3055 BA SANGAM COLLEGE

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WORKSHEET 13

School: Ba Sangam College **Year:** 13

Subject: Chemistry **Name:**

Strand	**4 - Materials**
Sub strand	**4.2- Organic Chemistry**
Content Learning Outcome	**-Describe the difference between aliphatic and aromatic hydrocarbons.** **-Explain Markovnikov's rule and apply it to the addition reaction of alkenes.**

Hydrocarbons

Hydrocarbons are organic compounds that consist primarily of carbon andhydrogen atoms.

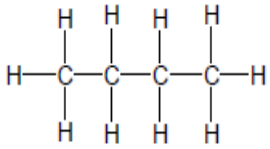
There are two types of hydrocarbons: Aliphatic and Aromatic

1. Aliphatic Hydrocarbons

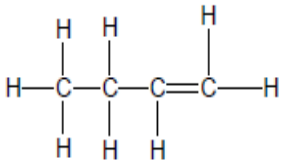
- Aliphatic hydrocarbons consist of linear chains of carbon atoms.
- They can be either saturated or unsaturated.
- Alkanes, alkenes and alkynes are examples of aliphatic hydrocarbons.

Examples

1. Butane



2. But-1-ene



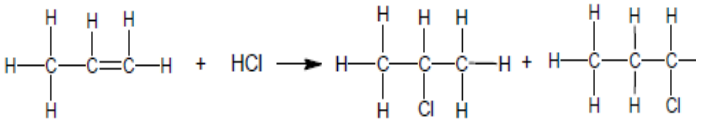
Reactions of Aliphatic Hydrocarbons

Addition Reaction in Unsymmetrical Alkenes Markovnikov's Rule

Markovnikov's rule states that in the addition of molecules to anunsymmetrical alkene, **the hydrogen atom of the attacking molecule attaches to the carbon atom of the double bond that has the greaternumber of hydrogen atom attached to it.**

Example 1: Hydrohalogenation

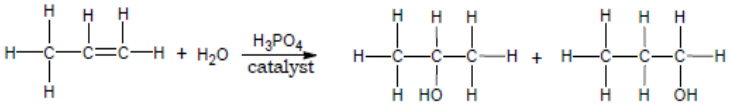
Addition of HCl to propene



Propene | **2-chloropropane** (Major Product) | Chloropropane (Minor Product)

Example 2: Hydration

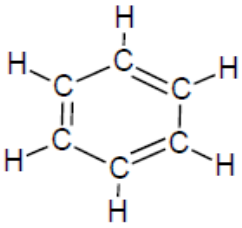
Addition of H_2O to propene



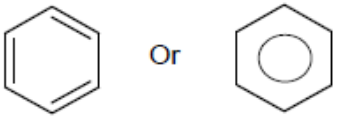
Propan-2-ol (Major product) | Propan-1-ol (Minor product)

2. Aromatic Hydrocarbons

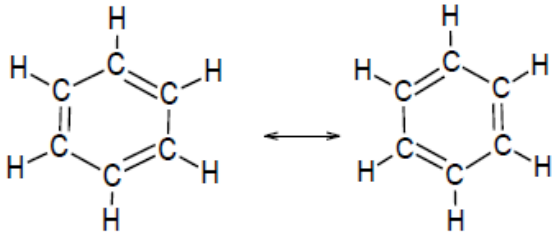
- Aromatic hydrocarbons consist of closed rings of carbon atoms.
- The building block of aromatic hydrocarbons is the benzene (C_6H_6)ring.
- The benzene ring has six carbon atoms, each holding one hydrogenatom (H).



- The benzene ring is represented as a hexagon either with alternatingsingle or double bonds or a circle.

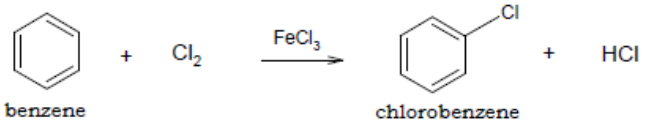


- Two resonance structures for benzene are:



- Although the individual resonance structures for benzene show doublebonds, the molecule does not react like other organic molecules thathave carbon-carbon double bonds.
- This is because of the formation of a resonance hybrid which is morestable than either of the resonance form of benzene. This resonancehybrid is represented by a hexagon with a circle in the centre.
- This circle also represents the delocalised bonds of the benzene ring,which strongly stabilises the ring. For this reason, benzene does noteasily undergo addition reactions. Instead, the **benzene ringundergoes substitution reactions**, those in which one of the H atomfrom the ring is replaced by another atom or group. If benzeneundergoes addition reaction, then the ring of delocalised pi electronsmust be broken and that requires a lot of energy. For this reason,benzene mostly undergoes substitution reactions.

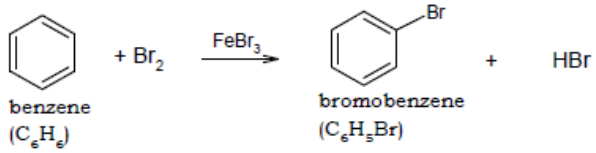
Example



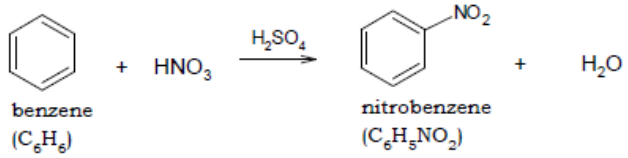
Other substitution reactions with benzene are also possible, provided a suitable catalyst is present.

Other Examples

1.



2.



EXERCISE

1. Using relevant examples, differentiate between aliphatic and aromatic hydrocarbons.

2. State the Markovnikov's Rule.

3. Give the structural formula and name of the major products of the following addition reactions.

   a. $CH_3CH_2CH_2CH{=}CH_2 + HCl \rightarrow$ _____

   b. $CH_3CH_2CH_2C(CH_3)CH_2 + HCl \rightarrow$ _____

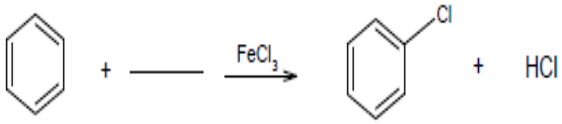
   c. $CH_3CH_2C(CH_3)CHCH_3 + HBr \rightarrow$ _____

   d. $CH(CH_3)_2CHC(CH_3)CH_2CH_3 \xrightarrow[H_2SO_4]{H_2O}$ _____

4. Explain why benzene does not undergo addition reactions like other aliphatic alkenes.

5. Complete the following reaction equations.

a.



b.