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STD – XI

VOLUME – I

UNIT – 4

Hydrogen

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UNIT- 4
HYDROGEN

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II. Write brief answer to the following questions:

22. Explain why hydrogen is not placed with the halogen in the periodic table.

i) Hydrogen has similarities with alkali metals as well as the halogens

ii) it is diffi cult to find the right position in the periodic table. However, in most of its compounds hydrogen exists in +1 oxidation state.

iii) Therefore, it is reasonable to place the hydrogen in group1 along with alkali metals as shown in the latest periodic table published by IUPAC.

23. An the cube at 0^oC, is placed in some liquid water at 0^oC, the ice cube sinks - Why ?

The ice cubes only float and not able to sink in the water.

i) If the water is at 0 degree Celsius, There is some change in the ice melts.

ii) The ice melts slow down because of the absorption of the thermal energy.

iii) The ice melts can minimize the temperature of the water by a single degree.

24. Discuss the three types of Covalent hydrides.

They are compounds in which hydrogen is attached to another element by sharing of electrons.

Covalent hydrides are further divided into three categories,viz.,

i) Electron precise (CH_4, C_2H_6, SiH_4, GeH_4),

ii) Electrondeficient (B_2H_6)

iii) Electron-rich hydrides (NH_3, H_2O).

Since most of the covalent hydrides consist of discrete, small molecules that have relatively weak intermolecular forces, they are generally gases or volatile liquids.

25. Predict which of the following hydrides is a gas on a solid (a) HCl (b) NaH. Give your reason.

NaH is a solid as the ions Na^+ and H^- are held together by strong electrostatic forces but it's not so in HCl. therefore HCl is a gas

26. Write the expected formulas for the hydrides of 4th period elements. What is the trend in the formulas? In what way the first two numbers of the series different from the others ?

4th period elements hydrides

1. **MH** - KH (Ionic (Saline) hydrides)
2. **MH_2** - CaH_2 (Ionic (Saline) hydrides)
3. **Metallic (Interstitial) hydrides**

   Most of the hydrides are non-stoichiometric with variable composition (**$TiH_{1.5-1.8}$**)

   3d series elements stoichiometry **MH** (Ti H , VH, NiH) or sometimes **MH_2** - **ZnH_2**
4. **XH_3**, - GaH_3 Ga_2H_6 - Covalent hydride (electron deficient)
5. **XH_4** - GeH_4 EH_4 - GeH_4 - Covalent hydrides (electron precise)
6. **EH_3** - AsH_3 Covalent hydrides (electron-rich hydrides)
7. **H_2E** - H_2Se. selenium hydride, or selane
8. **HX** - HBr
9. **HNgY**, where Ng = noble-gas atom and Y = electronegative fragment HKrCl

27. Write chemical equation for the following reactions.

i) reaction of hydrogen with tungsten (VI) oxide WO_3 on heating.

ii) hydrogen gas and chlorine gas.

i) Powdered tungsten(VI) oxide is heated to temperatures in the range 550 - 850°C in a stream of hydrogen.

$WO_3(s) + 3H_2(g) \longrightarrow W(s) + 3H_2O(g)$

Tungsten(VI) oxide react with hydrogen to produce tungsten(IV) oxide and water. This reaction takes place at a temperature of 570-600°C.

$WO_3 + H_2 \longrightarrow \longrightarrow WO_2 + H_2O$

ii) $H_2 + Cl_2 \longrightarrow 2HCl$

28. Complete the following chemical reactions and classify them in to (a) hydrolysis (b) redox (c) hydration reactions.

1) $KMnO_4 + H_2O_2 \longrightarrow$ **2) $CrCl_3 + H_2O \longrightarrow$** **3) $CaO + H_2O \longrightarrow$**

Redox reaction

1) $3H_2O_2 + 2KMnO_4 \longrightarrow 3O_2 + 2MnO_2 + 2KOH + 2H_2O$

Hydrolysis

2) Chromium(III) chloride react with water to produce hydrogen chloride and chromium(III) oxide. This reaction takes place at a temperature of 350 - 450°C.

$$2CrCl_3 + 3H_2O \longrightarrow 6HCl + Cr_2O_3$$

hydration reactions

$$3\,CaO + H_2O \longrightarrow Ca(OH)_2$$

29. Hydrogen peroxide can function as an oxidising agent as well as reducing agent. substantiate this statement with suitable examples.

Oxidising Nature-

1. It oxidised black lead sulphide to white lead sulphate.

. $$PbS + 4H_2O_2 \longrightarrow PbSO_4 + 4H_2O$$

Reducing Nature-

1.Reduces moist silver oxide to sliver. $H_2O_2 + Ag_2O \longrightarrow Ag + H_2O + O_2$

2.Reduecs chlorine to hydrogen chloride $Cl_2 + H_2O_2 \longrightarrow 2HCl + O_2$

30. Do you think that heavy water can be used for drinking purposes ?

Deuterium is not radioactive and only toxic in larger quantities.

Some living organisms like algae and bacteriae can live entirely on Deuterium (all water in their organism and cells is replaced by Deuterium).

For humans and other mammals if 50% of all water was replaced by Deuterium, this would probably be lethal and big problems would begin at about 25%.

You could probably drink some heavy water (Deuterium) once without adverse effects,

but over time it will be toxic.

31. What is water-gas shift reaction ?

The carbon monoxide of the water gas can be converted to carbon dioxide by mixing the gas mixture with more steam at 400°C and passed over a shift converter containing iron/copper catalyst. This reaction is called as *water-gas shift reaction*.

$$CO + H_2O \longrightarrow CO_2 + H_2$$

32. Justify the position of hydrogen in the periodic table ?

Resemblance with alkali metals:

1. Like alkali metals, hydrogen contains one valence electron in its valence shell.

H : $1s^1$ **Li** : $1s^2\ 2s^1$ **Na** : $1s2\ 2s^2\ 2p^6\ 3s^1$

1. It forms unipositive ion (H^+) like alkali metals (Na^+, K^+, Cs^+)

2. It forms halides (HX), oxides (H_2O), peroxides (H_2O_2) and sulphides (H_2S) like alkali metals (NaX, Na_2O, Na_2O_2, Na_2S)

3 In their compounds both hydrogen & alkali metals show +1 oxidation states. **Eg** HCl & NaCl

Resemblance with halogens:

1. Both hydrogen and halogens require one electron to complete their octets.

H : $1s^1$ F : $1s^2\ 2s^2\ 2p^5$ Cl : $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$

Hence, hydrogen can gain one electron to form a uni negative ion

2. Like halogens, it forms a diatomic molecule and several covalent compounds.

3. Unlike alkali metals, hydrogen does not possess metallic characteristics. On the other hand, it possesses a high ionization enthalpy. Also, it is less reactive than halogens

Owing to these reasons, hydrogen cannot be placed with alkali metals (group- I) or with halogens (group VII). In addition, it was also established that H^+ ions cannot exist freely as they are extremely small. H^+ ions are always associated with other atoms or molecules. Hence, hydrogen is best placed separately in the periodic table.

33. What are isotopes? Write the names of isotopes of hydrogen.

All isotopes of an element have the same atomic number. What they differ in is their 'mass number Hydrogen has three main isotopes;

Protium - $_1H^1$ - does not contain a neutron

Deuterium - $_1H^2$ and **tritium-** $_1H^3$

These isotopes form naturally in nature. Protium and deuterium are stable.

34. Give the uses of heavy water.

1. Heavy water is widely used as moderator in nuclear reactors as it can lower the energies of fast neutrons

2. It is commonly used as a tracer to study organic reaction mechanisms and mechanism of metabolic reactions

3. It is also used as a coolant in nuclear reactors as it absorbs the heat generated.

35. Explain the exchange reactions of deuterium.

$$CH_4 + 2\ D_2 \longrightarrow CD_4 + 2\ H_2$$

$$2\ NH_3 + 3\ D_2 \longrightarrow 2\ ND_3 + 3\ H_2$$

36. How do you convert parahydrogen into ortho hydrogen ?

It Can also be converted by passing an electric discharge,

ii) Heating above 800°C and mixing with paramagnetic molecules such as O_2, NO, NO_2 or with nascent / atomic hydrogen.

37. Mention the uses of deuterium.

i) It is used in various experimemts with accelerators involving deuteron beams.Heavy water(Deuterium Oxide(D_2O)) is used in Heavy water reactors as a neutron moderator

ii) Deuterium is a great fuel for experimental fusion reactors ,amateur fusors and neutron generators

38. Explain preparation of hydrogen using electrolysis.

High purity hydrogen (>99.9 %) is obtained by the electrolysis of water containing traces of acid or alkali

anode : nickel

cathode : iron

At anode : $2\,OH^- \longrightarrow H_2O + \frac{1}{2}O_2 + 2e^-$

At cathode : $2\,H_2O + 2\,e^- \longrightarrow 2OH^- + H_2$

Overall reaction : $H_2O \longrightarrow H_2 + \frac{1}{2}O_2$

39. A groups metal (A) which is present in common salt reacts with (B) to give compound (C) in which hydrogen is present in - 1 oxidation state. (B) on reaction with a gas (C) to give universal solvent (D).The compound (D) on reacts with (A) to give (B), a strong base. Identify A, B, C, D and E. Explain the reactions.

Metal (A) is sodium (present in common salt)

i) $2Na + H_2 \longrightarrow 2NaOH$

(A) (B) (C)

ii) $2H_2 + O_2 \longrightarrow 2H_2O$

(B) (D)

iii) $2Na + 2H_2O \longrightarrow 2NaOH$ **(E)** $+ H_2$

A- sodium B - Hydrogen C- NaH D- H_2O E - NaOH

40. An isotope of hydrogen (A) reacts with diatomic molecule of element which occupies group number 16 and period number 2 to give compound (B) is used as a modulator in nuclear reaction. (A) adds on to a compound (C), which has the molecular formula C_3H_6 to give (D). Identify A, B, C and D.

An isotope of hydrogen (A) - Normal hydrogen (H)

$2H_2 + O_2 \longrightarrow 2H_2O$ **compound (** B) moderator (coolant)

In traditional nuclear reactors, the moderator is the same thing as the coolant**: it's water!** When fast neutrons strike the hydrogen atoms in H_2O, they slow down a lot .

Compound - C is C_3H_4 after hydrogenation with H it forms into C_3H_6

$$C_3H_4 + H_2 \longrightarrow C_3H_6$$

A - is normal hydrogen (H) , B - H_2O C - C_3H_4 (propyne) D - C_3H_6 (propene)

41. NH_3 has exceptionally high melting point and boiling point as compared to those of the hydrides of the remaining element of group 15 - Explain.

Explanation:

i) Has exceptionally high melting and boiling point as compared to those of the hydrides of the remaining elements of group 15 due to presence of hydrogen bonding.

ii) Hydrogen bonding (H-bonding) is an intermolecular force having partial ionic-covalent character. H^- bonding takes place between a hydrogen atom (attached with an electronegative atom (e.g. O, N and F) and an electronegative atom (O,N and F).

42. Why interstitial hydrides have a lower density than the parent metal.

The term interstitial compound, or interstitial alloy, is used to describe a compound that is formed when an atom of sufficiently small radius sits in an interstitial "hole" in a metal lattice.

The empty spaces between the molecules of the pure metal are the spaces where a molecule of rela tively small radius can be filled.

So,density is always increased in interstitial compounds not decreased when compared with its parent pure metal.

43. How do you expect the metallic hydrides to be useful for hydrogen storage ?

In metallic hydrides, hydrogen is adsorbed as H-atoms. This property of adsorption of hydrogen on transition metals is widely used as its storage media. Some of the metals such as Pd, Pt can accommo date a very large volume of hydrogen. This property has high potential for hydrogen storage and as a source of energy. Metallic

hydrides on heating decompose to form hydrogen and very finely divided metal.

44.Arrange NH_3, H_2O and HF in the order of increasing magnitude of hydrogen banding and explain the basis for your arrangement

The extent of hydrogen bonding depends upon electronegativity and the number of hydrogen atoms available for bonding. Among nitrogen, fluorine, and oxygen, the increasing order of their electronegativities are **N < O < F.**

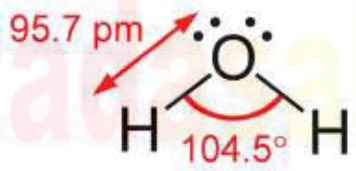
Hence, the expected order of the extent of hydrogen bonding is **HF > H_2O > NH_3**

But, the actual order is H_2O > HF > NH_3.

45. Compare the structures of H_2O and H_2O_2

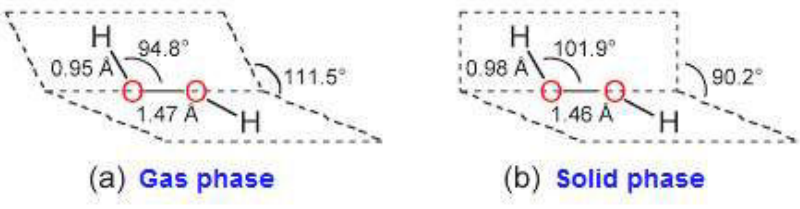
In gaseous phase, water molecule has a bent form with a bond angle of **104.5°**.

The O-H bond length is **95.7 pm.**



Hydrogen peroxide has a non-planar structure both in gas and solid phase.

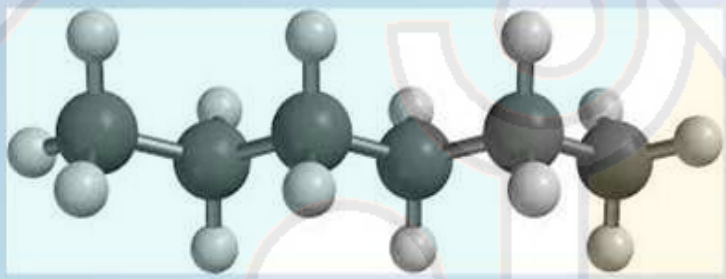
The dihedral angle in gas and solid phase is 111.5° and 90.2° respectively.



ORGANIC CHEMISTRY

STD – XI

UNIT - 12 & 13



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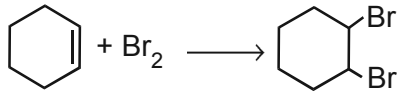
Unit - 12
Basic concepts of organic reactions

1. **For the following reactions** SHANMUGAM S ST.JOHN'S MHSS PORUR CHENNAI -116

(A) $CH_3CH_2CH_2Br + KOH \longrightarrow CH_2 = CH_2 + KBr + H_2O$

(B) $(CH_3)_3CBr + KOH \longrightarrow (CH_3)_3 COH + KBr$

(C)  + Br_2 ⟶

Which of the following statement is correct?

(a) (A) is elimination, (B) and (C) are substitution

(b) (A) is substitution, (B) and (C) are elimination

(c) (A) and (B) are elimination and (C) is addition reaction

(d) (A) is elimination, B is substitution and (C) is addition reaction.

2. What is the hybridisation state of benzyl carbonium ion?

(a) sp^2 (b) spd^2 (c) sp^3 (d) sp^2d

3. Decreasing order of nucleophilicity is

(a) $OH^- > NH_2^- > {}^-OCH_3 > RNH_2$ **(b) $NH_2^- > OH^- > {}^-OCH_3 > RNH_2$**

(c) $NH_2- > CH_3O^- > OH- > RNH_2$ (d) $CH_3O^- > NH_2^- > OH^- > RNH_2$

4. Which of the following species is not electrophilic in nature?

(a) Cl^+ (b) BH_3 **(c) H_3O+** (d) $+NO_2$

5. Homolytic fission of covalent bond leads to the formation of

(a) electrophile (b) nucleophile (c) Carbo cation **(d) free radical**

6. Hyper Conjugation is also known as

(a) no bond resonance (b) Baker - nathan effect

(c) both (a)and (b) (d) none of these

7. Which of the group has highest +I effect?

(a) CH_3- (b) CH_3-CH_2- (c) $(CH_3)_2-CH-$ **(d) $(CH_3)_3-C-$**

8. Which of the following species does not exert a resonance effect?

(a) C_6H_5OH (b) C_6H_5Cl (c) $C_6H_5NH_2$ **(d) $C_6H_5\overset{\oplus}{N}H_3$**

9. -I effect is shown by

(a) -Cl (b) -Br **(c) both (a) and (b)** (d) $-CH_3$

10. Which of the following carbocation will be most stable?

(a) $Ph_3\overset{\oplus}{C}-$ (b) $CH_3-\overset{\oplus}{C}H_2-$ (c) $(CH_3)_2-\overset{\oplus}{C}H$ **(d)** $CH_2= CH - \overset{\oplus}{C}H_2$

11. Assertion: Tertiary Carbocations are generally formed more easily than primary Carbocations ions.

Reason: Hyper conjugation as well as inductive effect due to additional alkyl group stabilize tertiary carbonium ions.

(a) both assertion and reason are true and reason is the correct explanation of assertion.

(b) both assertion and reason are true but reason is not the correct explanation of assertion.

(c) Assertion is true but reason is false (d) Both assertion and reason are false

12. Heterolytic fission of C-Br bond results in the formation of

(a) free radical (b) Carbanion

(c) Carbocation **(d) Carbanion and Carbocation**

13. Which of the following represent a set of nuclephiles?

(a) BF_3, H_2O, NH_2^- (b) $AlCl_3$, BF_3, NH_3

(c) CN^-, RCH_2^-, ROH (d) H+, RNH_3^+, $:CCl_2$

14. Which of the following species does not acts as a nucleophile?

(a) ROH (b) ROR (c) PCl_3 **(d) BF_3**

15. The geometrical shape of carbocation is

(a) Linear (b) tetrahedral **(c) Planar** (d) Pyramidal

16. Write short notes on (a) Resonance (b) Hyperconjucation

(a) Resonance

Certain organic compounds can be represented by more than one structure and they differ only in the position of bonding and lone pair of electrons. Such structures are called resonance structures

(b)Hyperconjucation The delocalisation of electrons of σ bond is called as hyper conjugation

17. What are electrophiles and nucleophiles? Give suitable examples for each.

Electrophiles :

Electrophiles are reagents that are attracted towards negative charge or electron rich center.

They are either positively charged ions or electron deficient neutral molecules

Neutral electrophiles : $AlCl_3$, CO_2 ,BF_3, $FeCl_3$, $:CCl_4$

Positively charged electrophiles : R^+ , H^+ , H_3O^+ , NO_2^+

Nucleophiles :

Nucleophiles are reagents that has high affinity for electro positive centers.

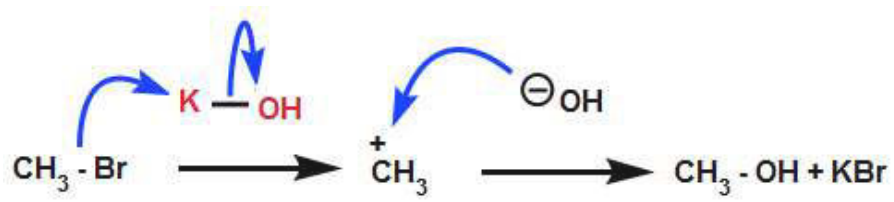
Neutral Nucleophiles : H_2O, R-OH , NH_3, R-O-R,

Negatively charged nucleophiles : OH^- , Cl^-, CN^- ,$RCOO^-$,RO^-

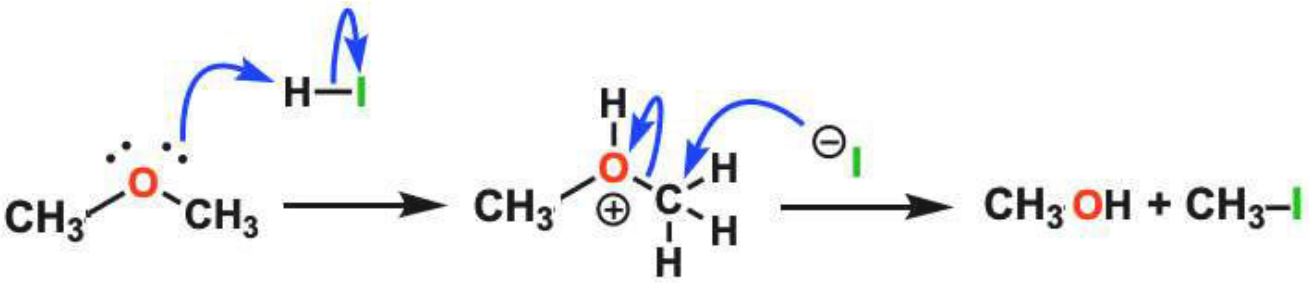
18. Show the heterolysis of covalent bond by using curved arrow notation and complete the following equations. Identify the nucleophile is each case.

(i) CH_3 - Br + KOH ⟶ **(ii) CH_3- OCH_3 + HI ⟶**

i)



ii)



19. Explain inductive effect with suitable example.

Inductive effect is defined as the change in the polarisation of a covalent bond due to the presence of adjacent bonds, atoms or groups in the molecule. This is a permanent phenomenon.

Their ability to release or withdraw the electron through sigma covalent bond is called **+I effect** and **- I effect** respectively

Electron withdrawing or - I group : -F, -Cl, -COOH, $-NO_2$, NH_2

Electron donating or + I groups : CH_3O^-, $C_2H_5O^-$, COO^- etc

The order of the –I effect of some groups are given below

$NH_3^+ > NO_2 > CN > SO_3H > CHO > CO > COOH > COCl > CONH_2 > F > Cl > Br > I > OH > OR > NH_2 > C_6H_5 > H$

The relative order of +I effect of some alkyl groups is given below

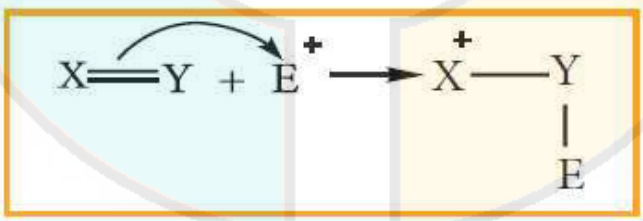
$-C(CH_3)_3 > -CH(CH_3)_2 > -CH_2CH_3 > -CH_3$

20. Explain electromeric effect.

Electromeric effect is a **temporary effect** and observed only in organic compounds with multiple bonds in the presence of an attacking reagent.

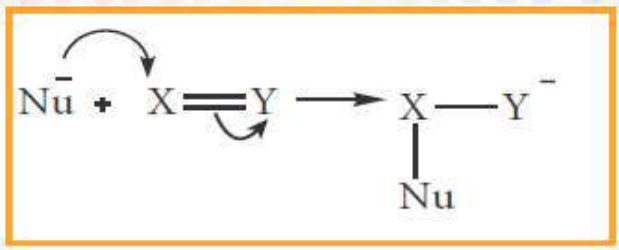
+ ve Electromeric effect.

When the σ electron is transferred towards the attacking reagent, it is called + E (positive electromeric) effect.



- ve Electromeric effect.

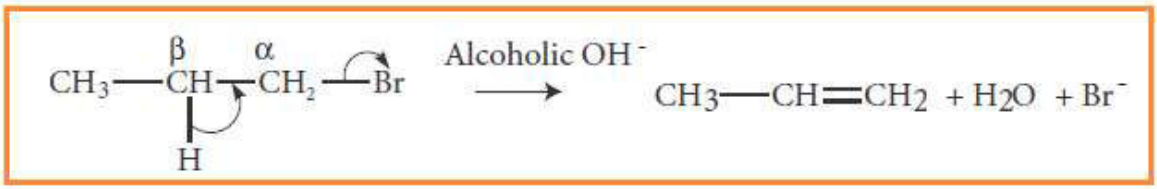
When the π electron is transfered away from the attacking reagent, it is called, -E (negative electromeric) effect



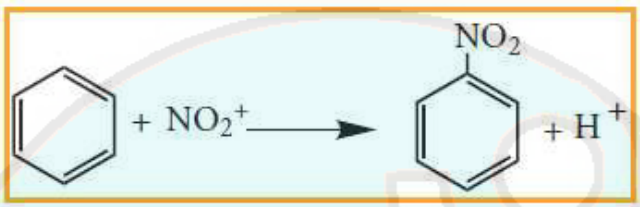
21. Give examples for the following types of organic reactions

(i) β - elimination (ii) electrophilic substitution.

(i) β



(ii) electrophilic sub



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Hydrocarbons

31. Give IUPAC names for the following compounds

1) $CH_3–CH=CH–CH=CH–C\equiv C–CH_3$ - Octa - 2,4 diene - 6-yne

2) $CH_3–\underset{\underset{CH_3}{|}}{\overset{\overset{C_2H_5}{|}}{C}}–\underset{\underset{H}{|}}{\overset{\overset{CH_3}{|}}{C}}–C\equiv C-CH_3$ - 2-ethyl -2,4 -dimethyl hex-4-yne

3) $(CH_3)_3\ C\ H – C \equiv C – CH\ (CH_3)_2$ - 2,5-dimetyl-hex-3-yne

4) ethyl isopropyl acetylene - 2,2-dimethyl-hex-3-yne

5) $CH \equiv C – C \equiv C – C \equiv CH$ - 1,3,5 hexatriyne

32. Identify the compound A, B, C and D in the following series of reactions

$$CH_3\text{-}CH_2\text{-}Br \xrightarrow{\text{alc KOH}} A \xrightarrow{Cl_2/CCl_4} B \xrightarrow{NaNH_2} D$$

$$A \xrightarrow[\text{ii) } Zn/H_2O\equiv]{\text{)}O_3} C$$

$$CH_3\text{-}CH_2\text{-}Br \xrightarrow{\text{alc KOH}} CH_2=CH_2 \xrightarrow{Cl_2/CCl_4} Cl\text{-}CH_2\text{-}CH_2\text{-}Cl \xrightarrow{NaNH_2} CH\equiv CH$$

$$CH_2=CH_2 + O_3 \longrightarrow \underset{\text{ozonide}}{\overset{O}{\underset{O-O}{CH_2\ \ CH_2}}} \xrightarrow{Zn/H_2O} 2\ HCHO$$

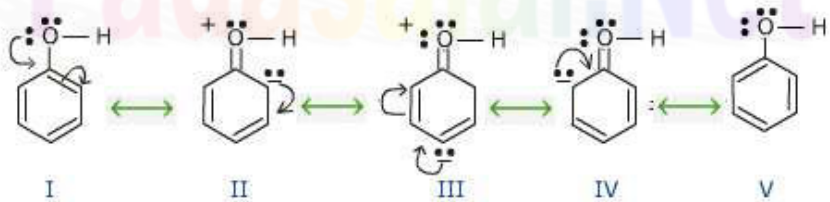
A- Ethene B - 1,2 dichloro ethane C- Formaldehyde D - ethyne

33. Write short notes on ortho, para directors in aromatic electrophilic substitution reactions.

Those which increases electron density at 'ortho' and 'para' position are known as ortho-para directors All the activating groups are 'ortho-para' directors.

Example –OH, $-NH_2$, -NHR, $-NHCOCH_3$, $-OCH_3$, $-CH_3$, $-C_2H_5$

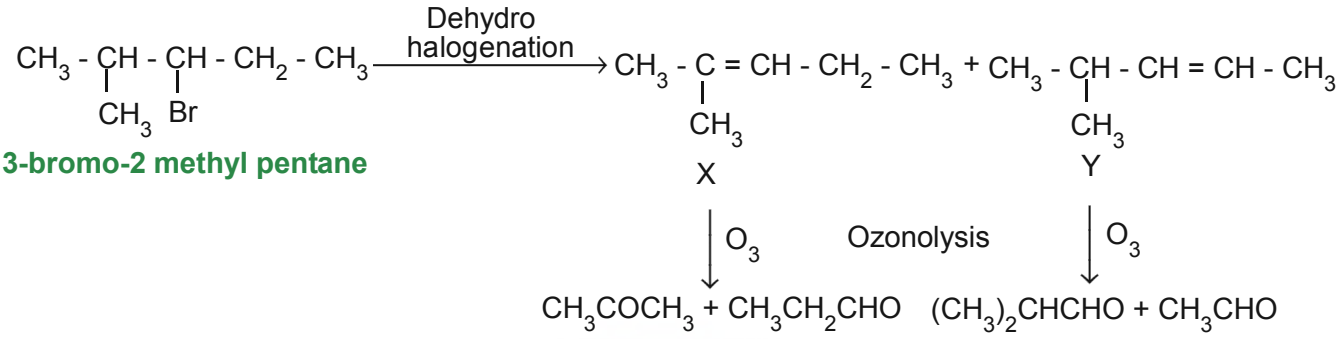
Let us consider the directive influences of phenolic (-OH) group. Phenol is the resonance hybrid of following structures.



34. How is propyne prepared from an alkylene dihalide ?

$$\underset{\underset{Br}{|}\ \ \underset{Br}{|}}{CH_3CH=CH_2} + KOH \xrightarrow[-H_2O\ /\ -KBr]{\text{alchol}} CH_3CH=CHBr \xrightarrow[-NaBr]{Na^+NH_2^-} CH_3\text{-}CH\equiv CH$$

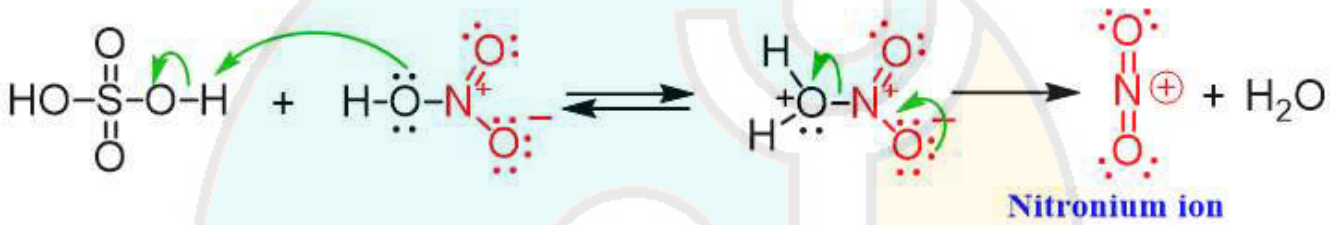
35. An alkylhalide with molecular formula $C_6H_{13}Br$ on dehydro halogenation gave two isomeric alkenes X and Y with molecular formula C_6H_{12}. On reductive ozonolysis, X and Y gave four compounds CH_3COCH_3, CH_3CHO, CH_3CH_2CHO and $(CH_3)_2CHCHO$. Find the alkylhalide.



36. Describe the mechanism of Nitration of benzene.

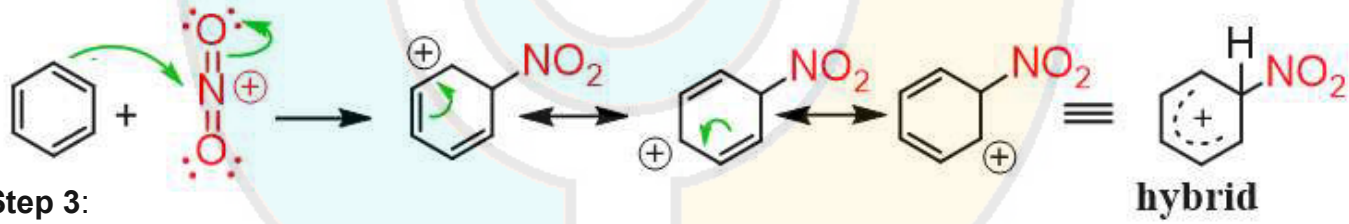
Step 1:

Nitric acid accepts a proton from sulphuric acid and then dissociates to form nitronium ion.



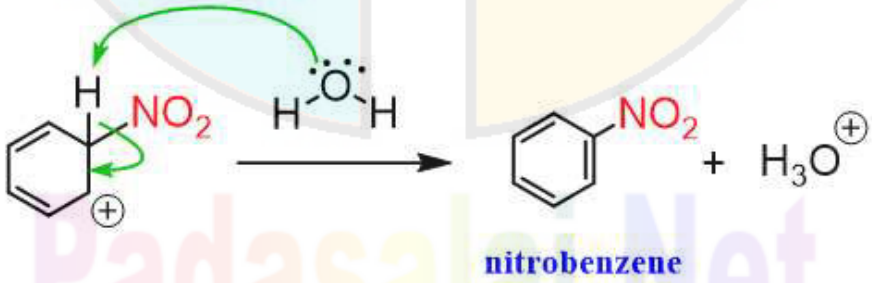
Step 2:

The nitronium ion acts as an electrophile in the process which further reacts with benzene to form an arenium ion.



Step 3:

The arenium ion then loses its proton to Lewis base forming nitrobenzene.



37. How does Huckel rule help to decide the aromatic character of a compound.

i) Presence of **(4n+2) π** electrons in the ring where n is an integer (n=0,1,2….)

ii) All carbon atoms should be sp^2 hyberdised.

iii) System should be cyclic.

iv) System should have conjugation.

Example : (i) The benzene is a planar molecule

(ii) It has six deloclaised π electorns

(iii) 4n + 2 = 6 4n = 6- 2 4n = 4

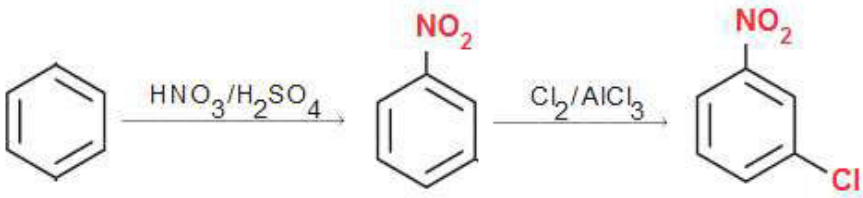
n = 1 it obeys Huckel's (4n+2) p electron rule with n = 1 hence, benzene is aromatic.

38. Suggest the route for the preparation of the following from benzene.

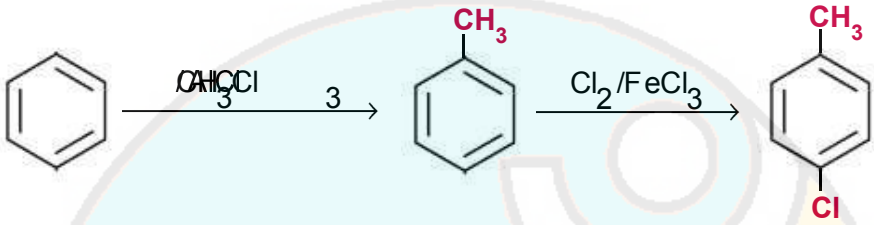
1) 3 – chloro nitrobenzene **2) 4 – chlorotoluene**

3) Bromo benzene **4) m - dinitro benzene**

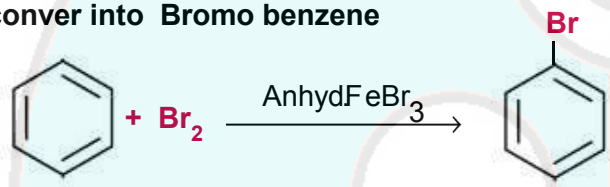
1) Benzene conver into 3- chloronitro benzene



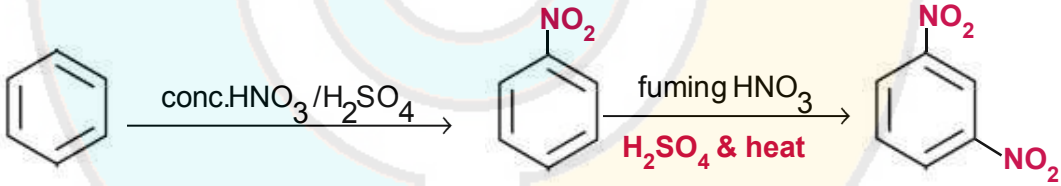
2) Benzene conver into 4 – chlorotoluene



3) Benzene conver into Bromo benzene



4) Benzene conver into m - dinitro benzene



39. Suggest a simple chemical test to distinguish propane and propene.

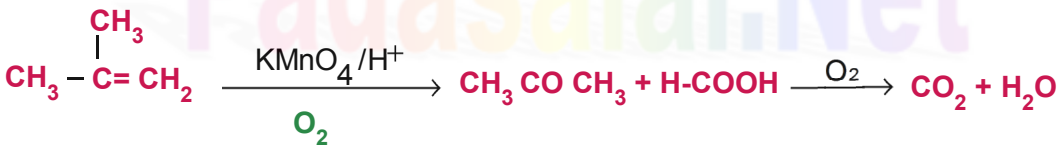
Propene (unsaturated) is an alkene, whereas propane (saturated) is an alkane

Add bromine water (brown) to the test tubes

If the bromine water stays brown, the test tube contains propane

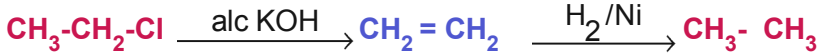
If the bromine water goes colourless, the test tube contained propene

40. What happens when isobutylene is treated with acidified potassium permanganate ?



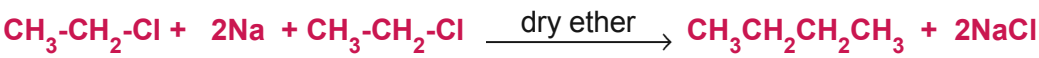
41. How will you convert ethyl chloride in to i) ethane ii) n- butane

i) Ethyl chloride in to ethane

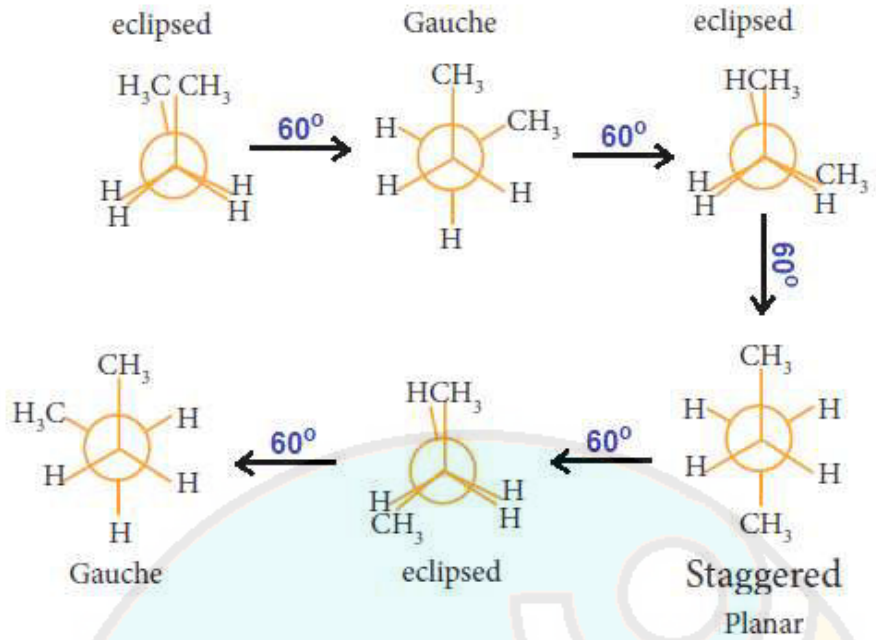


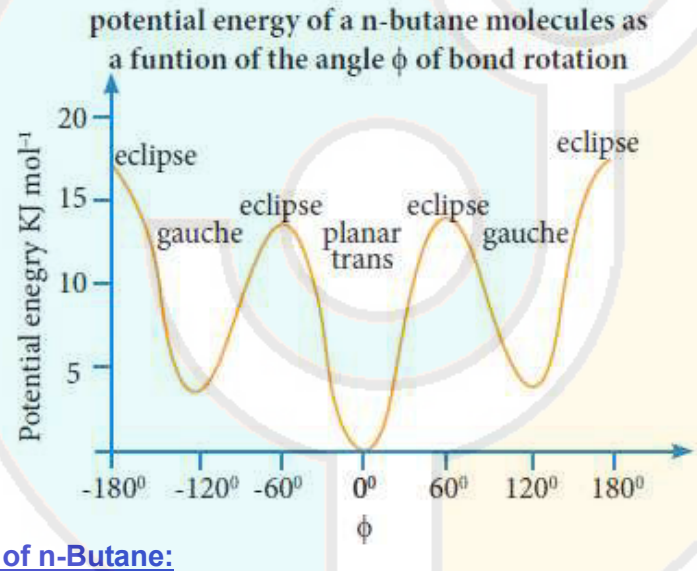
ii) Ethyl chloride into n- butane

Wurtz reaction.



42. Describe the conformers of n - butane.

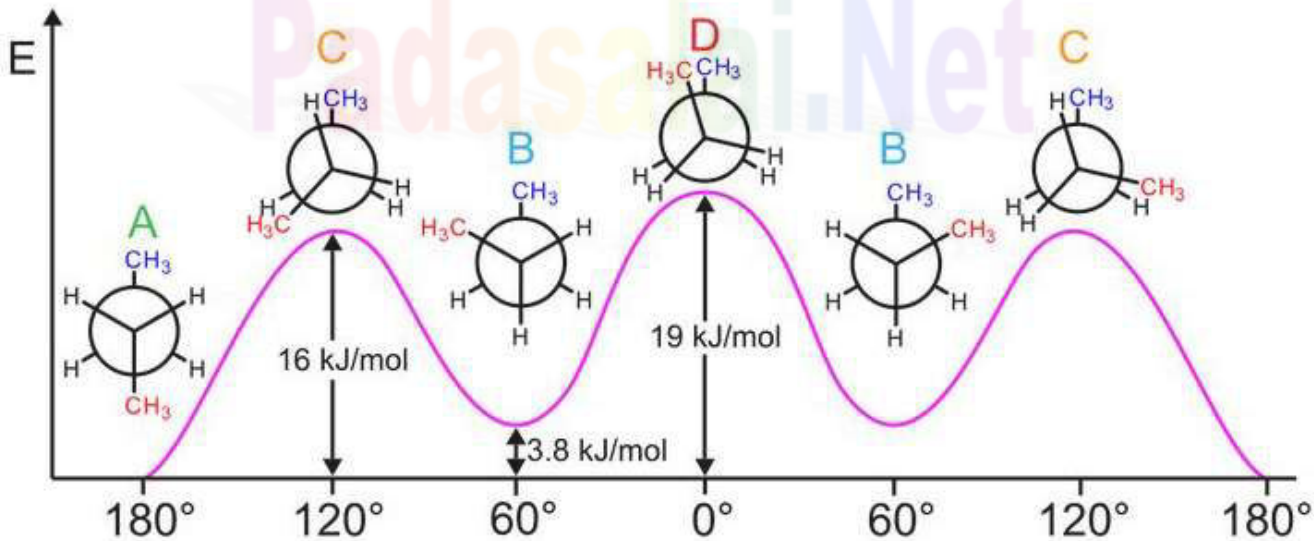




Conformations of n-Butane:

potential energy difference : **Eclipsed > Gauche > Staggered**

Stability order : **Staggered > Gauche > Eclipsed**



43. Write the chemical equations for combustion of propane

propane $CH_3\text{-}CH_2\text{-}CH_3 + 5\ O_2 \longrightarrow 3\ CO_2 + 4\ H_2O$

44. Explain Markownikoff's rule with suitable example.

"When an unsymmetrical alkene reacts with hydrogen halide, the hydrogen adds to the carbon that has more number of hydrogen and halogen add to the car- bon having fewer hydrogen".

This rule can also be stated as in the addition reaction of alkene / alkyne, the most electro negative part of the reagent adds on to the least hydrogen attached doubly bonded carbon.

The order of reactivity of diff erent hydrogen halides is HI > HBr > HCl.

Example :

$CH_3\text{-}CH = CH_2 + HBr \longrightarrow CH_3\text{-}\underset{\underset{Br}{|}}{CH}\text{-}CH_3 + CH_3\text{-}CH_2\text{-}CH_2Br$

2-Bromo Propane (major product)

1-Bromo Propane (Minor Product)

Mechanism:

Step: 1 Formation of electrophile: $HBr \longrightarrow H^+ + Br^-$

Step:2 Secondary carbocation is more stable than primary carbocation and it predominates over a the primary carbocation.

$CH_3\text{-}CH = CH_2 + H^+ \longrightarrow CH_3\text{-}CH_2\text{-}\overset{+}{C}H_2$ 1° carbocation

$CH_3\text{-}\overset{+}{C}H\text{-}CH_3$ 2° carbocation

Step:3 The Br^- **ion** attack the 2° carbocation to from 2 -Bromobutane, **the major product.**

$CH_3\text{-}\overset{+}{C}H\text{-}CH_3 + Br^- \longrightarrow CH_3\text{-}\underset{\underset{Br}{|}}{CH}\text{-}CH_3$

45. What happens when ethylene is passed through cold dilute alkaline potassium permanganate.

$H_2C = CH_2 + (O) + H_2O \xrightarrow[\text{Baeyer's reagent}]{\text{alkaline } KMnO_4} \underset{\underset{OH}{|}}{CH_2}\text{-}\underset{\underset{OH}{|}}{CH_2}$

46. Write the structures of folowing alkanes.

1) 2, 3 – Dimethyl – 6 – (2 – methyl propyl) decane

$CH_3\text{-}\underset{\underset{CH_3}{|}}{CH}\text{-}\underset{\underset{CH_3}{|}}{CH}\text{-}CH_2\text{-}CH_2\text{-}\underset{\underset{CH_2\text{-}CH\text{-}CH_3}{|}}{\underset{\underset{CH_3}{|}}{CH}}\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_3$

2) 5 – (2 – Ethyl butyl) – 3, 3 – dimethyldecane

$CH_3\text{-}CH_2\text{-}\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}\text{-}CH_2\text{-}\underset{\underset{CH_2\text{-}CH\text{-}CH_2\text{-}CH_3}{|}}{\underset{\underset{CH_2\text{-}CH_3}{|}}{CH}}\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}CH_3$

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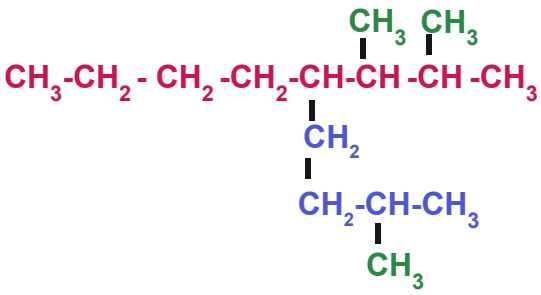
3) 5 – (1, 2 – Dimethyl propyl) – 2 – methylnonane



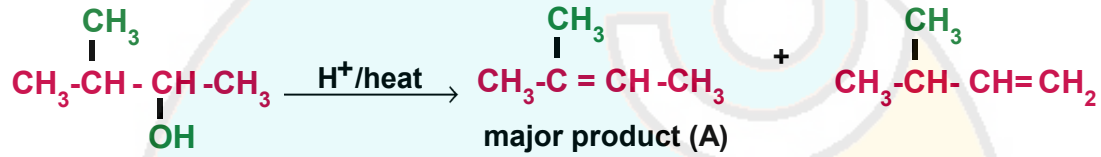
47. How will you prepare propane from a sodium salt of fatty acid ?

Sodium butanoate (sodium salt of butanoic acid) on heating with sodalime yields propane by decarboxylation.

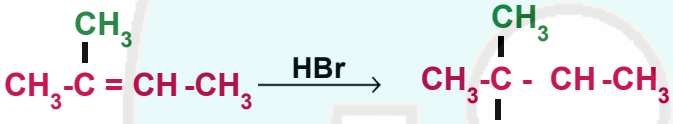
$$CH_3CH_2CH_2COONa \xrightarrow{CaO\ /NaOH} CH_3CH_2CH_3 + Na_2CO_3$$

48. $CH_3 - CH(CH_3) - CH(OH) - CH_3 \xrightarrow{H^+/heat}$ **(A) major product** $\xrightarrow{HBr}$ **(B) major product**

Identify A and B



major product (A)



major product (B)

A- 2-methyl-2-butene B- 2-Bromo -2- methyl-2-butane

49. Complete the following :

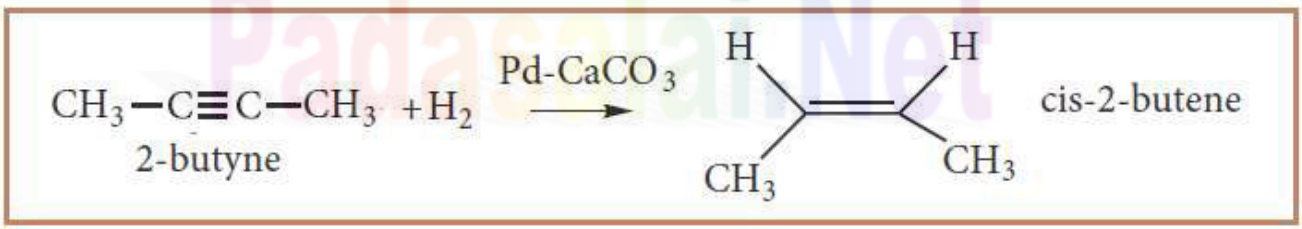
i) 2 – butyne $\xrightarrow{\text{Lindlar Catalyst}}$

ii) $CH_2 = CH_2 \xrightarrow{I_2}$

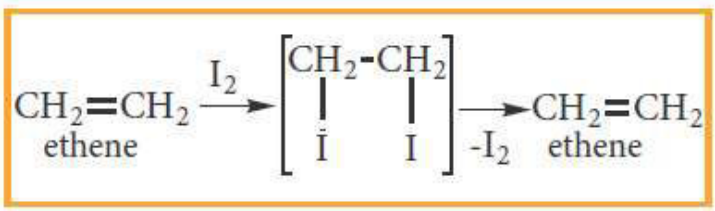
iii) $CH_2Br = CH_2Br \xrightarrow{Zn/C_2H_5OH}$

iv) $CaC_2 \xrightarrow{H_2O}$

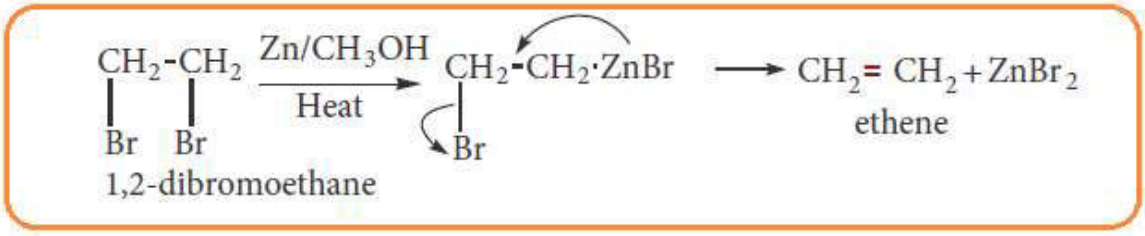
i)



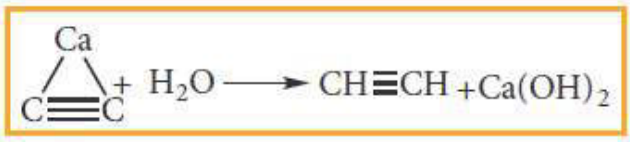
ii)



iii)



iv)

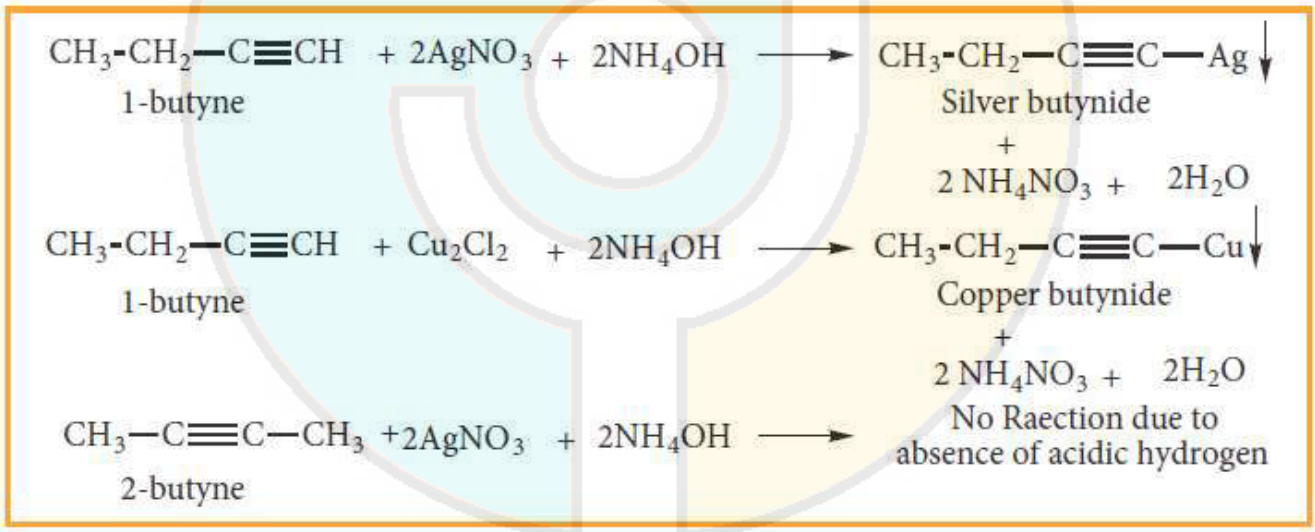


50. How will you distinguish 1 – butyne and 2 – butyne?

i) 1-butyne and 2-Butyne are distinguished by "Tollins reagent test ".

1-butyne gives tollins reagent test but 2-Butyne doesn't.

ii) There will be no reaction between butene-2 and Cu_2Cl_2 because it has no acidic hydrogen. In butyne-1 the terminal hydrogen is acidic (CH_3CH_2-C= CH) so it will give a real ppt with ammonical Cu_2Cl_2



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