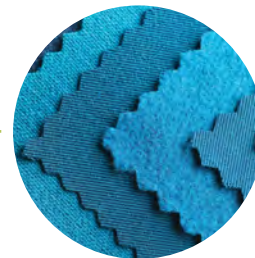


Origin and Properties of Synthetic and Natural Fibers

A Carolina Essentials™ Activity

Student Worksheet



Overview

Have you ever wondered why some of your clothes wrinkle while others never do? Or why some fabrics get dirty and stay dirty, and others only need a damp cloth to get clean?

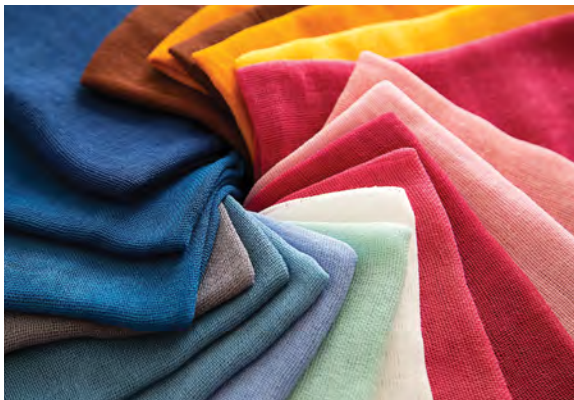
Sports clothing is advertised to wick water away from your skin, keeping you cooler and dry. Wool clothing keeps you warm. Fibers or fabrics can be grouped into these categories: natural fibers, synthetic fibers, and blends of more than one fiber type. Natural fibers can be subdivided into plant based and protein-based fibers. Every fiber has its own properties, and those properties are related to the chemical structure of the fiber.

You will research a natural and synthetic fiber and then perform some tests to identify the fibers' properties.

Phenomenon

A definitive test for separating synthetic and natural fabrics is the burn test. How the fabric responds to the heat of a flame, the color of smoke produced, the odor, and properties of the ash or residue remaining identifies the base unit of the fabric-cellulose, protein, or a man-made monomer. Make observations from the burn test demonstration your teacher completes or watch the 4-minute video "[Textile Fibers Burning Test](#)" with numerous examples.

What are your observations?



SAFETY REQUIREMENTS



MATERIALS

Fiber Investigation

- 1 or 2 natural fiber fabric squares, 10 cm × 10 cm
- 1 or 2 synthetic fiber fabric squares, 10 cm × 10 cm
- Electronic balance
- Ruler
- Plastic beaker, 250 mL
- Hair dryer or heat lamp
- Blue or red food coloring
- Wash bottle
- Tap water

Essential Question

How do synthetic and natural fibers compare in composition, properties, natural resource use, and impact on society?

Investigation Objectives

1. Complete research to identify the properties, source, and manufacturing processes for natural and synthetic fibers.
2. Collect data on properties of natural and synthetic fibers through investigations and compare lab findings to research.

Safety and Disposal

Food coloring will stain your hands and clothing so keep your work space clean and clear. Hair dryers or heat lamps can burn your skin if exposed for too long. Your teacher will tell you where to dispose of your fabric swatches.

Continued on the next page.

Activity Procedures

Research

1. Your teacher will assign you one or more natural fiber and one or more synthetic fiber for which you will complete research to answer the following questions:
 - What is the source of the fiber?
 - What is the chemical composition of the fiber?
 - What is the chemical structure of the fiber?
 - What are the beneficial and negative properties of the fiber?
 - What is the process for manufacturing the fiber and fabric?
 - What are the common uses for the fiber or fabric?
 - What is the average cost per yard of fabric made from the fiber?
2. Cite all your research sources.
3. Present your findings to the class.

Investigation of Fiber Properties

My fibers are _____

1. Measure the length and width of the fabric samples in centimeters. Record your answers in the data table.
2. Weigh the fabric samples in grams.
3. Record the weights in the data table.

Stretch Test

1. Hold the fabric at the center top.
2. Pull the fabric from the center bottom and measure the stretched length in centimeters.
3. Repeat the procedure for the width.
4. Hold the fabric at the upper left corner and pull the lower right corner. Measure the stretched length in centimeters.
5. Repeat the procedure with all fabric samples. Record your answers in the data table.

Wrinkle Test

1. Make a fist around a tightly balled up fabric sample for 45–60 seconds.
2. Release the fabric and count the number of wrinkles and creases. Record your answers in the data table.
3. Repeat for all the fabric samples. Record your answers in the data table.

Absorbency Test

1. Put about 100–125 mL of tap water in the plastic beaker.
2. Submerge all the fabric swatches in the water for 3–4 minutes.
3. Pull out a swatch and let it drip over the beaker until no more water is running out of the fabric.
4. Weigh the fabric swatch and subtract the dry weight of the fabric. Record the amount of water absorbed by the fabric in the data table.
5. Repeat for all the fabric samples. Record your answers in the data table.

Shrinkage Test

1. Place the wet fabric swatches on the desk. Use a hair dryer or heat lamp to completely dry the fabric swatches.
2. Measure the length and width of all samples.
3. Subtract the dried measurements of length and width from the original measurements of length and width to calculate shrinkage. Record your answers in the data table.
4. Optional: Calculate the area of fabric shrinkage in units of cm^2 .

Continued on the next page.

Dye Test

1. Fill the wash bottle with tap water.
2. Place the fabric swatches on a flat surface. Make sure they are dry.
3. Place a drop of food coloring on the fabric in 3 different places. Do not let the spots run together.
4. Let the dye sit for 5 minutes.
5. Hold a swatch by a corner, directly over the beaker. Use the wash bottle to rinse off any excess dye into the plastic beaker.
6. Record the diameter of the stains and the depth of the color in the data table.

Data and Observations

Data Table

| | | Sample 1 | Sample 2 | Sample 3 | Sample 4 |
|--|---|----------|----------|----------|----------|
| Investigation of Fiber Properties | Fiber | | | | |
| | Natural or Synthetic | | | | |
| | Length (cm) | | | | |
| | Width (cm) | | | | |
| | Initial Weight (g) | | | | |
| Stretch Test | Vertical Stretch Length (cm) | | | | |
| | Horizontal Stretch Width (cm) | | | | |
| | Diagonal Stretch Length (cm) | | | | |
| Wrinkle Test | # of Wrinkles and Creases | | | | |
| Absorbency Test | Water Absorbed (g) (Saturated Weight – Initial Weight) | | | | |
| Shrinkage Test | Dried Length (cm) | | | | |
| | Dried Width (cm) | | | | |
| | Shrinkage Length (cm) (Original Length – Dry Length) | | | | |
| | Shrinkage Width (cm) (Original Width – Dry Width) | | | | |
| | Shrinkage Area (cm ²) (Length × Width) | | | | |
| Dye Test | Dye Spot Diameter (cm) | | | | |
| | Dye Spot Color | | | | |

Continued on the next page.

Analysis and Discussion

1. Add your data to a class data table.
2. Summarize the properties of natural and synthetic fibers.
3. How does the manufacturing and processing of fibers and fabrics impact natural resources and society?
4. How did your investigation results compare to your research findings?