FLINN SCIENTIFIC

Name_____

Activity A. Sodium Alginate — A Natural Polymer

Observations and Results

1. Describe the appearance, form, and texture of (a) sodium alginate solution, (b) calcium alginate, and (c) copper alginate.

2. *(a)* What causes the calcium and copper products to appear swollen and translucent?

   (b) What evidence is there that copper ions are incorporated into the alginate polymer?

3. How and why does the appearance of calcium alginate change when it is placed in saturated sodium chloride solution?

4. Polymer solutions form solid gels when numerous long-chain polymer molecules interact to build a three-dimensional "network." How do calcium or copper ions bind alginate molecules together to form a network?

5. Calcium alginate is spun into fibers that are used to make gauze-type dressings for burns and other wounds. Suggest some possible advantages of calcium alginate wound dressings compared to other types of materials.

Activity B. Molding Glue—Properties of an Amorphous Polymer

Observations and Results

1. Describe any changes that were observed when the hardened glue strip was placed in hot water.

2. How easy or hard was it to mold the hot glue strip into the desired shape? Did the molded glue strip maintain its new shape after it was placed in ice water?

3. Write a short paragraph (2–3 sentences) relating the physical properties of glue when it is heated and then cooled to changes in the polymer molecules themselves. Include the following terms: Amorphous polymer, glass transition temperature, glassy versus rubbery solid.

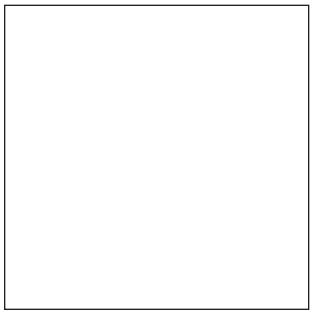
4. Most clear plastic flatware items (knives, forks, and spoons) are made from polystyrene. What are the properties of a polystyrene spoon at room temperature? What temperature would be needed to mold a polystyrene spoon into a new shape? Explain.

Activity C. Seeing Polymers in a New Light—Polarized Light and Birefringence

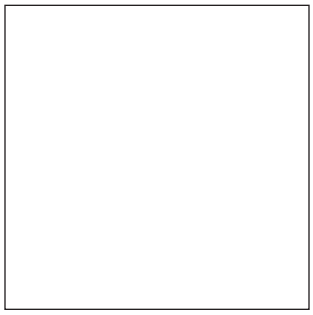
Observations and Results

1. Describe how the amount of light that is transmitted through two polarizing filters changes when the second filter is rotated. (a) What is the alignment of the "slits" on the two filters when the maximum amount of light passes through? (b) What is the alignment of the slits when all of the light is blocked?

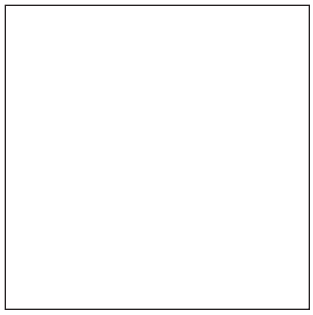
2. In the first box below (Box A), use colored pencils to draw and color the birefringence pattern observed for the plastic Petri dish.



Box A



Box B



Box C

3. In the second box (Box B), mark off and label the areas of the plastic Petri dish in which the polymer molecules are in an amorphous versus a partially crystalline state, respectively.

4. Plastic Petri dishes are manufactured by a process called injection molding—the melted polymer is forced through a narrow nozzle into a mold. The polymer flows into the mold, where it cools and solidifies. The mold then opens and the plastic object is ejected. In Box C, use an arrow to show where the polymer flows into the mold.

5. Explain why some areas of the lid are dark when viewed between "crossed" polarizing filters.

6. How and why does the birefringence pattern of the plastic "dumbbell" change after it has been stretched? Explain how "stress" of this type may orient the polymer molecules.

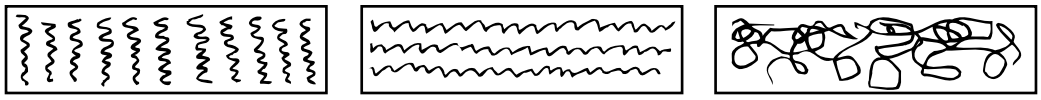
Activity D. Teflon Tape — The Long and Short of It

Observations and Results

1. Describe the appearance, texture, and "feel" of Teflon. Be as specific as possible.

2. Compare the ability of Teflon tape to stretch when it is pulled lengthwise versus widthwise. Does the tape return its original shape after it has been stretched widthwise?

3. Based on the elasticity of the tape when it is pulled in either direction, which representation below is the best "picture" of how the polymer molecules are arranged? Explain.



4. Compare the appearance of the torn ends of tape after it has been pulled lengthwise versus widthwise. What is happening to the polymer molecules when the Teflon strip is being stretched lengthwise and the tape breaks?

5. Which are stronger, the forces of attraction between the polymer molecules or the forces of attraction within the polymer chain? Give evidence to support your answer.