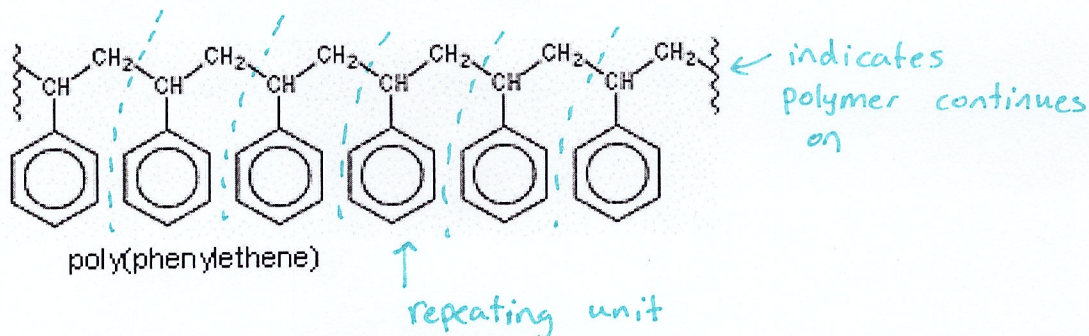


Polymers

- * A **polymer** is a very long molecule that is made by linking together many smaller molecules called **monomers**

EXAMPLE:



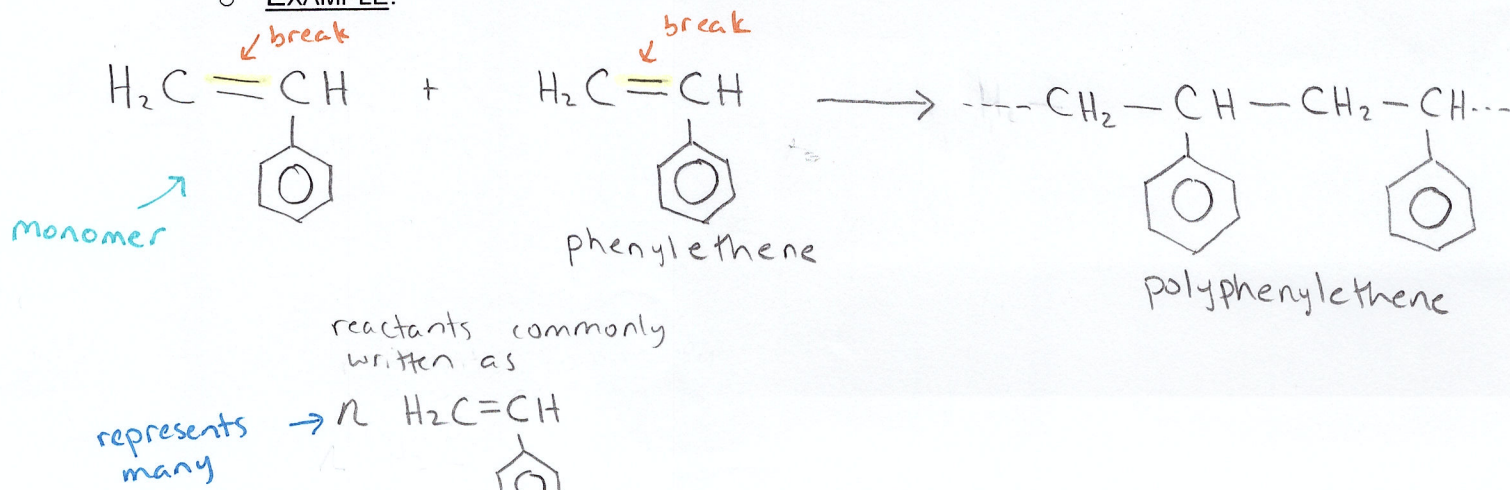
Know examples of both!

- * **Synthetic polymers** are man-made polymers. Some synthetic polymers include plastics, Styrofoam (ie. polystyrene), nylon, polyester, and polyvinylchloride.
- * Naturally occurring polymers
 - o Carbohydrates, cellulose, starch, and glycogen are natural polymers consisting of glucose monomers
 - o Proteins are natural polyamides, where the monomers are amides (a functional group that contains a nitrogen atom)
 - o DNA is a natural polymer consisting of nucleotide monomers
- * Notice how many polymers contain the word "poly" in their name, which provides us with a general way to identify a compound as a polymer
 - o Polymers are simply named after their monomer, but with the word "poly" added out in front

MAKING SYNTHETIC POLYMERS

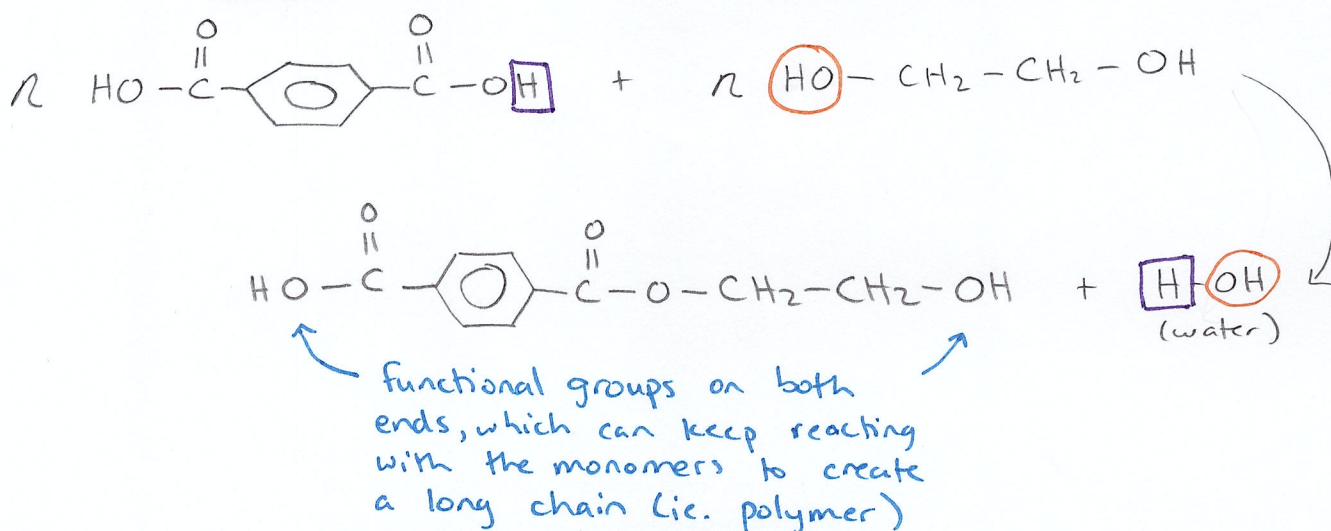
* 1. Addition Polymerization

- o **Addition polymerization** is a reaction in which identical alkene/alkyne monomers are joined through multiple addition reactions to form a polymer
- o EXAMPLE:



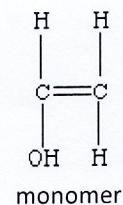
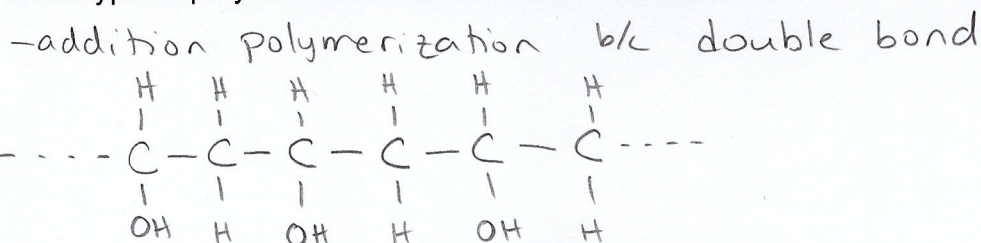
* 2. Condensation Polymerization

- o In a **condensation reaction**, two different monomers are combined through multiple condensation reactions to form a polymer. Recall, a condensation reaction is when two reactants react to form one larger product and one smaller product (usually water)
- * o For a condensation polymerization to occur, **each monomer must have two functional groups attached to each end of the monomer**
- o EXAMPLE:

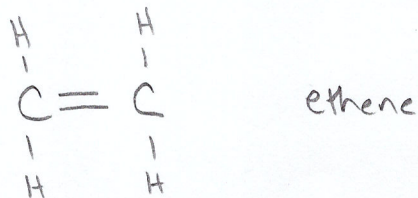
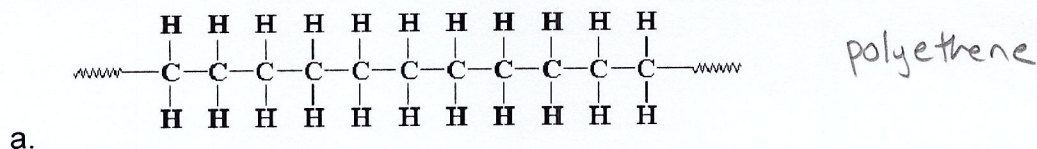


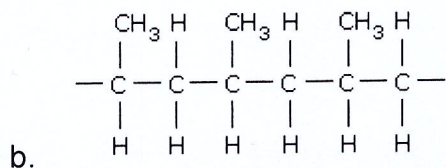
EXAMPLES:

1. Draw out the polymer that would form from using the given monomer? What type of polymerization reaction would take place?

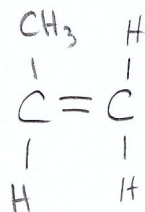


2. Identify the monomer(s) that is/are needed to create the following polymer.

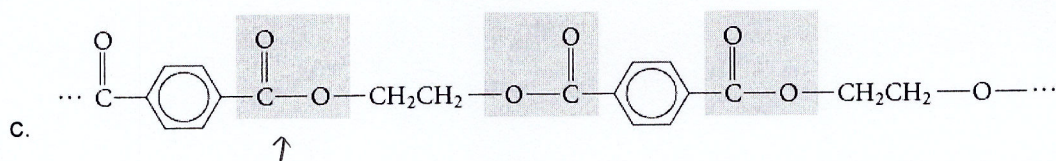




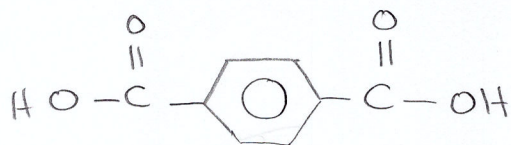
polypropene



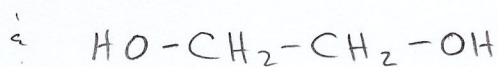
propene



ester group ∴
most likely formed from a condensation polymerization



monomer #1



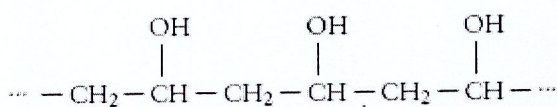
monomer #2

Now try pg. 606# 7-9a,b,10a,c,d, 11a,c,d & pg. 614 # 1a,b, 4a,b,d, 5b, & Practice Problems

Practice Problems

- The polymerization of propene, $\text{CH}_3\text{CH}=\text{CH}_2$, can be classified as
 - an addition reaction
 - an elimination reaction
 - a substitution reaction
 - a condensation reaction

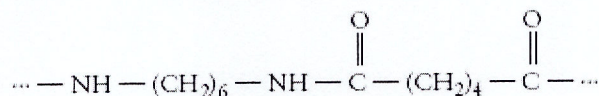
- Polyvinyl alcohol has the following structure.



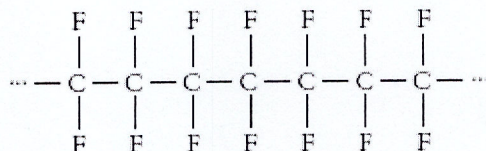
What is the monomer that is used to form this polymer?

- $\text{HO} - \text{CH}_2 - \text{CH}_3$
 - $\text{HO} - \text{CH}_2 - \overset{\text{O}}{\parallel}{\text{C}} - \text{H}$
 - $\text{HO} - \text{CH} = \text{CH}_2$
 - $\overset{\text{O}}{\parallel}{\text{C}} - \text{CH}_3$
-
- Nylon 6-6 and Teflon™ are two widely used synthetic polymers. Their structures are shown below.

Nylon 6-6



Teflon™

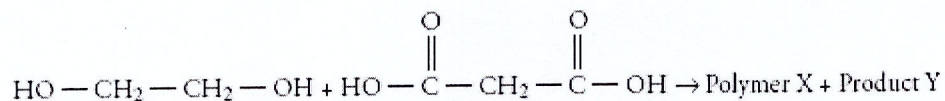


Which of the following types of reactions are responsible for the formation of these polymers?

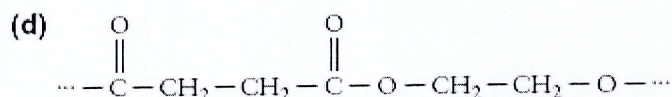
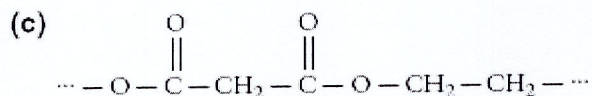
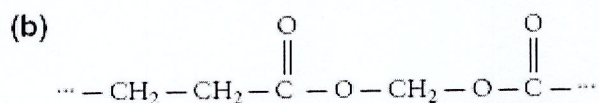
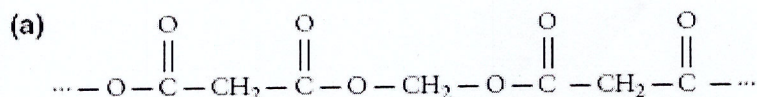
	Nylon 6-6	Teflon™
(a)	Addition	Condensation
(b)	Condensation	Substitution
(c)	Condensation	Addition
(d)	Substitution	Condensation

Use the following information to answer questions 4, 5, and 6.

Two organic compounds react together to form a polymer as shown.



4. Which of the following is polymer X?



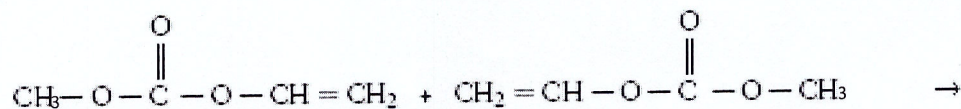
5. Product Y formed in this reaction is

- carbon dioxide gas
- hydrogen gas
- oxygen gas
- water

6. What type of polymerization reaction occurs?

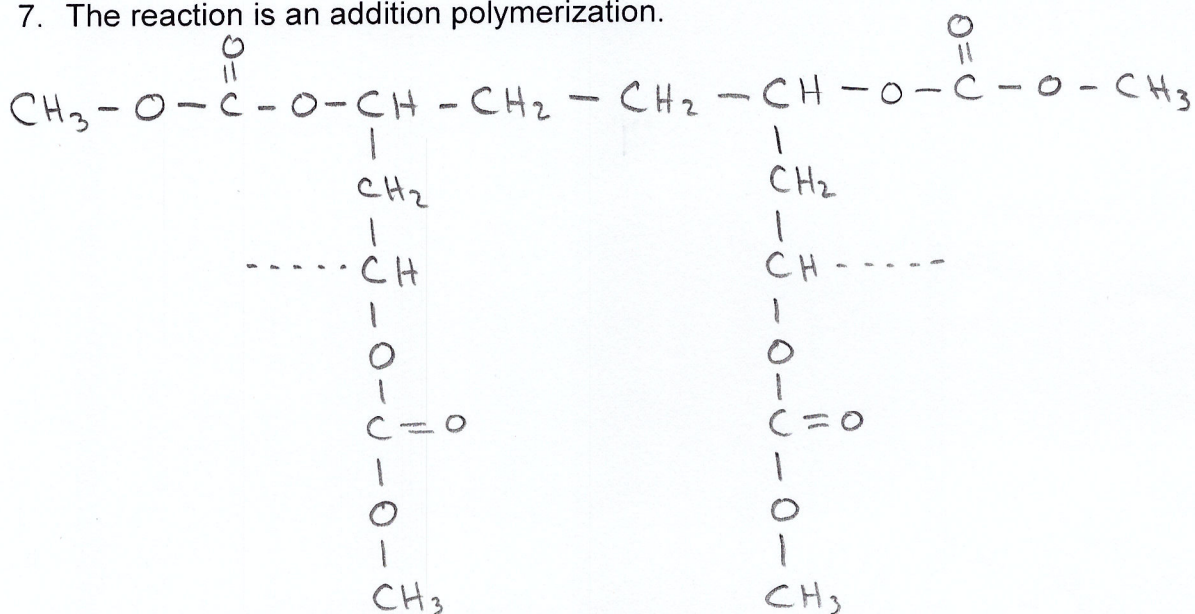
- condensation polymerization
- reformation polymerization
- addition polymerization
- radical polymerization

7. The reactants to a polymerization are given below. Draw the product for the polymerization reaction. Include at least three linkages for the polymer product. Classify the polymer as an addition polymer or a condensation polymer.



Answers

1. A
2. C
3. C
4. C
5. D
6. A
7. The reaction is an addition polymerization.



Section 15.2 Review Answers

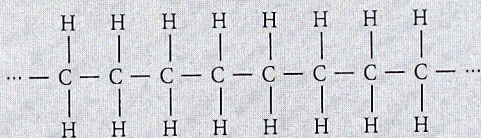
Student Textbook page 614

- (a) A major difference between synthetic and natural polymers is how the monomer is obtained. For synthetic polymers the monomers are derived or extracted from petrochemicals, which undergo controlled chemical syntheses.

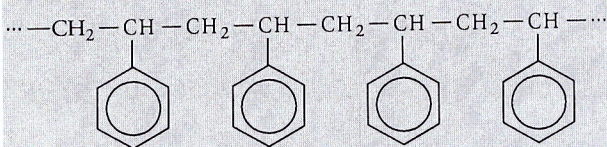
(b) Examples of natural polymers include cellulose, starch, proteins, and DNA. Three common synthetic polymers are polyethylene, polypropylene, and polyvinyl chloride.

(c) Glucose is the monomer in both cellulose and starch, amino acids are the monomers in proteins, and nucleotides are the monomers in DNA. Polyethylene is composed of ethene monomers, while propene monomers form polypropylene and vinyl chloride monomers form polyvinyl chloride.
- The reaction processes are classified as addition reactions and condensation reactions.
- (a) a carboxyl group and an alcohol group

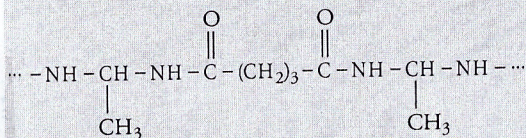
(b) a carboxyl group and an amino group
- Student answers may depend on whether they use complete, condensed, or line structural formulas.
 - Addition polymerization



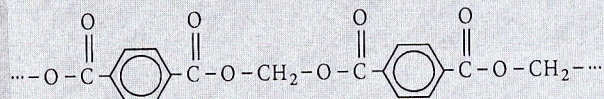
(b) Addition polymerization



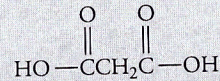
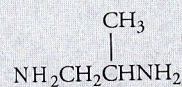
(c) Condensation polymerization



(d) Condensation polymerization



5. (a)



(b)

