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Kian Ali Agheli

Chemistry 2, Lesson 7

Substituted Hydrocarbons and Their Reactions

1. Identify two elements that are commonly found in functional groups.

   Oxygen and hydrogen are two elements commonly found in functional groups.

2. The functional group for an alcohol is _____.

   a. **-OH**

   b. -COOH

   c. -NH2

   d. -Cl

3. Which of the following is not a property of ethanol?

   a. Miscible with water

   b. Higher boiling point than hydrocarbons of similar shape and size

   c. **Non-polar**

   d. An effective antiseptic

4. Because ethers have no hydrogen atoms bonded to the oxygen atom, they _____.

   a. Have high boiling points

   b. **Cannot form hydrogen bonds**

   c. Are more soluble in water than alcohols

   d. Are non-reactive

5. The general formula for an amine is _____.

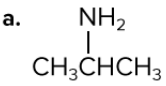
   a. ROR'

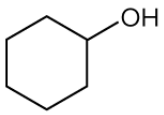
   b. RX

   c. **RNH2**

   d. ROH

6. Name the substance represented by each structure.

a. 

b. 

c. $CH_3—O—CH_2CH_2CH_3$

a. -NH2 represents the amino group.

b. -OH represents the result of a reaction between an alkyl halide and a basic solution.

c. O represents the oxygen atom of a carbonyl group.

Carbonyl Compounds

1. The carbonyl group is a(n) _____.

a. Carbon triple-bonded to an oxygen

b. Carbon single-bonded to an oxygen

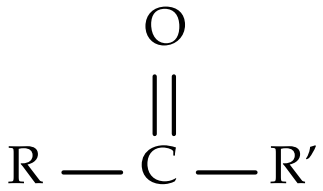
c. **Carbon double-bonded to an oxygen**

d. Oxygen single-bonded to another oxygen

2. The general formula for alkanes is C_nH_{2n+2}. Derive a general formula to represent an aldehyde, a ketone, and a carboxylic acid.

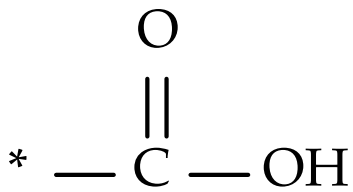
Aldehyde: "*CHO, where * represents an alkyl group or a hydrogen atom"

ketone:



"Where R and R' represent carbon chains or rings bonded to functional groups."

carboxylic acid:



"where * represents a hydrogen atom, carbon chain, or ring bonded to the functional group."

3. Describe the products of a condensation reaction between a carboxylic acid and an alcohol.

A condensation reaction between a carboxylic acid and an alcohol may produce an ester, that which "is any organic compound with a carboxyl group in which the hydrogen of the hydroxyl group has been replaced by an alkyl group."

Other Reactions of Organic Compounds

1. In which kind of reaction is a combination of atoms removed from two adjacent carbon atoms, forming an additional bond between the carbon atoms?

   a. Condensation

   b. **Elimination**

   c. Substitution

   d. Addition

2. In which kind of reaction is an atom or group of atoms in a molecule replaced by another atom or group of atoms?

   a. Condensation

   b. Addition

   c. **Subtraction**

   d. Elimination

3. Which of the following is a type of addition reaction?

   a. **Hydrogenation**

   b. Dehydrogenation

   c. Halogenation

   d. Dehydration

4. Identify the type of organic reaction that would best accomplish each conversion.

   Alkyl halide → alkene

   elimination

   Alkene → alcohol

   addition

Alcohol + carboxylic acid → ester

subtraction

Alkene → alkyl dihalide

addition

5. List the type of organic reaction needed to perform each of the following transformations.

Alkene → alkane

hydrogenation

Alkyl halide → alcohol

oxidation

Alkyl halide → alkene

subtraction

Amine + carboxylic acid → amide

addition

Alcohol → alkyl halide

dehydration

Alkene → alcohol

addition

6. Classify each of the following organic reactions as substitution, addition, oxidation-reaction elimination, or condensation.

2-butene + hydrogen → butane

hydrogenation

Propane + fluorine → 2-fluoropropane + hydrogen fluoride

2-propanol → propene + water

dehydration

Cyclobutene + water → cyclobutanol

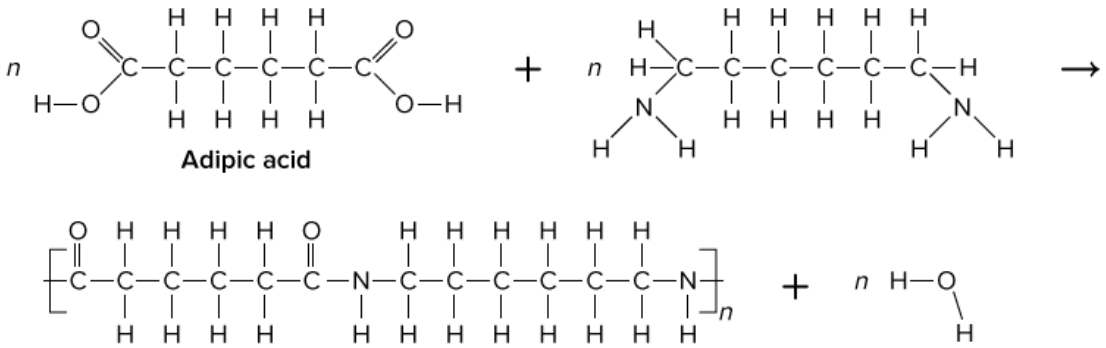
hydration

Polymers

1. What is a polymerization reaction?

   A polymerization reaction is "a reaction in which monomer units are bonded together to form a polymer".

2. *a.* What does the term structural unit of a polymer mean? How is the structural unit of the polymer represented in the reaction shown below?

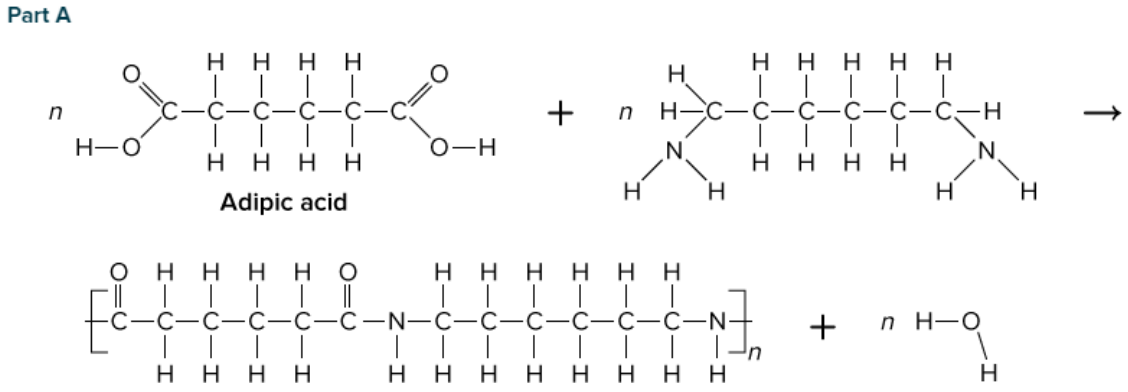


   A polymer's "structural unit" generally refers to one of the patterns which constitutes a polymer. The structural unit of the polymers below are shown as repeating H—C—H structures.

   b. What type of polymerization reaction is shown: an addition polymerization or a condensation polymerization? Explain.

   A condensation polymerization is shown. A large product and some water byproduct is shown.

3. *a.* One of the monomers in the reaction shown below is adipic acid. What category of compound is this substance? How can you tell?



   Adipic acid is a thermoplastic polymer, for reaction to product a new polymer requires remolding.

   b. The polymer produced is called nylon 6,6. What is the name for the functional group that has formed in the polymer product? A(n) _____ group.

   ketone

   What is the common name of the by-product of the reaction? _____

   Water.