

Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (Third year)

Subject: Chemistry

Paper Code: CHC101

Paper Title: Inorganic Chemistry and Organic Chemistry

Unit: 3: Aliphatic Hydrocarbons

Module Name: Alkanes (upto 5 carbons): Preparation- By Catalytic Hydrogenation

Module No: 35

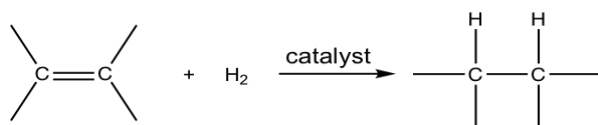
Name of the Presenter: Ms Sneha Naik

Notes

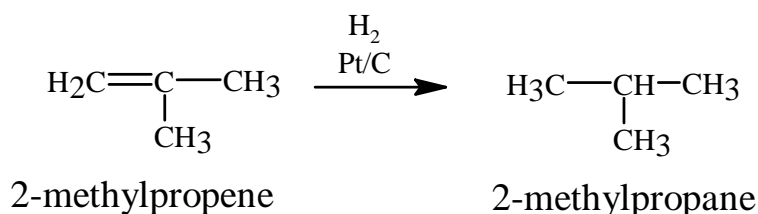
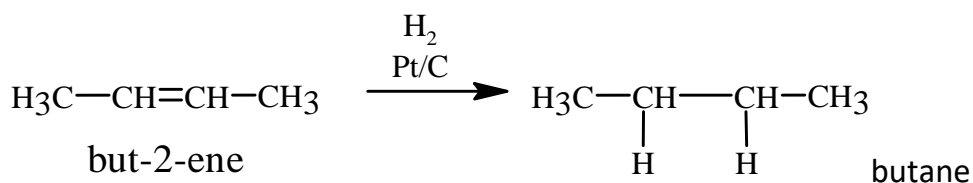
Catalytic hydrogenation

When alkenes react with hydrogen gas in the presence of a variety of metal catalysts, a hydrogen molecule is added across the double bond to give alkanes as the product, such addition reaction is called **catalytic hydrogenation**. The addition of H_2 across the π -bond is syn, i.e., from the same side of the double bond.

General reaction:



Examples:



Catalyst used:

The commonly applied metal catalysts involve palladium and platinum. Palladium, which is used as a powder absorbed on charcoal to maximize the surface

area, is the most common catalyst that is referred to as palladium on charcoal (Pd/carbon). Platinum, which is used usually as oxide PtO_2 , is also employed frequently and referred to as Adams catalyst. These metal catalysts are not soluble in the reaction mixture and therefore are described as heterogeneous catalysts. The heterogeneous catalyst can be easily filtrated out of the reaction mixture after reaction, and then be recycled and reused.

MECHANISM OF HYDROGENATION

This reaction is an example of a heterogeneous catalysis process. The reaction takes place on the surface of the metal.

STEP 1: H_2 molecule approaches the catalyst surface and gets adsorbed on the catalyst surface (figure 1)

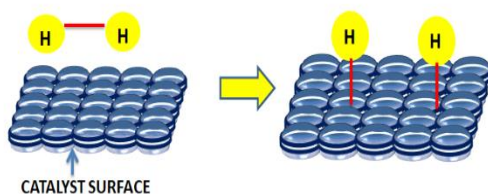


Figure 1

STEP 2: The pi bond of the alkene interacts with the metal catalyst thus weakening the bond and gets adsorbed on the catalyst surface (figure 2)

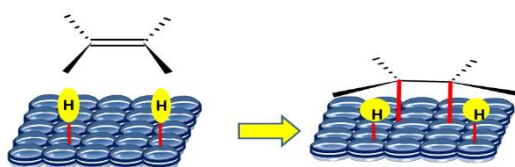


Figure 2

STEP 3: The double bond between the two carbons is replaced by two C-H bonds (figure 3).

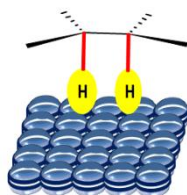


Figure 3

Order of Reactivity

Least substituted alkenes react more faster than the highly substituted ones due less steric crowding

