



*Drexel-SDP GK-12 ACTIVITY*

## **Activity: The Chain Gang**

**Subject Area(s)** Chemistry  
**Associated Unit** Polymers, module 1  
**Associated Lesson** none  
**Activity Title** The Chain Gang  
**Grade Level** 6 (3-8)  
**Activity Dependency** None  
**Time Required** 20 minutes  
**Group Size** 2  
**Expendable Cost per Group** None

### **Summary**

Students will be introduced to the basic linear polymer structure and more examples of household polymers.

This module will introduce the students to the world of polymers. Students will learn what a polymer is, how they are made, and how they are used. Students will learn how important polymers are in their everyday lives. Students will also investigate polymers' connection to renewable and nonrenewable resources, landfills, and recycling through various inquiry based lessons and activities.

### **Engineering Connection**

Chemical engineering is the application of science, mathematics and economics to the process of converting raw materials or chemicals into more useful or valuable forms. Chemical engineers work to produce the household items we use and appreciate every day, such as Teflon-coated

cookware, plastic cups and brightly-colored candies. Plastics ranging from milk jugs to ladies' handbags to thermal underwear are also designed by chemical engineers – these plastics are often referred to as polymers. In this activity, students will investigate the absorption property of a polymer and will try to guess its identity.

### Keywords

Polymer, chemical engineer,

### Educational Standards

- Science:4.2.7 Renewable and non-renewable resources, A. Know that raw materials come from natural resources, B. Examine the renewability of resources, 3.1.7 Unifying themes, C. Identify patterns as repeated or recurring elements in science and technology., 3.2.7 Inquiry and Design, B. Apply process knowledge to make and interpret observations., 3.4.7 Physical Science, Chemistry, and Physics, A. Describe concepts about the structure and properties of matter
- Math: 2.5-Mathematical Problem Solving and Communication, E. Develop problem solving strategies ( drawing a picture or a diagram), 2.6- Statistics and Data Analysis, A. Organize and display data using pictures, tallies, tables, charts, scatter plots, bar and circle graphs, 2.8-Algebra and Functions, B. Discover and describe patterns including linear, nonlinear relationships, D. Represent relationships using pictures, words and tables

### Pre-Requisite Knowledge

Be familiar with the practice of adding liquid in a controlled, measured way.

### Learning Objectives

After this lesson, students should be able to:

- Explain the properties of a polymer
- Provide examples of polymers around their house

### Materials List

Household polymer examples: plastic bottles, cool-max (Dupont) or Gortex shirts, nylons, eggs, Styrofoam, etc.

Magnetix® magnet sets

Plastic toy beads (to demonstrate polymer formation)

### Introduction / Motivation

Students will be able to explain what a polymer is, build a model of a polymer, and examine their importance in everyday life.

### Vocabulary / Definitions

Word	Definition
Monomer	A simple molecule that can combine with other to form a polymer.
Initiator	An agent used to start the polymerization of a monomer.
Copolymer	Polymers made of two or more different types of monomers.
Random	A copolymer consisting of alternating segments of two monomeric units of

copolymer	random distribution.
Block copolymer	Adjacent blocks being multiples of different monomers
Alternating copolymer	A polymer derived from two (or more) monomers.

## Procedure

### Background

Nearly all materials that make up living organisms involve polymers. Stages of civilization are characterized by the building materials used. The Stone Age was first, followed by the Bronze, Iron, and Steel Ages. We are now living in the age of polymers. The word polymer might be unfamiliar, but without them life as we know it would not exist.

### Before the Activity

- Prepare an arrangement of everyday household products to bring to class made from polymers. Place the selection of products on table and let the students pick them up and evaluate them.
- Ask the students: (Think/Pair/Share)
  - Do you know what these products have in common? What is different?
- Explain that a polymer is made from many many molecules strung together, almost like a string of beads.
- A MONOMER is a basic repeat unit in a polymer. ( like each individual bead in a necklace)
- Polymers are formed by a chemical reaction.
- Volunteers: Have one student be the “reactive end” of the polymer, he grabs another students hand and pulls them up front, then another, then another. Eventually we have a POLYMER. Each student would represent a molecule or MONOMER.
- We can have different types of monomers (such as boys vs. girls , A=girl, B=boy)
  - BLOCK: AAAAAABBBBBBBB
  - RANDOM: ABBBABABABABABA
  - ALTERNATING: ABABABABABAB

### With the Students

Pipcleaners are to be used to attach MONOMERS  
 1 BEAD = 1 MONOMER  
 Each COLOR = a different type of monomer

#### CHALLENGE #1 :

Make a RANDOM COPOLYMER. Draw a picture below. Label COLORS of beads.  
 How many MONOMER units are in your polymer?

#### CHALLENGE #2:

Make a REPEATING COPOLYMER. Draw a picture below. Label the COLORS of the beads. How many MONOMER units are in your polymer?

**CHALLENGE #3:**

Make a copolymer using THREE pipecleaners. Draw a picture below. Label the colors of the beads. How many MONOMER units are in your polymer?

**Safety Issues**

- None

**Troubleshooting Tips**

Students may have trouble understanding the repeating chains and how to translate that into a model. Give some demonstrations in front of the class using boys and girls as elemental blocks.

**Investigating Questions**

How many MONOMER units are in your polymer?

**Assessment**

**Pre-Activity Assessment**

None

**Activity Embedded Assessment**

Each student completes worksheet of questions during class.

**Post-Activity Assessment**

Assign a writing activity based upon this lesson.

**Activity Extensions**

**Suggested Reading:**

Polymers All Around You!- Linda Woodyard

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