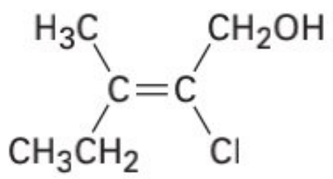
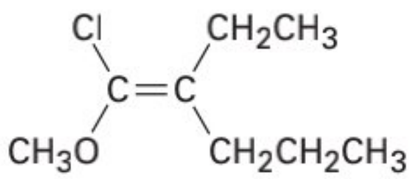
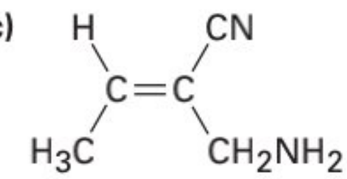
Problem 3.8 Which member in each of the following sets ranks higher?

(a) –H or –Br **(b)** –Cl or –Br **(c)** $-CH_3$ or $-CH_2CH_3$
(d) $-NH_2$ or –OH **(e)** $-CH_2OH$ or $-CH_3$ **(f)** $-CH_2OH$ or –CH=O

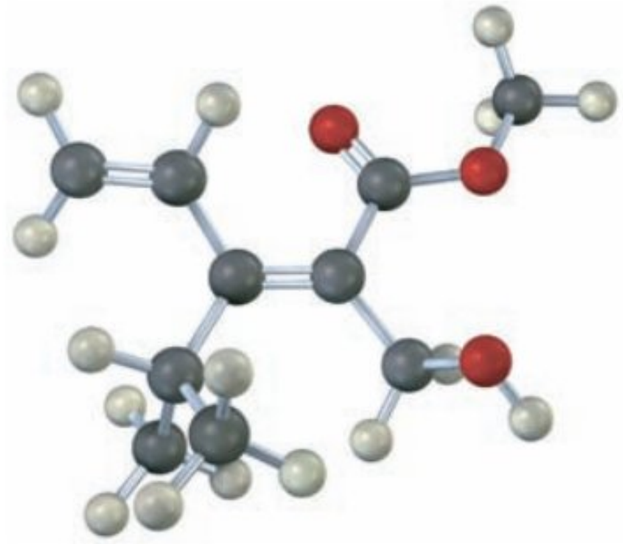
Problem 3.9 Assign *E* or *Z* stereochemistry to the following compounds:

(a)


(b)


(c)


Problem 3.10 Assign *E* or *Z* stereochemistry to the following compound (red = O):

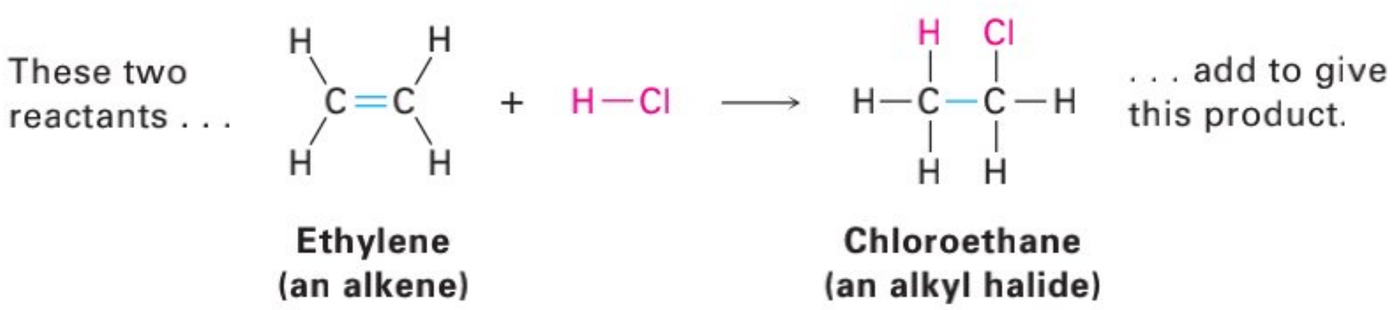


3.5 Kinds of Organic Reactions

Now that we know something about alkenes and alkynes, let's learn about their chemical reactivity. As an introduction, we'll first look at some of the basic principles that underlie all organic reactions. In particular, we'll develop some general notions about why compounds react the way they do, and we'll see some methods that have been developed to help understand how reactions take place.

Organic chemical reactions can be organized either by what kinds of reactions occur or by how reactions occur. Let's look first at the kinds of reactions that take place. There are four particularly broad types of organic reactions: *additions, eliminations, substitutions,* and *rearrangements.*

- **Addition reactions** occur when two reactants add together to form a single new product with no atoms "left over." An example that we'll be studying soon is the reaction of an alkene with HCl to yield an alkyl chloride.



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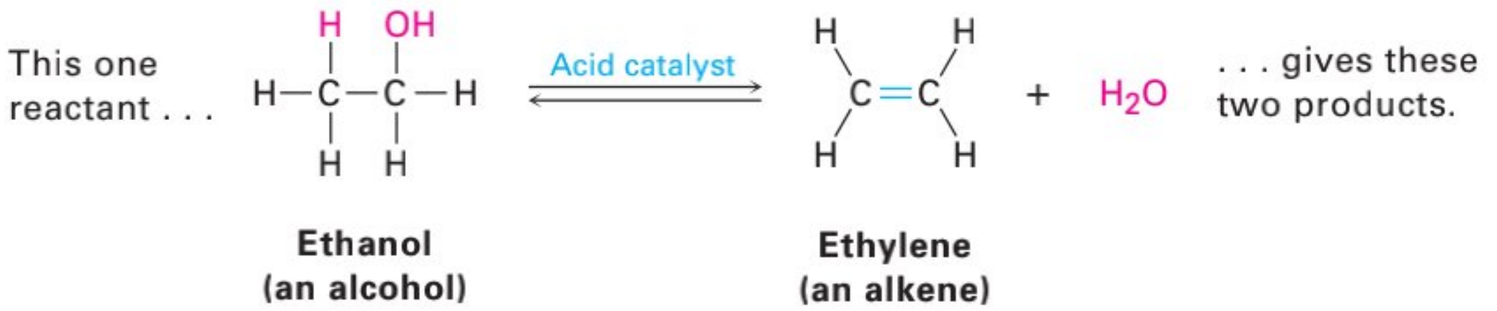
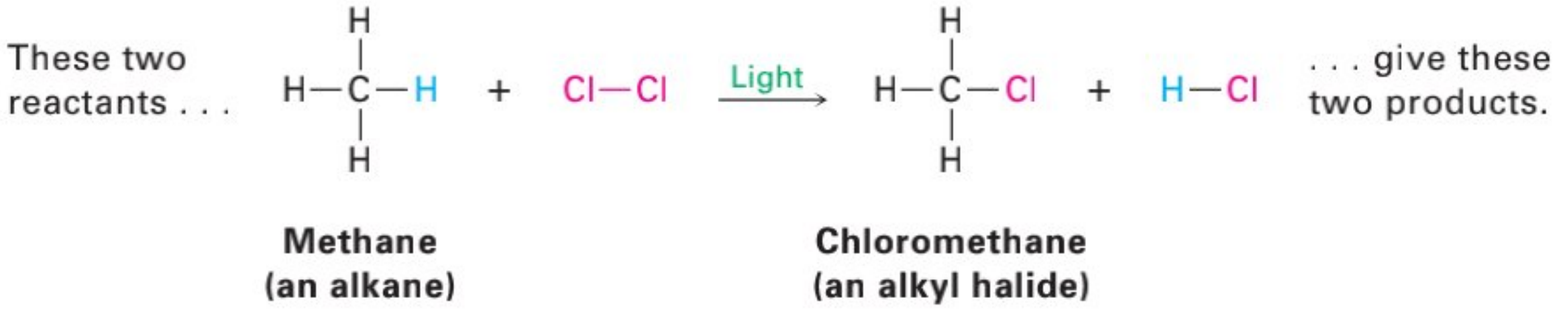
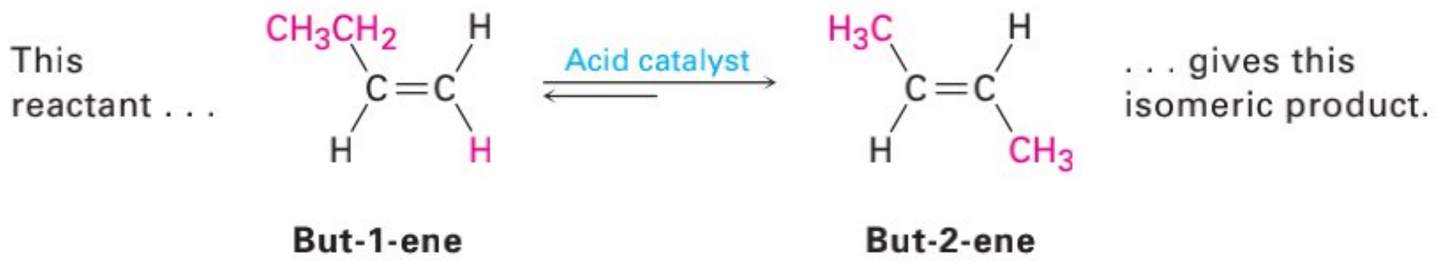
- **Elimination reactions** are, in a sense, the opposite of addition reactions. They occur when a single organic reactant splits into two products, often with formation of a small molecule such as H_2O or HCl. An example is the acid-catalyzed reaction of an alcohol to yield water and an alkene.



- **Substitution reactions** occur when two reactants exchange parts to give two new products. An example that we saw in Section 2.4 is the reaction of an alkane with Cl_2 in the presence of ultraviolet light to yield an alkyl chloride. A −Cl group substitutes for the −H group of the alkane, and two new products result.



- **Rearrangement reactions** occur when a single organic reactant undergoes a reorganization of bonds and atoms to yield a single isomeric product. An example that we saw in Section 3.3 is the conversion of *cis*-but-2-ene into its isomer *trans*-but-2-ene by treatment with an acid catalyst.



Problem 3.11 Classify the following reactions as additions, eliminations, substitutions, or rearrangements:

(a) $CH_3Br + KOH \rightarrow CH_3OH + KBr$

(b) $CH_3CH_2Cl + NaOH \rightarrow H_2C{=}CH_2 + NaCl$

(c) $H_2C{=}CH_2 + H_2 \rightarrow CH_3CH_3$

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