

# Polymers and People

	<b>Scientific / Technological Question</b>	<b>Research</b>	<b>Findings</b>
<b>1</b>	What are materials made of?	Chemistry	Discovery of the atom and the structure of molecules
<b>2</b>	How does carbon react with other substances?	1909 – American inventor Leo Beakelan treats a carbon-based acid with formaldehyde under heat and pressure	First synthetic polymer is made = Bakelite
<b>3</b>	What is the molecular structure for a polymer?	1920 – German chemist Hermann Staudinger suggests that polymers are long chains of chemical units	Staudinger is ridiculed by colleagues because he could not prove his theory.
<b>4</b>	What technology is needed to test Staudinger's theory?	1928 – German chemists use X-ray machines to examine polymers	They find that polymers do exist in long chains of chemical units.

5	How long are polymer chains?	Swedish scientist Theodor Svedburg invents the ultracentrifuge.	The ultracentrifuge could be used to determine how long and how heavy are the molecules in a polymer.
6	How can polymers be made?	1928 – DuPont Corporation chemist, Wallace Carothers, carefully joins small chemical units into long chains and examines their properties.	Longer chain molecules made stiffer and stronger polymers than shorter chain molecules. He finds a new class of polymers called “nylons.”
7	What types of polymers can be developed?	1930’s – Many chemists research the development of different types of polymers.	Development of PVC, Teflon, polyurethane, and polystyrene. These materials came to be known as “plastics” from the Greek “able to be molded.”

8	<p>What type of polymer can be made to meet the needs of the booming automobile industry and the military (World War II)?</p>	<p>Polymer scientists and engineers work to develop artificial rubber.</p>	<p>Large-scale production of artificial rubber begins in the 1940's.</p>
9	<p>How can artificial rubber be analyzed?</p>	<p>Peter Debye develops a light scattering technique to determine molecular weight and size of very long polymer molecules.</p>	<p>Polymer scientists use this technique to analyze artificial rubber and other complex molecules.</p>
10	<p>How can petroleum be used to develop polymers?</p>	<p>1953 – Scientists in Germany and Italy discover that catalysts can be used to join hydrocarbons together into long chains.</p>	<p>These catalysts are used today to make 40 billion pounds of polyethylene and polypropylene annually in the US.</p>

<p><b>11</b></p>	<p>Can polymers be used in the human body?</p>	<p>1980's – Scientists research a way to treat malignant brain cancer. Chemotherapy was not able to treat the disease.</p>	<p>1996 – The FDA approves the use of biodegradable polymer wafers to treat brain cancer. They are implanted in the brain and deliver drugs only to cells in specific parts of the brain.</p>
<p><b>12</b></p>	<p>Can polymers be used to grow replacement body parts and organs?</p>	<p>1980's – Scientists research growing cells on plastic frameworks.</p>	<p>Polymer scaffolds are used today to grow skin cells to make “artificial skin.” “Artificial skin” is used to replace skin on ulcer and burn victims.</p>