Polymers and Composites

Key Concepts

- How do polymers form?
- What are composites made of?
- How can you help reduce the amount of plastic waste?

A polymer is a large, complex molecule built from smaller molecules joined together. Many polymers contain atoms of carbon bonded to one another and to other kinds of atoms. Carbon atoms can form four chemical bonds, and they can bond to other carbon atoms in chains and ring-shaped groups. These structures form the "backbones" to which other atoms attach.

The smaller molecules from which polymers are built are called monomers. **Polymers form when chemical bonds link large numbers of monomers in a repeating pattern.**

Polymers can be either natural or synthetic. Cellulose is a flexible but strong natural polymer that gives shape to plant cells. People cannot digest cellulose. But plants also make digestible polymers called starches. Starches form from monomers of sugar molecules. Proteins are polymers. Within your body, **proteins** are assembled from combinations of smaller molecules (monomers) called **amino acids.** The properties of a protein depend on which amino acids are used and in what order. One combination builds the protein that forms your fingernails, while another combination carries oxygen in your blood.

Many polymers you use every day are made in factories from simpler materials. The starting materials for many synthetic polymers come from coal or oil. Products such as carpets, clothing, and glue can be made of synthetic polymers. However, **plastics,** which are synthetic polymers that can be molded or shaped, are the most common products.

Composites combine two or more substances in a new material with different properties. By combining the useful properties of two or more substances in a composite, chemists can make a new material that works better than either one alone. **Many composite materials include one or more polymers.** Like polymers, composites can also be either natural or synthetic. Wood is an example of a natural composite. Fiberglass composite is synthetic.

Synthetic polymers are inexpensive to make, are strong, and last a long time. Although synthetic polymers have replaced and improved many natural materials, they have caused problems too. For example, it is often cheaper to throw plastics away and make new ones than it is to reuse them. As a result, plastics increase the volume of trash. One solution is to use waste plastics as raw materials for making new plastic products. This is called recycling. **You can help reduce the amount of plastic waste by recycling.**

Polymers and Composites (pp. 306–313)

This section explains how large, complex molecules form. It also describes properties of materials made of two or more substances.

Use Target Reading Skills

The information in this book is organized with red headings and blue subheadings. Before you read, preview each red heading and blue subheading. Ask a question for each red heading to guide you as you read the topic. Answer the questions as you read.

Polymers and Composites		
Heading	**Question**	**Answer**
Forming Polymers	How do polymers form?	
Polymers and Composites		
Recycling Plastics		

Introduction (p. 306)

1. What is a polymer?

_____

_____

_____

2. Most polymers rely on the element _____ for their structures.

Forming Polymers (p. 307)

3. The smaller molecules from which polymers are built are called _____.

4. How do polymers form?

_____

_____

Polymers and Composites (pp. 308–312)

5. Is the following sentence true or false? Living things produce many natural materials made of large polymer molecules. _____

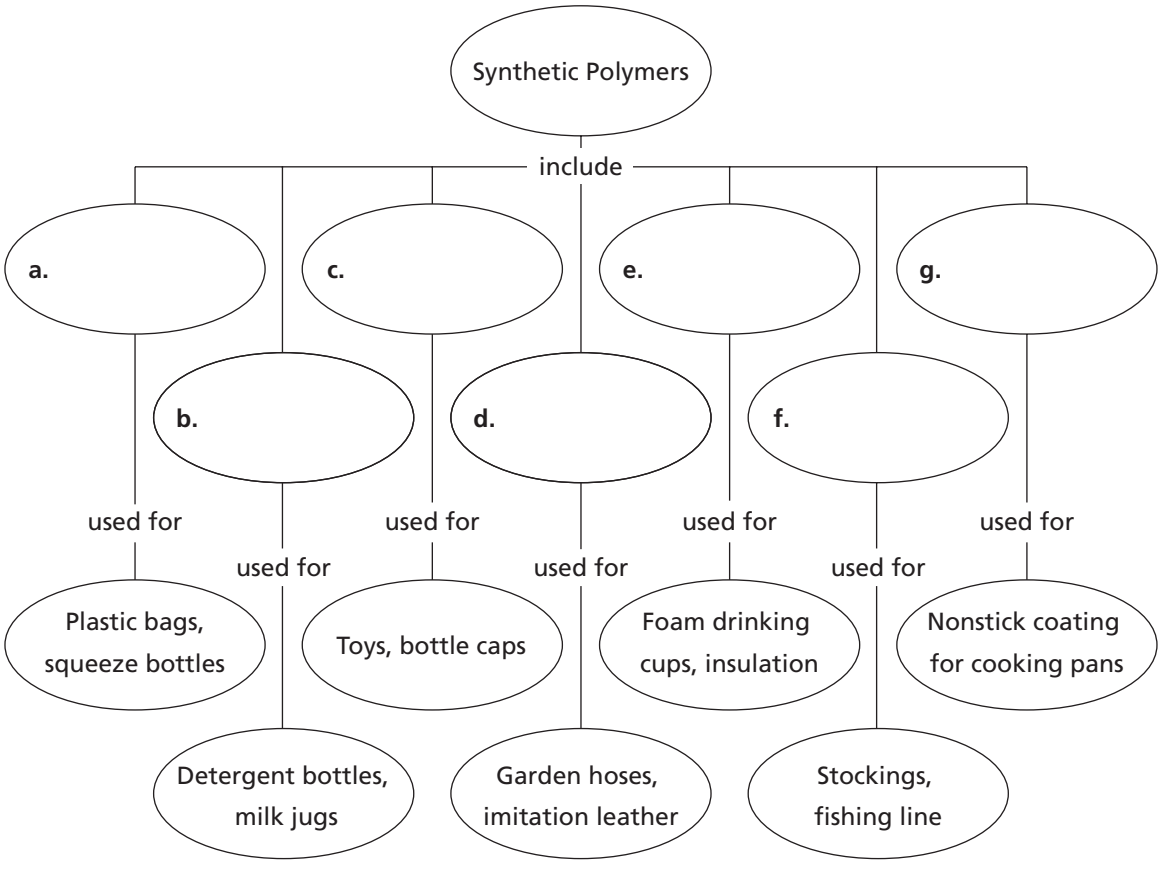
6. List two polymers made by plants.

_____

7. Is the following sentence true or false? Your best wool sweater is made from natural polymers. _____

8. In your body, proteins are polymers assembled from monomers called _____.

9. Complete the concept map about synthetic polymers.



Polymers and Composites *(continued)*

10. The starting materials for most synthetic polymers come from

_____

11. What are plastics?

_____

_____

_____

12. Why are synthetic polymers often used in place of some natural materials?

_____

_____

_____

13. What are composites?

_____

_____

_____

14. Is the following sentence true or false? Composite materials never include polymers. _____

15. _____ is a synthetic composite made of glass fibers and liquid plastic.

Recycling Plastics (pp. 312–313)

16. What are two disadvantages of using plastics?

_____

_____

_____

_____

_____

_____

17. What is one solution to solve the problems of plastics?

_____

_____

_____

_____