

Properties of Cycloalkanes

Physical properties:

- Cyclopropane and cyclobutane are gases at room temperature, the remaining cycloalkanes are liquids.
- m.p. and b.p. of cycloalkanes indicate a gradually increase with increase in molecular weight.

Chemical properties:

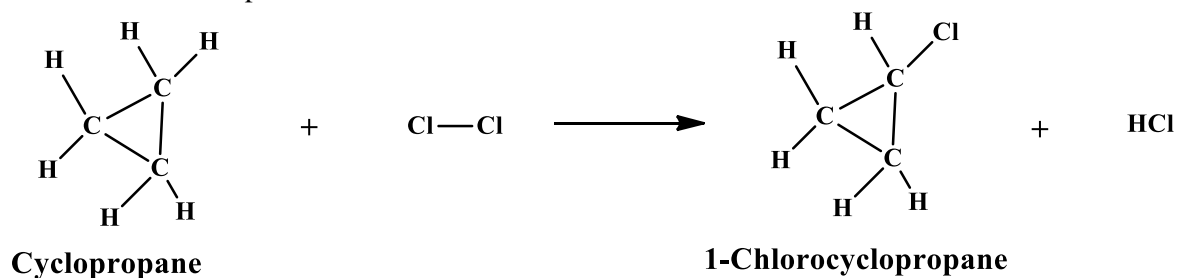
Cycloalkanes resemble alkanes in their chemical behavior.

However, cyclopropane and cyclobutane are the exceptions with certain reagents they undergo ring opening and give addition products.

i. Substitution reactions:

Substitution with Cl_2 and Br_2 :

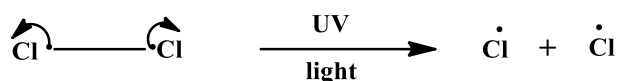
Cycloalkane reacts with chlorine and bromine in the presence of UV light to give substitution products.



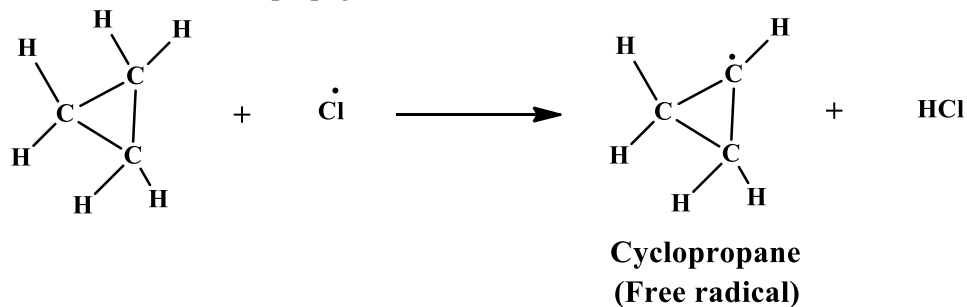
Mechanism:

a. Initiation:

Chlorine undergoes homolytic fission to form chlorine-free radicals.

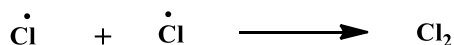


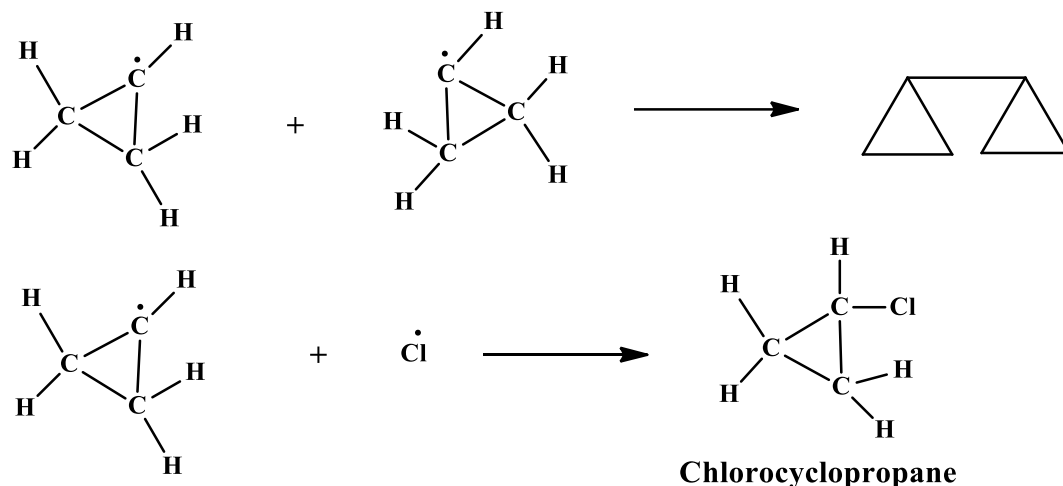
b. Chain propagation:



This is repeated over and over again.

c. Chain termination:

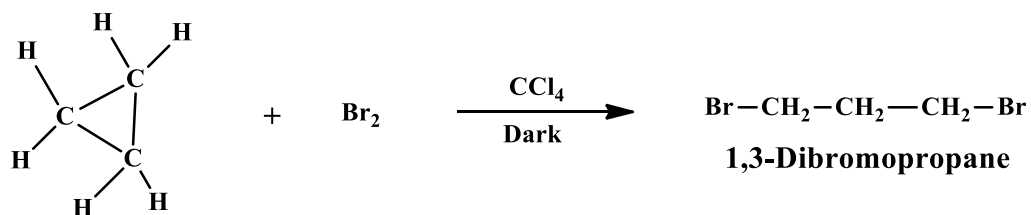




ii. Ring opening reactions:

a. Addition of Cl_2 or Br_2 :

Cyclopropane reacts with Cl_2 or Br_2 in the dark to form addition product.
 CCl_4 is used as a solvent.

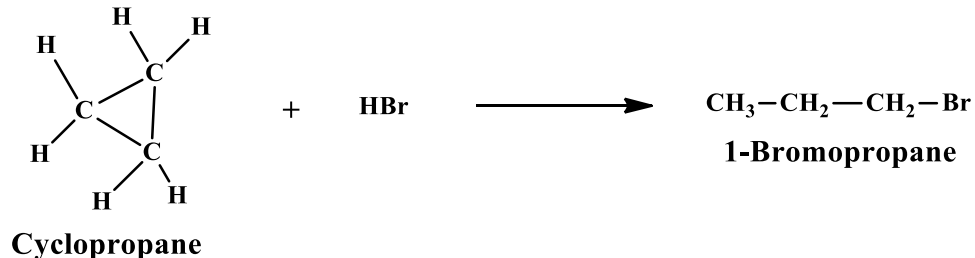


Ring splits opens Cyclopropane

Note: Cyclobutane and higher members do not give this reaction.

b. Addition of HBr and HI :

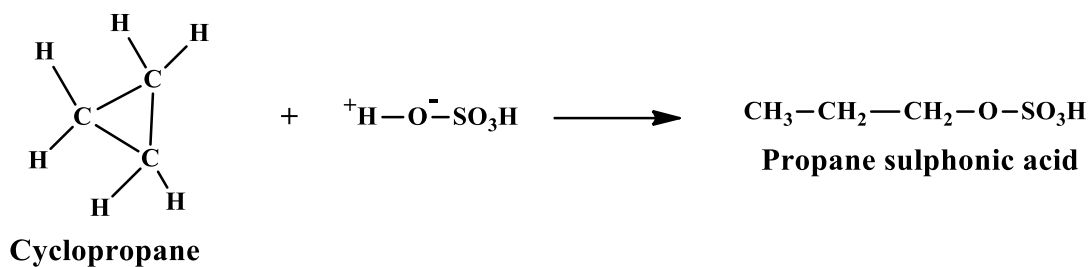
Cyclopropane reacts with conc. HBr and HI to yield 1- bromopropane/1-iodopropane.



Note: Cyclobutane and higher members do not give this reaction.

c. Addition of H_2SO_4 :

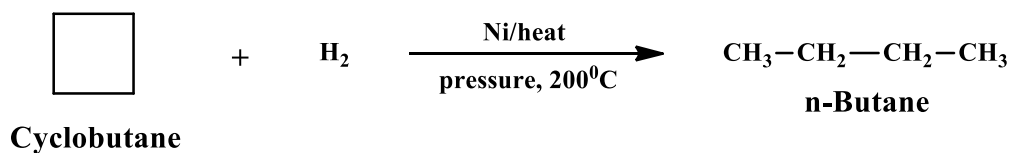
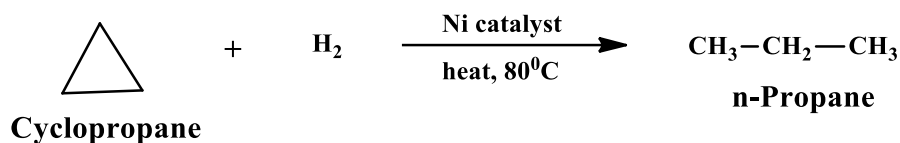
Cyclopropane reacts with conc. H_2SO_4 to form propane sulphonic acid.



Note: Cyclobutane and higher members do not give this reaction.

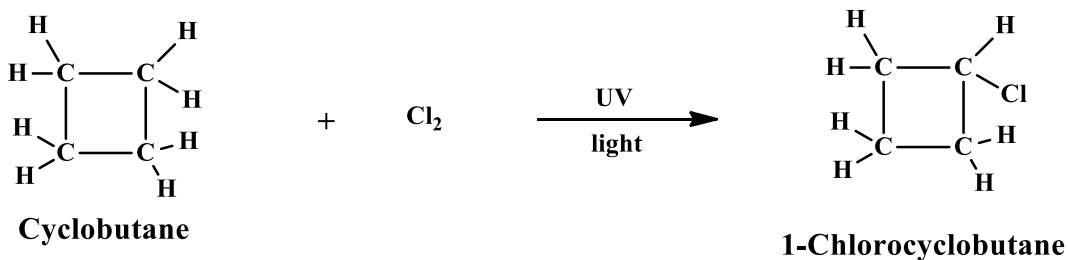
d. Addition of hydrogen:

Cyclopropane and cyclobutane reacts with hydrogen in presence of nickel catalyst to give propane and butane respectively.



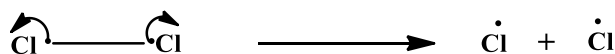
Note: Higher temperature is required for cyclobutane.

Cyclobutane substitution with Cl₂ and Br₂



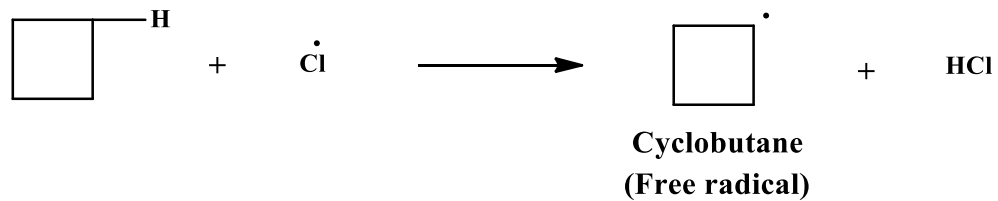
Mechanisms:

a. Initiation:



Chlorine undergoes homolytic fission to form chlorine-free radicals.

b. Chain propagation:



This is repeated over and over again.

c. Chain termination:

