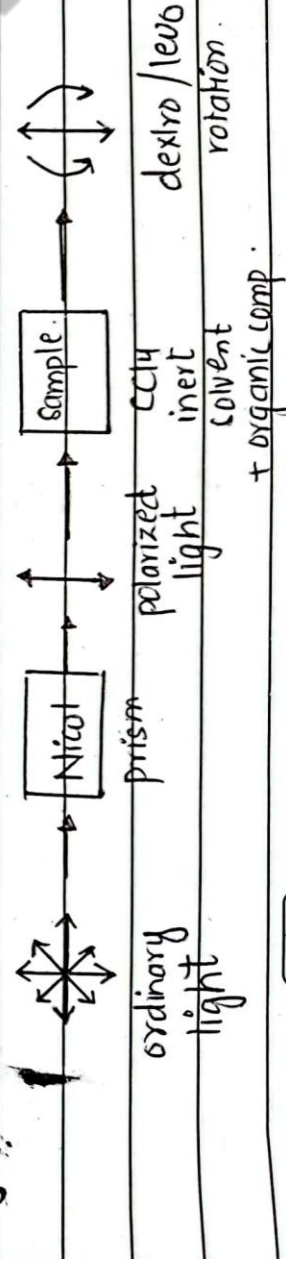
• original object

• Mirror image.

Optical Activity

Some of organic compounds dissolved in an inert sol can rotate plane polarized light to left or right.

diagram:



Date: _____

- Solution of some organic compound have ability to rotate plane of polarized light in opposite direction, this property is called optical activity.

dextrorotatory

- Rotate the plane polarized light in clockwise direction.
- +ve isomer.

levorotatory

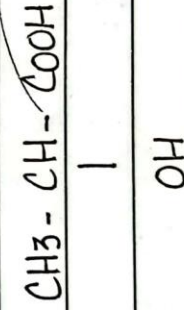
- Rotate the plane polarized light in anti-clockwise direction.
- -ve isomer

Optical isomerism

- Optical active compound exists in 2 isomeric form which rotate plane polarized light opposite direction.
- Dextrorotatory and levorotatory is called enantiomers.

Examples

Lactic acid:



• 2-Hydroxy propanoic acid

- 1-asymmetric carbon.

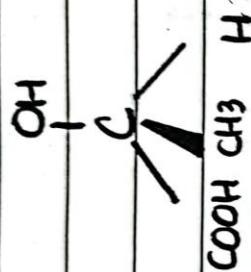
- It has 3 forms, 2 are actively optive and one is inactive.

Date: _____

I:-



II:-



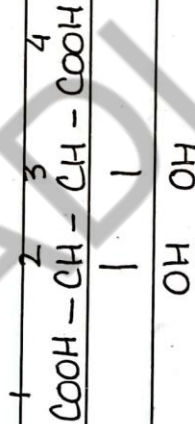
(+)-lactic acid

(-)-lactic acid

III:-

Equimolar mixture of (-) and (+) lactic acid. (Racemic mix).

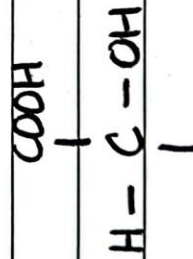
Tartaric acid:



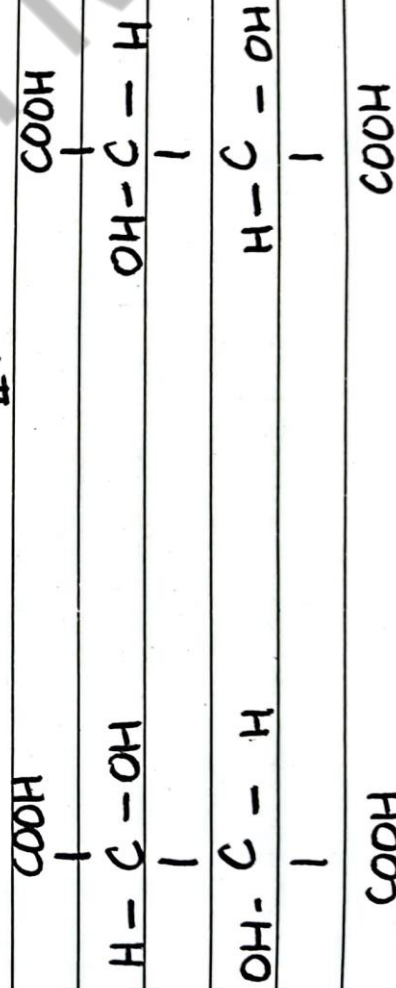
Δ 2,3 Dihydroxy - 1,4 butanedioic acid.

- There are 4 forms.
- 2 optically active (enantiomers)
- 2 optically in-active.

I:-



II:-



(+)-tartaric acid

(-)-tartaric acid

Page #



Teacher's Signature: _____

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Date: _____

III: $\begin{array}{c} \text{COOH} \\ | \\ \text{OH} - \text{C} - \text{H} \\ | \end{array}$

IV:

$\begin{array}{c} \text{COOH} \\ | \\ \text{OH} - \text{C} - \text{H} \\ | \end{array}$

Equimolar mixture of + & - tartaric acid.

$\begin{array}{c} \text{COOH} \\ | \\ \text{OH} - \text{C} - \text{H} \\ | \end{array}$

(I, II) & (III, IV).

diastereomers

COOH

Meso - tartaric acid

not mirror images

inactive

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Map

Isomerism

Stereoisomerism

Optical

- plane polarized light
- anti-clockwise / clockwise
- chiral carbon
- Plane of symmetry

Geometrical

Alkanes

- Stability through dipole moment
- No relation to π -bond.

Structural

- chain isomerism
- Position isomerism
- function isomerism
- Metamerism
- Tautomerism

Page #



Teacher's Signature: _____

Date: 01-07-24

Geometrical isomerism in cyclic Compds

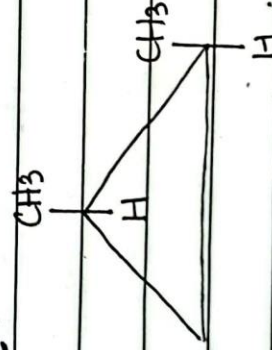
geometrical isomerism also occur in cyclic compds.

Open chain	alkyne	alkene
Open chain donot show isomerism because it don't fulfills the condition of 2 groups attach but rather 3 groups are attach.	The alkyne donot show any isomerism because only one group can attach to it.	The alkene show the geometrical isomerism because 2 groups can attach to it.

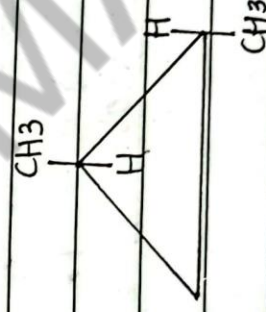
Closed Chain alkane

They form geometrical isomerism.

example:



cis - 1,2 dimethylcyclopropane.



Trans - 1,2 dimethylcyclopropane.

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Date: _____

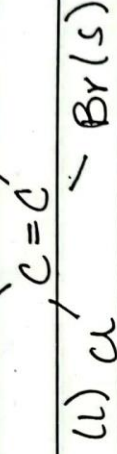
Z-form:

- When 4 diff groups attach is small - large order.



E-form:

- When 4 diff groups attach is small - large & large - small order.



Question #1

- a) ethene
- b) 3 - Propene
- c) 3 - Hexene
- d) 2-Methyl-1propene
- e) 1,3 - Pentadiene
- f) 2,3 - Hexadiene
- g) 2,3 - Dimethyl - 2-butadiene
- h) 2,2,5,5 - Tetramethyl - 3 - hexene.

Question #2

- a) $\text{CH}_3 = \text{CH} - \text{CH} = \text{CH}_2$
- b) $\text{CH}_2 = \text{C}(\text{CH}_3) = \text{CH} - \text{CH}_2 - \text{CH}_3$
- c) $\text{CH}_3 - \text{HC} = \text{CH} - \text{CH} = \text{CH} - \text{CH}_3$
- d) $\text{CH}_2 = \text{C}(\text{CH}_3) - \text{HC} = \text{CH}_2$
- e) $\text{CH}_2 = \text{CH} - \text{C}(\text{CH}_3) = \text{CH} - \text{CH}_3$

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Structure of alkene

Basic:

- carries sp^2 hybridization
- p-orbitals forms π bond and hybrid orbitals form σ bond.
- The bond length of ethene is much shorter than ethane.
 $\hookrightarrow 1.34 \text{ \AA}$ $\rightarrow 1.54 \text{ \AA}$
- The difference in bond length due to increase in electron charge density.
- Co-planar
- Rotation restricted due to cis & trans structure.

Preparation of alkene

Alkene can be prepared by 2 ways:

- Dehydration of alcohol
- Dehydrohalogenation of alkyl halide.

Date: _____

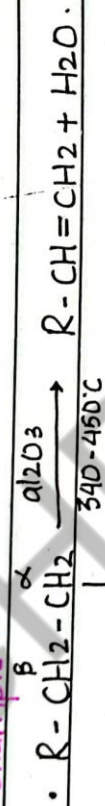
Dehydration of alcohol

Removal of H_2O from alcohol.

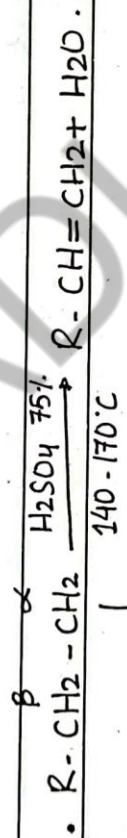
→ **Primary alcohol:**

The alpha carbon joined with only 1 another carbon.

example ~



1°-alcohol, primary alcohol.



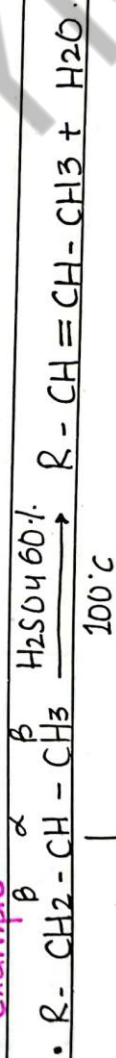
OH

1°-alcohol

→ **Secondary alcohol:**

The alpha carbon joined with 2 another carbon.

example:



OH

2°-alcohol

→ **Tertiary alcohol:**

The alpha carbon joined with 3 another carbon.

elimination Trick :-

Saytzeff rule → β -C

that has less H will be removed to form =.

dehydrating agent :

Al_2O_3 (alumina),

H_3PO_4 , P_4O_{10} , P_2O_5

H_2SO_4 (best becoz tell

order of reactivity &

fast rxn.

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Page #

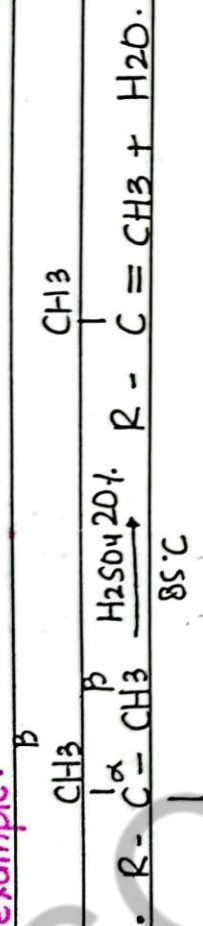
Teacher's Signature: _____

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

example:



ORDER OF REACTIVITY:

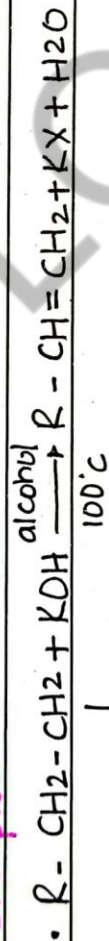


due to stability of carbon cation.

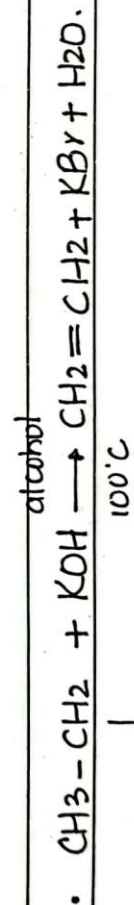
Dehydrohalogenation

The removal of H and halogen from alkyl halide.

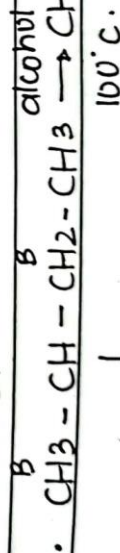
examples:



i-R-X



Br



Br

Reagent that participate in rxn.
Alcoholic KOH
elimination
Aqueous KOH
substitution

Page #

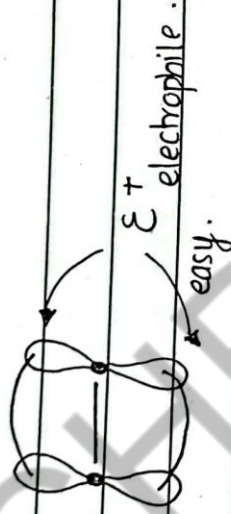


Teacher's Signature:

Date: _____

Reactivity of alkene

- more diffused bond (more e^- density)
- weak π bond
- less energy to break bond.



Electrophilic Addition rxn Alkene

electrophile

- electron loving
- E^+ cation $\rightarrow$ electron deficient
- $BF_3 \rightarrow B^+$

Nucleophile

- Nucleus loving
- Nu^- anion $\rightarrow$ electron rich specie
- OH^- (mostly bases involved).

definition of rxn

1. Halogenation: Addition of H_2 in the molecule of alkene is halogenation.

Date: _____

Catalyst:

Pressure:

→ Nickel cheap

• 1-5 atm

↳ 200-300°C

↳ usually not

→ in place of Ni, we can also use:

mentioned.

Pt/Pd ↳ requires room temp

+ Raney Nickel

↳ fast rxn, also requires very low temp, more reactive than normal Ni.

example: 1



indcat:

GET ADMISSION IN OUR ONLINE INSTITUTE

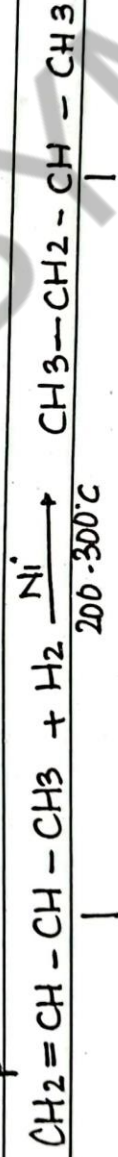
SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Importance:

• used in catalytic hydrogenation for preparing vegetable ghee from vegetable oil.

example: 2



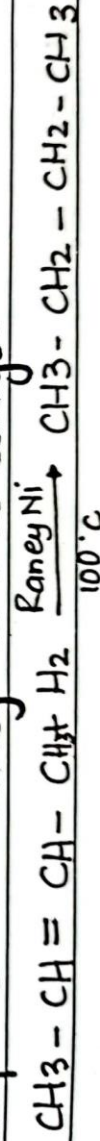
CH₃

CH₃

3-Methylbutene

3-Methylbutane.

example: 3 with Raney Nickel as catalyst



2-butene

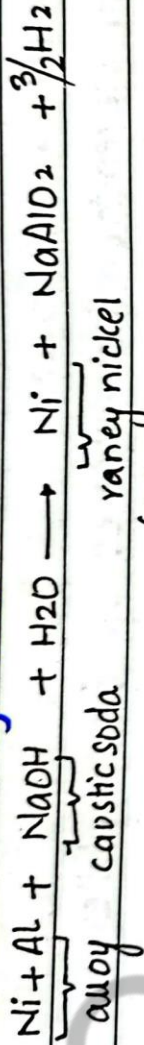
butane.

Page #



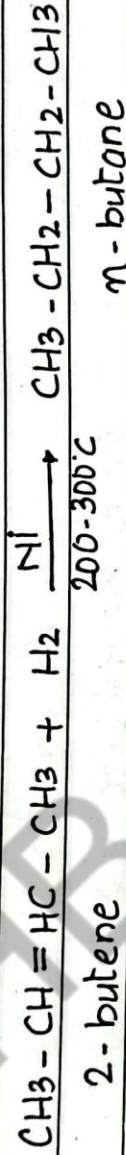
Teacher's Signature: _____

Formation of Raney Nickel :

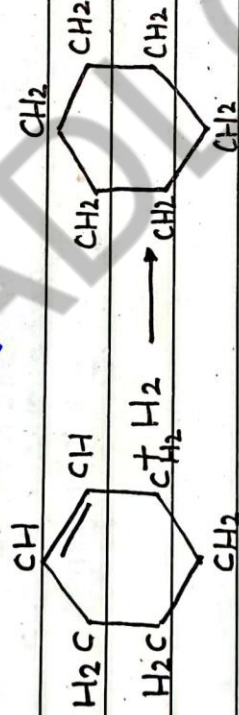


→ Conversion

- 2-butene $\rightarrow$ n-butane



- cyclohexene $\rightarrow$ cyclohexane



▲ cyclohexene

▲ cyclohexane

2- Hydrohalogenation

Addition of hydrogen and halogen in molecule is called hydrohalogenation.

Reactivity order of halogen Acid



F and I are not suitable for the reaction because:

- $F \rightarrow$ highly violent rxn, fast, more electronegative
- $I \rightarrow$ slow, irreversible.

Date: _____

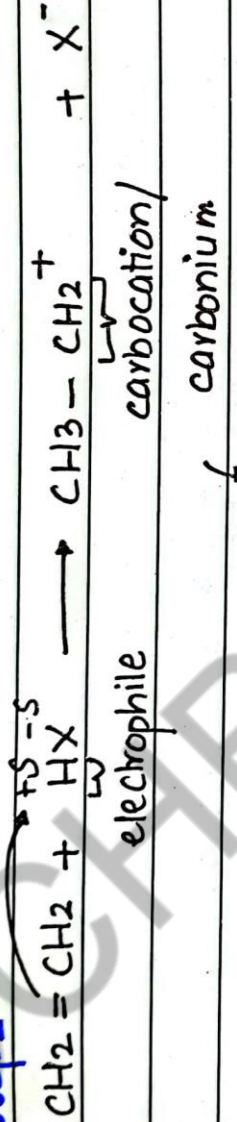
example:



Mechanism or Stereochemical evidence of Electrophile

rxn :-

Step 1 :-



Step 2:

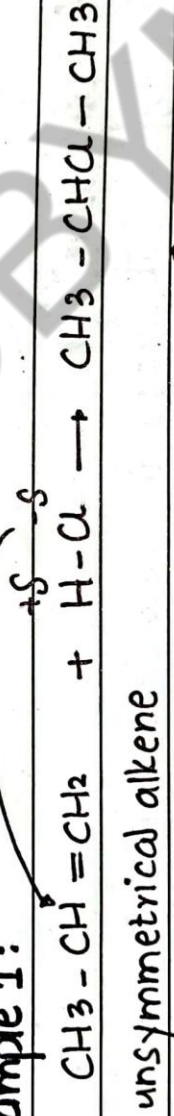


Inorganic hem, the arrow always point from - charge to + charge

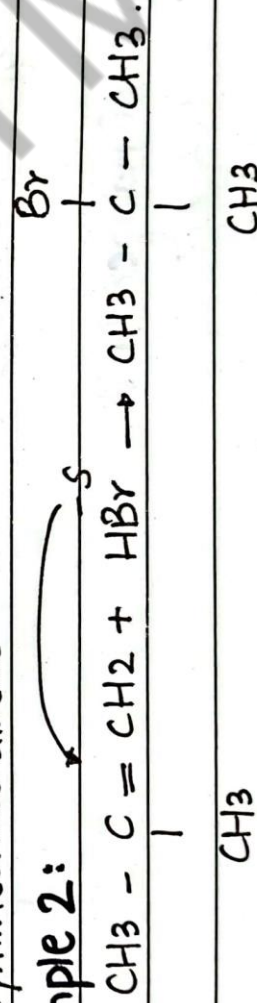
Markownikov's rule

- - δ charge will go towards = carbon which has less hydrogen.

example 1:



example 2:



2-Methyl-2-Propane

2-Bromo-2-methylpropane

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

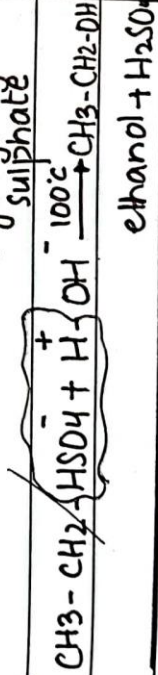
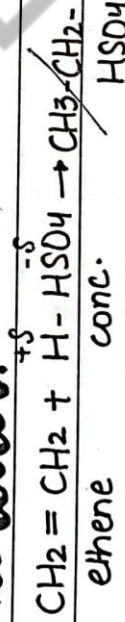
Hydration

3.

- Addition of water to alkene.
- This addition of water to alkene is not simple.
- Becoz, alkene (non-polar) doesn't dissolve in water (polar).
- For that, we indirectly dissolve/add water by adding H_2SO_4 .

The purpose is to generate polarity.

reaction



Overall:

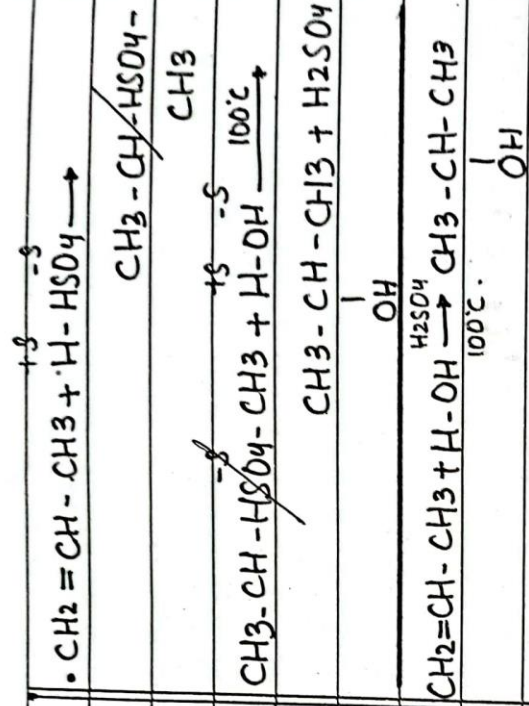


- H_2SO_4 is a catalyst.

- Partial synthesis.

Page #

Teacher's Signature: _____

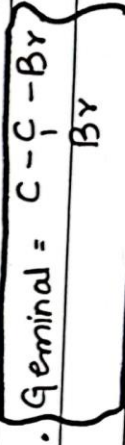


halogenation

- Partial synthesis
- "test for unsaturation"
- Addition of halogen in a molecule

- alkane halogenation takes place in presence of sunlight.
- alkene halogenation occurs only in presence of inert solvent CCl_4 .

- halogenation of alkene produces

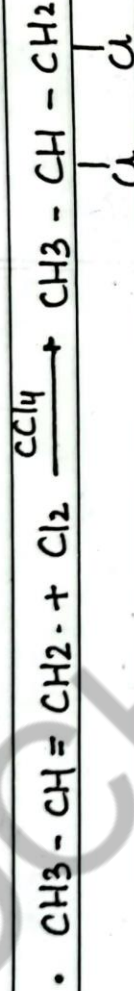


Date _____



• Vicinal dihalide

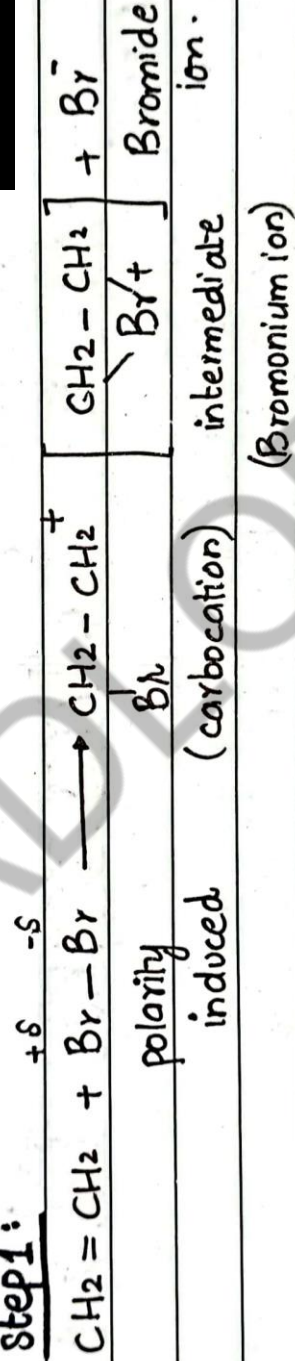
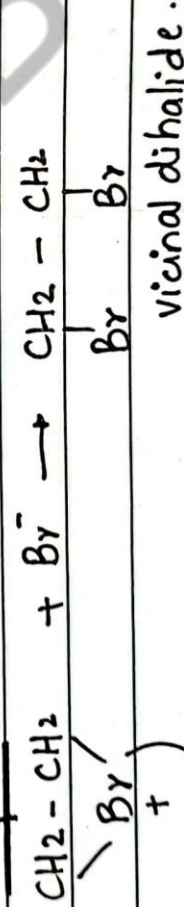
• 1,2-Dibromethane.



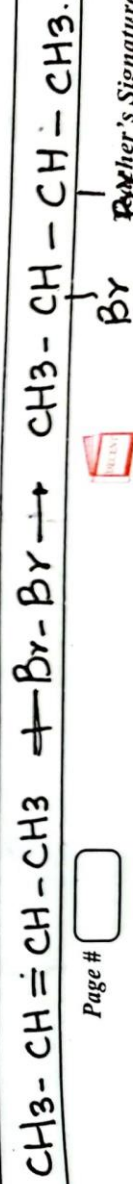
• Vicinal dihalide

• 1,2-Dichloropropane.

Mechanism

Step 1:Step 2:

bond breaking

Test
 $\text{Br}_2 \longrightarrow \text{colorless transparent}$
 (Brown)
 $\rightarrow \text{H.O.W:}$ Page #

Teacher's Signature: _____

Date: 07-08-24

s. halohydrin

• Addition of hypohalous acid (HOX) is called halohydrin.

→ Water act as solvent & reagent. → molecules of water become reactant too.

Formation of hypohalous acid:

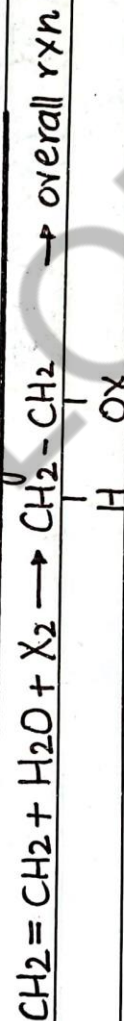


↳ hypohalous acid.

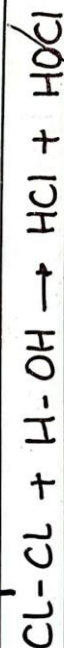
example: 1



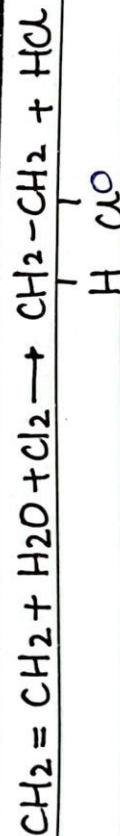
halohydrin.



example: 2



Hypochlorous acid



GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Page #

Teacher's Signature

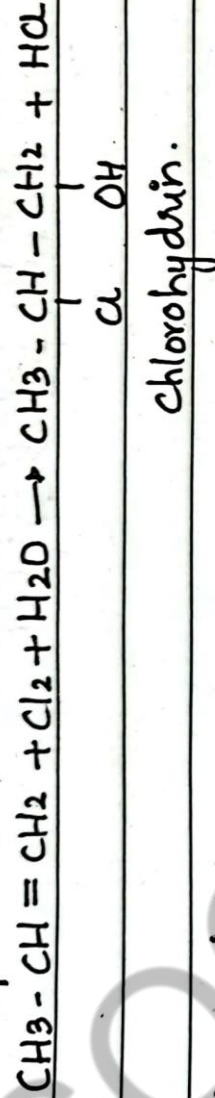
Date: _____

GET ADMISSION IN OUR ONLINE INSTITUTE

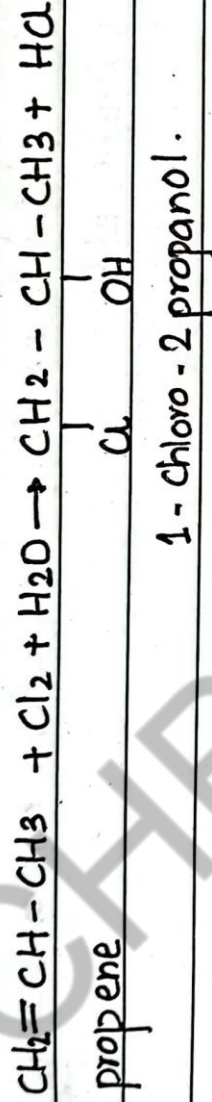
SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

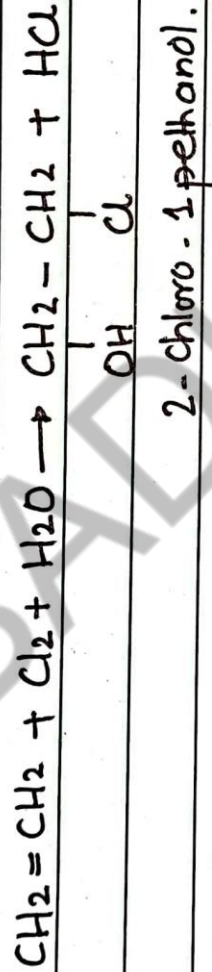
example 3:



Conversion 1:



Conversion 2:



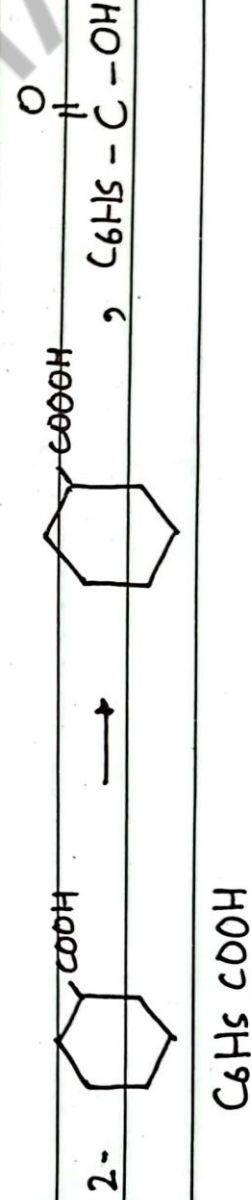
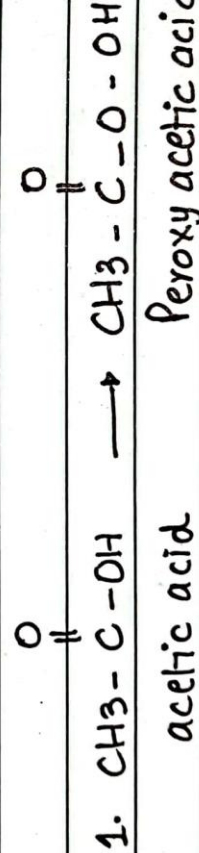
epoxidation

→ produces epoxy alkane.

→ CHCl_3 as catalyst

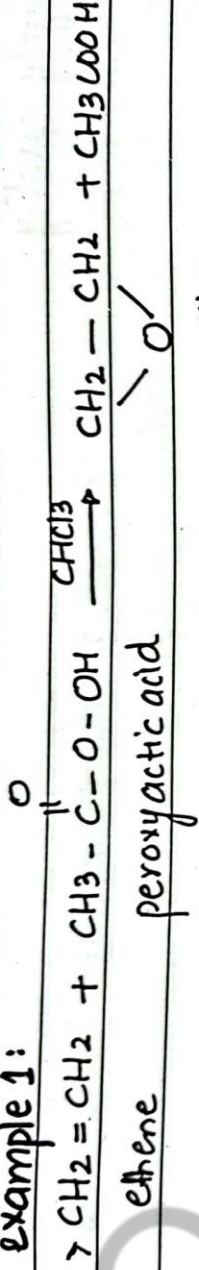
→ Peroxy acids or Peroxides are used :- Peroxy acetic acid or

Peroxybenzoic acid



Date: _____

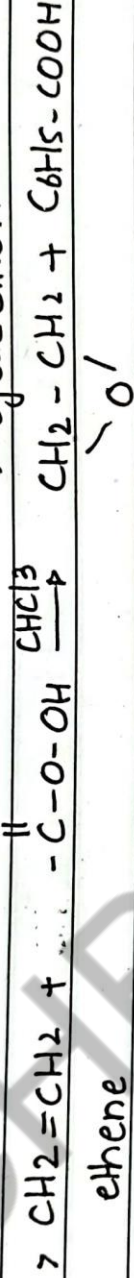
example 1:



• epoxy ether

• Epoxide

• cyclic ether.



GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

• epoxyethane

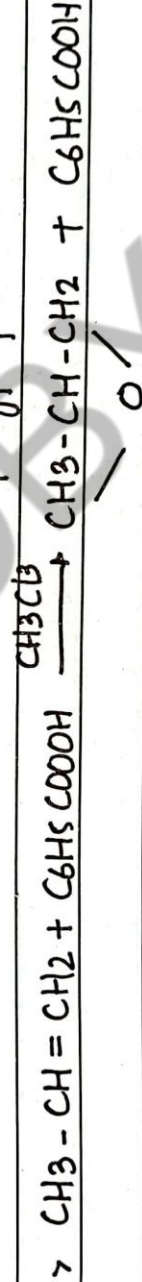
• epoxyether

• epoxide.

example 2:



• epoxypropane.

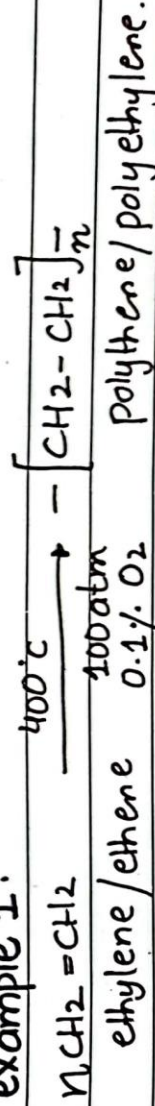


8. polymerization

Small molecule $\rightarrow$ larger molecule

• Process in which small molecules called monomers combines with each other & form large molecule called polymer.

example 1:



Page #

Teacher's Signature: _____

Date: _____

Highly quality

ethene is polymerized in presence of aluminium triethyl $Al(C_2H_5)_3$ & titanium tetrachloride ($TiCl_4$).

Ozonolysis

allotrope of $O_2 = O_3$ breaking

Addition of O_3 which causes unsaturated alkene/compound to break.

It produces Carbonyl group $\begin{matrix} \rightarrow \text{aldehyde} \\ \rightarrow \text{ketone} \end{matrix}$
Used to test the location of $=$ bond.

Steps

1. alkene + $O_3 \rightarrow$ Molozonide
(unstable).

2. Molozonide $\xrightarrow{\text{rearrange}}$ ozonide
(mild stable).

3. Ozonide + $H_2O \xrightarrow{Zn}$ Carbonyl comp + H_2O_2 .
 $\downarrow$ reducing
boiling

4. $H_2O_2 + Zn \rightarrow ZnO + H_2O$.

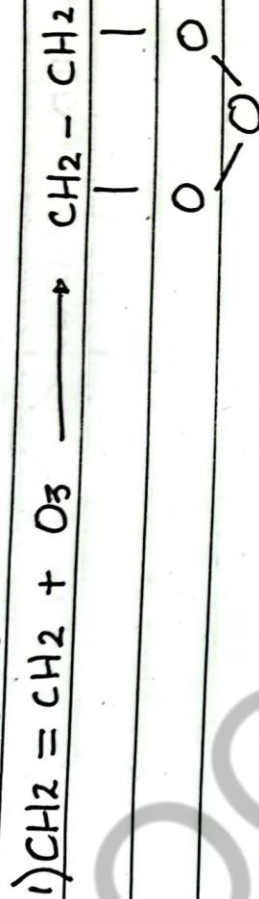
GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

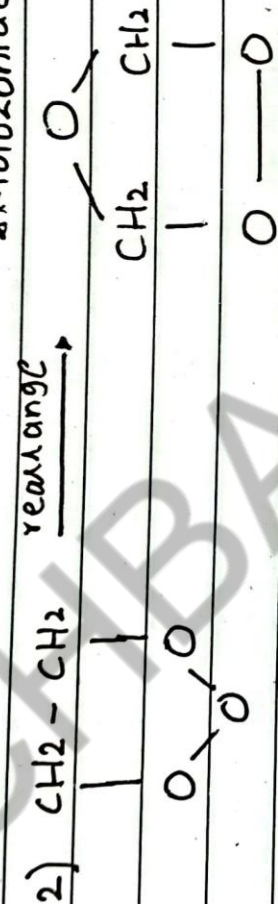
Contact WhatsApp Number: +92 331 5014353

Date: _____

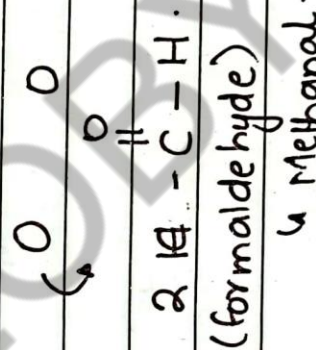
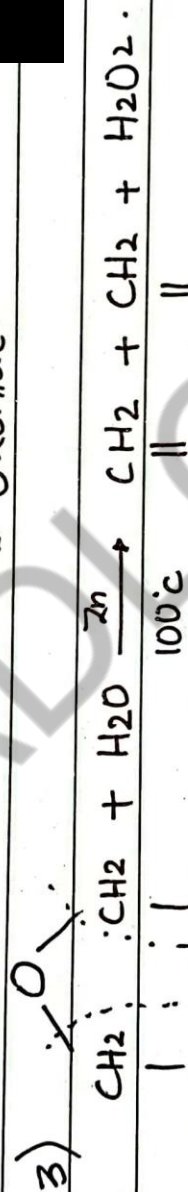
reactions



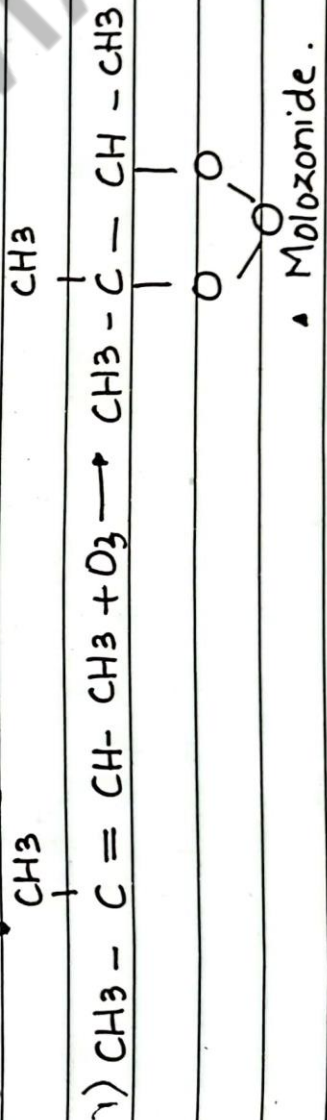
▲ Molozonide



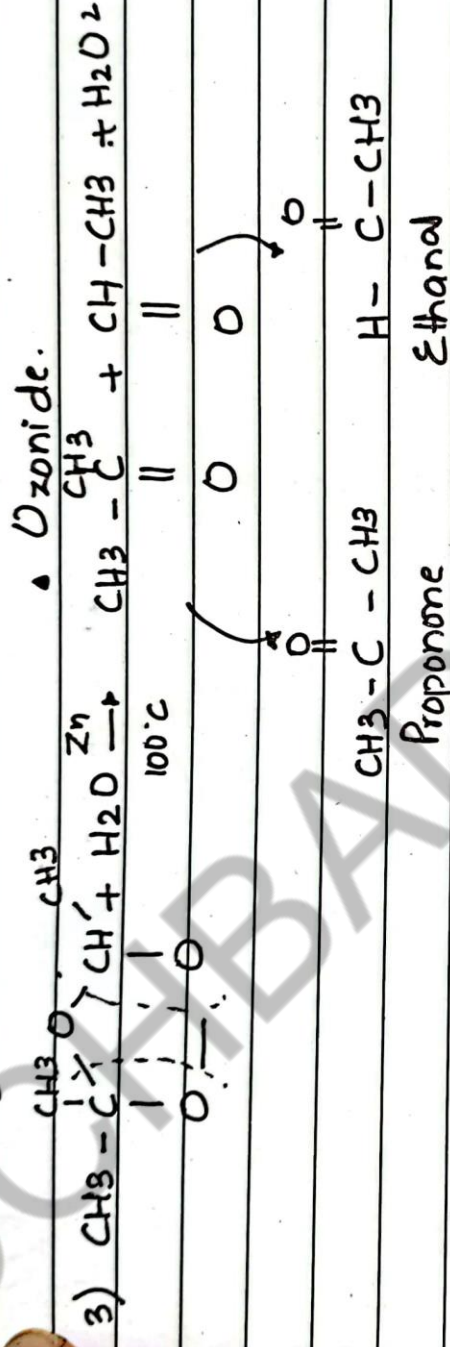
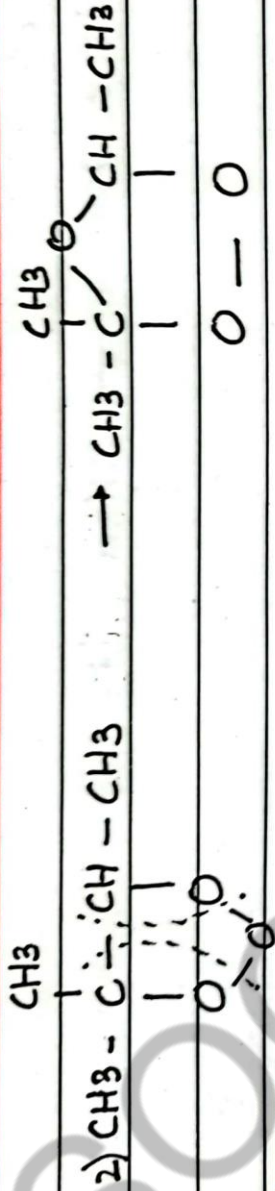
▲ Ozonide.



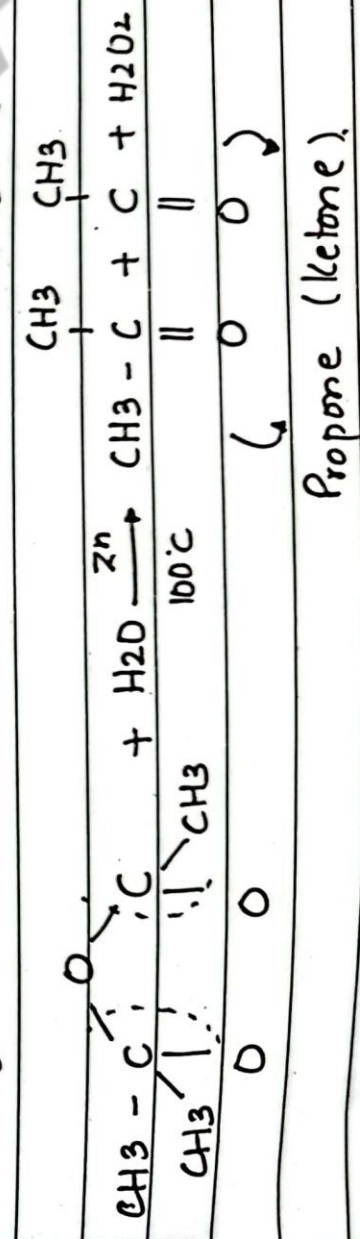
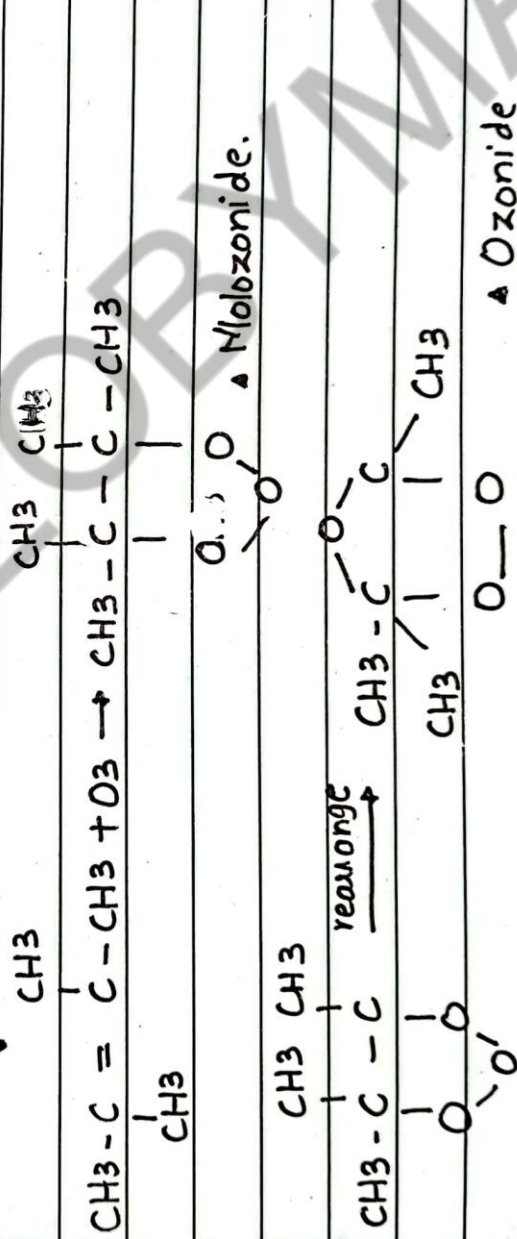
example 1



Date: _____

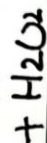
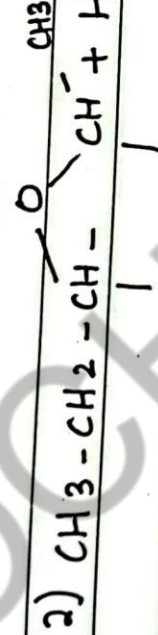
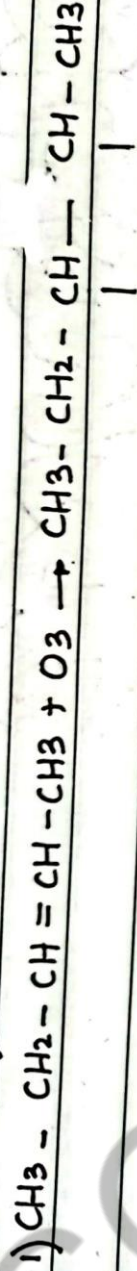


Example 2



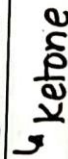
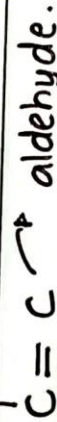
Date: _____

example 3

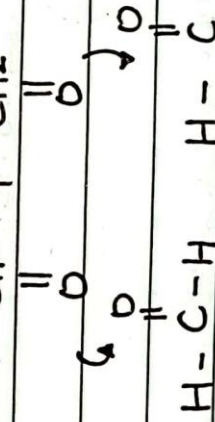
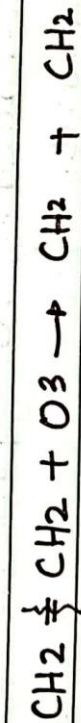


Trick

- alkene which have = carbon branch always form ketone.
- alkene which have = carbon no branch forms aldehyde.



• Add O_2 to Carbon double bond & see results.



GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Page #

Teacher's Signature: _____

Alkyne

Compounds having Triple bond.

Relative Stability:

alkene are less stable due to 1 pi bond.

alkyne are most stable due to 2 pi bond.

alkane are most stable than any other due to 1 sigma bond.

alkane > alkyne > alkene

alkene are most reactive due to 1 pi bond.

alkyne are less reactive due to 2 pi bond, consuming more energy to be broken.
↳ side overlap.

alkane are inert due to sigma bond, consuming less energy than any other.
↳ head overlap.

→ Have more charge density

alkene > alkyne > alkane

• Stability $\propto \frac{1}{\text{reactivity}}$

Date: _____

Example of energies:

f 1-Hexyne = 290 kJ/mole & ΔH of 1-Hexene = 126 kJ/mole.

Structure

• hybridization

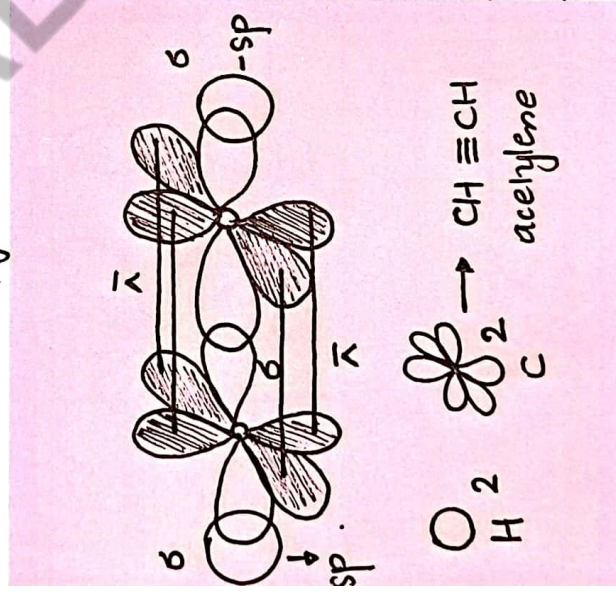
ve 50% s-character & 50% of p.

2-sp² orbitals linked by σ -bond.

hybrid p-orbitals linked by π -bond.

→ 2-2 → unhybrid p of another carbon.
unhybrid p of one carbon.

and of π -e⁻ is cylindrical to σ -bond axis.



Physical Properties

yne are non-polar. • increase in s-character causes $\uparrow$ in E.N of carbon.

yne are insoluble of water & soluble in organic solvent.

yne are colorless, odourless except acetylene → garlic odour

I.P, B.P, density $\uparrow$ with $\uparrow$ in C-atom.

2-C₄ → gas & C₅-C₁₂ → liquids & higher are solid at 25°C.

Page #

Teacher's Signature: _____

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Date: 10-08-20

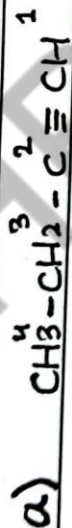
©sticity

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

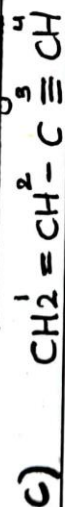
IUPAC Name:



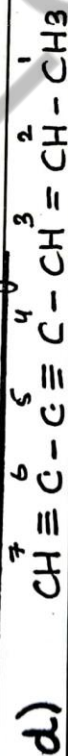
1-Butyne.



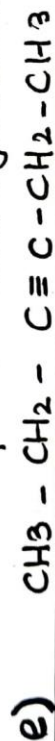
1,4-Butadiyne



1-Butene - 4-yne.



2-Heptene - 4,7-diyne.



3-hexyne.

Date: 12

Preparation of alkyne

Elimination

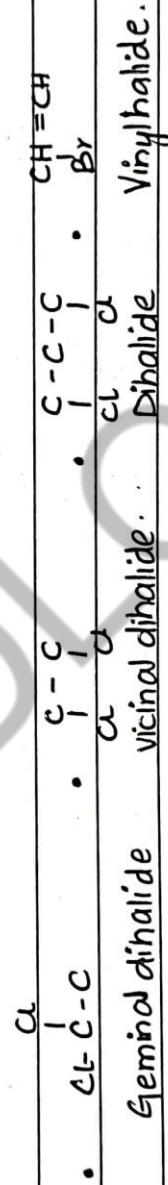
1- Dehydrohalogenation:



• Removal of HX from alkene, alkane molecule to form alkyne.

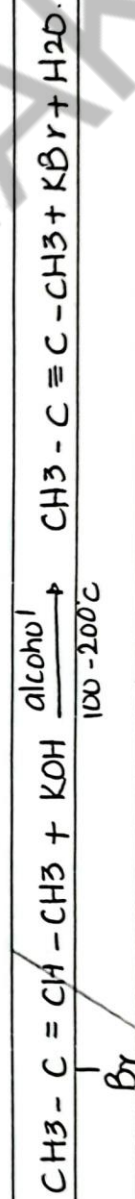
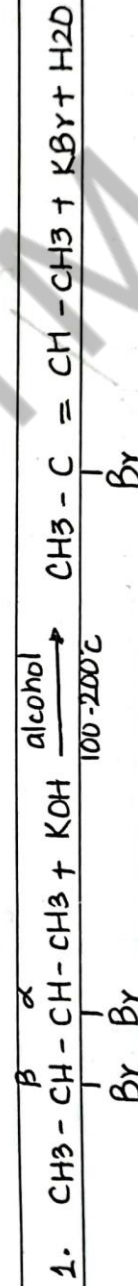
→ Reagent = alcoholic KOH (elimination) (100-200°C).

= $\text{NaNH}_2 + \text{Liq NH}_3$ (-33°C).

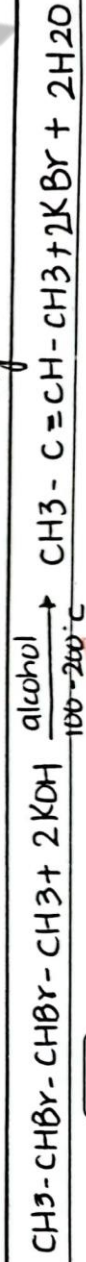


A Vicinal dihalide :-

example :-



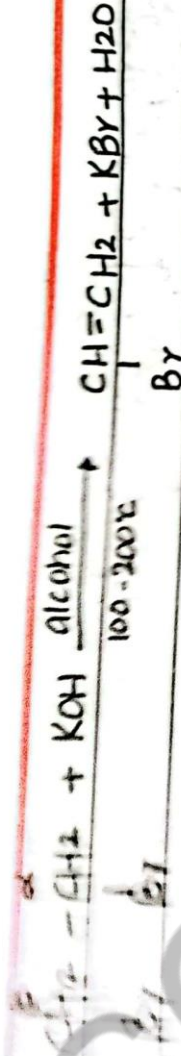
2- Butyne



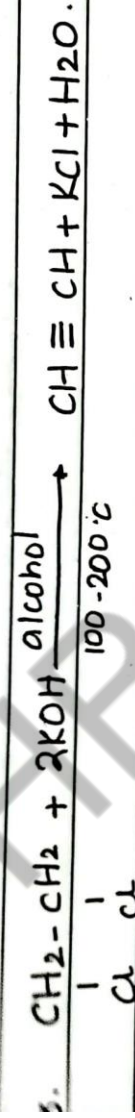
Page #

Teacher's Signature: _____

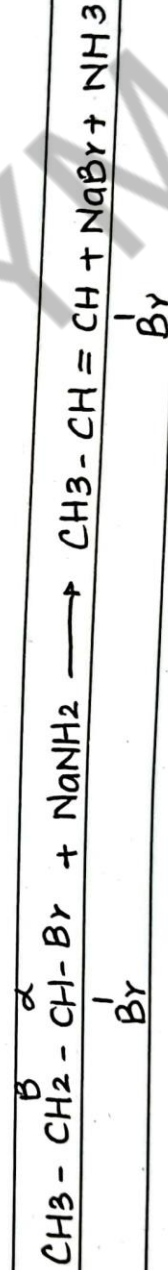
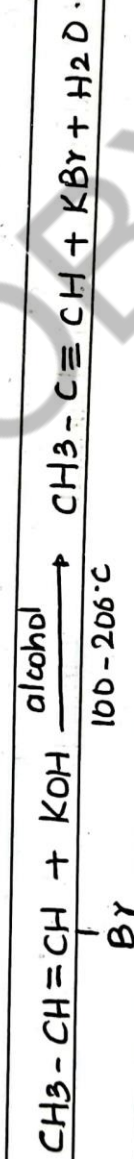
Date: _____



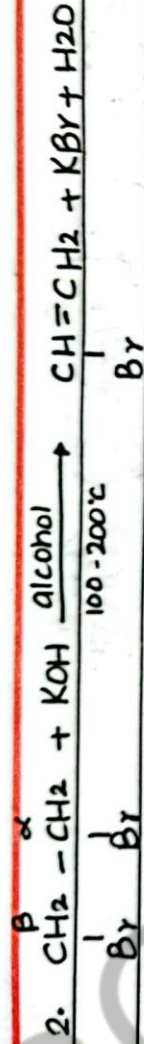
Vinyl bromide.



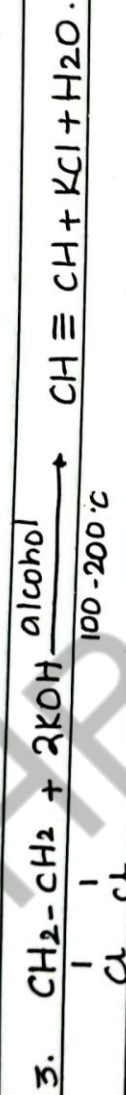
3) Chemical dihalide:



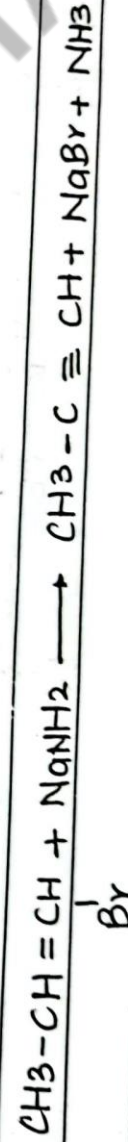
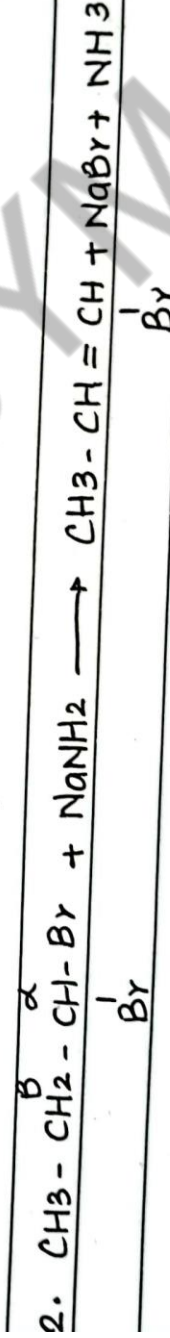
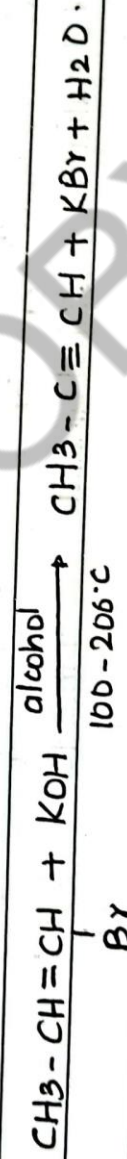
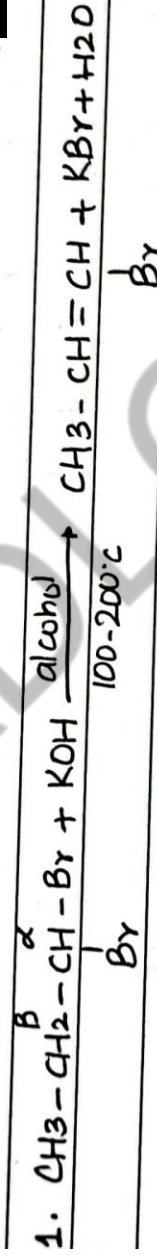
Date



Vinyl bromide.



B) Geminal dihalide:



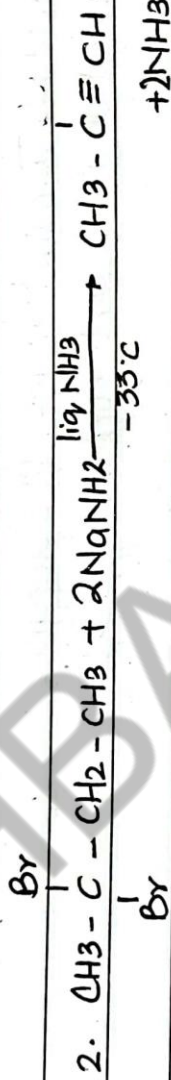
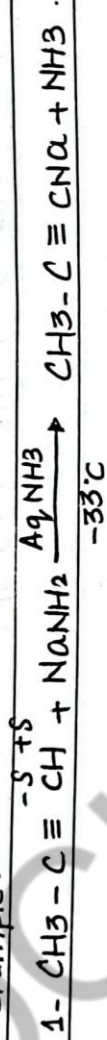
Date: _____

terminal alkynes :-

terminal alkyne are those in which

$\equiv$ bond is after 1st carbon (H) is acidic.

example :-



Reactivity

- alkyne is unsaturated hydrocarbon, shows addition rxn.
- It might undergo substitution rxn. due to easy cleavage of C-H bond.
- The π -bonds are cylindrically symmetrical about sigma bond.
- The removal of terminal hydrogen is possible.
- electrophilic substitution rxn possible in 1-alkyne.

alkene > alkyne > alkane.

1.34A⁺ 1.20A⁺ 1.54A⁺

C=C C $\equiv$ C C-C.

less e⁻ density
more e⁻ density
 π -bond not covered.
 π -bond covered.

Page #

Teacher's Signature: _____

Date: 14-8-24

terminal alkyne

alkyne whose $\equiv$ bond is after the first C-atom.

- $\text{CH} \equiv \text{CH}$
- $\text{CH} \equiv \text{C} - \text{CH}_2 - \text{CH}_3$

Reason

In ethyne and other terminal alkyne like propyne, the sp -hybridization is present containing 50% s-character.

The more s-character, the more polarity of C.

The C-atom of terminal will attract paired e^- more towards it, becoming strong acidic.

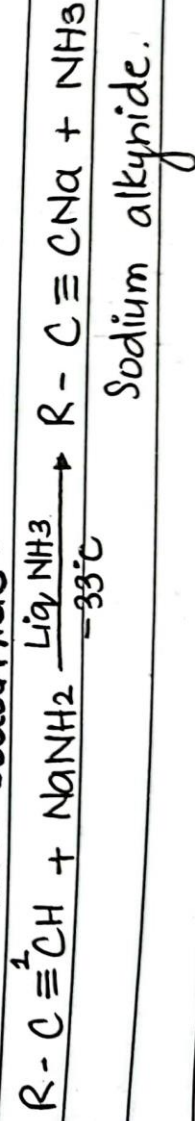
and H with it becoming electron deficit & weak acid. More capable of doing electrophilic rxns.

by reacting with mild base.

electrophilic substitution rxn

one +S, other +S
removed add

Reaction with Sodamide :-



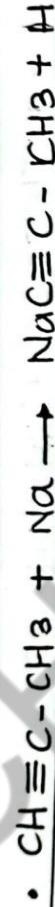
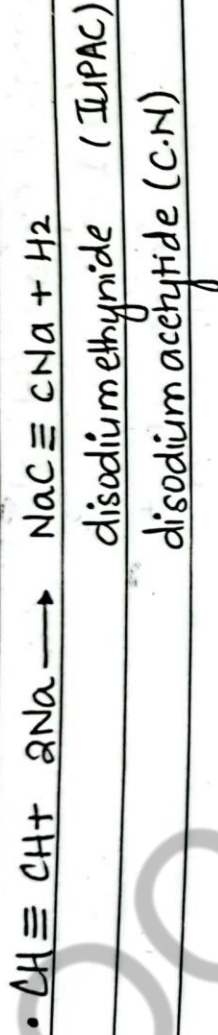
GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Date

Reaction with Na metal:



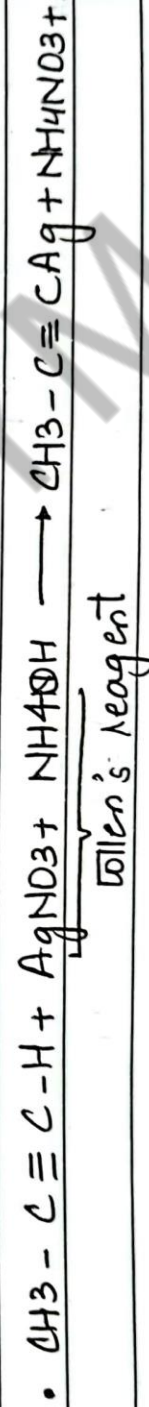
Reaction with ammonical silver nitrate: OR

Identification test for 1 alkyne

↳ when reaction $\text{AgNO}_3 + \text{NH}_4\text{OH}$, forms white ppt.



↳ This rxn is used for testing but 1 & 2 are not. The reason is that it's not soluble in water so we can differentiate.



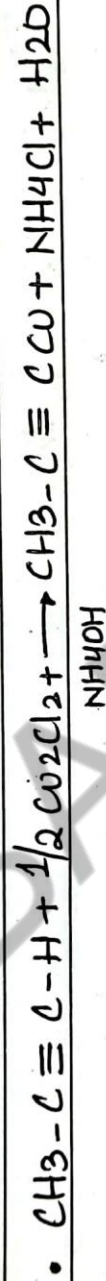
Date: _____

Reaction with Ammonical cuprous chloride $\xrightarrow{Cu^+}$ or
identification test for 1-alkyne

↳ give red-ppt

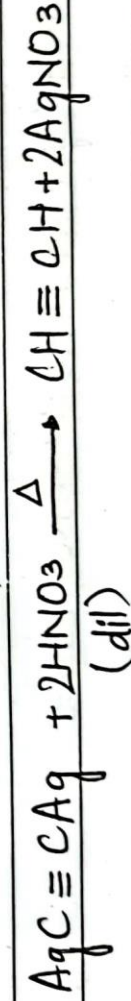
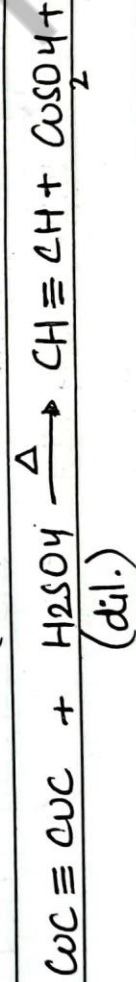
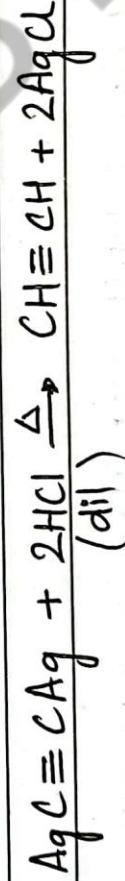


di-copper ethynide.



Uses of alkynide

- Preparation
- Separation
- Identification
- Purification



GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Date: _____

addition rxn

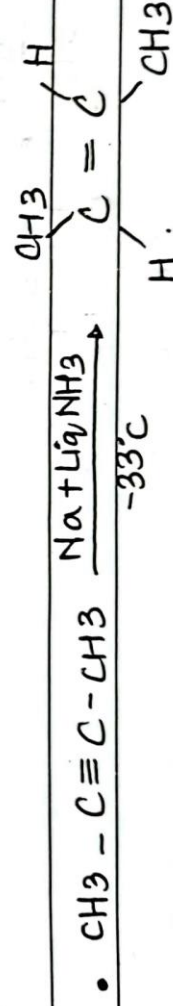
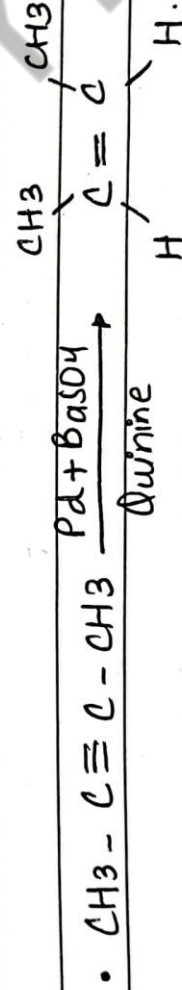
↳ addition of E^+ .

1. Hydrogenation:

- addition of H_2 .
- by using catalyst $\left[\begin{array}{l} \xrightarrow{Ni} (200-300^\circ C) \\ \xrightarrow{Pt, Pd} (Room temp 25^\circ C) \end{array} \right]$
- alkyne $\rightarrow$ alkene $\rightarrow$ alkane.
- $CH \equiv CH + H_2 \xrightarrow[Ni]{200-300^\circ C} CH_2 = CH_2$ } in steps.
- $CH_3 - CH = CH_2 + H_2 \xrightarrow[Ni]{200-300^\circ C} CH_3 - CH_2 - CH_3$ }
- $CH \equiv CH + 2H_2 \xrightarrow[Ni]{200-300^\circ C} CH_3 - CH_3$ } direct

2. Partial hydrogenation:

- cis-2-butene ($Pd + BaSO_4 + Quinine$) $\rightarrow$ Lindlar catalyst
- Trans 2-butene ($Na + LiqNH_3$) $\rightarrow -33^\circ C$.

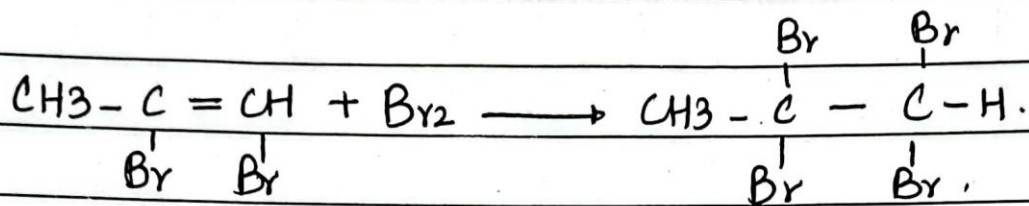
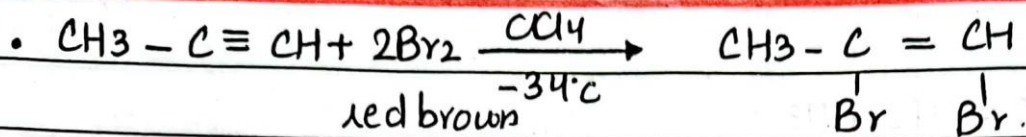


GET ADMISSION IN OUR ONLINE INSTITUTE

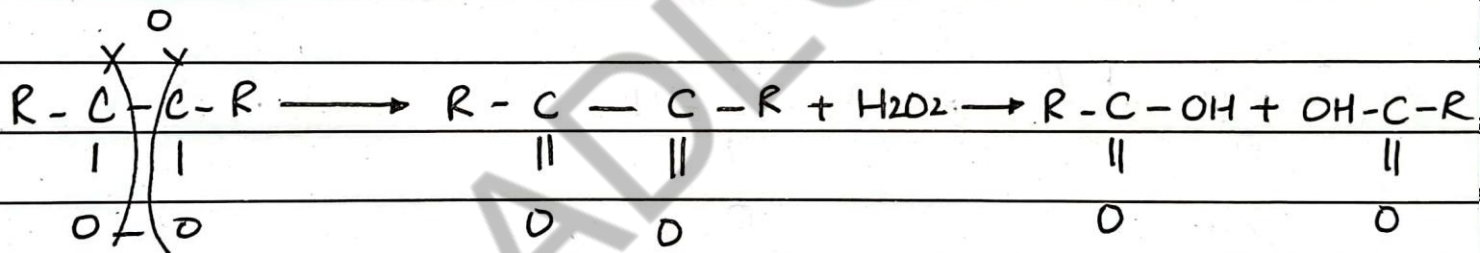
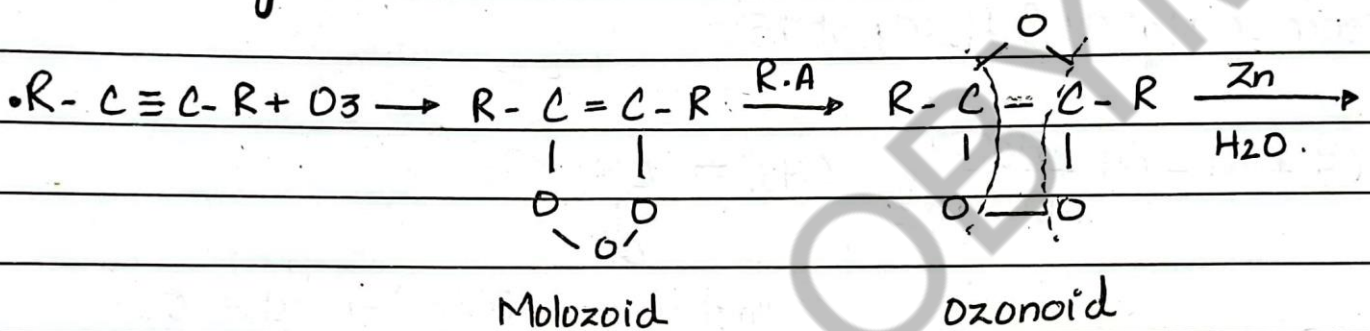
SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Date: _____



5. Ozonolysis:

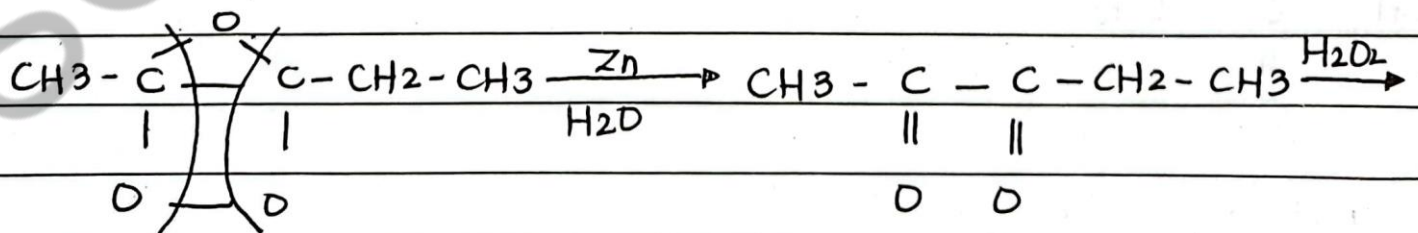
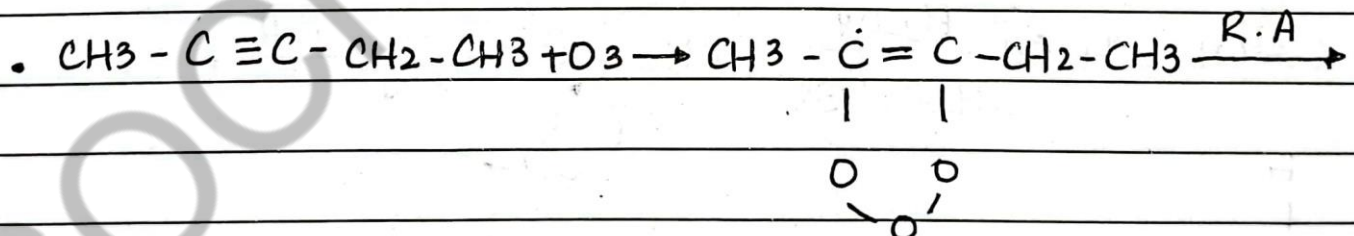


carboxylic acid.

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

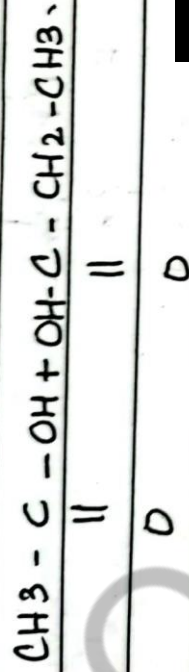


Page #



Teacher's Signature: _____

Date: _____



GET ADMISSION IN OUR ONLINE INSTITUTE

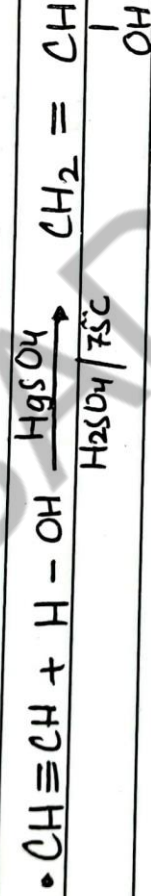
SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

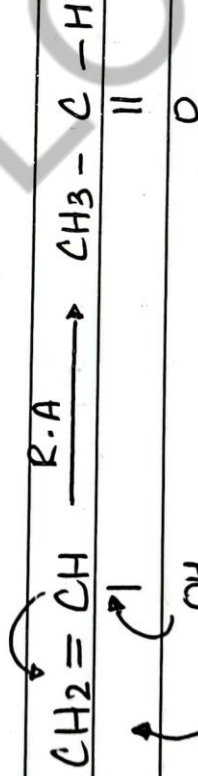
6. Hydration:

• Addition of H_2O

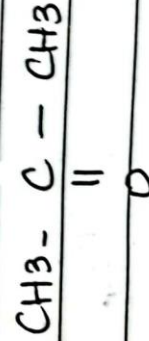
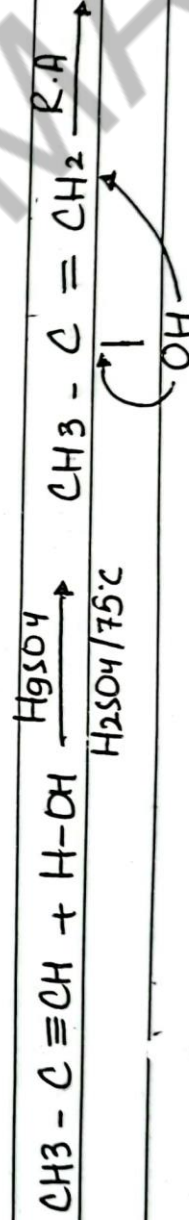
• presence of HgSO_4 & H_2SO_4 at 75°C .



vinyl alcohol (enol) $\rightarrow$ unstable



acetaldehyde
(ethanal).



acetone (ketone).

Date: 15-8-2024

nomenclature of benzene

- also known as Arenes.

rules

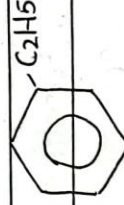
- Parent name is benzene.
- Substituent is placed before benzene.



chlorobenzene

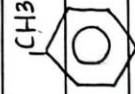


Nitrobenzene



ethylbenzene

- Special names are included in IUPAC.



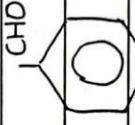
Toluene
methylbenzene



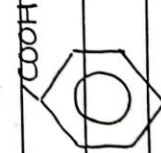
Phenol
hydroxybenzene.



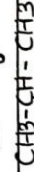
Aniline
Aminobenzene



Benzaldehyde.



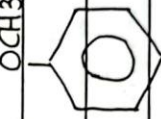
benzoic acid



Cumene
isopropylbenzene.



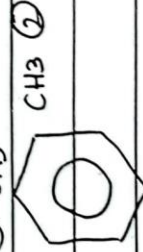
styrene
vinylbenzene



Anisole
methoxybenzene

- When 2 groups are attached on benzene, then it will be numbered.

① CH₃



1,2-dimethylbenzene.

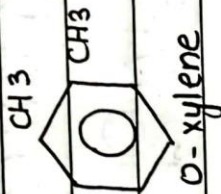
Page #

Teacher's Signature:

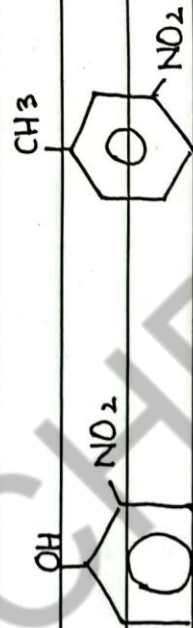
Date

• Relative position is given by special prefixes.

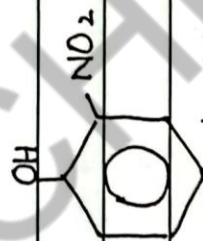
1. ortho (o) $\rightarrow$ 1-2



2. meta (m) $\rightarrow$ 1-3



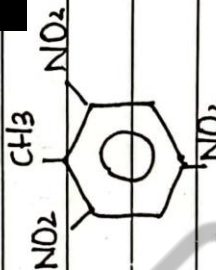
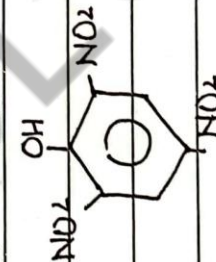
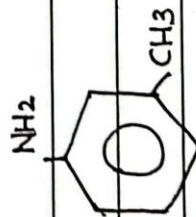
3. para (p) $\rightarrow$ 1-4



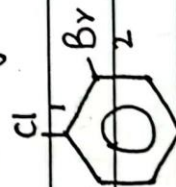
• Priority order of different functional group.

$-\text{COOH}$, $\text{C}\equiv\text{N}$, CHO , CO , OH , NH_2 , $-\text{OR}$, R (alkoxy)

aldehyde $\rightarrow$ ketone



• When no group is listed then follow alphabetical order.



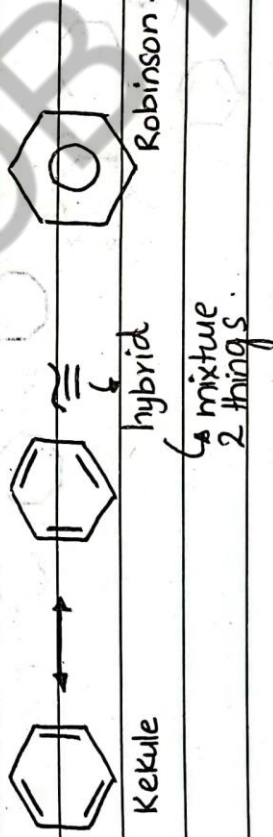
Date: _____

Activity

- Chlorobenzene
- 1, 3, 4 - Trichlorobenzene
- styrene / vinylbenzene
- 2-Bromo-1-chlorobenzene
- 1-ethyl-4-Iodobenzene
- 3, 5 - Dinitrotoluene.

Structure Of Benzene

- Molecular formula = C_6H_6



Special feature

- Resonance (to come repeatedly)
- Electrophillic substitution
- Conjugation (movement of bonds)

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Page #

Teacher's Signature...

2- It has dual nature. (follow less addition and more substitution)

↳ Resonance

3. All C-C bond length are equal to $1.4 \text{ \AA}$.

↳ C-H = $1.09 \text{ \AA}$

↳ Bond angle = 120°

↳ πe^- in benzene are delocalized evenly among six carbon atom via resonance.

4. Less reactive.

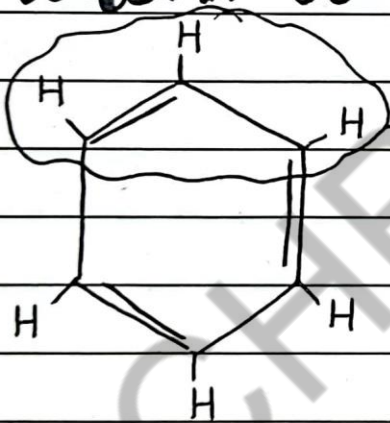
↳ (alkene, alkyne, benzene, alkane)

↳ due to aromaticity

↳ delocalized πe^-

↳ can't react truly with electrophiles.

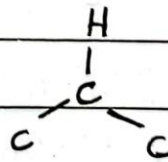
Modern Concept



GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353



- benzene has sp^2 hybridization.
- Each carbon has 3 hybrid orbital.
- Each carbon has 1 unhybrid orbital.
- Hybrid orbitals for σ bond. (s, p_x, p_y)
 - ↳ 12 σ bond.
- delocalized π bond
 - ↳ p_z .
- Unhybrid orbitals form π bond. (p_z)

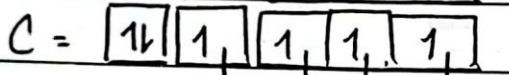
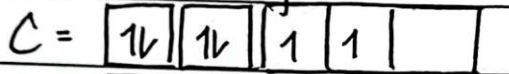


Date: 19-Aug-24

molecular Orbital treatment of benzene

configuration

$$C = 1s^2 2s^2 2p^2$$

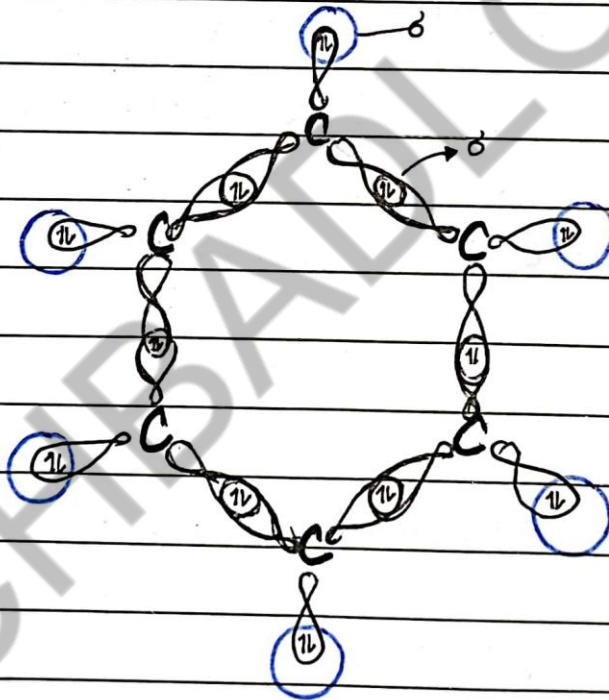


$\underbrace{\quad\quad\quad}_{\sigma\text{-bond}} \quad \underbrace{\quad\quad\quad}_{\pi\text{-bond}}$

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

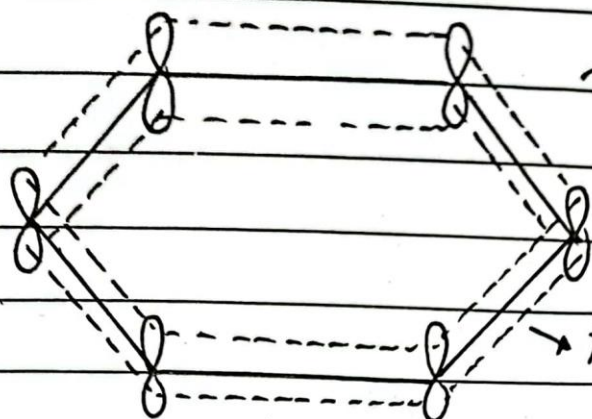


▲ Framework of σ -bond

Page #

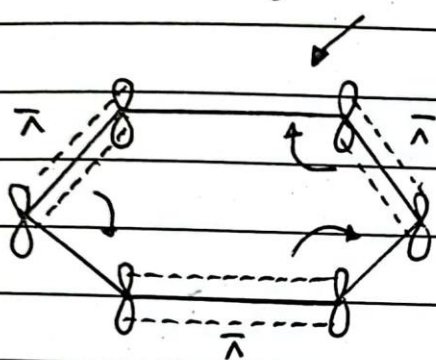


Teacher's Signature: _____

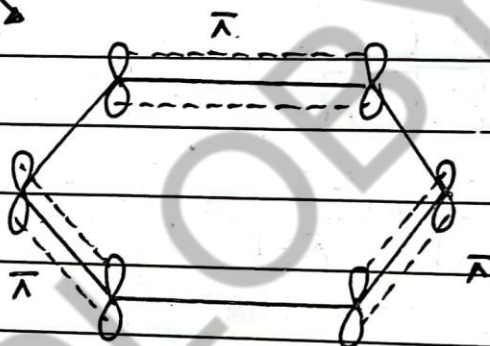


→ This structure is a mixture of Kekulé both structure

→ π - delocalized bond.



1 - Kekulé structure.



2 - Kekulé structure.

- The six- p-orbitals one each C-atom is $\perp$ to σ -bond.

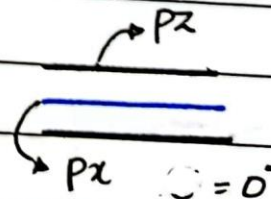
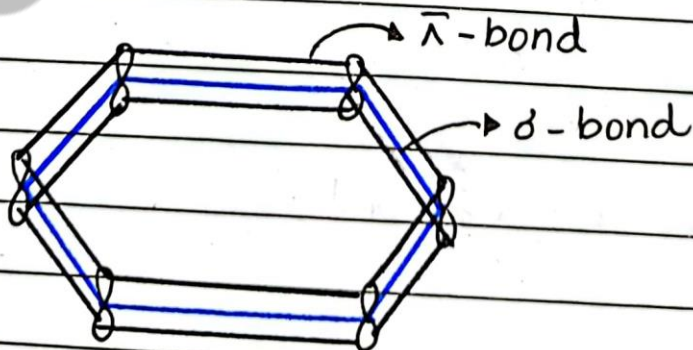


GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

- Each p is in a position to overlap parallel manners with neighbouring orbitals.



- The p_z - π orbitals form continuous sheath of $-ve$ charges up & down.
- It results in extensive π -bond spreading over all carbon nuclei.
- The delocalized p -orbitals forms sandwich like structure over the ring.
- This reduce energy due to continuous movement.

• Benzene are stable.

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

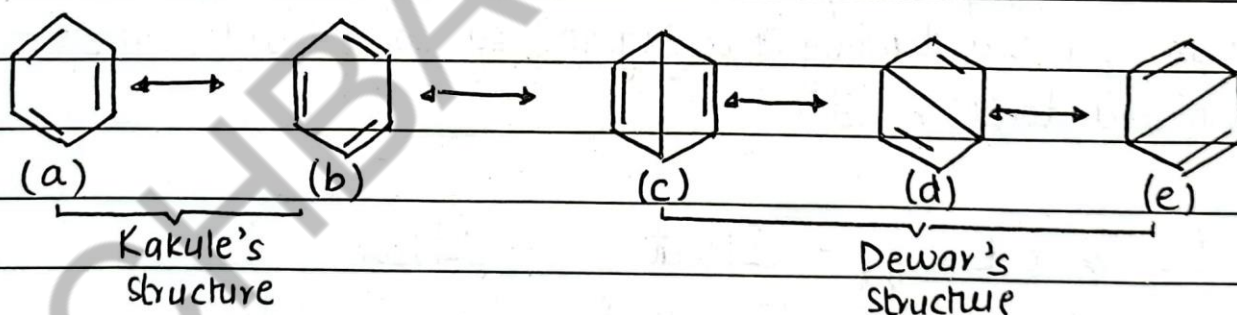
resonance

"The possibility of different pairing schemes of valence e^- of an atom within the molecule."

"The arranged structures are Resonance or Canonical structures."

resonance $\propto$ stability
structure

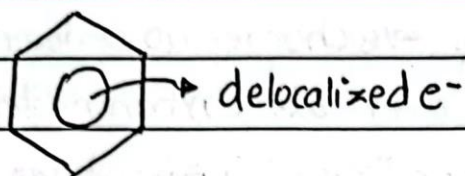
Structure



• Kakule's structure = stable = a, b. (80%)

• Dewar's structure = unstable = c, d, e. (20%)

↳ becoz the difference in bond length makes them unstable & thermally unstable.



▲ Robinson's structure

why benzene is stable?

- delocalized π bond
- due to resonance structure
- due to high resonance energy (152 kJ/mole).

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

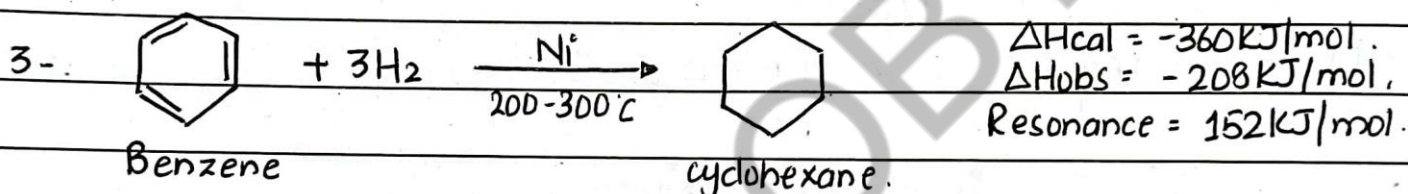
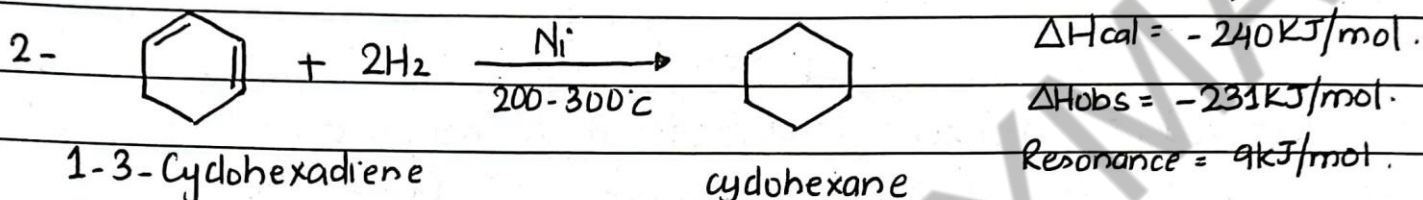
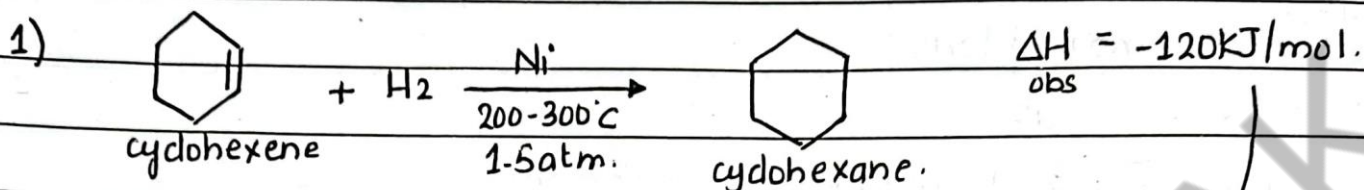
Resonance Energy

- Decrease in energy due to resonance is called Resonance Energy.
- Difference between heat of hydrogenation of calculated and heat of hydrogenation of observed is Resonance energy.
- This refers to conjugated system.
- measure of extra stability of conjugated sys compared to corresponding no. of isolated double bond.

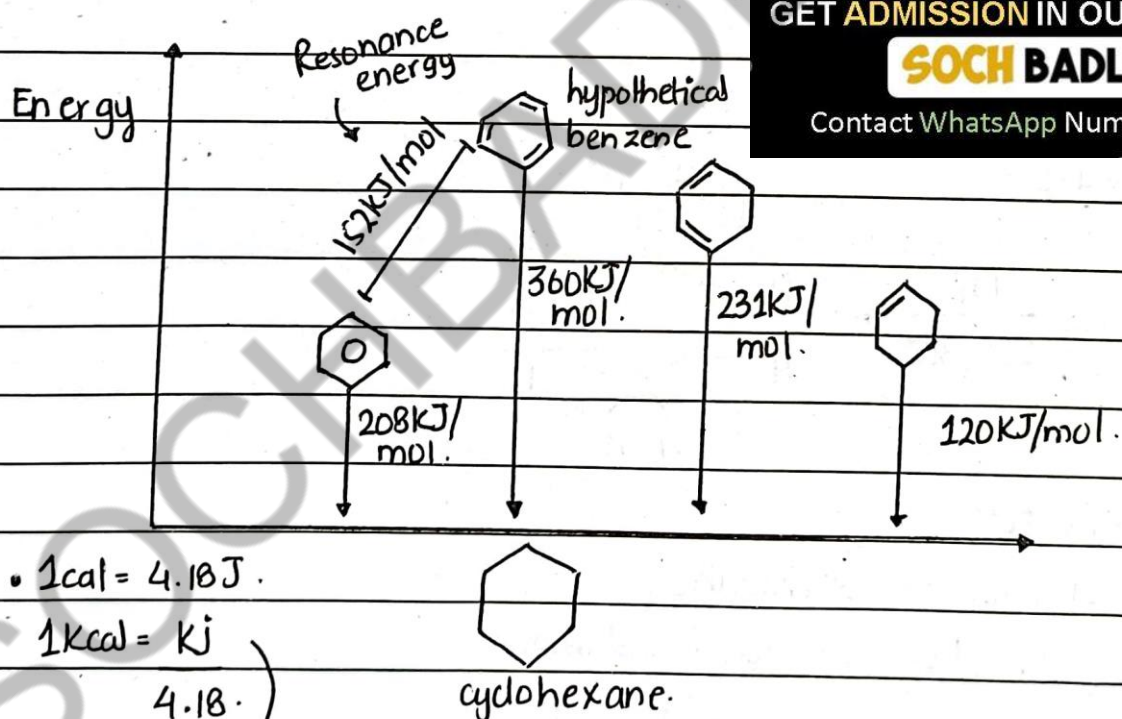
$$\text{Resonance Energy} = \Delta \text{Heat}_{(\text{Theoretical})} - \Delta \text{Heat}_{(\text{experimental})}$$

Resonance Energy $\propto$ Stability

reaction



Group h



• $1 \text{ cal} = 4.18 \text{ J.}$

$1 \text{ kcal} = \text{KJ}$
 $4.18 \cdot$
 kcal/mol.

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353



- High Resonance energy of benzene as compared to all is high so it's more stable.

Benzene > 1,3-cyclohexadiene > cyclohexene

Reaction

more stable.

addition

- P-delocalized e^- of benzene, and arenes make them nucleophiles.
- It's more likely to undergo substitution rxn than addition.
- This destroys aromatic system.
- Addition rxn requires more vigorous conditions.

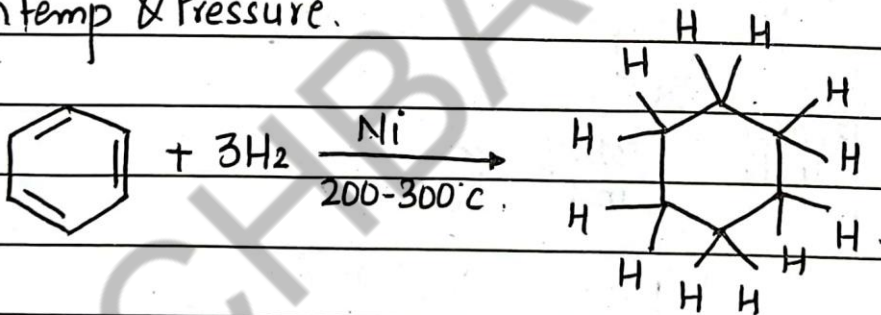
Catalytic hydrogenation

- Ni $\rightarrow$ 200-300°C.
- Pt/Pd $\rightarrow$ 25°C.
- Raney Nickel = 100°C.
- High temp & Pressure.

GET ADMISSION IN OUR ONLINE INSTITUTE

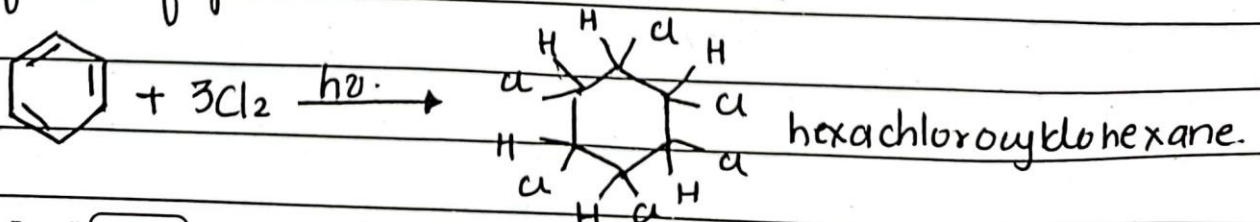
SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

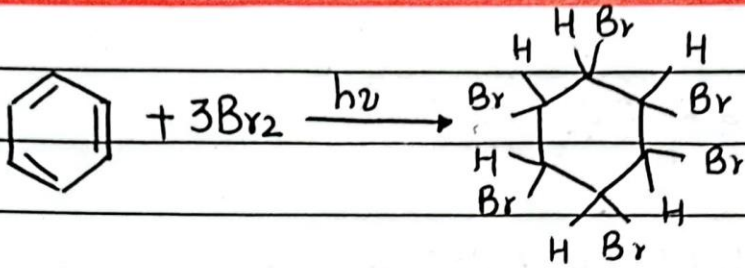


halogenation

- Add 3 molecule of Bromine & chlorine.
- Add influence of light, become saturated more.



Date: _____



GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

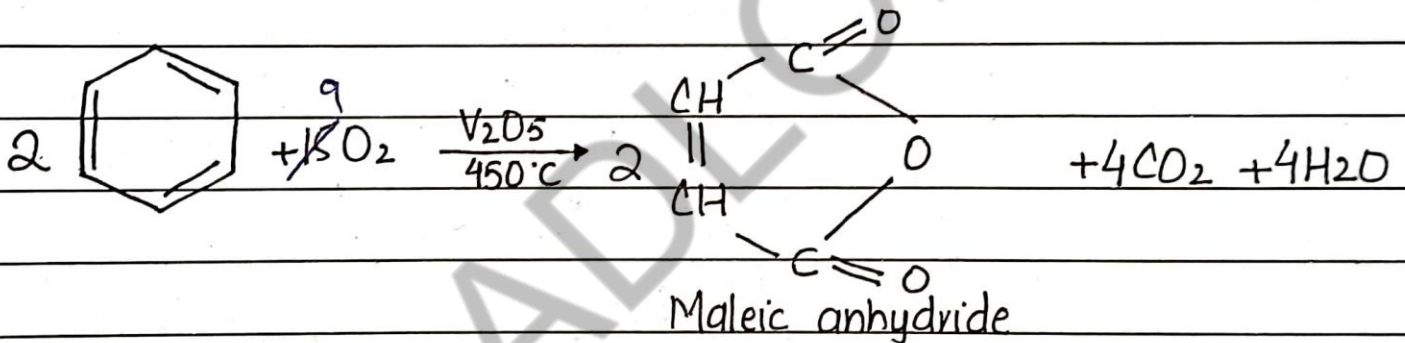
Contact WhatsApp Number: +92 331 5014353

• hexabromocyclohexane.

Oxidation Rxn

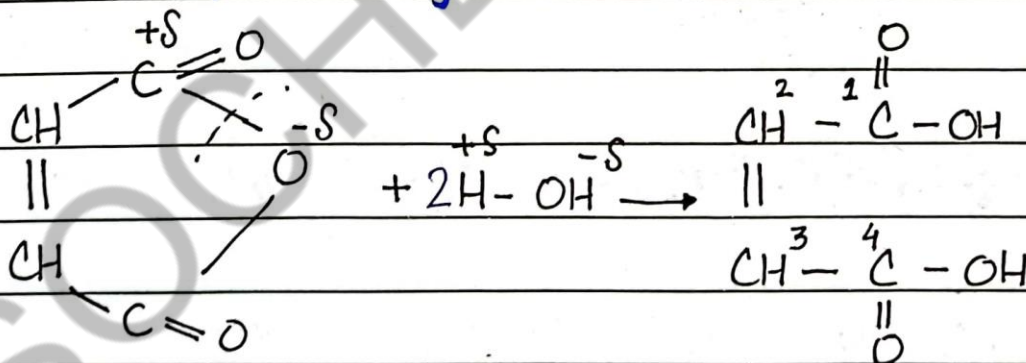
• Benzene can't be oxidized with KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ due to its very stable structure.

• For Oxidation, we need $450^\circ\text{C} + \text{O}_2 + \text{V}_2\text{O}_5$.



ALD:

Convert Maleic anhydride to Maleic acid



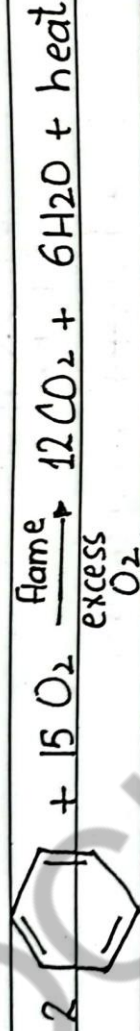
Maleic acid

2-butene-1,4-dioic acid

Date: _____

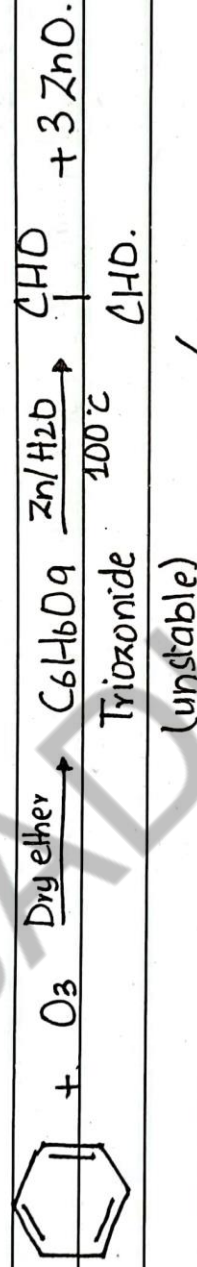
2. Combustion

- Burning of benzene in presence of O_2 .



3. Ozonolysis

- produce glyoxal through trioxonide as intermediate.

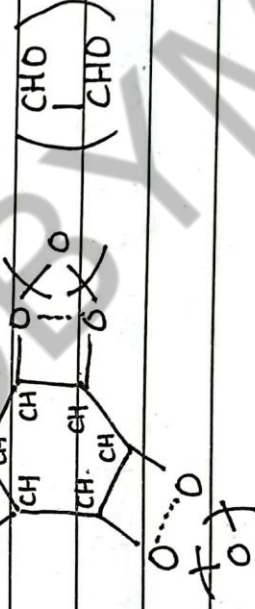


GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Produce by trioxonide



4. Oxidation of side rxn or identification test for alkyl benzene

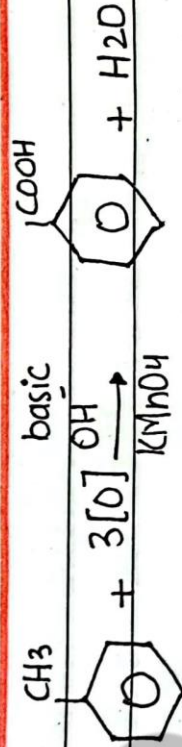
- Benzene it self does not react with KMnO_4 or $\text{K}_2\text{Cr}_2\text{O}_7$.
- However, alkyl group present on benzene is oxidized to COOH .

GET ADMISSION IN OUR ONLINE INSTITUTE

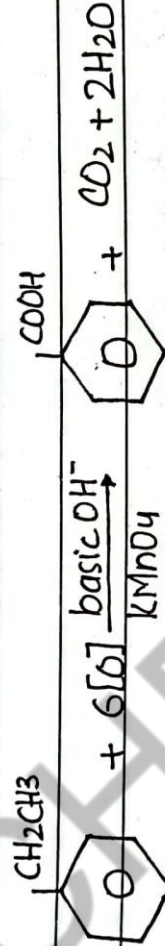
SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

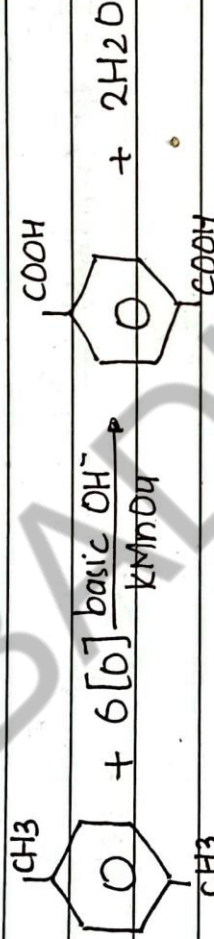
Date



toluene



ethyl benzene



p-xylene

Terephthalic acid

benzene-1,4-dioic acid

Substitution rxn

- for substitution rxn, we always need an electrophile.
- But the delocalized π e⁻ are so stable that they don't readily undergo rxn.
- Rather a weak electrophile won't work.
- We require a powerful electrophile for successful attack to penetrate & continuous sheath of e⁻ cloud.
- Substitution is preferred over substitution to preserve stable aromatic character.

Date: _____

General rxn

E^+ = electrophile

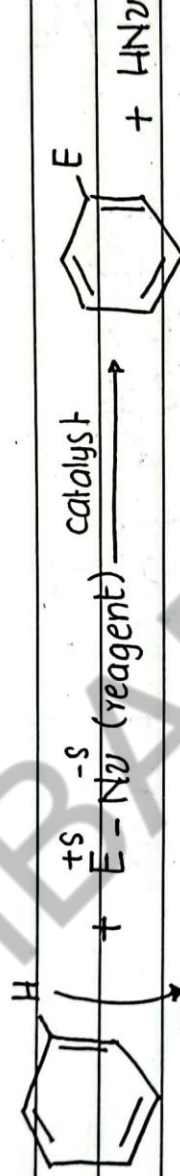


GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

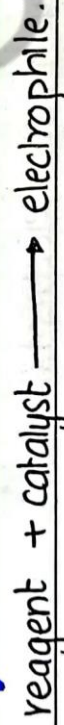
Contact WhatsApp Number: +92 331 5014353

Should be strong enough to act up resonance e^- .

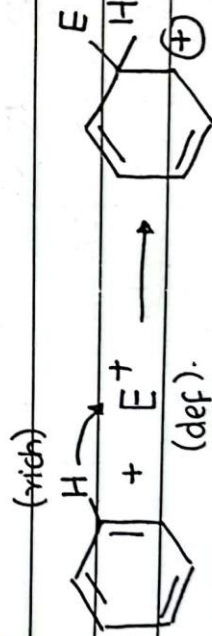


mechanism / Stereochemical evidence

Step 1: formation of electrophile

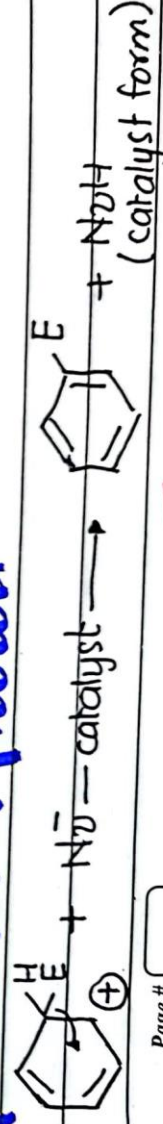


Step 2: attack of electrophile / phenonium ion



Phenonium / Arrhenium ion.

Step 3: loss of proton



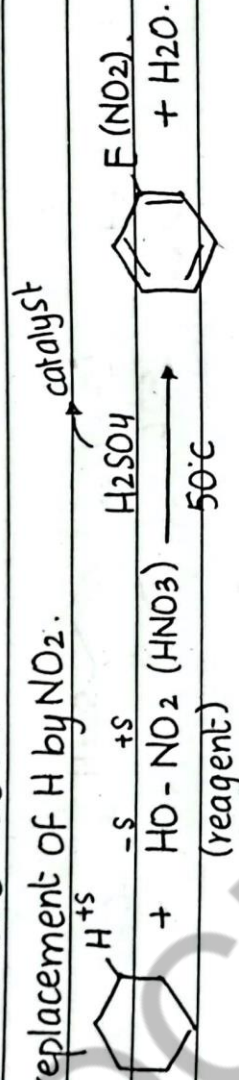
Page #

Teacher's Signature: _____

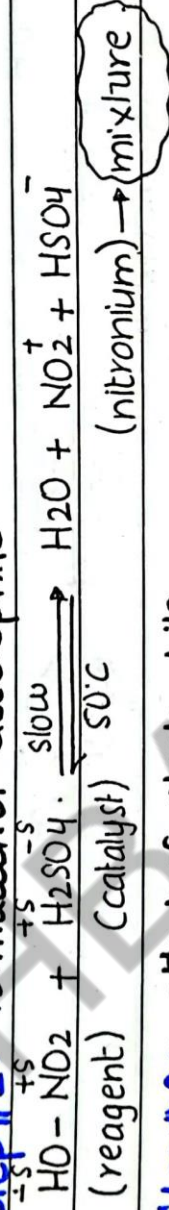
Date: _____

(1) Nitration

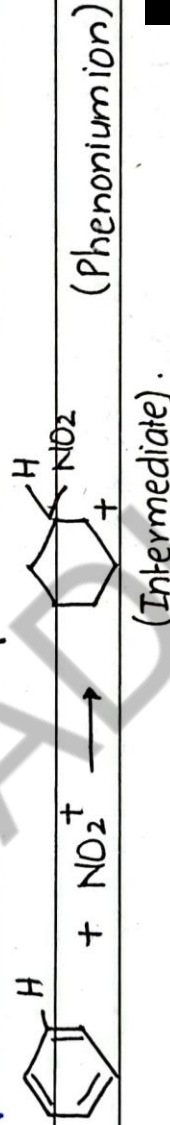
- replacement of H by NO_2 .



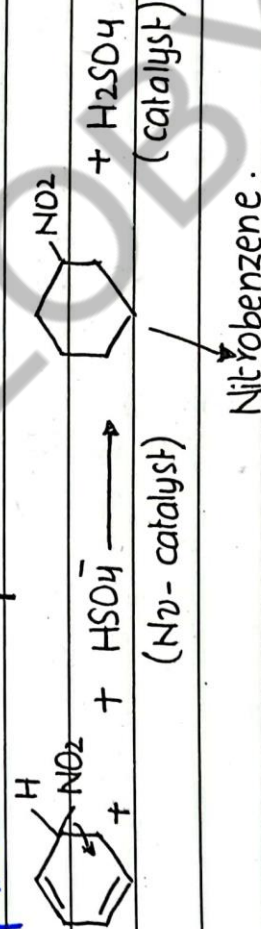
Step #1: formation of electrophile



Step #2: attack of electrophile

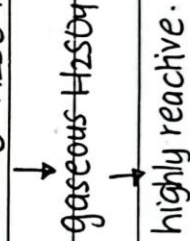


Step #3: Loss of proton



(2) Sulphenation

- Sulphonic acid group added
- Benzene is heating with fume H_2SO_4 or conc. of H_2SO_4



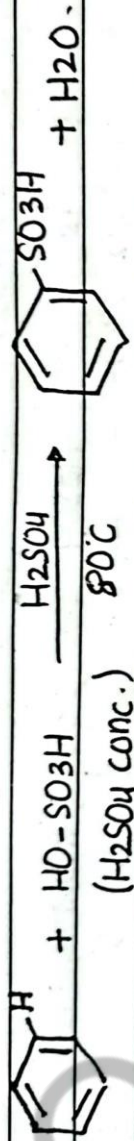
GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

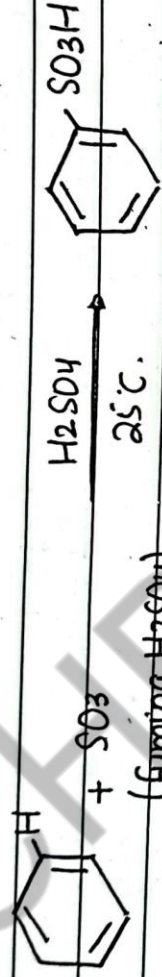
Date: _____

• H_2SO_3 (sulphonic acid).

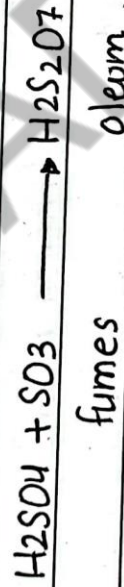


Benzene

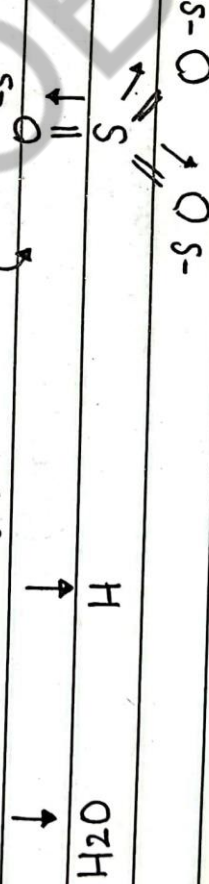
Benzenesulphonic acid



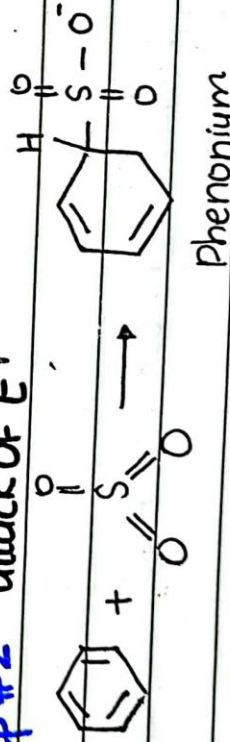
(forming H_2SO_4)
more reactive



Step #1 Formation of SO_3 or E^+

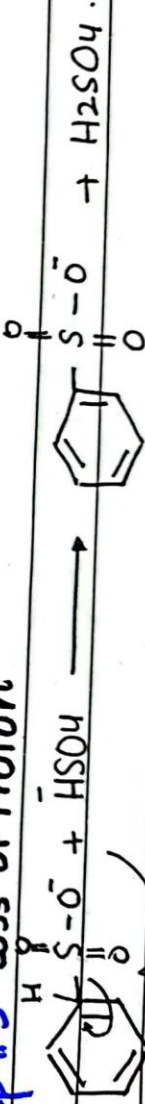


Step #2 attack of E^+



phenonium

Step #3 Loss of Proton



Page #



Teacher's Signature: _____

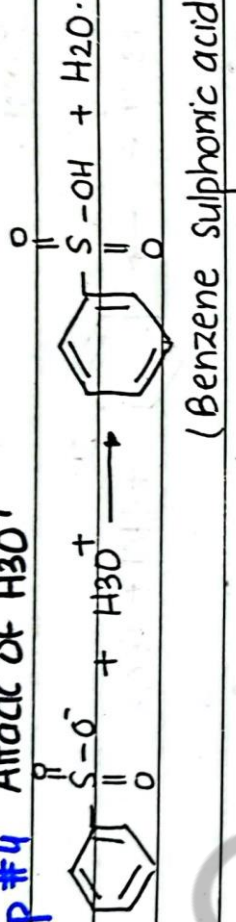
GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

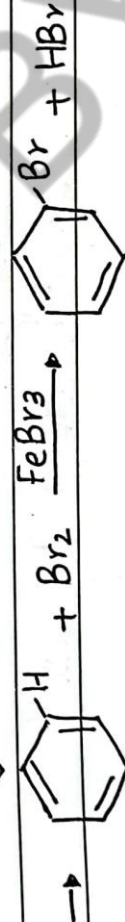
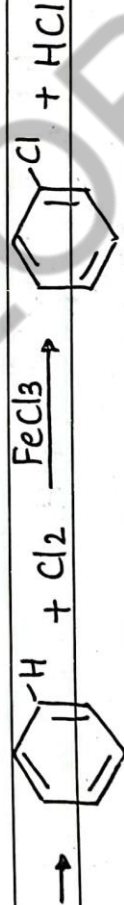
Date: _____

Step #4 Attack of H_3O^+

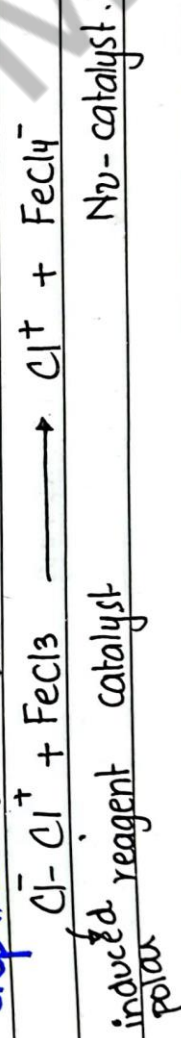


3. halogenation

- The substitution of benzene to halide benzene in presence of Lewis acid catalyst.
- Substitution of halogen to benzene ring.
- Occurs in Presence of halogen (X_2).
- Cl_2 & Br_2 are frequently used than Fl_2 & I_2 due to their rxns.

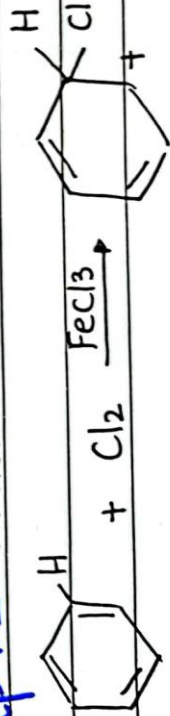


Step #1 formation of E^+



NO^- - catalyst.

Step #2 Attack of E^+



Page #

Teacher's Signature: _____

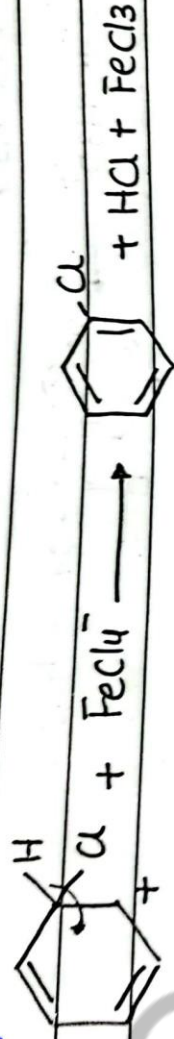
GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

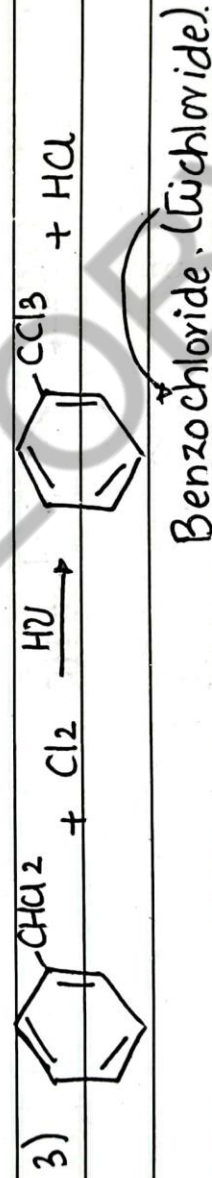
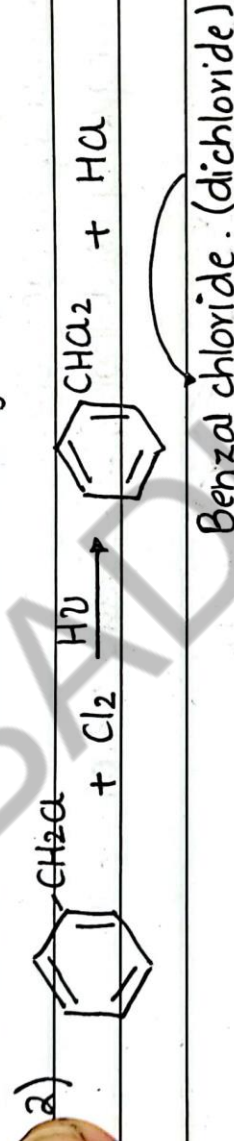
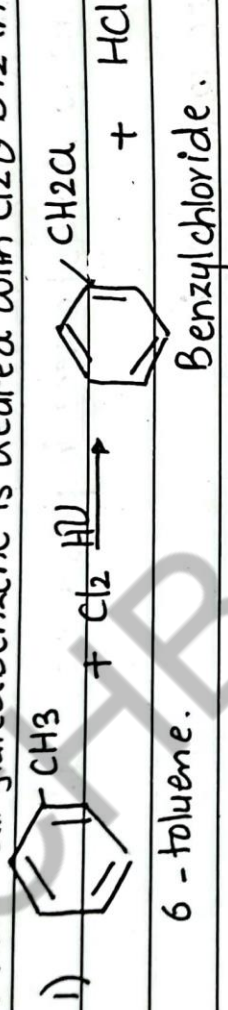
Date: _____

Step # 43 Loss of Proton.



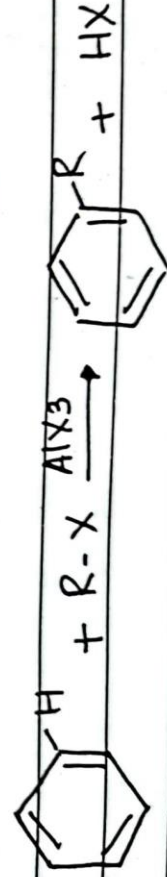
4- halogenation of alkyl side chain

When alkylated benzene is treated with Cl_2 & Br_2 in presence of H_2O .



5) Friedel-Crafts alkylation

- Substitution of alkyl group in the benzene ring.
- In presence of AlCl_3 (Lewis acid catalyst).
- alkylated benzene form.



GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Page #

Teacher's Signature: _____

Date: _____



Step #1 Formation of E⁺

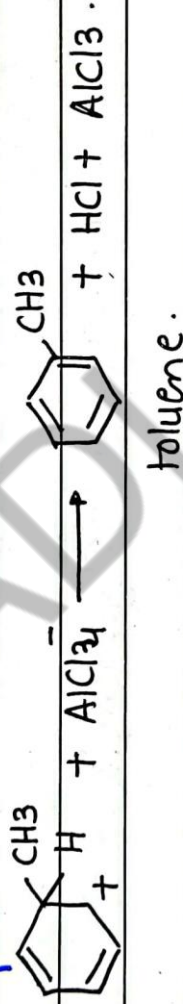


Step #2 attack of E⁺



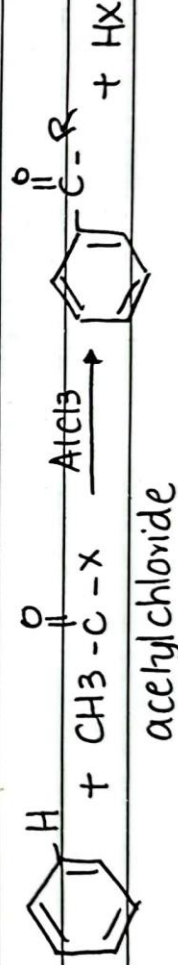
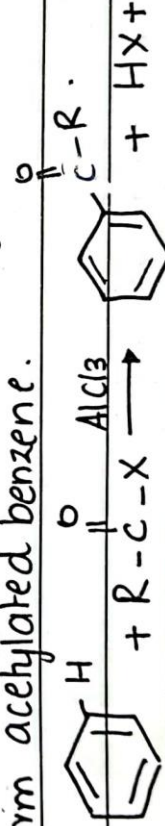
Phenonium ion

Step #3 Loss of H⁺



6- Friedel-Craft acylation

- The substitution of acyl group (RCO-) to benzene ring.
- In presence of Lewis acid catalyst AlCl_3 .
- form acetylated benzene.



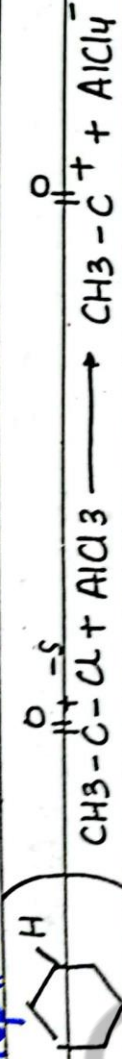
GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

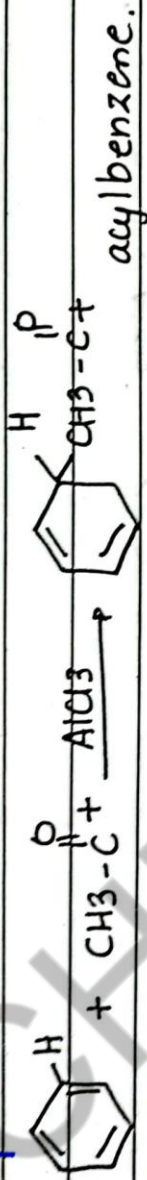
Contact WhatsApp Number: +92 331 5014353

Date: _____

Step #1 Formation of E^+

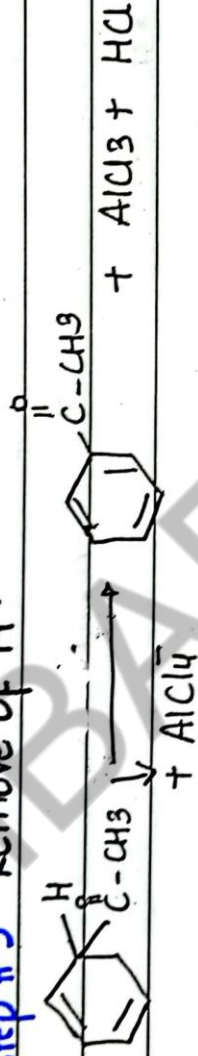


Step #2 Attack of E^+



acylbenzene.

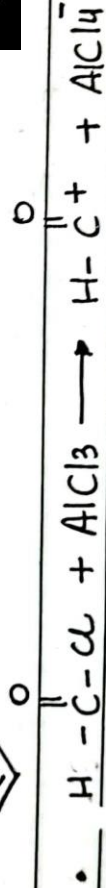
Step #3 Remove of H^+



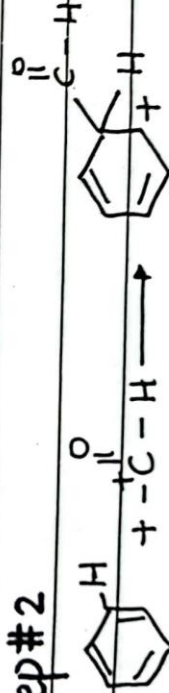
acetophenone (methylphenyl ketone)

Convert formaldehyde to formaldehyde? or Benzene to formaldehyde?

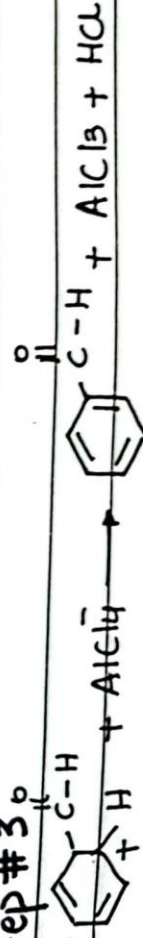
Step #1



Step #2



Step #3



GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Page #

Teacher's Signature: _____

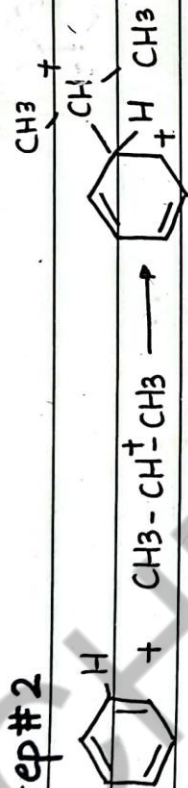
Date: _____

Convert benzene to Cumene?

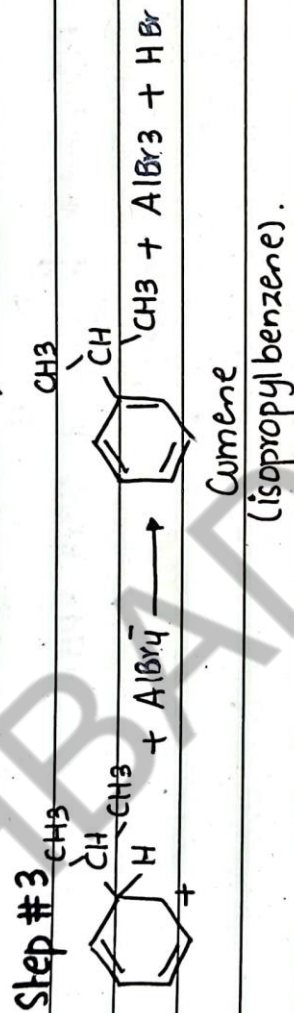
Step #1



Step #2



Step #3

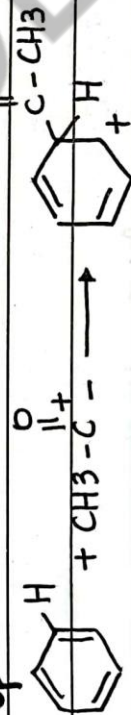


Convert Benzene to acetophenone?

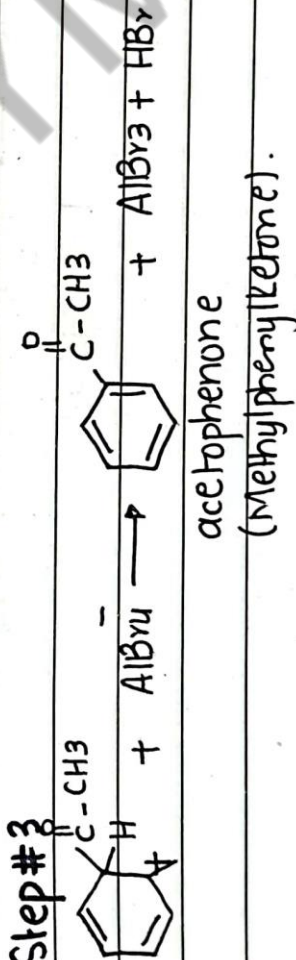
Step #1



Step #2



Step #3



Page #

Teacher's Signature: _____

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

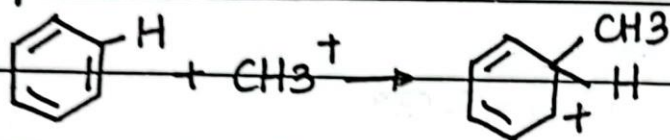
Contact WhatsApp Number: +92 331 5014353

Convert benzene to toluene?

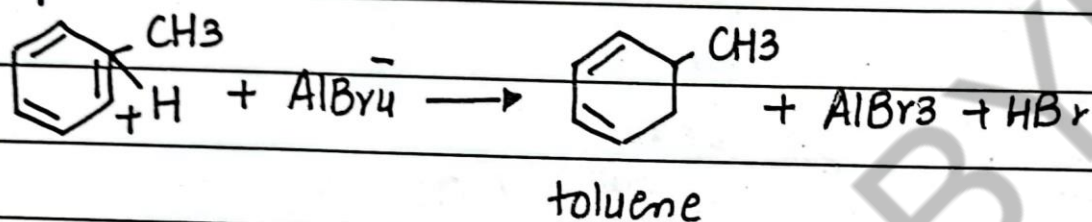
Step #1



Step #2

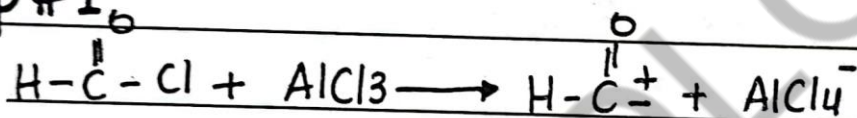


Step #3

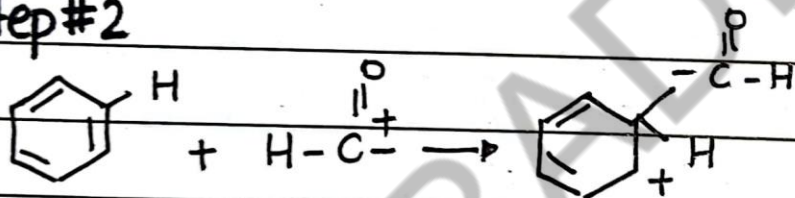


Convert benzene to benzaldehyde?

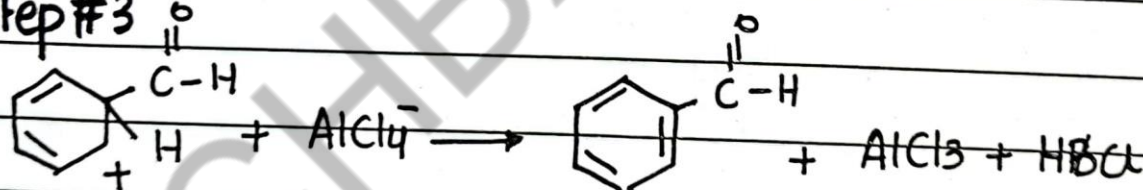
Step #1



Step #2



Step #3



Benzaldehyde.

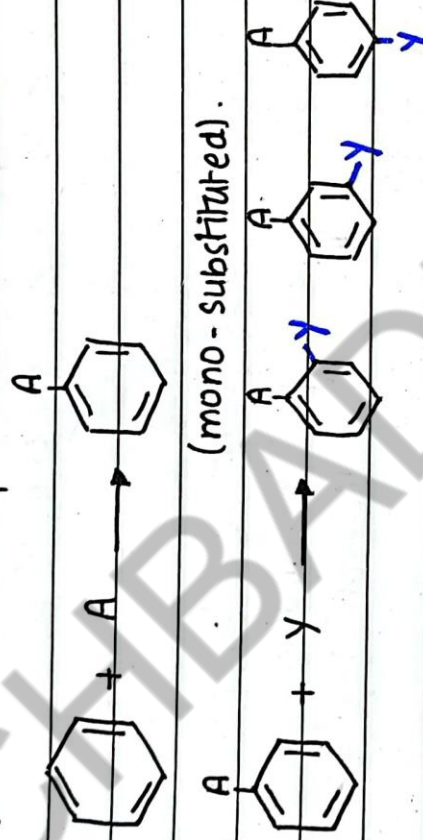
GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Date: 29-08-24

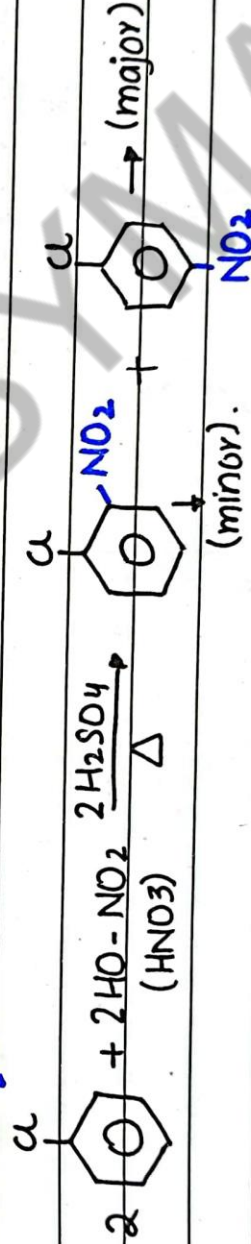
It is an effect that refers to how substituents on a benzene ring influence the position of an electrophilic substitution reaction.



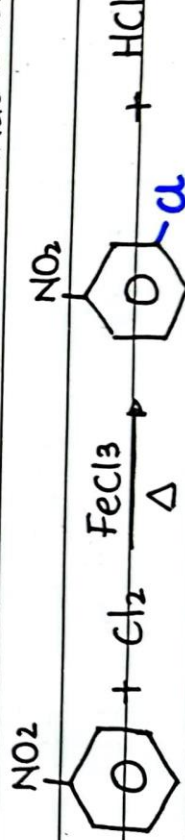
ortho 'o' meta 'm' para 'p'
(1,2) (1,3) (1,4).

→ On a statistical basis, the proportion of disubstituted products would be:
 $O = 40\%$, $m = 20\%$, $p = 40\%$.

example



→ The nitration of chlorobenzene shows that it follows o-p disubstitution.



→ The chlorination of nitrobenzene shows it follows m-substitution.

Page #

Teacher's Signature: _____

ner

→ These all example shows that mono-substituted grp will decide position of 2nd grp.

1- Ortho-Para directing group

The group which direct incoming groups to ortho-para position.

- These group are e^- donating to benzene making o&p position rich.

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

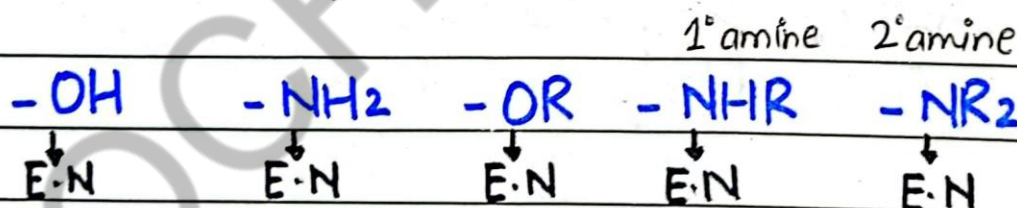
→ When any group got attached to 1st position, its lone pair will be transported to benzene and roaming all around ortho & para position due to delocalisation that's why electrophile gets attached to these e^- rich position.

rules

- When group is made up of only 1 atom it will be always ortho & para directing group.

→ F, Cl, Br, I

- When directly bonded atom has more E.N then 2nd group is also ortho & para.



- All groups are activators except halogen that is are partial activators due to their high electronegativity. that they do not want their all e^- to be lost or donated.

order

F, Cl, Br, I, -OH, -NH₂, -OR, -NHR, -NR₂, -R.

partial
activators

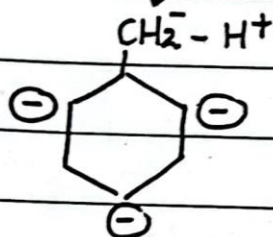
complete activators.

Example

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

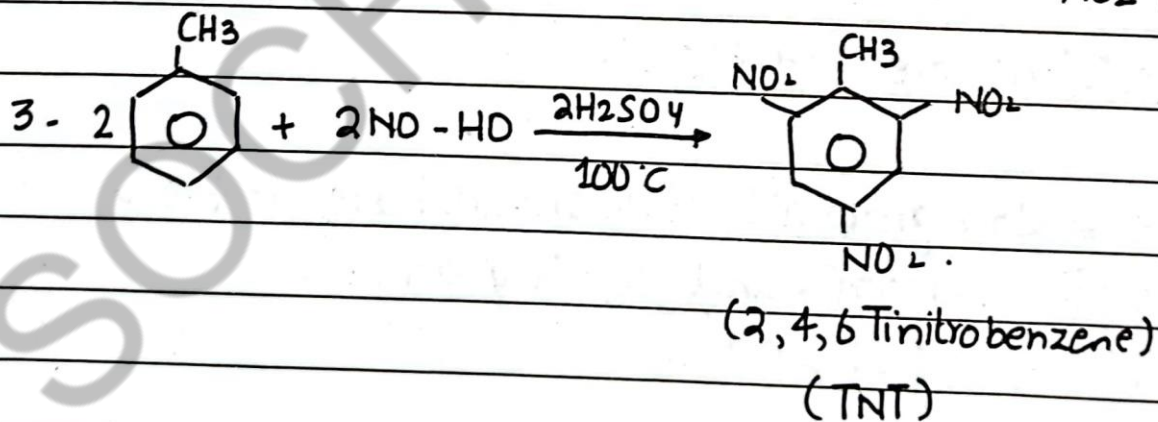
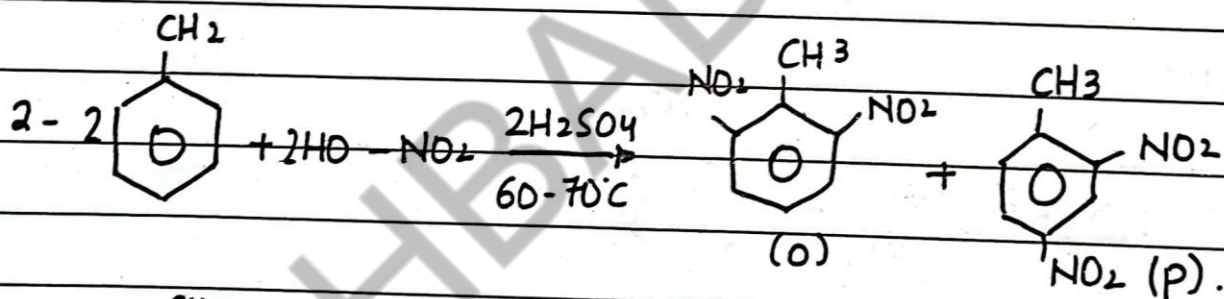
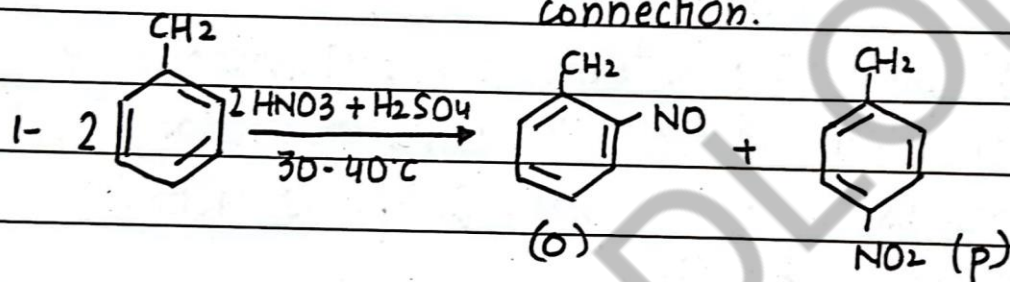
Contact WhatsApp Number: +92 331 5014353



hyperconjugation

S-orbital - p-orbital
e⁻ π bond

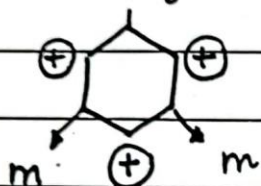
connection.



2. Meta-directing groups

Groups which direct incoming groups to meta position is called meta-directing groups.

- These are electron withdrawing group, they attract e^- from benzene ring & benzene ring became e^- deficient.



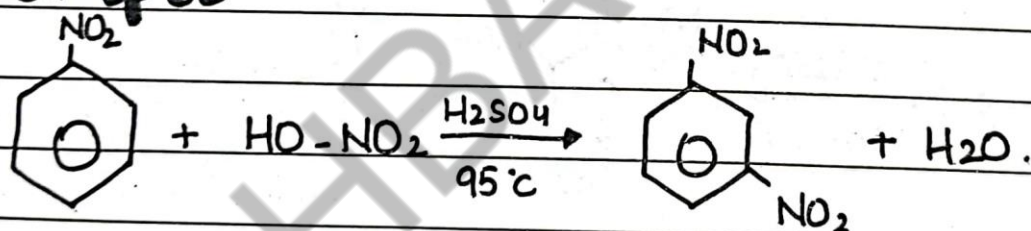
GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

- e^- deficiency occurs at ortho & para position, so only left place is meta, where electrophile attack.
- They either attract e^- , producing a temporary positive charge at ortho & para position, thus electrophile can't attract at these position due to repulsion. So, only place left is meta.
- They decrease the Benzene Activity.

example



→ Ortho-para positions are e^- deficient.

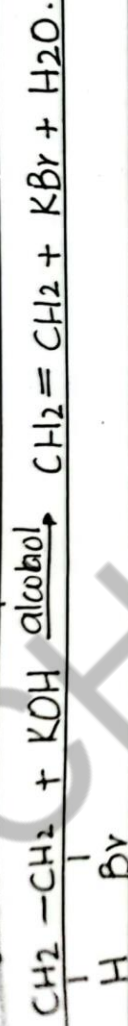
rule

- 2 or more than 2 atom group atleast it should have double & triple bond except ammonia and tertiary amine.

$C \equiv N$, NO_2 , $-SO_3H$, $COOH$, CHO , COR_2 , $COOR$ (ester)
 NR_3 , NH_3

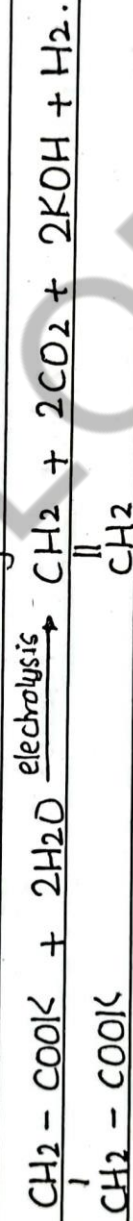
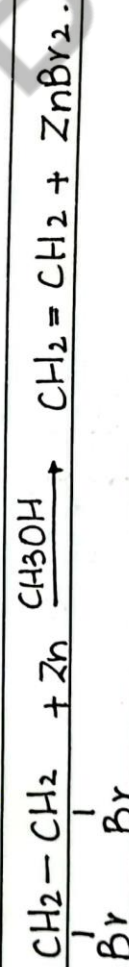
an alkyl halide:

Heating of bromoethane from alcoholic KOH.

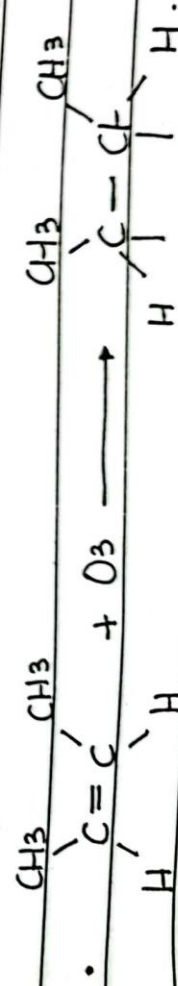
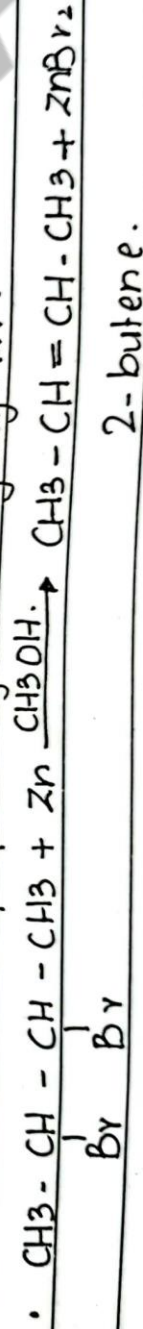
alcohols:electrolysis of salt:

When aqueous sol of potassium salt of succinic acid is electrolyzed.

Reaction is called Kolbe's electrolysis.

Vicinal-dihalides:1,2-Bromoethane

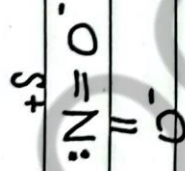
3- First we need to prepare any alkene by any rxn.



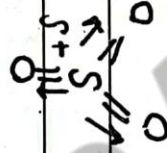
cis-2-butene monozide.

Date: _____

- Directly bonded atom has less electronegativity than second and 3rd atom bonded to it.

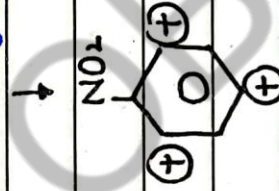
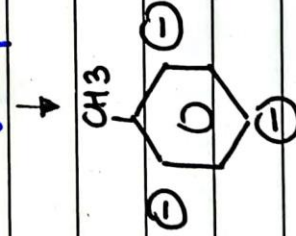


- If central atom is electron deficient, it will also act as meta directing group.



- all meta directing grps are complete deactivators.

ortho-Para directing > Benzene > meta-directing group

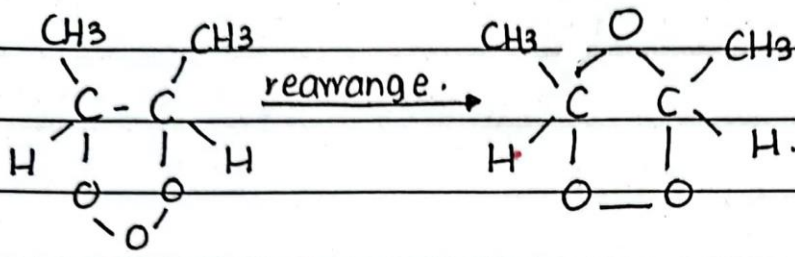


GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Date: _____



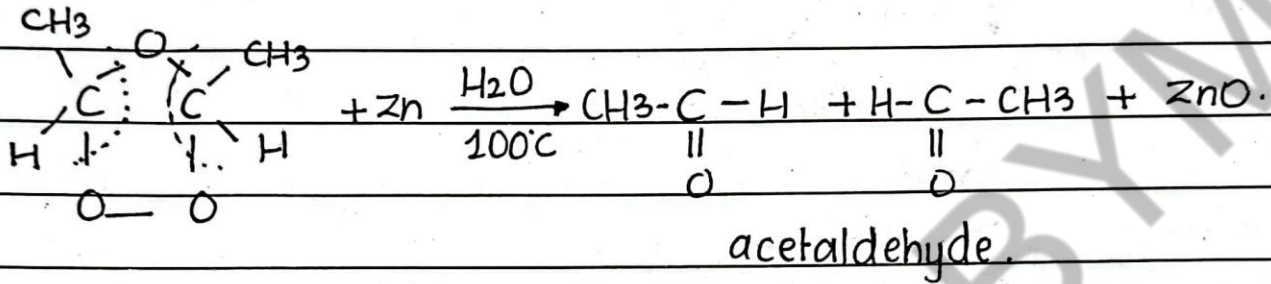
molezonide

ozonide.

GET ADMISSION IN OUR ONLINE INSTITUTE

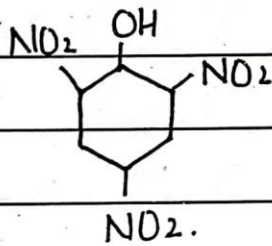
SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

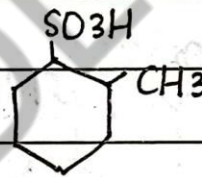


Question 7

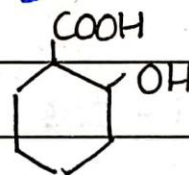
2,4,6-Trinitrophenol



2-methylbenzenesulphonic acid



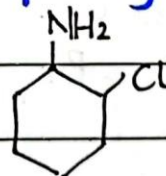
2-hydroxybenzoic acid



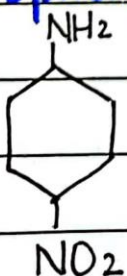
1,4-dichlorobenzene



2-chlorophenylamine



4-nitrophenylamine



Date: _____

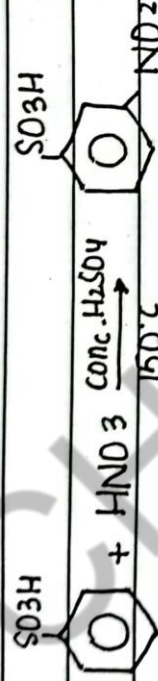
8



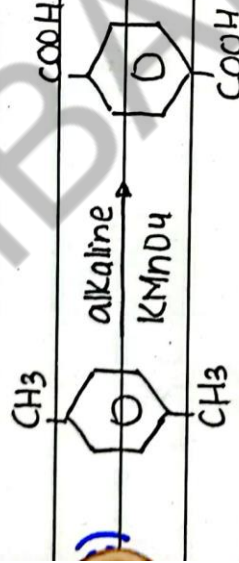
toluene

1-Methylcyclohexane

b)

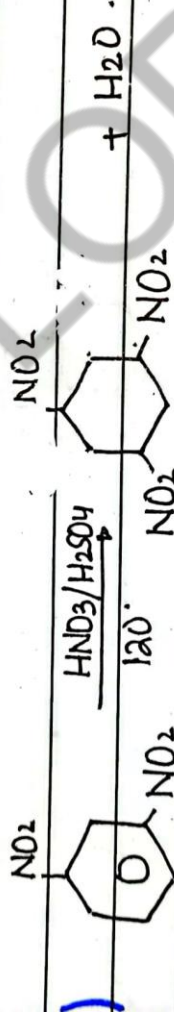


3-Nitrobenzenesulphonic acid

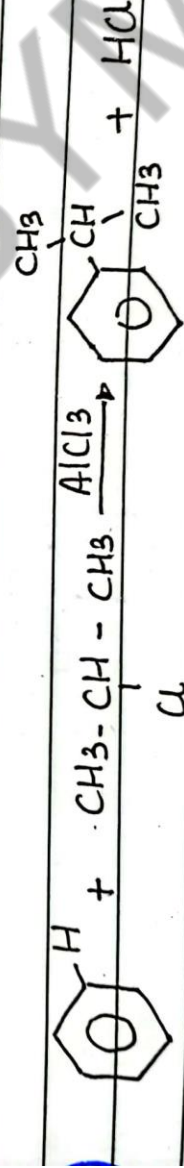


p-xylene

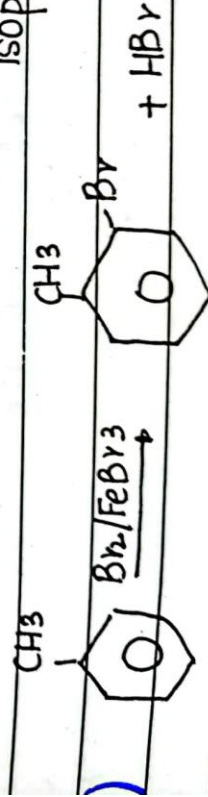
terephthalic acid



1,3,5-Trinitrobenzene



isopropylbenzene / Cumene



toluene

o-bromotoluene

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

9-

- a) 1, 3- Dibromobenzene
- b) 2- Ethyl toluene , ~~1, 3~~-Dimethylbenzene.
- c) 1, 2, 3- Trimethylbenzene.
- d) 5- Bromo - 3- Chloronitrobenzene.
- e) 5-nitrobenzoic acid
- f) 3- chlorophenol.

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

1- Why organic compound are diverse in nature?

Organic compounds are diverse in nature because of the ability of carbon atom to make stable bonds, Long chains, rings and complex structures due to their catenation property with single, double & triple bonds.

2- How many carbon can combine (max?)

There's no limit. Their catenation property makes them possible to form longest possible chain.

3- Is saturated comp more stable than unsaturated?

Single bond is present in saturated compounds which contains single electrons that's are very strong to be broken down whereas unsaturated comp contains σ & π e^- leading to less stability.

Why benzene is aromatic?

Huckle Rule:-

$$4 \cdot + 2 = 6e^-$$

If $n =$ whole digit, then comp is aromatic & obeys rule.

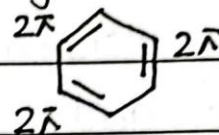
$$4 \cdot + 2 = 6e^-$$

$$4n = 6 - 2$$

$$4n = 4$$

$$n = 1.$$

thus, it's an aromatic comp.



GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Why straight chains have higher boiling point?

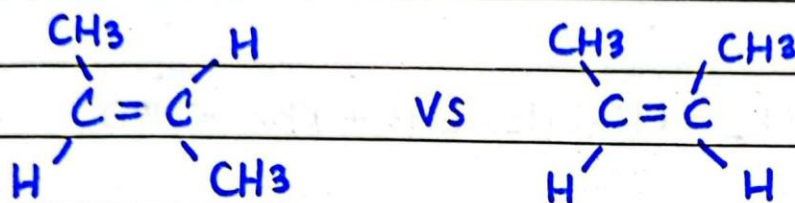
Straight chains have higher boiling points as they can pack closely together leading to strong inter-molecular forces compared to branched chains. This requires more energy to break interaction & transition among substances.

Why chlorine can't be reacted in presence of diffused light but bromine can do so in direct and diffused light?

Chlorine requires less energy due to dissociate into reactive chlorine radicals compared to bromine which means it can readily under broader range of light conditions. On the other hand, bromine requires more energy to initiate the rxn.

Why trans are more stable than cis?

It's because 2 bulky groups lie on an opposite side of double bond so steric repulsion is less (in trans) & dipole moment is zero than cis.



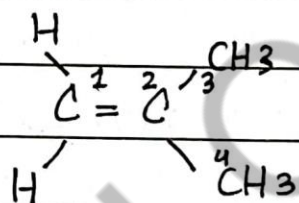
Why 1-butene does not form cis and trans isomerism?

1-butene :-

It does not form cis and

trans because double

bond is present between first



and second carbon, each carbon atom involved must have 2 different groups attached whereas 1-butene 1st carbon is to 2 same H-groups.

GET ADMISSION IN OUR ONLINE INSTITUTE

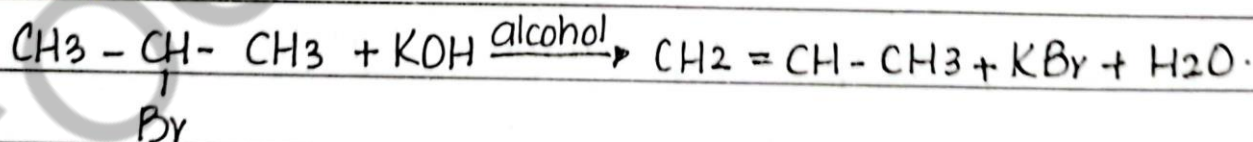
SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

How will you prepare alkene from dehydrohalogenation?

We ~~know~~ remove the halogen group from an alkyl halide :-

example:



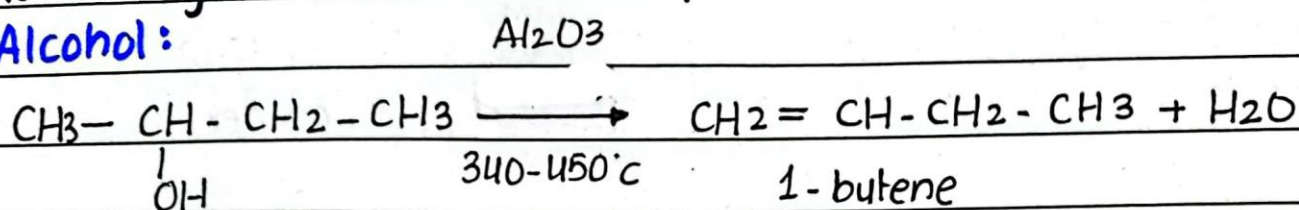
Write 2 methods for prep of alkene.

We can prepare alkenes by :-

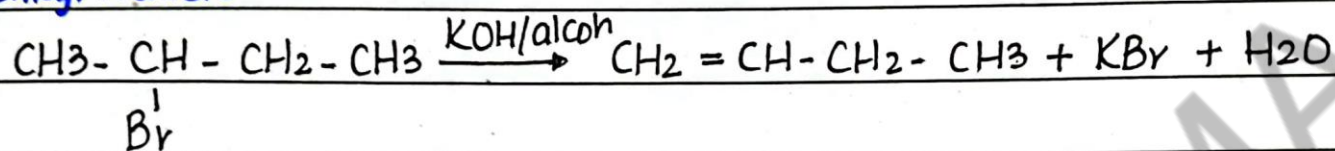
- dehydrohalogenation of alkyl halides
- Dehydration of alcohol.

How will you obtain 1-butene from - alcohol & - alkyl halide?

Alcohol:



alkyl halide:

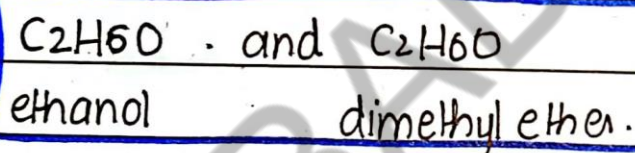


Difference b/w Position and functional group isomerism?

In position isomerism, there's the same functional group present by their position or arrangement is diff.



Whereas in functional group isomerism, there's no concerned with position but there's change in isomerism.



GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

How is halogenation a test for Saturation?

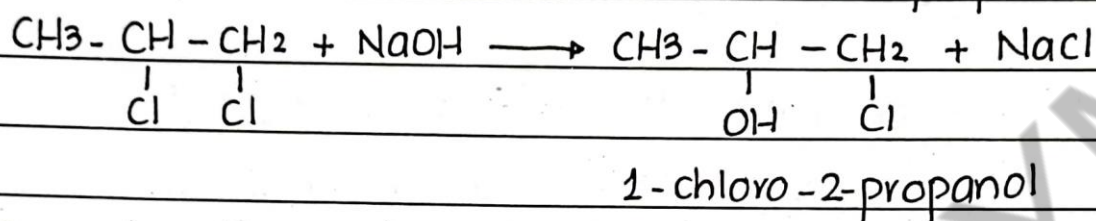
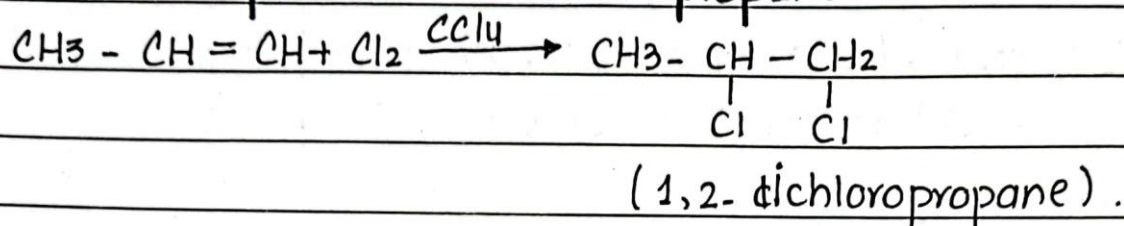
Yes, it's test for saturation.

→ **Positive:** The color of halogen solution (orange, red) disappears in reaction with unsaturated comp.

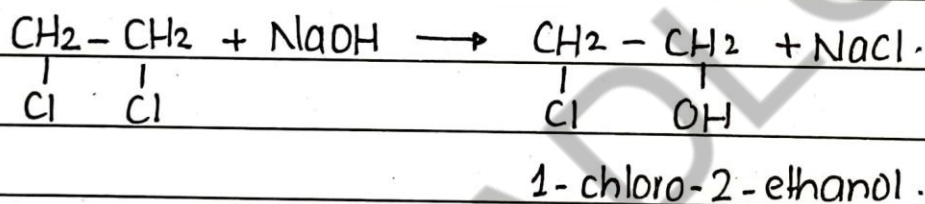
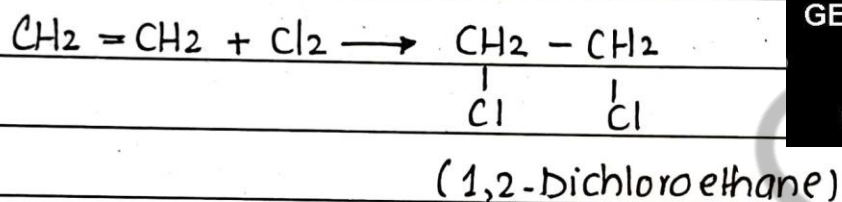
→ **Negative:** In reaction, with saturated comp It does not change color because there's no reaction.

Date: _____

Convert Propene to 1-chloro-2-propanol.



Convert 2 Ethene to 2 chloroethanol.

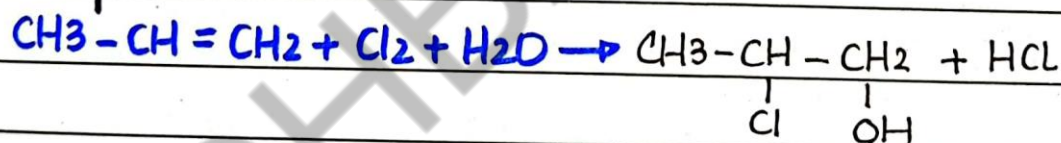


GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

Complete the rxn:



Trick for Ozonolysis mcq

- Alkene in which = bond carbon has branch, will surely form branch.
- Alkene in which = double bonded carbon has no branch will surely form aldehyde.

1-butyne is more acidic than 2-butyne?

The position of triple bond - triple bond is present at terminal position in 1-butyne thus it's terminal alkyne while 2-butyne is an internal alkyne.

GET ADMISSION IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353

How we can distinguish between ethene and ethyne sol.

Ethene does not react with cuprous chloride and no precipitate is formed. On the other hand, ethyne reacts with cuprous chloride to form red precipitate.

How we can distinguish between 1-pentyne and 2-pentyne.

1-pentyne has a terminal alkyne group which reacts with ammoniacal cuprous chloride & forms red precipitate. 2-pentyne does not react with cuprous chloride, they're no precipitate forms.

Why alkanes are less reactive?

Alkanes are less reactive because they have strong carbon to carbon and carbon & hydrogen. Single bonds are relatively stable and non-polar.

Why alkanes are called Paraffins?

They are called Paraffins because the name **Parum affins** - Latin word meaning **little affinity**. This term reflects their low reactivity.



Why alkenes are called olefins?

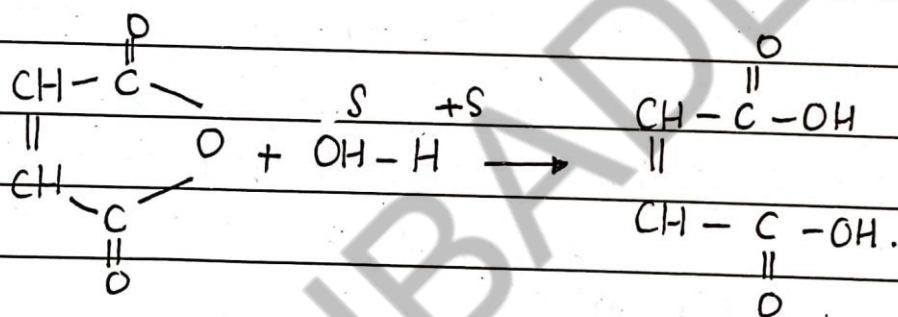
The alkenes are called so because lower members of series react with chlorine to form oily product. The term **olefins** was derived from **Original French 'Gaz oléfiant'** which means **oil forming gas**.

Why Benzene is stable?

Benzene is a stable compound due to :-

- Delocalization of π bonds
- 5 Resonance structure.
- high resonance energy (152 kJ/mol)

Write formula of Maleic acid.



Why there's a need of strong electrophile.

A strong electrophile is needed because benzene is highly stable due to its aromaticity to disrupt this stability and allow alkyl group to attach the alkyl halide must be converted into a stronger electrophile (a carbocation). This strong electrophile then reacts with benzene ring allowing substitution.

Difference b/w ortho - para & meta groups.

ortho - para groups

meta groups

definition

The groups which direct the incoming electrophile towards ortho & para positions.

The groups which direct the incoming electrophile towards meta positions.

activity

Makes activity greater.

Makes activity reduced.

specie

electron - rich specie.

electron - deficient specie.

atoms

The electrophile have 1 atom.

The electrophile have 2 or more atoms.

E.N.

Directly bonded atom have more E.N.

Directly bonded atom have less E.N.

Reactions

Activators rxn.

Deactivators rxn.

example

OH, NH₂, OR, NHR, NR₂

CN, NO₂, NR₃, NH₃,
SO₃H etc.

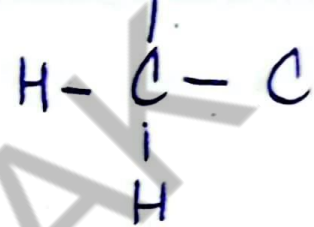
GET **ADMISSION** IN OUR ONLINE INSTITUTE

SOCH BADLO BY MAK

Contact WhatsApp Number: +92 331 5014353



Exercise



1: Select the right answer from the choices given with each question.

- i. The molecule of ethane possesses which hybridization;
✓ a. sp^3 b. sp^2 c. sp d. sp^2d
- ii. The sp^2 hybrid orbitals are oriented in space at one angle;
a. 109.5° b. 180° c. 100° d. 120° ✓
- iii. The geometry of acetylene is,
a. angular b. bent c. trigonal d. linear ✓
- iv. Which reaction is used as test for the presence of alkene;
✓ a. reaction of cold diluted alkaline KMnO_4 b. Combustion
c. Polymerization d. Catalytic hydrogenation
- v. The general formula of alkane is;
✓ a. $\text{C}_n\text{H}_{2n+2}$ b. C_nH_n c. C_nH_{2n} d. $\text{C}_n\text{H}_{2n-2}$
- vi. Sodalime is;
a. NaOH b. KOH c. Mixture of Na and Ca hydroxide d. CaO and NaOH ✓
- vii. The marsh gas is
a. Ethane ✓ b. Methane c. Propane d. Butane

- viii. Acidic hydrogen is present in
a. Acetylene ✓ b. Ethane c. Benzene d. Ethene
- ix. The electrophile in aromatic sulphonation is;
a. H_2SO_4 b. HSO_4^- c. SO_3 ✓ d. SO_4^{2-}
- x. Catalyst used for Friedal Craft's reaction is;
a. HNO_3 b. MgCl_2 c. BeCl_2 ✓ d. FeCl_3
- xi. Benzene can not undergo
a. Elimination ✓ b. Substitution c. Oxidation d. Addition
- xii. Shape of benzene molecule is
a. Pyramidal b. Liner planar c. Trigonal ✓ d. Hexagonal
- xiii. The isomers of a substance must have
(a) same chemical properties ✓ (b) same molecular weight
(c) same structural formula (d) same functional groups
- xiv. Ethanol and dimethyl ether are best considered:
(a) structural isomers ✓ (b) stereoisomers (c) enantiomers (d) diastereomers
- xv. Alkenes show geometrical isomers due to
(a) asymmetry (b) rotation around a single bond
(c) resonance (d) restricted rotation around a double bond ✓
- xvi. Geometrical isomerism is shown by
(a) lactic acid ✓ (b) maleic acid (c) 1-butene (d) 1,1-dichloroethylene
 $\text{C} \equiv \text{C}$
- xvii. A molecule is said to be chiral
(a) if it contains plane of symmetry (b) it contains center of symmetry
(c) if it cannot be superimposed on its mirror image ✓
(d) if it can be superimposed on its mirror image
- xviii. Which of the statements is false regarding chiral compounds
(a) rotate the plane of polarized light (b) have cis and trans isomers ✓
(c) exist as enantiomers (d) can be detected with a polarimeter
- xix. An optically active compound
(a) must contain at least four carbons
(b) when in solution rotate the plane of polarized light
(c) must always contain an asymmetric carbon atom ✓
(d) in solution always give a negative reading in polarimeter
- xx. Plane polarized light is affected by
(a) identical molecules (b) all polymers
(c) chiral molecules ✓ (d) all biomolecules
- xxi. It is possible to distinguish between optical isomers
(a) by using chemical tests (b) by mass spectrometry
(c) by IR spectroscopy ✓ (d) by polarimetry ✓

2: Answer the following questions briefly.

1. What is cis-trans isomerism?
2. Why alkanes are relatively chemically inert?
3. Alkenes usually undergo addition reactions while alkanes do not why?

rotate
plane
polarize
light