

FIBER TEST

AT A GLANCE

Students will determine what type of fiber was left at a crime scene.

OBJECTIVES

Students will:

- Use microscopes to examine differences in fibers
- Determine the properties of fibers with a flame test

KEY VOCABULARY

Fiber: strands of thread that make up thousands of products, including clothing, upholstery, carpet, rope and building components

Microscope: An Instrument used for magnifying objects

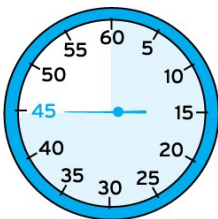
Flame Test: A test that can be used to determine an unknown fiber

SUGGESTED GRADE

LEVELS: 6-12

PACE YOURSELF

45 MINUTES



NATIONAL SCIENCE EDUCATION STANDARDS

5-8:

NS 5-8.1 Science as Inquiry
NS 5-8.2 Physical Science
NS 5-8.5 Science and Technology
NS 5-8.6 Science in Personal and Social Perspectives

9-12:

NS 9-12.1 Science as Inquiry
NS 9-12.2 Physical Science
NS 9-12.5 Science and Technology
NS 9-12.6 Science in Personal and Social Perspectives



ADVANCE PREPARATION

NOTE: One part of this experiment includes open flames. Be sure to check your school's policies and use your best judgment on whether or not to perform this lab.

1. Collect samples of fabric made of wool, rayon, polyester, silk, and cotton in the same color.
2. Choose whatever fiber you want to be the unknown sample (the one found on the "victim"). If you teach more than one class, you might want to change the unknown for each class.
3. Place a paper cut-out of a victim on the floor or draw an outline on the floor with chalk or tape. (*Optional*)
4. Place a few of the unknown fibers on the victim.
5. Make copies of the data sheets for students.



MATERIALS

Per Class:

(*optional*) Cut out or drawing of "victim"

Per Group:

Compound light microscope
Slide
Safety glasses
Cover slip
Forceps
White paper
Candle
Match

FIBER TEST

“Unknown” fiber

Samples of wool, rayon, silk, polyester, and cotton

Per Student:

Worksheets

Writing Utensil



WHAT YOU NEED TO KNOW

Fibers, strands of thread that make up yarn, are all around us. Fibers make up thousands of products, including clothing, upholstery, carpet, rope and building components. As you interact with these products loose fibers become attached to your body and clothes. When you enter a room, you pick up some of the fibers present in the room. Therefore, the fiber evidence you are carrying can often provide information about where people have been.

Fibers can be divided into two large groups: natural and man-made. The earliest people wore animal skins and furs for clothing. From these plant and animal products, people learned to form individual threads that could be woven into large pieces of cloth. By the time of the Industrial Revolution, weaving was a mechanized process that produced plenty of fabric for a growing population and its needs. However, the fabric industry still depended on nature for its raw materials. After the Industrial Revolution, scientists worked hard to develop man-made fibers.

Different types of fibers have different observable characteristics that can be useful in forensic investigations. However, for fiber evidence to be useful in a crime scene investigation, scientists must be able to narrow down its origin to one or two sources. Because most clothing, upholstery, and carpets are mass-produced, this is sometimes difficult to do. Forensic scientists use **microscopes** to help them identify where fiber comes from. A Microscope allows the forensic scientist to magnify, or increase the size of the fiber they are looking at many times larger than what their eyes can do. This lets them see the fiber in greater detail. If the fiber is still not able to be identified then the forensic scientist will perform a **flame test**, which allows them to see the characteristics of the fiber when it burns. By doing this side by side with know fibers they can determine what the unknown is with more confidence.

Different fibers look and react differently. This can help forensic scientists determine who was at a crime scene, especially when the fibers are unique or uncommon. By looking at the fiber in questions under a microscope along with know types of fibers the scientists can compare small physical characteristics of the fibers. Some examples would be color, the number of strands that make up the fiber, how they are woven together, along with many others. If this is not enough to make a match they the forensic scientist can perform a flame test. In a flame test the fiber, or a small piece of it is burned to see what happens to it. Some of the things the forensic scientists look for are flame of smoke color, speed the fiber burns and how it burns, does it melt or turn to ash. All these will help lead the forensic scientist to determine what type of fiber was left at the crime scene and possibly which suspect it could of come from.



WARM UP

Ask your students what kind of clothes they are wearing. What are they made of? How are they different from their classmates? Are they similar? Explain that today they will be testing different fibers to identify a fiber left at a crime scene.



ACTIVITY

MICROSCOPE EXAMINATION (DATA TABLE 1)

1. Collect an unknown fiber from the victim by carefully lifting the fiber with a pair of tweezers. Do not touch the fiber with your hands or you might contaminate the evidence.

FIBER TEST

2. Place the fiber on a piece of white paper.
3. Fold the paper in half twice, making an envelope.
4. Carry the fiber to your lab station.
5. Prepare a wet-mount slide of the fiber by placing it on a slide, adding a drop of water, and covering the fiber and water with a cover slip.
6. Use a microscope to examine the fiber under low, medium, and high magnification.
7. On your data table, sketch what you see. Note any pits or striations on the fiber.
8. Repeat this procedure with the samples of wool, rayon, silk, polyester, and cotton.
9. Sketch each sample and make notes on your data table.

FLAME TEST (DATA TABLE 2)

1. Light your candle and perform the following procedure with each of the fiber samples, including the unknown from the crime scene.
2. Holding the fiber in the tweezers, bring it close to but not touching the flame.
3. On your data table, describe the fiber's behavior as it approaches the flame. Does it melt, ignite, or curl?
4. Holding the fiber in the tweezers, touch the fiber to the flame.
5. On your data table, describe what happens. Does it ignite quickly or slowly? Does it sputter, drip, or melt?
6. Remove the fiber from the flame.
7. On your data table, describe any odor associated with the fiber in the flame. Does it smell like vinegar or hair?
8. Make a note on your data table what kind of residue is left after the fiber is removed from the flame. Does it leave a white fluffy ash, a hard bead, or a melted blob?



CHECK FOR UNDERSTANDING

1. What are some of the observations you made when you look at the fiber strands with the microscope and when you performed the flame test?
2. Why is it important to have other pieces of evidence to go along with fiber evidence?
3. Why do forensic scientists investigate fiber evidence?

FIBER TEST

Name: _____

Date: _____

Data Table 1

Make a sketch of the fiber in the microscope under different magnifications.

Type of Fiber	Low Magnification	Medium Magnification	High Magnification
Wool			
Rayon			
Silk			
Polyester			
Cotton			
Unknown (Crime Scene)			

FIBER TEST

Name: _____

Date: _____

Data Table 2

Describe what happens to the fiber during the flame test.

	Approaching Flame	In Flame	Removed from Flame	Odor	Residue
Wool					
Rayon					
Silk					
Polyester					
Cotton					
Unknown (Crime Scene)					