

Aromatic Molecular Structures

Talk to a Teacher

<http://spoken-tutorial.org>

National Mission on Education through ICT

<http://sakshat.ac.in>

Madhuri Ganapathi

IIT Bombay

26 November 2013



Learning Objectives



Learning Objectives

We will learn to



Learning Objectives

We will learn to

- **Convert Cyclohexane to Cyclohexene**



Learning Objectives

We will learn to

- Convert Cyclohexane to Cyclohexene
- Convert Cyclohexene to Benzene



Learning Objectives

We will learn to

- Convert Cyclohexane to Cyclohexene
- Convert Cyclohexene to Benzene
- **Substitute Hydrogen of Benzene ring with other atoms**



Learning Objectives

We will learn to

- Convert Cyclohexane to Cyclohexene
- Convert Cyclohexene to Benzene
- Substitute Hydrogen of Benzene ring with other atoms
- **Substitute Hydrogen of Benzene ring with group of atoms**



Learning Objectives

We will learn to

- Convert Cyclohexane to Cyclohexene
- Convert Cyclohexene to Benzene
- Substitute Hydrogen of Benzene ring with other atoms
- Substitute Hydrogen of Benzene ring with group of atoms
- Merge two molecules



System Requirement



System Requirement

- **Ubuntu Linux OS v 12.04**



System Requirement

- **Ubuntu Linux OS v 12.04**
- **GChemPaint v 0.12.10**



Pre-requisites



Pre-requisites

You should be familiar with



Pre-requisites

You should be familiar with

- **GChemPaint** chemical structure editor



Pre-requisites

You should be familiar with

- **GChemPaint** chemical structure editor
- If not, for relevant tutorials, please visit <http://spoken-tutorial.org>



Assignment

Draw the structures of:

- 1 **Cyclobutane** and **Convert to Cyclobutadiene**
- 2 **Cyclopentane** and **Convert to Cyclopentadiene**



Functional groups



Functional groups

- **Functional groups** can substitute **hydrogens in Benzene** to derive various chemical compounds



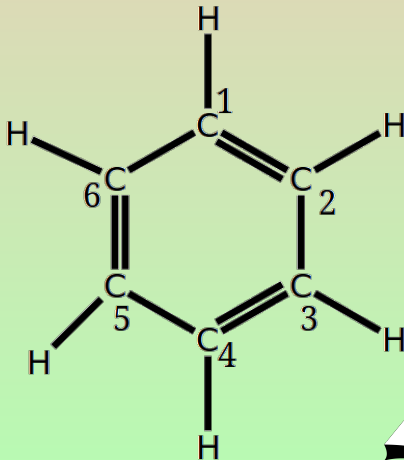
Functional groups

- **Functional groups** can substitute hydrogens in **Benzene** to derive various chemical compounds
- **Functional groups that substitute hydrogen are,**
fluoro(F), methyl(CH_3), nitro(NO_2), hydroxy(OH)



Benzene Ring Positions

Six carbon atoms
are numbered from
1 to 6 in **Benzene**
All six positions are
equivalent before
Hydrogen is
substituted



Electron Density



Electron Density

- **Electron density of the ring changes, when Hydrogen is substituted by a functional group.**



Electron Density

- **Electron density** of the ring changes, when Hydrogen is substituted by a functional group.
- **Electron density** is dependent on the substituent



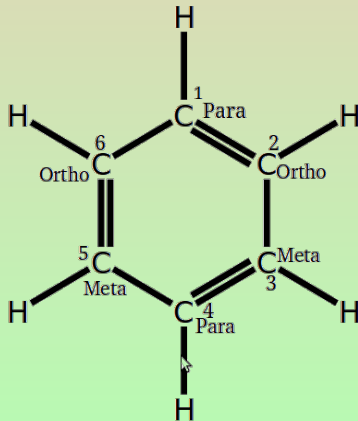
Carbon Positions



Carbon Positions

A mono-substituted compound of **Benzene** can be substituted at positions :

1 & 4 as **Para**
2 & 6 as **Ortho**
3 & 5 as **Meta**



Assignment I

Draw seven **Benzene** structures,
Substitute one of the Hydrogens of-

- 1 first **Benzene** with bromo(Br)
- 2 second **Benzene** with iodo(I)
- 3 third **Benzene** with Hydroxy(OH)
- 4 fourth **Benzene** with amino(NH_2)
- 5 fifth **Benzene** with ethyl(C_2H_5)



Assignment II

Also substitute

- ⑥ two of the hydrogens of the sixth **Benzene** with chlorine(Cl) atoms
- ⑦ first and fourth hydrogen positions of the seventh **Benzene** with carboxy($COOH$) groups



Summary

We have learnt to,

- Convert Cyclohexane to Cyclohexene
- Convert Cyclohexene to Benzene
- Substitute Hydrogen of Benzene with fluoro(F), methyl(CH_3), nitro(NO_2) and carboxy($COOH$) groups
- Merge two four membered cycles



Assignment

Merge

- 1 Two **Benzene** molecules
- 2 Two **Pentane** structures
- 3 **Cyclopentane** and **Cyclohexane** molecules



About the Spoken Tutorial Project

- Watch the video available at http://spoken-tutorial.org/What_is_a_Spoken_Tutorial
- It summarises the Spoken Tutorial project



About the Spoken Tutorial Project

- Watch the video available at http://spoken-tutorial.org/What_is_a_Spoken_Tutorial
- It summarises the Spoken Tutorial project
- If you do not have good bandwidth, you can download and watch it



Spoken Tutorial Workshops

The Spoken Tutorial Project Team

- Conducts workshops using spoken tutorials
- Gives certificates to those who pass an online test
- For more details, please write to contact@spoken-tutorial.org



Acknowledgements

- Spoken Tutorial Project is a part of the Talk to a Teacher project
- It is supported by the National Mission on Education through ICT, MHRD, Government of India
- More information on this Mission is available at <http://spoken-tutorial.org/NMEICT-Intro>

