

UNIT-13**HYDROCARBONS****MY REVISION TIMELINE:-**

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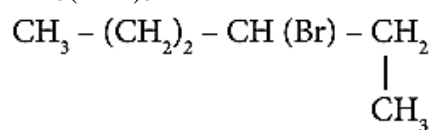
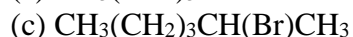
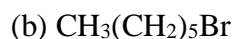
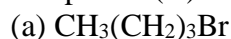
SUMMARY:-

- The hydrocarbons are compounds composed entirely of carbon and hydrogen.
- Hydrocarbons are classified into two:
 - Aliphatic hydrocarbons
 - Acyclic and cyclic hydrocarbons
 - Alkanes (saturated)
 - Alkenes (unsaturated)
 - Alkynes (unsaturated)
 - Aromatic hydrocarbons or Arenes (unsaturated)
- General formula: Alkanes – C_nH_{2n+2}
- General formula: Alkenes – C_nH_{2n}
- General formula: Alkynes – C_nH_{2n-2}
- There exists free rotation about C-C single bond. Such rotation leaves all groups or atoms bonded to each carbon into an infinite number of readily interconvertible three dimensional arrangements. Such readily interconvertible three dimensional arrangement of a molecule is called conformations.
- Stabilities of various conformations of ethane are Staggered > Skew > Eclipsed
- Aromaticity is a function of electronic structure.

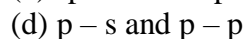
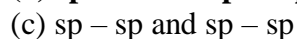
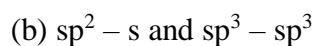
TEXTBOOK EVALUATION**Multiple choice questions:-**

1. The correct statement regarding the comparison of staggered and eclipsed conformations of ethane is [NEET]
 - (a) the eclipsed conformation of ethane is more stable than staggered conformation even though the eclipsed conformation has torsional strain.
 - (b) the staggered conformation of ethane is more stable than eclipsed conformation, because staggered conformation has no torsional strain.**
 - (c) the staggered conformation of ethane is less stable than eclipsed conformation, because staggered conformation has torsional strain.
 - (d) the staggered conformation of ethane is less stable than eclipsed conformation, because staggered conformation has no torsional strain.
2. $C_2H_5Br + 2Na \xrightarrow{\text{Dry ether}} C_4H_{10} + 2NaBr$
 The above reaction is an example of which of the following?
 - (a) Reimer Tiemann reaction
 - (b) Wurtz reaction**
 - (c) Aldol condensation
 - (d) Hoffmann reaction

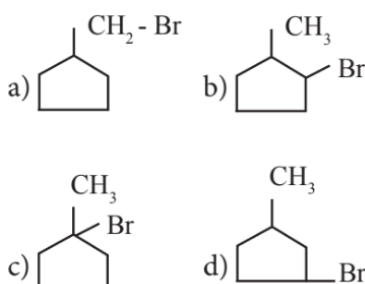
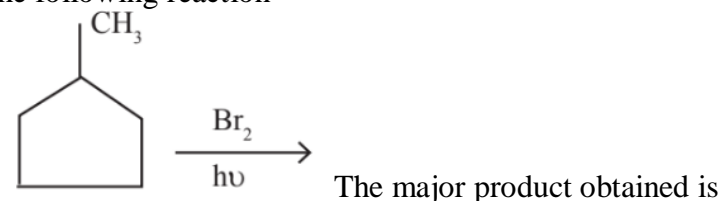
3. An alkyl bromide (A) reacts with sodium in ether to form 4, 5-diethyloctane, the compound (A) is



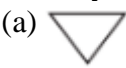
4. The C-H bond and C-C bond in ethane are formed by which of the following types of overlap



5. In the following reaction



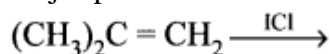
Option c)

6. Which of the following is optically active?
 (a) **2 - Methylpentane** (b) Citric acid
 (c) Glycerol (d) none of these
7. The compounds formed at anode in the electrolysis of an aqueous solution of potassium acetate are
 (a) CH_4 and H_2 (b) CH_4 and CO_2
 (c) **C_2H_6 and CO_2** (d) C_2H_6 and Cl_2
8. The general formula for cycloalkanes is
 (a) C_nH_n (b) **C_nH_{2n}**
 (c) $\text{C}_n\text{H}_{2n-2}$ (d) $\text{C}_n\text{H}_{2n+2}$
9. The compound that will react most readily with gaseous bromine has the formula [NEET]
 (a) **C_3H_6** (b) C_2H_2
 (c) C_4H_{10} (d) C_2H_4
10. Which of the following compounds shall not produce propene by reaction with HBr followed by elimination (or) only direct elimination reaction? [NEET]
 (a)  (b) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH}$
 (c) **$\text{H}_2\text{C} = \text{C} = \text{O}$** (d) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2\text{Br}$
11. Which among the following alkenes on reductive ozonolysis produces only propanone?
 (a) 2 - Methylpropene (b) 2 - Methylbut - 2 - ene
 (c) 2, 3 - Dimethylbut - 1 - ene (d) **2, 3 - Dimethylbut - 2 - ene**

12. The major product formed when 2-bromo-2-methylbutane is refluxed with ethanolic KOH is

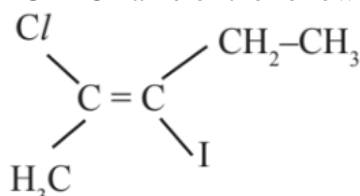
- (a) 2-methylbut-2-ene (b) 2-methylbutan-1-ol
(c) 2-methylbut-1-ene (d) 2-methylbutan-2-ol

13. Major product of the below mentioned reaction is



- (a) 2-chloro-1-iodo-2-methylpropane
(b) 1-chloro-2-iodo-2-methylpropane
(c) 1,2-dichloro-2-methylpropane
(d) 1,2-diiodo-2-methylpropane

14. The IUPAC name of the following compound is

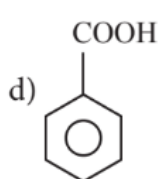
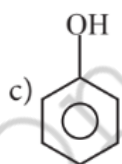
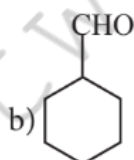
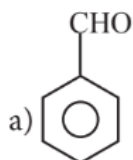
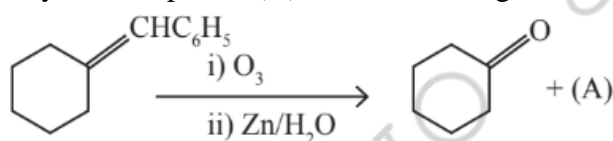


- (a) trans-2-chloro-3-iodo-2-pentene
(b) cis-3-iodo-4-chloro-3-pentane
(c) trans-3-iodo-4-chloro-3-pentene
(d) cis-2-chloro-3-iodo-2-pentene

15. cis-2-butene and trans-2-butene are

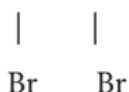
- (a) conformational isomers (b) structural isomers
(c) configurational isomers (d) optical isomers

16. Identify the compound (A) in the following reaction.



Option c)

17. $\text{CH}_2 - \text{CH}_2 \xrightarrow{\text{(A)}} \text{CH} \equiv \text{CH}$



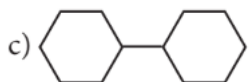
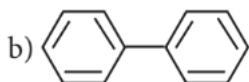
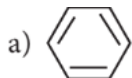
where A is

- (a) Zn (b) Conc. H_2SO_4
(c) Alc. KOH (d) Dil. H_2SO_4

18. Consider the nitration of benzene using mixed conc. FeSO_4 and HNO_3 , if a large quantity of KHSO_4 is added to the mixture, the rate of nitration will be

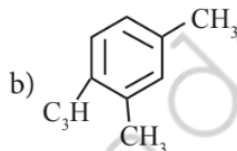
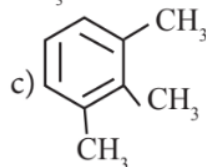
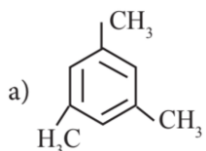
- (a) unchanged (b) doubled
(c) faster (d) **slower**

19. In which of the following molecules, all atoms are co-planar?



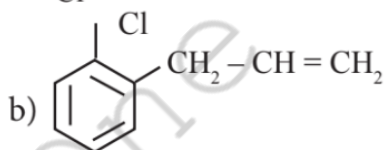
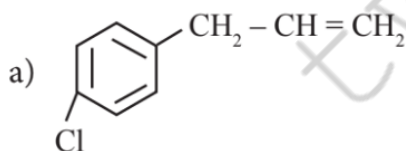
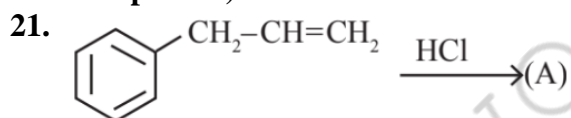
d) **both a) and b)**

20. Propyne on passing through red hot iron tube gives

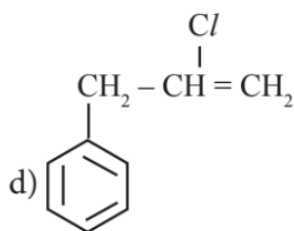


d) none of these

Option a)

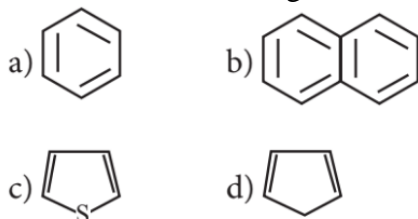


c) both (a) and (b)



Option d)

22. Which one of the following is non-aromatic?



Option d)

23. Which of the following compounds will not undergo Friedal – crafts reaction easily?
[NEET]

- (a) **Nitrobenzene** (b) Toluene
(c) Cumene (d) Xylene

24. Some meta-directing substituents in aromatic substitution are given. Which one is most deactivating?

- (a) – COOH (b) – NO₂
(c) – C N (d) – SO₃H

25. Which of the following can be used as the halide component for friedal – crafts reaction?

- (a) Chlorobenzene (b) Bromobenzene
(c) Chloroethene (d) **Isopropyl chloride**

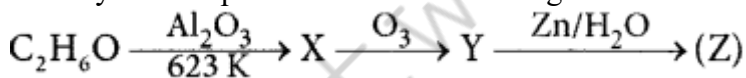
26. An alkane is obtained by decarboxylation of sodium propionate. Same alkane can be prepared by

- (a) Catalytic hydrogenation of propene
(b) **action of sodium metal on iodomethane**
(c) reduction of 1 – chloropropane
(d) reduction of bromomethane

27. Which of the following is aliphatic saturated hydrocarbon?

- (a) C₈H₁₈ (b) C₉H₁₈
(c) C₈H₁₄ (d) All of these

28. Identify the compound 'Z' in the following reaction.



- (a) **Formaldehyde** (b) Acetaldehyde
(c) Formic acid (d) None of these

29. Peroxide effect (Kharasch effect) can be studied in case of

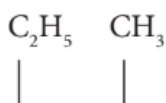
- (a) Oct – 4 – ene (b) Hex – 3 – ene
(c) **Pent – 1 – ene** (d) But – 2 – ene

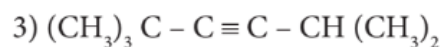
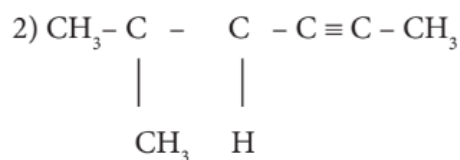
30. 2 – butyne on chlorination gives

- (a) 1 – chlorobutane (b) 1, 2 – dichlorobutane
(c) 1, 1, 2, 2 – tetrachlorobutane (d) **2, 2, 3, 3 – tetrachlorobutane**

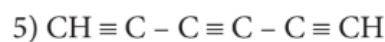
Write brief answers to the following questions:-

31. Give IUPAC names of the following compounds



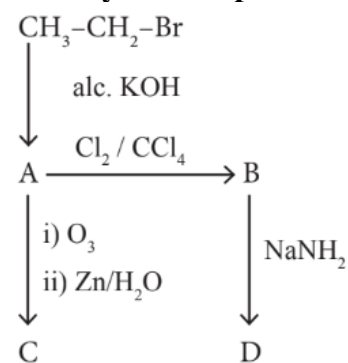


4) ethyl isopropyl acetylene

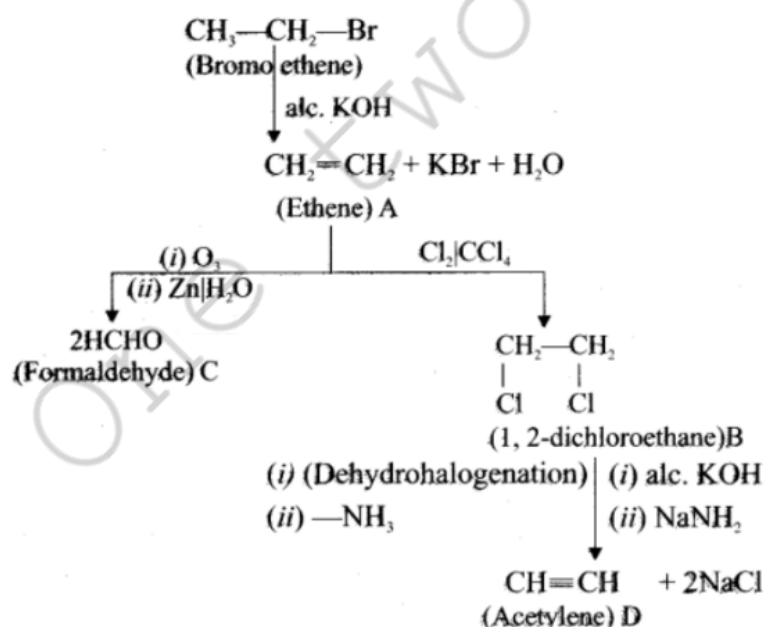


- Octa -2,4 -diene-6 yne
- 5 ethyl -4,5 -dimethyl -hex -2-yne
- 2,2,5-trimethyl hex-3-yne
- 2-methyl hex-3-yne
- Hexa -1,3,5-triyn

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



Answer:



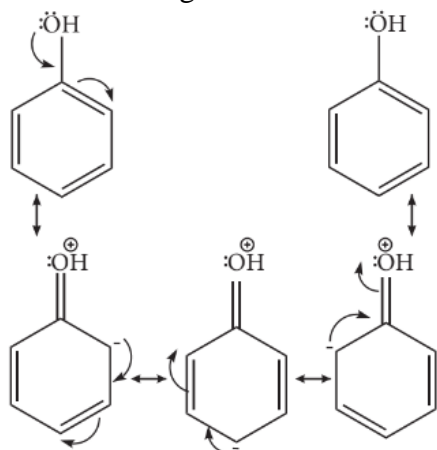
Compound	Name
A	Ethene
B	1,2 - dichloroethane
C	Formaldehyde
D	Acetylene

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

The group which increases the **electron density** at ortho and para positions of the ring are known as **ortho-para directors**.

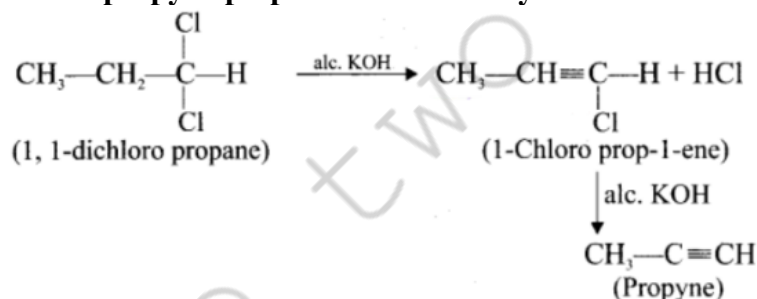
Example: $-\text{OH}$, $-\text{NH}_2$, $-\text{NHR}$, $-\text{CH}_3$, $-\text{OCH}_3$ etc.

Let us consider the directive influences of **phenolic** ($-\text{OH}$) group. Phenol is the resonance hybrid of following structure.

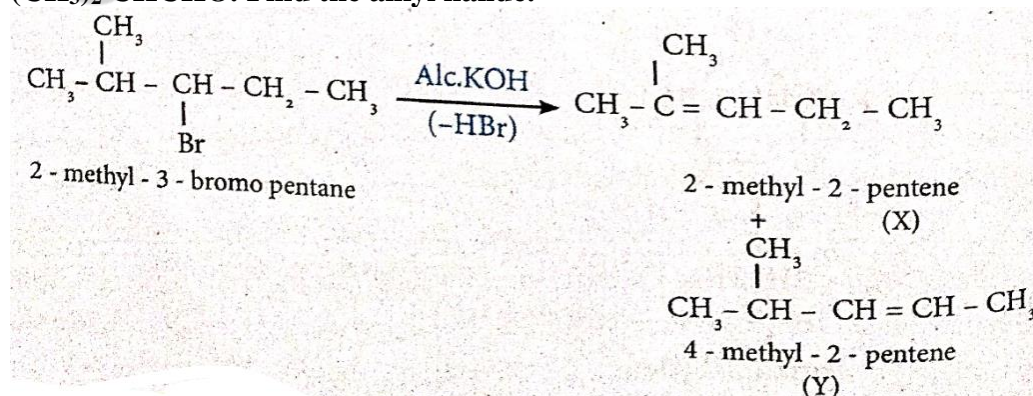


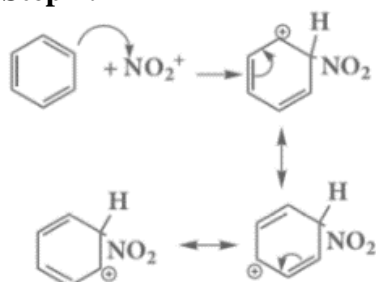
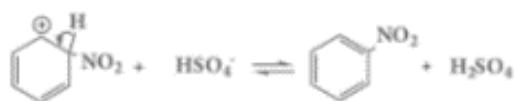
In these resonance structures the **negative charge residue** is present on ortho and para positions of the ring structure. Therefore the electron density at ortho and para positions **increases** as compared to the **meta position**, thus phenolic group activates the benzene ring for electrophilic attack at ortho and para positions and hence $-\text{OH}$ group is an **ortho-para director** and **deactivator**.

34. How is propyne prepared from an alkylene dihalide?



35. An alkyl halide with molecular formula $\text{C}_6\text{H}_{13}\text{Br}$ on dehydrohalogenation 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 , $\text{CH}_3\text{CH}_2\text{CHO}$ and $(\text{CH}_3)_2\text{CHCHO}$. Find the alkyl halide.



36. Describe the mechanism of Nitration of benzene.**Step 1:****Step 2:****Step 3:****37. How does Huckel rule help to decide the aromatic character of a compound?**

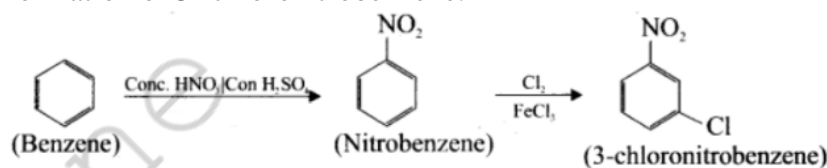
A compound is said to be aromatic, if it obeys the following rules:

- The molecule must be cyclic.
- The molecule must be co-planar.
- Complete delocalisation of its electrons in the ring.
- Presence of $(4n + 2)$ π electrons in the ring where n is an integer ($n = 0, 1, 2, \dots$)

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**

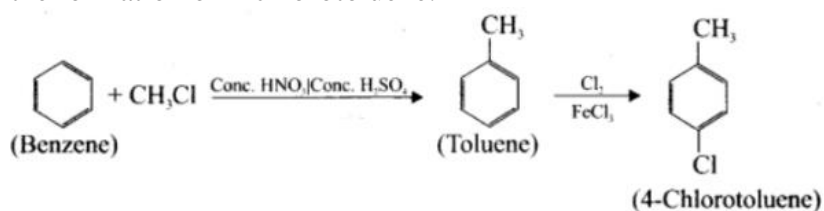
- Preparation of 3-chloronitrobenzene from benzene:

Benzene undergoes nitration and followed by chlorination and it leads to the formation of 3-chloronitrobenzene.



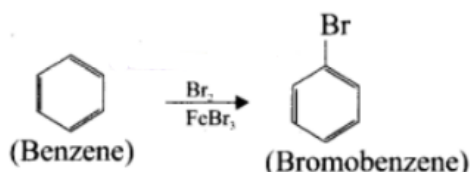
- Preparation 4-chlorotoluene from benzene:

Benzene undergoes Friedel craft's alkylation followed by chlorination and it leads to the formation of 4-chlorotoluene.



- Preparation of Bromobenzene from benzene:

Benzene undergoes bromination to give bromobenzene.

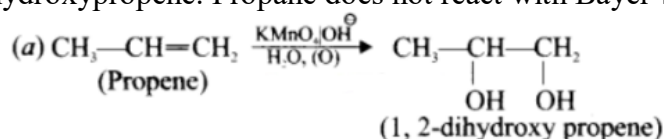


- Preparation of m-dinitrobenzene from benzene:
Benzene undergo twice the time nitration to give m-dinitrobenzene.

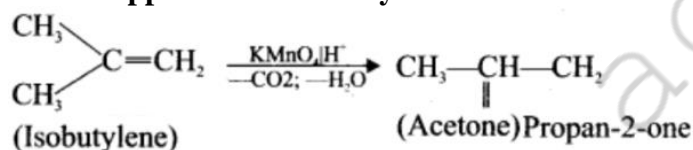


39. Suggest a simple chemical test to distinguish propane and propene.

When propene reacts with **Bayer's reagent** [$\text{Br}_2/\text{H}_2\text{O}$ (Bromine water)] it gives 1,2-dihydroxypropene. Propane does not react with Bayer's reagent.

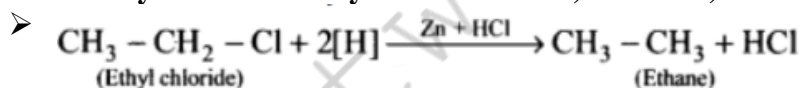


40. What happens when isobutylene is treated with acidified potassium permanganate?

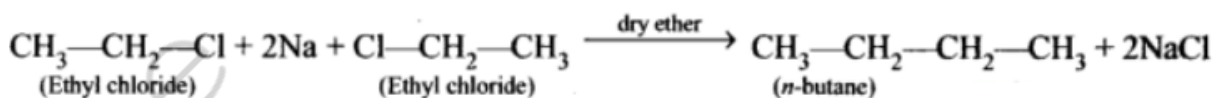


The **purple** KMnO_4 becomes colourless producing **acetone**.

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



- **Wurtz reaction:**



42. Describe the conformers of n - butane.

n-butane may be considered as a **derivative of ethane** as one **hydrogen** on each **carbon atom** is replaced by a **methyl group**.

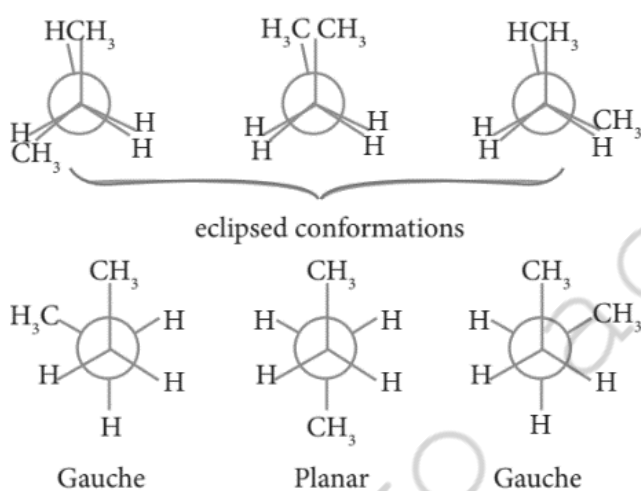
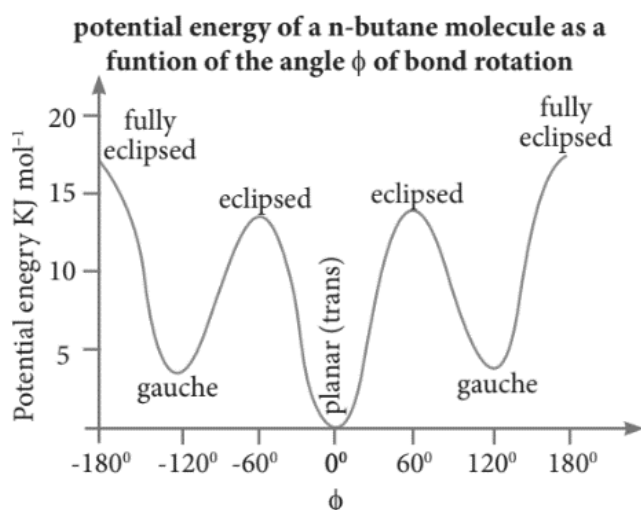
- **Eclipsed conformation:**

In this conformation, the distance between the two methyl groups is minimum so there is **maximum repulsion** between them and it is the **least stable conformer**.

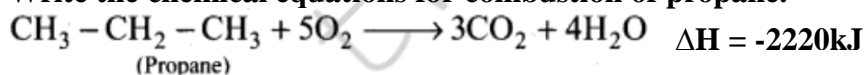
- **Anti or staggered form:**

In this conformation, the distance between the two methyl groups is maximum and so there is **minimum repulsion** between them. It is the **most stable conformer**.

The following potentially energy diagram shows the relative stability of various conformers of n-butane.



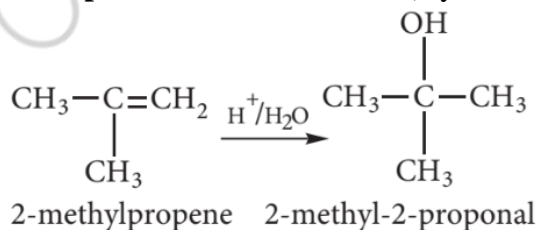
43. Write the chemical equations for combustion of propane.



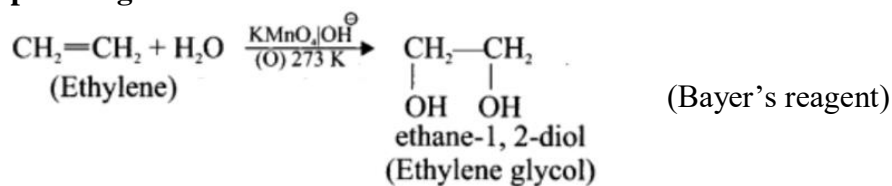
44. Explain Markovnikoff's rule with suitable example.

When an unsymmetrical alkene reacts with hydrogen halide, the hydrogen adds to the carbon atom that has more number of **hydrogen** and **halogen** adds to the carbon atom having **fewer hydrogen atoms**. This is called **Markovnikoff's rule**.

Example: Addition of water: (Hydration of alkenes)

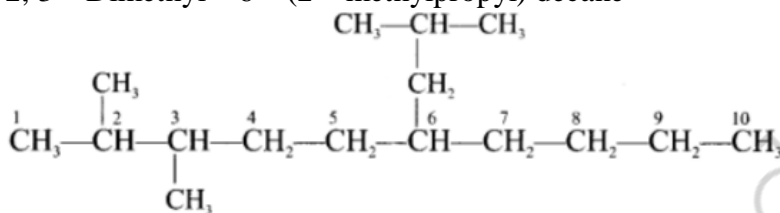


45. What happens when ethylene is passed through cold dilute alkaline potassium permanganate?

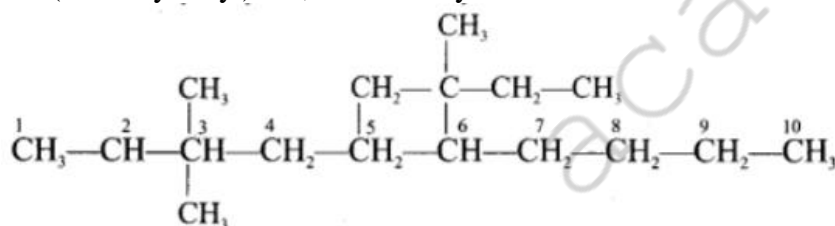


46. Write the structures of following alkanes.

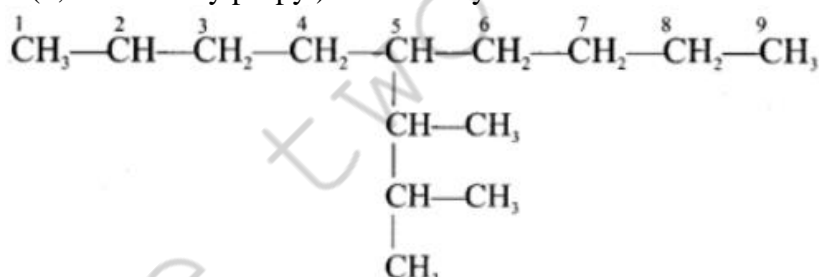
- 1, 2, 3 – Dimethyl – 6 – (2 – methylpropyl) decane**
2, 5 – (2 – Ethylbutyl) – 3, 3 – dimethyldecane
3, 5 (1,2 – Dimethylpropyl) – 2 – methylnonane
 ➤ **2, 3 – Dimethyl – 6 – (2 – methylpropyl) decane**



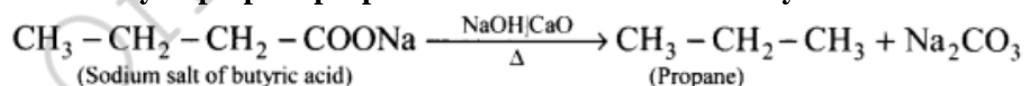
- 5 – (2 – Ethylbutyl) – 3, 3 – dimethyldecane



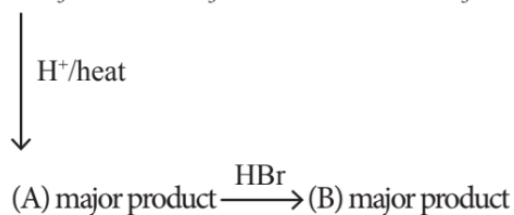
- 5 (1,2 – Dimethylpropyl) – 2 – methylnonane

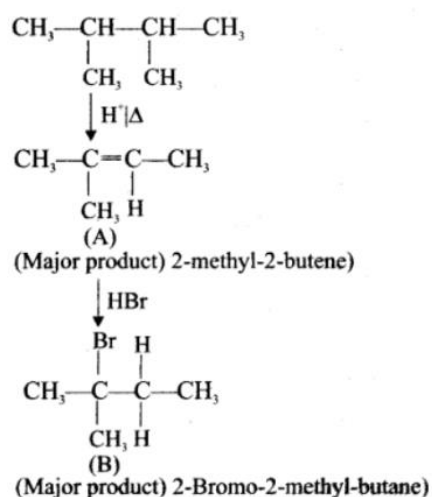


47. How will you prepare propane from a sodium salt of fatty acid?



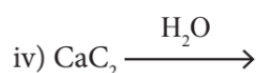
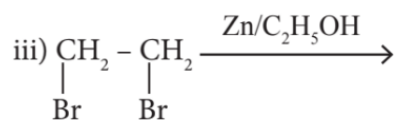
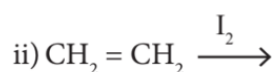
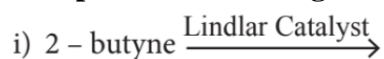
48. Identify A and B $\text{CH}_3 - \text{CH}(\text{CH}_3) - \text{CH}(\text{OH}) - \text{CH}_3$



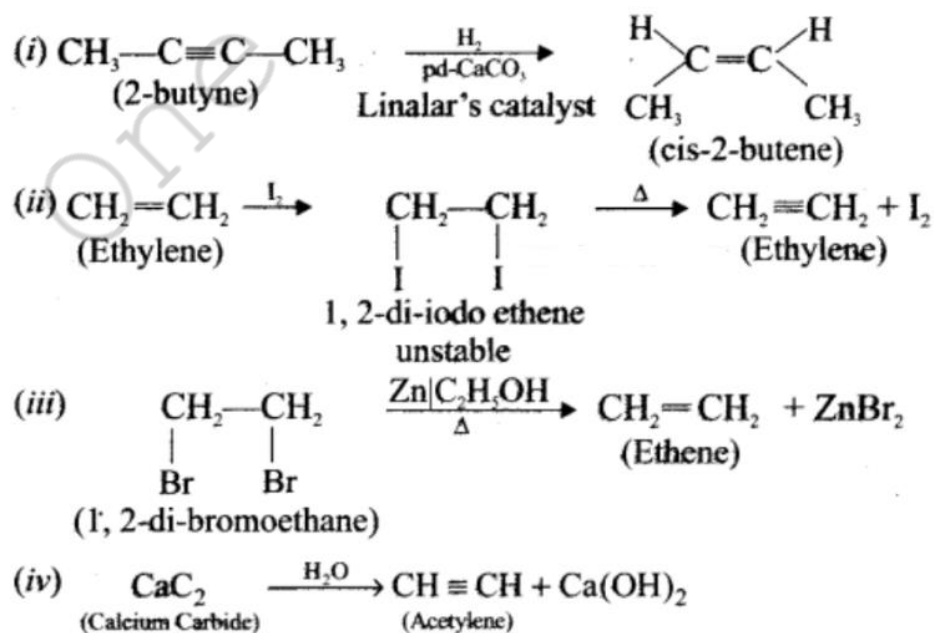


Compound	Name
A	2-methyl-2-butene
B	2-Bromo-2-methyl-butane

49. Complete the following:



Answer:



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

In 1-butyne, terminal carbon atom contains atom one acidic hydrogen, therefore it will react with **silver nitrate** in the presence of **ammonium hydroxide** to give silver butynide. Whereas 2-butyne does not undergo such type of the reaction, because of the **absence of acidic hydrogen**.

