

FIBERS AND FORENSICS

QUICK PEEK

In this lesson, students become forensic scientists as they observe fibers under a microscope and perform a burn test.

SUGGESTED GRADE LEVELS: 9-12

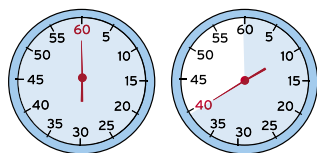
ILLINOIS STATE LEARNING GOALS

SCIENCE
11.A, 13.A

LANGUAGE ARTS
1.C, 3.A, 4.A

OBJECTIVES

- ★ Students will analyze different types of fibers by using a microscope and performing a burn test.
- ★ Students will collect data and draw conclusions to determine which fiber matches the “unknown”.



PACE YOURSELF:
100 MINUTES



PREPARE YOURSELF

NOTE: One part of this experiment includes open flames. Be sure to check your school’s policies and use your best judgement 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. Choose whatever fiber you wish to be the one found on the victim, or the “unknown”.
2. (*Optional—but the students love it!*) A paper cutout of a victim may be placed on the floor or you can draw an outline of the victim on the floor with chalk. Sprinkle a few of the unknown fibers on the victim.
3. 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
- “unknown” fiber
- Samples of wool, rayon, silk, polyester, and cotton

Per Student:

- Data Sheets
- 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. You also drop some of the fibers you are carrying. Therefore, fiber evidence can often provide information about where people have been.

TIP: If teaching more than one class per day, change what type of fabric you use as the “unknown”.

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. Drought, flooding, disease, and cold weather could badly damage the fiber crops and reduce the amount a cloth available. After the Industrial Revolution, scientists worked hard to develop man-made fibers.



WARM UP!

Ask students what fibers are and where they are found. How could forensic scientists use fibers to solve a crime?



THE “HOW TO”

All students and teachers should be wearing safety goggles and gloves.

- 1.** Collect an “unknown” fiber from the “victim” by carefully lifting the fiber with a pair of forceps. Do not touch the fiber with your hands. (Remind students how important it is not to contaminate the evidence.) Place the fiber on a piece of white paper, then fold the paper in half twice.
- 2.** Carry the fiber to your lab station. Prepare a wet-mount slide of the fiber by placing it on the slide, adding a drop of water, and covering the fiber and water with a cover slip.
- 3.** Examine the fiber under low, medium and high magnification with your microscope. Sketch what you see. Note any pits or striations on the fiber. Place the sketch and notes in your data table.
- 4.** Repeat this procedure with the samples of wool, rayon, silk, polyester, and cotton. Sketch each of these samples at low, medium and high power. Place your sketch and notes about the fibers in your data table.
- 5.** Light your candle and perform the following procedure with each of the fabric samples, including the “unknown”.
 - a.** Holding the fiber in the forceps, bring it close to, but not touching, the flame. Describe the fiber’s behavior as it approaches a flame: does it begin to melt, ignite, or curl?
 - b.** Holding the fiber in forceps, touch the fiber to a flame. Does it ignite quickly or slowly? Does it sputter, drip, or melt?
 - c.** Remove the fiber from the flame and describe how it behaves. Does it self-extinguish, continue to burn, or continue to glow?
 - d.** Note any odor associated with the fiber in the flame. Does it smell like vinegar or hair?
 - e.** What kind of residue is left after the fiber is removed from the flame? Does the fiber leave a white, fluffy ash, a hard bead, or a melted blob?

Until the 1970’s, manufacturers used more natural than synthetic fibers to make products. Today, about twice as much synthetic fiber than natural fiber is used.

Man-made fibers include: rayon, acetate, nylon, polyester, acrylic, and spandex.



WHAT’S GOING ON HERE?

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.



DID THEY GET IT?

POSTLAB QUESTIONS (*can be answered in a whole group discussion or individually*):

1. From your observation of the fibers under the microscope, which type of fiber is most like the unknown fiber taken from the victim? Describe the similarities of these two fibers.
2. From the burning tests, which type of fiber is most similar to the unknown fiber taken from the victim? Describe the characteristics they have in common.
3. Why might an investigator want to identify unknown fibers from a crime scene?
4. What must scientists be able to do in order for fiber evidence to be useful in a crime scene investigation?
5. From where do we get the materials to make natural fibers?
6. How are synthetic fibers classified? Give examples of each type.
7. You investigated the properties of five different types of fibers in this lab. What are some other characteristics of these fibers that we could have analyzed? Why would it be important to know the characteristics of these fibers that you just listed?
8. Judging from this lab and your own personal experiences, describe the types of products made from the five fibers you analyzed. Why would you use that particular fiber for the product(s) you listed? What are the pros and cons of that fiber's use for the product you listed?

Rayon was the first synthetic fiber to be manufactured. It is made by chopping and chemically treating wood pulp and cotton to produce a soft mass of cellulose. This cellulose is spun into threads.



ET CETERA

1. Some students have a very difficult time explaining in writing what they observe. It would be helpful to model this in front of the class. Strike a match and ask a student(s) what they observed. Write it on the board so they can see the transition from verbal to written language. Ask students to use all their senses: sight, sound, smell, touch and sound.
2. If possible, bring in examples of products made from synthetic and natural fibers.

Wool, silk, cotton, flax, and the husks of some dry fruits are examples of natural fibers.

DATA TABLE
Examination of Fiber Under the Microscope

TYPE OF FIBER	LOW MAGNIFICATION SKETCH	MEDIUM MAGNIFICATION SKETCH	HIGH MAGNIFICATION SKETCH
Wool			
Rayon			
Silk			
Polyester			
Cotton			

DATA TABLE 2
Behavior of Fibers in Flame

	APPROACHING FLAME	IN FLAME	REMOVED FROM FLAME	ODOR	RESIDUE
Wool					
Rayon					
Silk					
Polyester					
Cotton					
Unknown					

SCORING

MICROSCOPE DATA TABLE	
Detailed drawings and notes in each box	15
Drawings are not detailed and only a few notes	10
Drawings lack detail and no notes	5
Not all boxes contain drawings	0
Flame data table	
Detailed observations within each box	30
Notes in each box, some detail	25
Notes in each box, very little detail	15
Data table has some entries but is not complete	5
ANSWERS TO QUESTIONS	
All questions fully answered in complete detail.	40
Questions are answered, but not in complete sentences	30
All questions are attempted, but not fully answered	20
Some questions are attempted	10
Little or no thought given to answers	0
TOTAL:	85