Ministry of Higher Education and Scientific Research

Al-Muthanna University

Organic chemistry

For the 1st year students of the «faculty of Pharmacy»

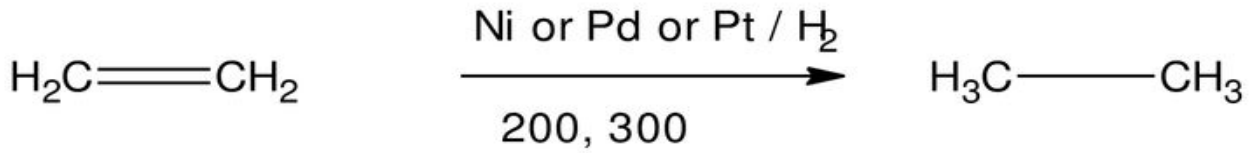
Lecture (4)

Alkanes

Dr. Rusul Alabada

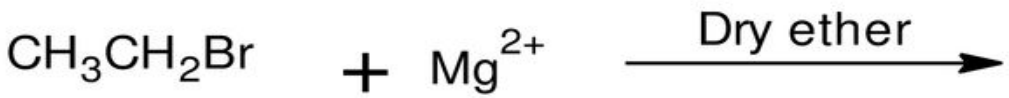
Preparation of alkanes

1- Hydrogenation of unsaturated hydrocarbon:



2- Hydrolysis of Grignard reagent

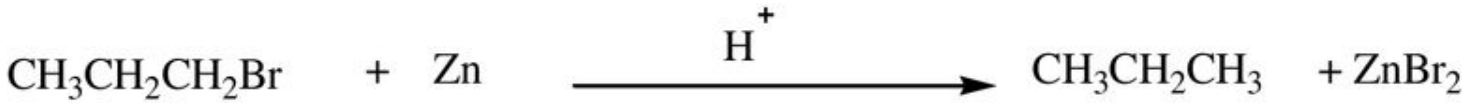
- i) R—X + Mg → RMgX (Grignard reagent)
- ii) RMgX + H_2O → RH + Mg(OH)X

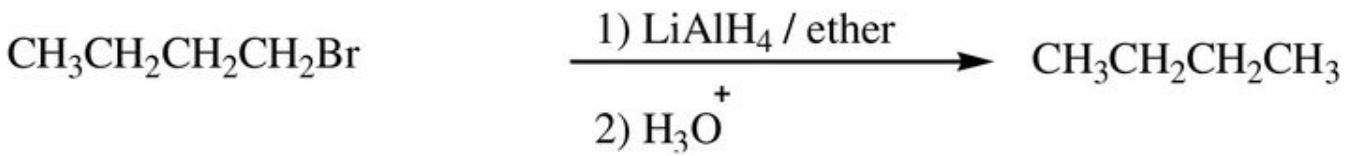


Grignard reagent

3- Reduction of alkyl halides

a) by metal and acid or by metal hydrides





b) By sodium metal (Coupling reaction)

c) By lithium dialkyl cuprate

Cycloalkanes

- Cycloalkanes are alkanes which have some of their carbon atoms arranged in a ring. Rings of different sizes starting with three carbons atoms.

- Cycloalkanes are saturated since all the carbon atoms that make up the ring are single bonded to other atoms.

- The general formula for cycloalkanes is CnH_2n

Stability of Cycloalkanes

The angles between bonds in small cycles are smaller than the angles between bonds in big cycles (108°), therefore they are unstable, they are characterized by addition reactions proceeding with by breaking the cycle:

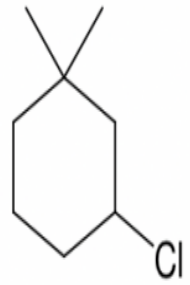
Naming of Cycloalkanes

Cycloalkanes are alkanes that contain a ring(s) as part of the structure. For a cycloalkane that contains one ring, there are *two fewer* hydrogens than the non-cyclic alkane, so the general formula of cycloalkanes with one ring is $\mathbf{C_nH_{2n}}$.

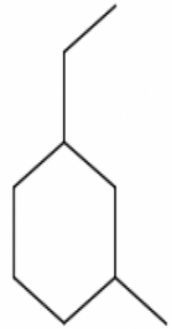
UPAC NOMENCLATURE of CYCLOALKANES

1. The parent name is “cycloalkane”.
2. Number the ring to provide the lowest possible numbering sequence (when two such sequences are possible, cite substituents in alphabetical order, and the No. 1 position is given to the first cited substituent).

:Example



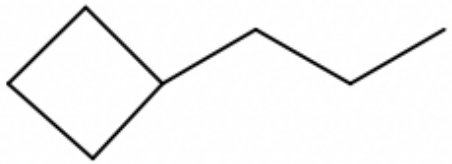
1,1-dimethyl-3-chlorocyclohexane



1-ethyl-3-methylcyclohexane

3. When both the ring and chain are included in the structure, compare the number of carbons in the ring vs the chain and select the one with more carbons as the parent structure; the other is treated as a substituent.

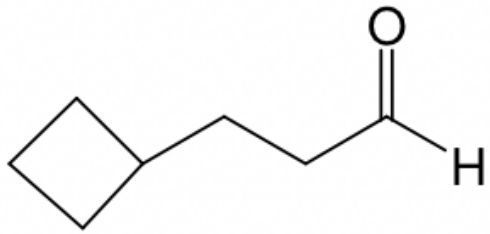
Example:



propylcyclobutane

4. When higher-priority functional groups are present (more in **section 2.2**), parent structure will contain that functional group.

Example:



3-cyclobutylpropanal

The chemical reactions of cycloalkanes

The chemical behavior of cycloalkanes depends on the ring size and the nature of the reagent used ;for example, ring fission (ring opening) occurs with small rings like cyclopropane and cyclobutane to yield an open chain compounds..

Halogenation

Hydrohalogenation

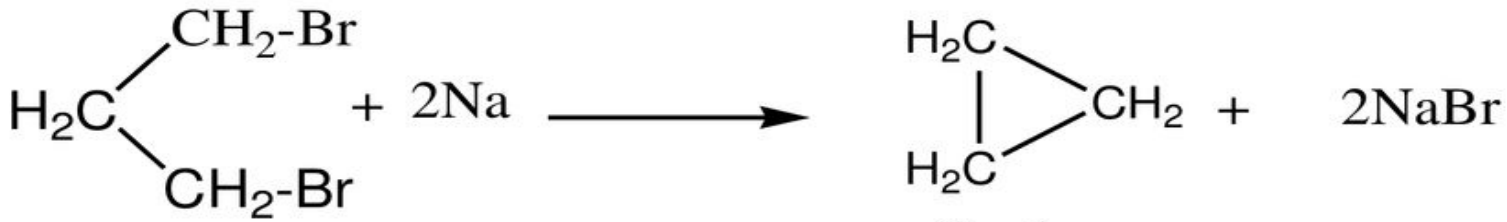
Cycloalkanes contains 5, 6 and 7 carbon atoms (normal cycles) are chemically inactive, they are most characterized by substitution reactions (similar to alkanes):

- **Dehydrogenation of cyclohexane leads to the formation of benzene:**

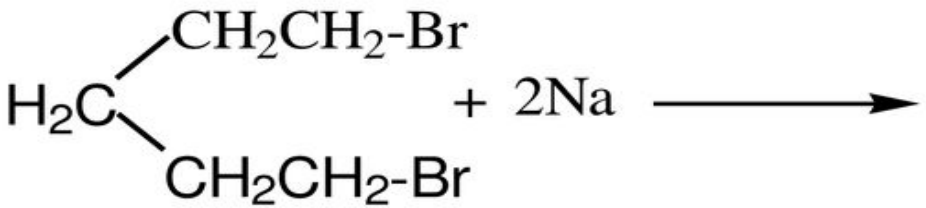
PREPRATION OF CYCLOALKANES

Dehalogenation of α, ω dihalides

When α, ω dihaloalkanes are treated with sodium or better with Zn dust in warm alcohol. The corresponding Cycloalkanes are formed.



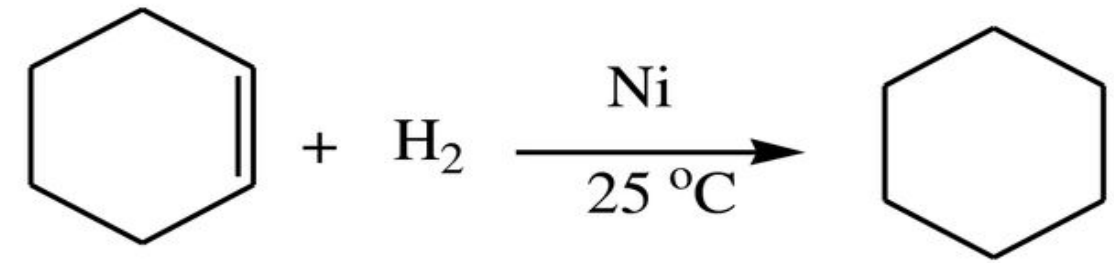
Cyclopropane

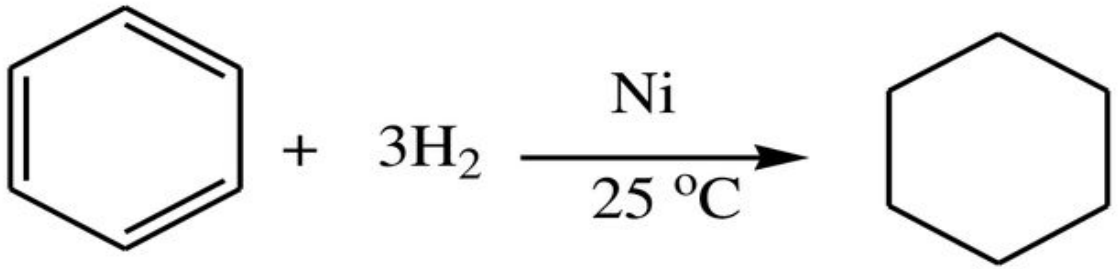


Cyclopentane

Catalytic Hydrogenation of Cyclic Alkenes

Cyclo alkanes may also be prepared conveniently by the catalytic hydrogenation of cycloalkenes.






Best Regards!
Thank you!