

Organic Reactions

Aim

- to describe common reactions of organic compounds

Notes

Some reactions of hydrocarbons

★ Combustion - burning

☆ with sufficient oxygen → CO₂ and water

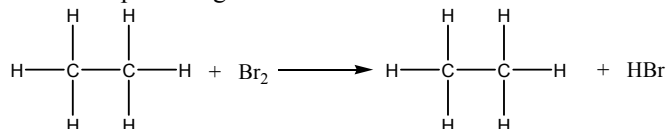
★ example: $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

☆ with insufficient oxygen → CO and water

★ example: $2C_3H_8 + 7O_2 \rightarrow 6CO + 8H_2O$

★ Substitution - replacement of hydrogen in saturated hydrocarbons

☆ example: halogen substitution



ethane + bromine → monobromoethane + hydrogen bromide

★ Addition

☆ Definition = Adding two or more atoms to carbon at a point of unsaturation

☆ Characteristics

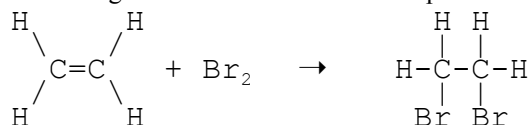
★ take place more easily than substitutions

★ unsaturated bonds are more reactive than saturated bonds and alkynes are more reactive than alkenes

★ results in the formation of a single product

☆ Examples

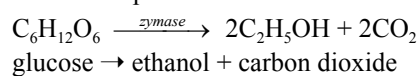
★ halogenation - occurs at room temperature



☆ Hydrogenation

★ Definition - addition of hydrogen to an alkene or an alkyne (or other carbon compounds with double or triple bonds)

★ Fermentation - enzymatic breakdown of organic molecules during anaerobic respiration



★ Esterification - formation of esters

☆ General formula: RCOOR

☆ Formation: $ROH + RCOOH \rightarrow RCOOR + H_2O$

☆ importance:

★ fruit flavorings and aromas

★ lipids are formed by esterification of glycerol by fatty acids

★ Saponification - hydrolysis of fats by bases

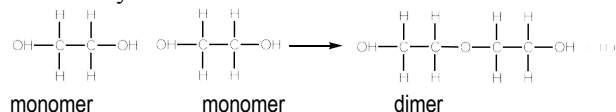
☆ produces organic salts called soaps

☆ forms glycerol as a byproduct

★ Polymerization - formation of large molecules from repeating units of smaller ones

☆ Polymer - large molecule formed from many smaller, repeating units or *monomers*

☆ Condensation - joining monomers by dehydration synthesis



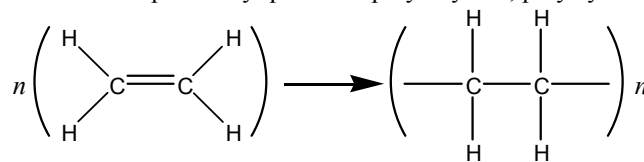
★ condensation polymers must have at least two functional groups

★ the process can be repeated to form long chain polymers

★ examples: silicones, polyesters, polyamides, phenolic plastics, and nylons

☆ Addition polymerization - involves opening up double and triple bonds of unsaturated hydrocarbons

★ examples: vinyl plastics - polyethylene, polystyrene



ethylene monomer

polyethylene

Answer the questions below by circling the number of the correct response

- One of the products produced by the reaction between CH_3COOH and CH_3OH is
 - HOH
 - H_2SO_4
 - HCOOH
 - $\text{CH}_3\text{CH}_2\text{OH}$
- A fermentation reaction and a saponification reaction are similar in that they both can produce
 - an ester
 - an alcohol
 - an acid
 - a soap
- The product of a reaction between a hydrocarbon and chlorine was 1,2-dichloropropane. The hydrocarbon must have been
 - C_5H_{10}
 - C_2H_4
 - C_3H_6
 - C_4H_8
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 - C_2H_4
 - C_3H_6
 - C_4H_8
- The reaction $\text{C}_3\text{H}_6 + \text{H}_2 \rightarrow \text{C}_3\text{H}_8$ is an example of
 - substitution
 - addition
 - polymerization
 - esterification
- The reaction $\text{C}_2\text{H}_4 + \text{H}_2 \rightarrow \text{C}_2\text{H}_6$ is an example of
 - addition
 - substitution
 - saponification
 - esterification
- A reaction between an acid and an alcohol produces an ester and
 - carbon dioxide
 - water
 - glycerol
 - ethanol
- The fermentation of $\text{C}_6\text{H}_{12}\text{O}_6$ will produce carbon dioxide and
 - a polymer
 - a soap
 - an ester
 - an alcohol
- The reaction: $\text{C}_4\text{H}_8 + \text{Cl}_2 \rightarrow \text{C}_4\text{H}_8\text{Cl}_2$ is an example of
 - substitution
 - addition
 - polymerization
 - fermentation
- A reaction between CH_3COOH and an alcohol produced water and an ester $\text{CH}_3\text{COOCH}_3$. Which alcohol was used in the reaction?
 - CH_3OH
 - $\text{C}_2\text{H}_5\text{OH}$
 - $\text{C}_3\text{H}_7\text{OH}$
 - $\text{C}_4\text{H}_9\text{OH}$
- The hydrolysis of fat by a base is called
 - saponification
 - esterification
 - polymerization
 - neutralization
- Which is the product of the reaction between ethene and chlorine?
 - $$\begin{array}{c} \text{H} & \text{H} \\ | & | \\ \text{H}-\text{C}-\text{C}-\text{Cl} \\ | & | \\ \text{H} & \text{H} \end{array}$$
 - $$\begin{array}{c} \text{H} \\ | \\ \text{H}-\text{C}-\text{Cl} \\ | \\ \text{H} \end{array}$$
 - $$\begin{array}{c} \text{H} & \text{H} \\ | & | \\ \text{Cl}-\text{C}-\text{C}-\text{Cl} \\ | & | \\ \text{H} & \text{H} \end{array}$$
 - $$\begin{array}{c} \text{H} \\ | \\ \text{Cl}-\text{C}-\text{Cl} \\ | \\ \text{H} \end{array}$$
- Which equation represents an esterification reaction?
 - $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{C}_2\text{H}_5\text{OH} + \text{CO}_2$
 - $\text{C}_5\text{H}_{10} + \text{H}_2 \rightarrow \text{C}_5\text{H}_{12}$
 - $\text{C}_3\text{H}_8 + \text{Cl}_2 \rightarrow \text{C}_3\text{H}_7\text{Cl} + \text{HCl}$
 - $\text{HCOOH} + \text{CH}_3\text{OH} \rightarrow \text{HCOOCH}_3 + \text{HOH}$
- In a condensation polymerization, a product always formed is
 - water
 - hydrogen
 - oxygen
 - carbon dioxide
- The organic reaction, $\text{HCOOH} + \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH} \rightarrow \text{HCOOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3 + \text{HOH}$, is an example of
 - fermentation
 - esterification
 - polymerization
 - saponification
- Which compound will undergo a substitution reaction with chlorine?
 - CH_4
 - C_2H_4
 - C_3H_6
 - C_4H_8
- The reaction represented by the equation $n\text{C}_2\text{H}_4 \rightarrow (-\text{C}_2\text{H}_4-)_n$ is called
 - saponification
 - fermentation
 - esterification
 - polymerization
- Which organic reaction involves the bonding of monomers by a dehydration process?
 - substitution
 - oxidation
 - addition polymerization
 - condensation polymerization
- The reaction $\text{CH}_3\text{OH} + \text{HCOOH} \rightarrow \text{HCOOCH}_3 + \text{H}_2\text{O}$ is an example of
 - hydrogenation
 - polymerization
 - esterification
 - addition
- The reaction $\text{C}_4\text{H}_{10} + \text{Br}_2 \rightarrow \text{C}_4\text{H}_9\text{Br} + \text{HBr}$ is an example of
 - substitution
 - addition
 - fermentation
 - polymerization