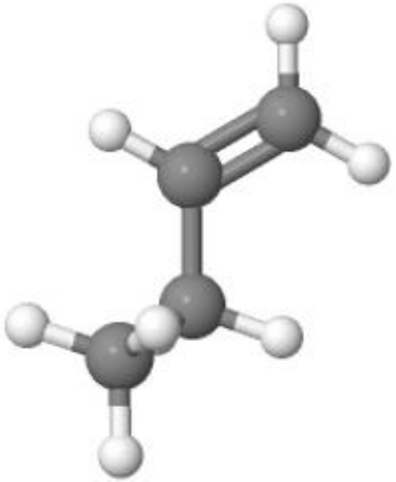
2302263 – Organic Chemistry I – Part III

Lecture 2-4

Alkenes – Reactions 2



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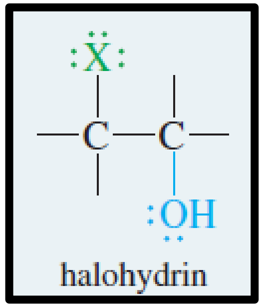
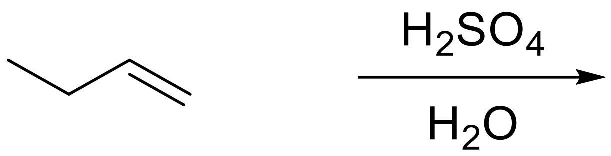
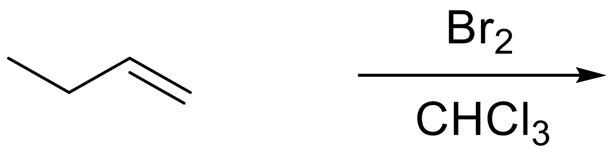
Recommended Textbook:
Chapter 8 in *Organic Chemistry*, 8th Edition, L. G. Wade, Jr., **2010**, Prentice Hall (Pearson Education)

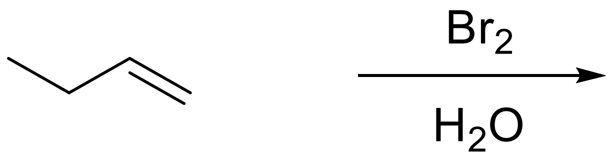
6) Formation of Halohydrins

A **halohydrin** is an alcohol with a halogen on the adjacent carbon atom.



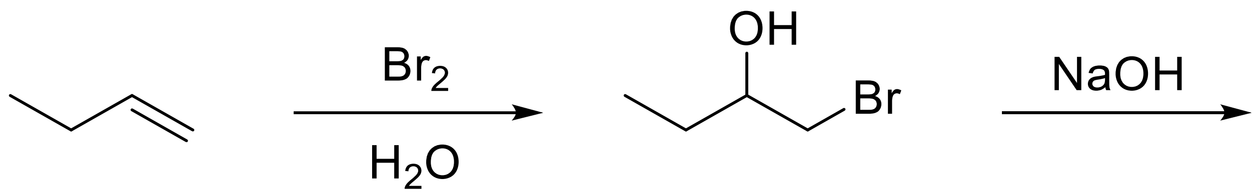






6) Formation of Halohydrins

Reaction of halohydrin: Formation of epoxide

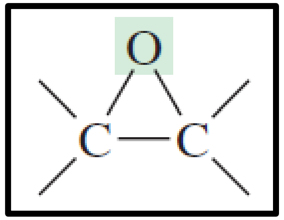


6) Formation of Halohydrins

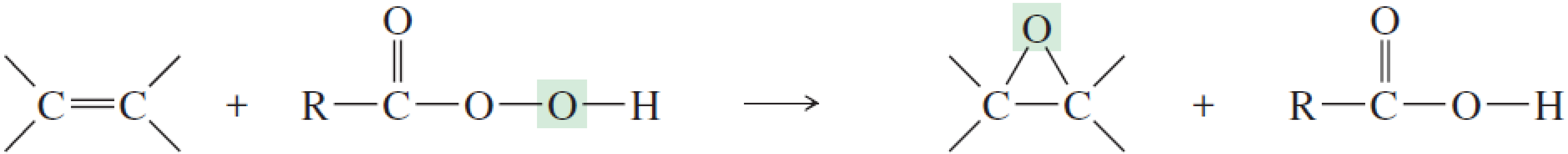
Example 1 Propose mechanisms and predict the major products of the following reaction. Include stereochemistry where appropriate.

7) Epoxidation of Alkenes

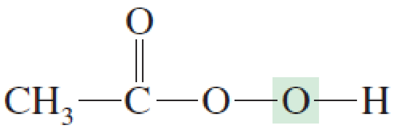
An **epoxide** is a three-membered cyclic ether**.** Epoxides are valuable synthetic intermediates used for converting alkenes to a variety of other functional groups.

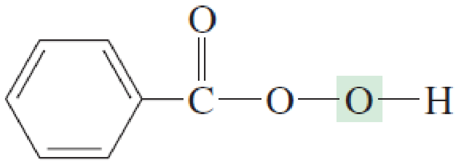


An alkene is converted to an epoxide by **"epoxidation"** using a **peroxyacid**



Examples of peroxyacid:

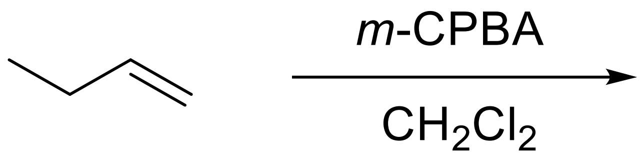




***m*-CPBA**
***m*-chloroperbenzoic acid**

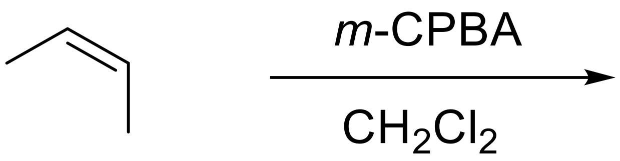
7) Epoxidation of Alkenes

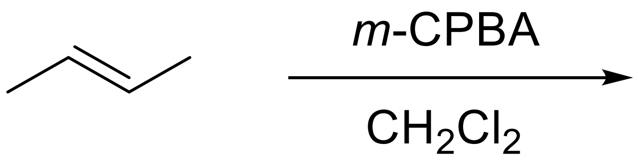
Mechanism



7) Epoxidation of Alkenes

Stereochemistry

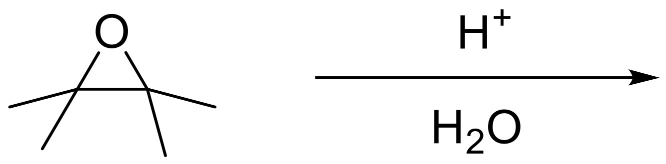




7) Epoxidation of Alkenes

Reaction of epoxide: Acid-catalyzed ring opening

Any moderately strong acid protonates the epoxide. Water attacks the protonated epoxide, opening the ring and forming a 1,2-diol, commonly called a **glycol.**



7) Epoxidation of Alkenes

Example 2 Propose mechanisms and predict the major products of the following reactions. Include stereochemistry where appropriate.

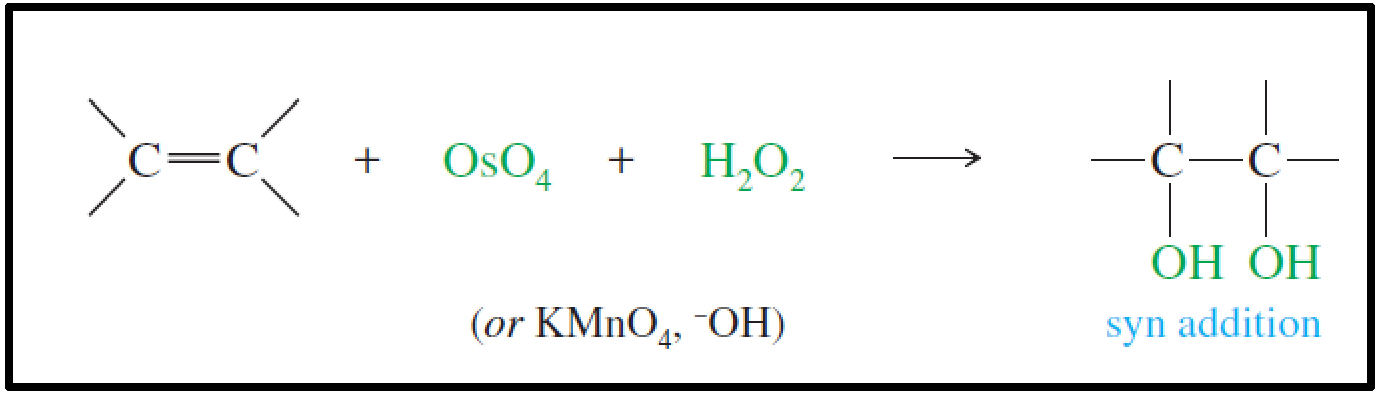
(a)

7) Epoxidation of Alkenes

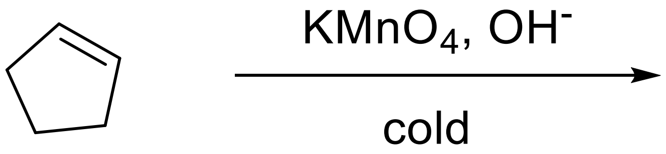
Example 2 Propose mechanisms and predict the major products of the following reactions. Include stereochemistry where appropriate.

(b)

8) Syn Dihydroxylation

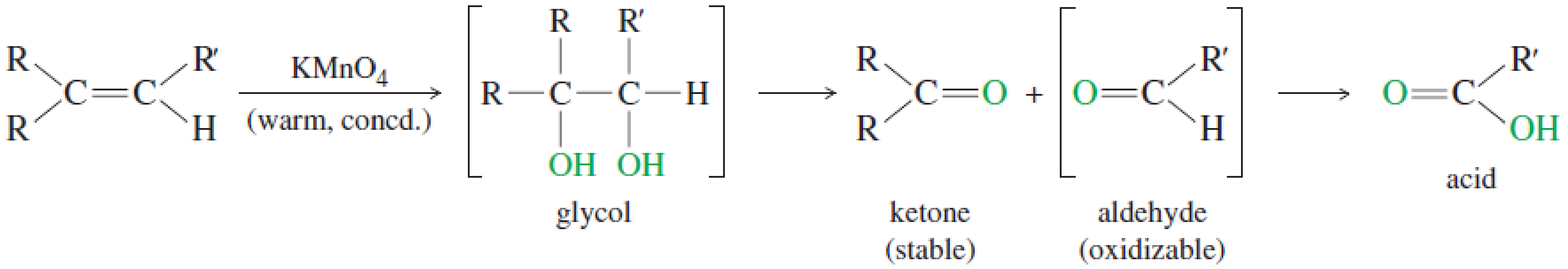


Mechanism for $KMnO_4$

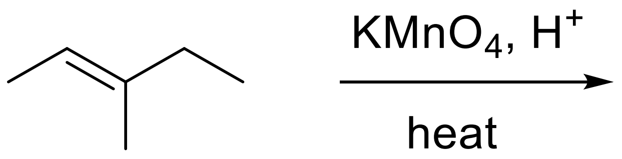


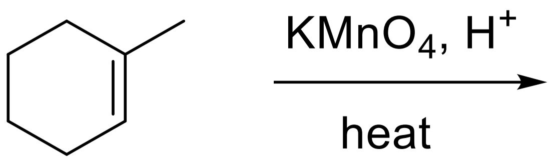
9) Oxidative Cleavage

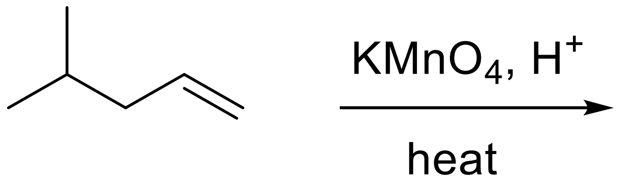
- **$KMnO_4$** if the solution is **warm** or **acidic** or **too concentrated**

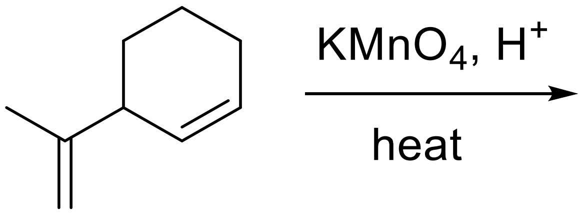


Examples:



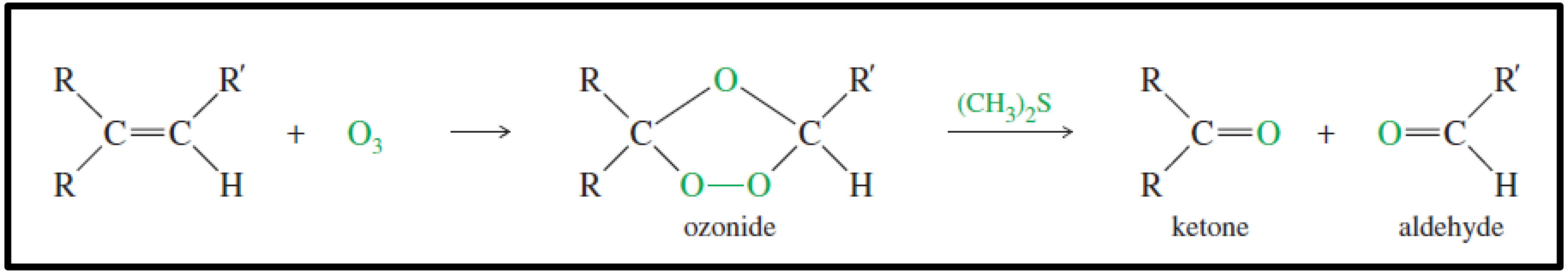


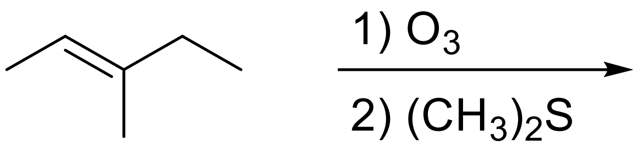


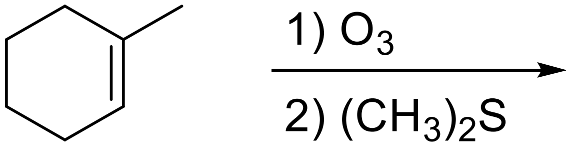


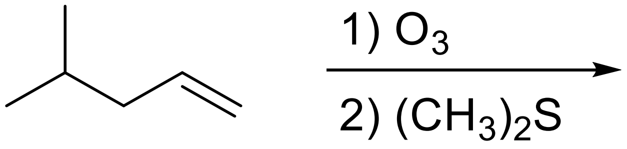
9) Oxidative Cleavage

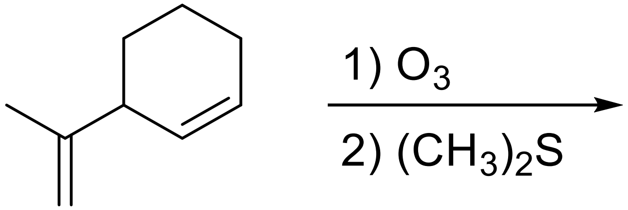
- **Ozonolysis** cleaves double bonds to give ketones and aldehydes. However, ozonolysis is milder, and both ketones and aldehydes can be recovered without further oxidation.





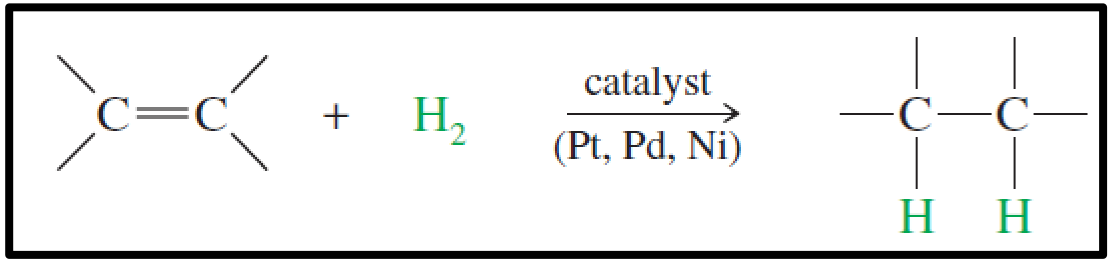




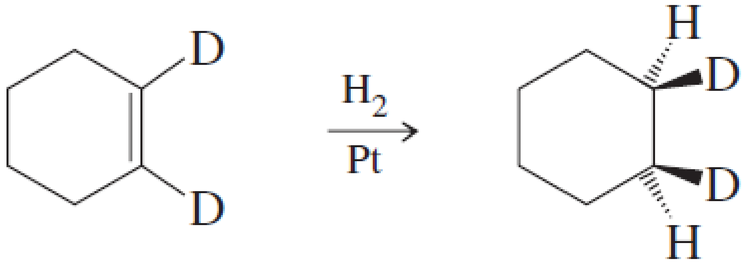


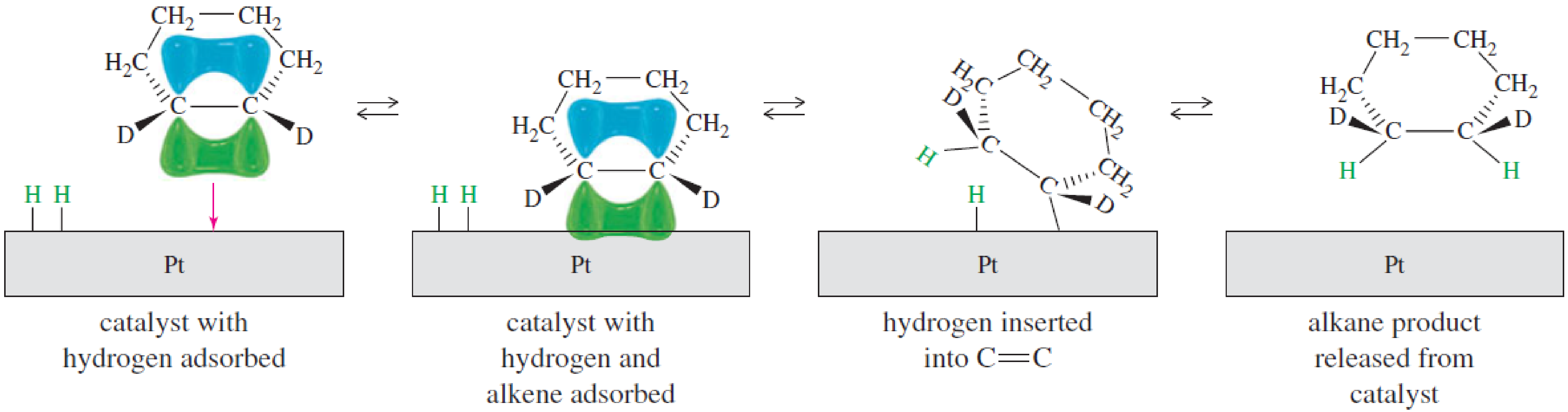
10) Catalytic Hydrogenation

Hydrogenation of an alkene is formally a **reduction**, with adding across the double bond to give an **alkane**. The process usually requires a catalyst containing **Pt, Pd, or Ni**.



Because the two hydrogen atoms add from a solid surface, they add with **syn** stereochemistry.





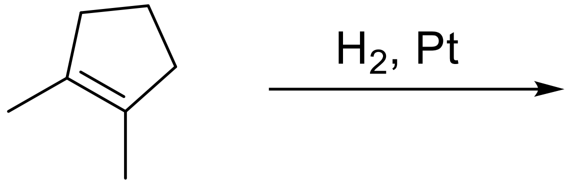
10) Catalytic Hydrogenation

Example 3 Predict the product of the following reactions. Include stereochemistry where appropriate.

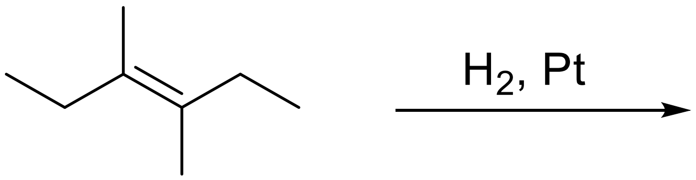
(a)

(b)

(c)



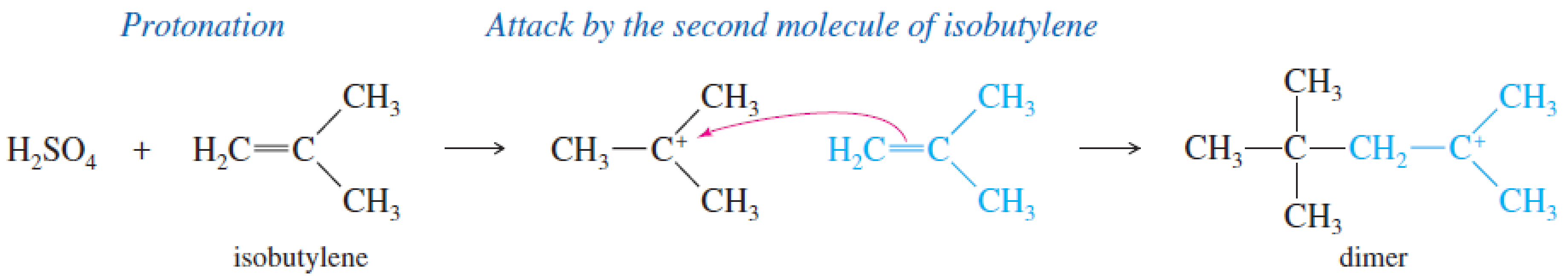
(d)



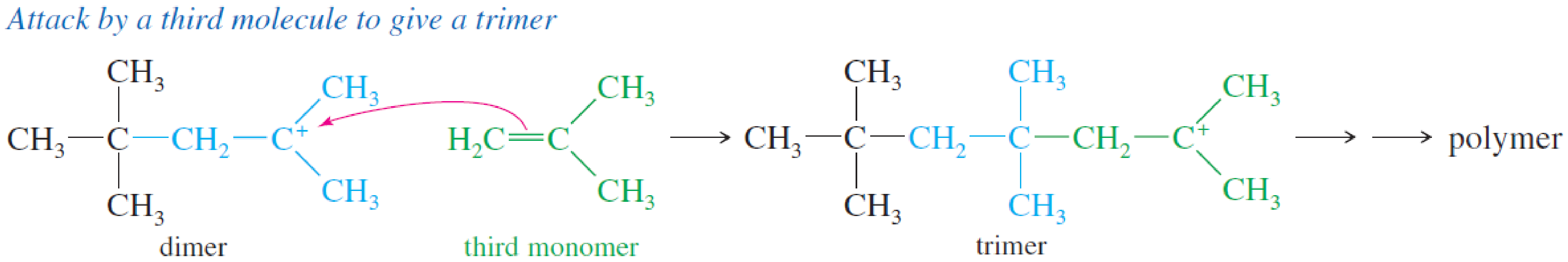
11) Polymerization

- **Cationic Polymerization**

Alkenes that easily form carbocations are good candidates for **cationic polymerization**



If a large concentration of alkene is available, another molecule of the alkene may act as the nucleophile and attack the carbocation



11) Polymerization

- **Cationic Polymerization**

Example 4 Propose the mechanism and predict the product of the following reaction.