

Great Balls of Fire

Objective

Students will experiment with different kinds of fabric to determine which ones burn fastest.

Background

Clothes do more than reflect your style. They are an important form of protection. Clothing made from cotton keeps you cool in the summer. Cotton absorbs moisture and allows it to evaporate away from your body. Wool is a good choice when it's cold outside. Wool clothing is made from the wool of sheep. Wool will not freeze when it gets wet like other fabrics do. When it is stretched, it springs back into shape. Wool also burns slower than any other fabric.

No one knows exactly how old cotton is. Scientists searching caves in Mexico found bits of cotton bolls, or seed pods, and pieces of cotton cloth that proved to be at least 7,000 years old. They also found that the cotton itself was much like that grown in America today.

Cotton, a product of Oklahoma agriculture, is the most common natural textile in use today. In 2015, Oklahoma cotton fields produced 374,000 bales of cotton. A bale is about the size of a refrigerator and weighs 480 pounds. Most Oklahoma cotton is grown in the southwestern part of the state. The top five cotton-producing counties in 2015 were Jackson, Tillman, Harmon, Caddo and Beckham Counties.

Sheep have been providing meat and clothing to people for over 10,000 years. Oklahoma sheep growers sheared 17,000 sheep in 2015. From the fleece of these sheep, manufacturers produced about 95,000 pounds of wool. The largest numbers of sheep and lambs are produced in north central Oklahoma. In 2016 the top Oklahoma counties in sheep and lamb production were Kay, Caddo, Bryan, Craig and Cherokee Counties. Wool can have a wide range of natural colors and textures, depending on which animal produced the fleece.

In 1953 the federal government passed the Flammable Fabrics Act to protect people, especially children, from fabrics that burn too quickly. In clothing fires, burns are often deeper and cover more skin surface. These kinds of burns are more likely to cause hospitalization and death. Many times hospital treatment from clothing burns is longer and more expensive. Many synthetic fabrics cause severe burns because they melt and stick to the skin.

In the 1970s the government set standards for children's sleepwear, carpets, rugs, mattresses and mattress pads. None of these products can be sold in the United States unless they pass certain flammability tests. The Consumer Product Safety Commission is the government agency that sets standards for the garment industry.

Oklahoma Academic Standards

GRADE 6

Physical Science: 1-4; 3-3,4

GRADE 7

Physical Science: 1-2

GRADE 8

Physical Science: 1-3

Resources Needed

lab table or table covered with aluminum foil

2 deep glass dishes

long fireplace-type matches

1 flat glass or metal pie plate

metal tongs leather glove

3” square swatches of the following fabrics with natural fibers— wool, cotton, linen, silk

3” square swatches of the following fabrics with synthetic fibers— poly- ester, acrylic, nylon
large bowl or pitcher of water

fire extinguisher

stop watch or watch with a second hand

samples of raw wool, cotton bolls, wood and other raw materials used in fabric

Activity: Testing Fabric Flammability

Note: Check with your school’s safety officer, the principal or appropriate school administrator before conducting this activity.

1. Read and discuss background and vocabulary.
2. The demonstration should be performed over a lab table or a table covered with aluminum foil. Clear the area of loose papers or debris.
 - Review lab safety rules.
 - Show students the fabric swatches.
 - Students will identify the swatches according to their fiber content.
 - Students will use online search engines or library references to find the source of each fiber identified.
 - Students will record information on Worksheet A.
 - Students will predict the rate (fast or slow) of flammability and burn for each fiber on the worksheet.

Note: Make sure you know exactly what you are burning. A swatch that is 20% cotton and 80% polyester will burn differently than one that is 100% polyester. Dyes and fabric finishes may alter the flammability and burning pattern of fabrics. They may also affect the shape and color of the residue. Generally, however, fabrics will burn true to form.

- Assign one person as timekeeper and provide him/her with a stop watch or a watch with a second hand.
- Hold one fabric swatch at a time with the tongs, and light the edge.
- The timekeeper will record how long it takes each sample to burn.
- Hold each sample above the glass dish so the class can observe the burning pattern.
- As the remains fall into the glass dish, students will observe the characteristics of the ash (color, texture, etc.).
- Students will discuss the effect each material might have on a burn victim.
- Transfer the ashes or residue to the pie plate.
- Students will inspect the material with a magnifying glass.
- When students are finished examining the ashes, place the ashes in water.

ACTIVITY TWO: RESEARCH AND ANALYZE

1. After all fabrics have been burned, students will answer the questions on Worksheet B.
2. Students will compare and contrast the properties of the different kinds of fabrics.
 - What differences did students see between the natural and synthetic fabrics?
3. After the class discussion each student will write a short summary of the results of the fiber test by reviewing the information gathered on Worksheets A and B.or paper towels with the wet side of the glove down, against the paper.

Extra Reading

- Ballard, Carol, *Grouping Materials: From Gold to Wool (Science Answers)*, Heinemann, 2003.
- Denenberg, Barry, *So Far From Home: The Diary of Mary Driscoll, An Irish Mill Girl, Lowell Massachusetts, 1847*, Scholastic, 2003.
- Gleason, Carrie, *The Biography of Cotton (How Did That Get Here?)*, Crabtree, 2005.
- Gleason, Carrie, *The Biography of Wool (How Did That Get Here?)*, Crabtree, 2007.
- Hopkinson, Deborah, *Up Before Day Break: Cotton and People in America*, Scholastic Nonfiction, 2006.
- Macaulay, David, *Mill*, Graphia, 1989.
- Paterson, Katherine, *Lyddie*, Puffin, 2004.
- Paulsen, Gary, *The Quilt*, Random House, 2005.
- Storey, Rita, *Wool and Cotton (How We Use Materials)*, Smart Apple, 2007.

Vocabulary

- absorb**—to soak up a liquid or take in nutrients or chemicals gradually
- bale**—a large bundle or package of a raw material such as hay or cotton, tightly bound with string or wire to keep its shape during transportation or storage
- cotton boll**—rounded seed pod of the cotton plant
- evaporate**—to change a liquid into a vapor
- flammable**—readily capable of catching fire
- fleece**—the coat of wool on a sheep or similar animal
- shear**—to cut hair, fleece, or foliage from the surface of something using a sharp tool
- textile**—raw material used for making fabrics, e.g. fiber or yarn
- texture**—the feel and appearance of a surface, especially how rough/ smooth or soft/hard it is

Worksheet A: Fire and Fabric Investigation

Use an internet search engine or library references to find and record the raw material used in the production of each fabric listed below. List products made from the fabric, and use the information to predict the rate of burn for each fabric. rate between 1-5, with 5 being the fastest to burn. Use the remaining spaces to record your observations from the experiment.

Fiber	Source	Products	Prediction (Rate from 1-5)	Rate	Odor	Ashes
cotton						
wool						
linen						
silk						
polyester						
acrylic						

Name _____

Worksheet B: Fire and Fabric Investigation

Discussion Questions

Question	Cotton	Wool	Linen	Silk	Polyester	Acrylic
How easily did the fabric ignite?						
Did the fire go out or stop spreading when the flame source was removed?						
How quickly did the fire spread?						
Was there a tendency for the fabric to burst into flames?						
Did the material seem to melt and disappear or turn to ash?						
Which of the natural fibers burned fastest?						
Which of the synthetic fibers burned fastest?						
Which fabric would be best suited for ski wear?						
Which fabric would be best suited for summer wear?						
Which fabric would be best suited for children's sleep wear?						
Which fabric would be best suited for elderly or handicapped individuals?						

Worksheet A: Fire and Fabric Investigation (answers)

Use an internet search engine or library references to find and record the raw material used in the production of each fabric listed below. List products made from the fabric, and use the information to predict the rate of burn for each fabric. rate between 1-5, with 5 being the fastest to burn. Use the remaining spaces to record your observations from the experiment.

Fiber	Source	Products	Prediction (Rate from 1-5)	Rate	Odor	Ashes
cotton	Fiber surrounding the seed of the cotton plant—grown in southern OK, Ca, africa, Turkey, India and around the world	jeans, T-shirts, towels, sheets, other clothing		fast	burning paper	soft
wool	From sheep— raised on farms and ranches in OK and world- wide	sweaters, pants, coats, mittens, hats, rugs		slow	burning hair	crush-able, black
linen	From the stem of the flax plant	dresses, slacks, shirts, jackets, skirts, table- cloths, napkins		fast	burning paper	soft
silk	From filaments which silkworms spin to make their cocoons. Japan and China are lead- ing producers.			slow	burning hair	crush-able black
polyester	petroleum products	all kinds of clothing		fast	sweet odor	hard black bead
acrylic	petroleum products	sweaters, shirts, dresses		fast	chemical odor	brittle, black, hard bead