



Elasticity Test

Lesson Plan

~ No. 1 ~



ITW Hi-Cone

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Subject Area: Science, Math

Objectives: To introduce students to the concepts of photodegradation in plastic six-pack carriers, to test the elasticity of rings exposed to ultraviolet light.

Method: Working in groups, students will carry out a controlled experiment which will compare the elasticity of six-pack carriers that have been exposed to ultraviolet light to that of carriers which have not been exposed.

Materials: For each group of students: 26 six-pack carriers, thumbtacks, yardstick or meter stick, a place to mount the carriers outside (if a fence or wall is not available, you may have to use a piece of wood), location should have a southern exposure without obstructions to sunlight.

Vocabulary: Low density polyethylene (LDPE), photodegradable, elasticity, ultraviolet (UV) light.

Procedure:

1. Tell students you will be carrying out an experiment that will investigate one aspect of six-pack carriers, their ability to break down in the presence of sunlight. Have students brainstorm a list of all they know about six-pack carriers.

Undoubtedly this will lead to a discussion of their usefulness as well as the fact that the carriers are sometimes littered. The inappropriate disposal of the carriers can result in animals becoming entrapped in them. Tell students that in an effort to prevent harm to wildlife, the manufacturer of the carriers has made them from photodegradable plastic since 1988. When the carriers are left out in the open, ultraviolet light from the sun causes the plastic to break down. The longer the carriers are exposed to ultraviolet light, the more brittle, or less elastic, they become. (As a rule of thumb, carriers take three to four weeks to degrade in a warm climate during the summer, and three to four months to degrade in a cold, cloudy climate during the winter.)

After the process of photodegradation is well along, a littered carrier would pose less of an entanglement risk to animals.





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Procedure Continued:

- To carry out the experiment, each group of students will take one of the six-pack carriers. Holding the carrier the long way, have one student insert the toe of his or her shoe through one of the bottom rings. This student will be the designated "puller" for the remainder of the experiment. Another student holds the meter stick next to the puller's foot so that the one centimeter mark is nearest the floor. A third student will be appointed the "measurer." On this student's go ahead, the puller pulls the top of the carrier, stretching it until it breaks. The measurer marks and records this height. It is important to have the pullers pull with only one hand holding one of the top rings in the carrier. This first carrier will serve as the control for the experiment. It is important to grip and pull carriers the same for each test.
- After students have recorded the measurement for the control carrier, they tack the remaining six-pack carriers to the board or building surface outside in a southern exposure, without obstructions to sunlight. Make sure students record the date and current weather conditions.

For the remainder of the experiment (12 weeks) the students should record the weather conditions daily. Number the carriers 1 through 12. Have students hypothesize about what will occur when they perform this test after the carriers have been exposed to ultraviolet light. After a week has gone by students bring in carrier number 1 and repeat the experiment. Remember to have the original pullers and measurers repeat their tasks. Record the results. Retest a control carrier (the unexposed carriers) each time also, and record those results as well. When the second week has passed, the students carry out the experiment with carrier number 2 and a control carrier. Repeat this procedure for the following ten weeks until all the carriers have been used. You will be testing two carriers per week.

- Compile the students' results. Was the class's hypothesis correct? Did the carriers become more brittle (break more easily) over time? If your class had varying results, discuss possible causes. (Point out that the amount of UV exposure the rings receive will vary with the seasons, changes in weather, and with location.) Discuss how photodegradability of the carriers protects wildlife. Discuss proper disposal and recycling methods for the carriers.





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Extension:

1. Perform this experiment at the beginning of the school year and repeat it for a 12 week period in the autumn (September, October, November) and in the spring (March, April, May). Compare and discuss results.
2. Have students repeat the experiment placing groups of carriers in a number of different locations, some of which receive full sunlight and others which receive varying amounts of partial sunlight. Compare results for the various locations.
3. Contact other teachers through the Internet and arrange to perform this experiment concurrently, comparing results with schools located at different longitudes and latitudes.

Vocabulary:

Elasticity: the state or quality of being elastic; having the property of recovering shape after deformation.

Low density polyethylene (LDPE): industry coded #4 plastic, commonly used to manufacture plastic grocery bags, coffee can lids, six-pack ring carriers.

Photodegradable: able to be broken down by exposure to ultraviolet rays, i.e.: from the sun; having the ability to absorb the high-energy radiation in the UV portion of the light spectrum, which activates the (plastics') electrons to higher activity and causes oxidation, cleavage, and other degradative reactions.

Ultraviolet (UV) light: the region of the electromagnetic spectrum that is adjacent to the violet end of the visible spectrum and is characterized by wave lengths shorter than violet light.

