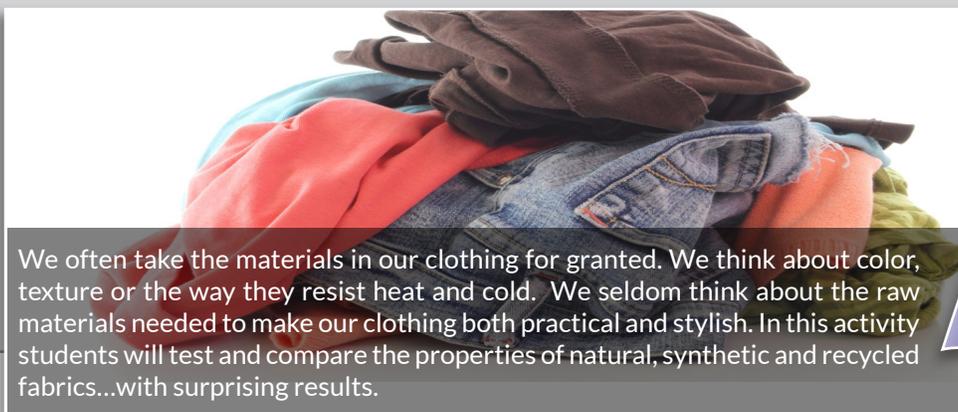


# Fashion Show



We often take the materials in our clothing for granted. We think about color, texture or the way they resist heat and cold. We seldom think about the raw materials needed to make our clothing both practical and stylish. In this activity students will test and compare the properties of natural, synthetic and recycled fabrics...with surprising results.

GRADES  
9-12



## PREPARE:

Time Required: 2 class periods (90 minute) without extensions

- Gather materials (see activity pages).
- Divide students into groups of 3-4.
- Make copies of the Fashion Show student data sheet.
- Collect samples of fabrics, with labels, including natural, synthetic and recycled that are approximately the same size and color (see note on teacher page).
- SDS sheets should be available for all chemicals.
- Confirm students will have access to computers and Internet.



## MOTIVATE:

- Hand out several samples of fabric to each group of students.
- As a class, have them examine the labels and put each fabric into one of the three categories.

Natural Primary Fabric	Synthetic Primary Fabric	Recycled Material
------------------------	--------------------------	-------------------



## TEACH:

- Explain to the students that humans moved from furs and leathers to fabric five thousand years ago. The properties of some cellulose-based fabrics (such as linen, hemp and cotton) have been modified through plant breeding since then. Synthetic fabrics, common today, are often made from non-renewable resources such as oil. Recycling those materials to make new products becomes more important as the raw materials become more difficult and expensive to obtain.
- Conduct activity according to the directions on the activity page. Give each group of students 4 samples of fabric. They should each have a labeled sample of a natural, synthetic, and recycled material as well as an unlabeled fabric they will need to identify.
- Be sure to review safety procedures with the students anytime chemicals are in use.
- Have students collect and record their data.
- Have the class discuss their observations.



## REFLECT/ASSESS

Students should be able to:

- Perform lab activities with measures in place to ensure fair tests and valid results.
- Identify the properties of each fabric sample and consider traits that may make a fabric more valued over another.
- Compare and contrast natural materials and synthetics, and primary synthetic fabrics and recycled synthetic fabrics, and discuss possible reasons for the differences.
- Identify a mystery fabric sample based on evidence.



## EXTEND

When people shop for clothing, they seldom think about the way the item will wash or resist wrinkles. Instead, they think about how they will look. But it's vitally important that we re-use and recycle. Develop a short video advertisement that features the popular appeal of a fabric and sells recycling at the same time.

Here are some facts you might use:

- 48 recycled plastic water bottles = a 6 x 8 carpet
- 17 recycled plastic water bottles = a sweatshirt
- 90 recycled plastic water bottles can produce enough fabric to cover the back seat of a car.
- You can find other facts about recycling on the web!

Have students research the development of fabrics from around 4000 B.E.C. to the invention of “denim”. Include in the timeline the qualities and properties that made each of the fabrics useful and valued.



## JOURNAL QUESTION

Each year humans use billions of plastic water bottles! The “fixed” carbon in a plastic is a great raw material for new fabrics, and chemical engineers can design processes that address the specific needs of various vendors—strength, versatility, stain or wrinkle resistance, ability to absorb interesting dyes or to take on unique textures. If this is the case, why do we still use so many natural and synthetic primary fabrics? How do you predict this might change in the future? Who are some of the stakeholders that would be affected?



## WEBLINKS

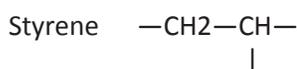
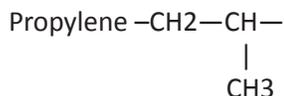
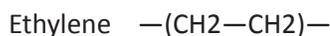
ISRI – Textiles <http://www.isri.org/recycling-industry/commodities-specifications/textiles#.Vpcsv8YrLIU>

# Fashion Show

## Background

Fabrics can fall loosely into two categories. Natural fabrics like cotton and linen are made from protein fibers (hair or fur made into felt) or complex carbohydrates like cellulose (linen and cotton). The reading selection provided for students gives a little of the history of these fabrics.

Synthetic fabrics are often made from polymers—chains of organic units like:



Fabrics made from recycled plastic are becoming more common in the marketplace. Here are just a few of those currently available:

- EcoSpun® - Polyester fiber made from recycled plastic bottles
- Eco-Fi®-- Polyester fiber made from recycled plastic bottles (see above)
- Consoltex'sEarthwhile™ - Performance fabrics made from a combination of organic and recycled materials
- "Innova®- yarns" are the only yarns, synthetic or natural, that begin as a by-product of post-industrial waste.
- Repreve® - An eco-friendly yarn made from recycled materials
- Recyclon™ - A new nylon fiber made from post-industrial recycled nylon, which uses only 15 percent of the production energy required to for virgin nylon fiber from petroleum

(Source: <http://www.fabriclink.com/News/Sustainability.cfm>) Before the activity begins plan ahead to get your sample of fabric made from recycled plastic since you will want your other samples to be of approximately the same color for the insulation test in the activity. A list of vendors can be found at <http://www.ecomall.com/biz/clothing.htm>. The site anchor-age.nine@gmail.com (617 616-5333) offers samples for \$1. But the fabrics are becoming so common that a quick search at a large store that sells jogging materials and sports jackets may be the fastest route.

The question which directs the student activity, "What is the difference..." is deceptively simple on the surface because the answer is often "none." Synthetic fabrics have very specific advantages over natural fabrics (for example, wrinkle or stain resistance.) These advantages are about the same, whether the fabric is made from raw materials like oil or from recycled polymer units.

A specific property of a fabric may or may not be appealing to consumers. Some people prefer a wrinkle-resistant fabric like polyester, while others may prefer the natural look or feel of linen or raw cotton. An extended discussion of what constitutes "fashion" is appropriate to the lesson--with a healthy respect for diversity. The key concept that students should gain from this lesson is that there is no generic difference between synthetic fabrics made from primary sources (i.e.; oil) and those made from recycled materials (such as plastic bottles.)

## Reference Chart

When plastics are collected for recycling, they are generally mixed and may also be collected with denser glass and metals. Plastics are generally classified into these categories. The symbols (left column) are required to be printed on the products you purchase:



PET

Polyethylene Terephthalate, or PETE is used to make many common household items like beverage bottles, medicine jars, peanut butter jars, combs, bean bags, and rope. Recycled PETE is used to make fabrics and carpets.



HDPE

High-Density Polyethylene, or HDPE is quite stable and suitable for foods and drinks. It can be used to contain milk, motor oil, shampoos and conditioners, soap bottles, detergents, and bleaches, and to make children's toys—especially those that might be chewed. It can be recycled make plastic crates, plastic lumber, fencing, and more.



V

Polyvinyl Chloride, or PVC is used for plumbing pipes and tiles. It is not commonly recycled, but when it is, it can be used to make flooring, mobile home skirting, and other valuable products.



LDPE

Low-Density Polyethylene, or LDPE is both durable and flexible and used to make plastic cling wrap, sandwich bags, squeezable bottles, and plastic grocery bags. It is not normally recycled in the standard municipal mix, but when placed in designated containers (often at the stores) it can be used to make garbage cans, lumber, furniture, and more.



PP

Polypropylene, or PP is strong and can withstand higher temperatures than most plastics. It's found in plastic diapers, food containers, prescription bottles, and plastic coffee cups. Only a few municipal systems currently recycle it, but when it is reclaimed it can be used to make tools.



PS

Polystyrene (Styrofoam), or PS can be recycled but often ends up in landfills because the recycling processes don't account for its low density. It's found in disposable coffee cups, plastic food boxes, plastic cutlery, packing foam, and packing peanuts are made from PS. It can be recycled to make license plates, rulers and other durable plastic objects.



OTHER

If a plastic is unique and doesn't fit into another category it is classified in this one. Examples include polycarbonate, used to make water bottles, compact disks and some medical products. It can be recycled to make plastic lumber.

The reading selection should reinforce the idea that fabrics are designed to serve specific purposes in specific human communities.

## Answers to Student Questions:

1. Think of each property that you measured. Were any of them more important than others? **This will differ with each group; Depending on the geographic location, the age range, the economic capacity of the consumer, the properties will take on different priorities.**
2. Were there generic differences between natural materials and synthetics? **In general, synthetics have more resilience and strength. But modern genetic engineering has enabled consumers to get wrinkle-resistant cottons, color-fast linens, etc.**
3. Were there differences between primary synthetic fabrics and recycled synthetic fabrics? **In general, recycled materials have the same value/properties as primary synthetics made from oil or other materials.**



# Fashion Show

Since the beginning of time, man developed many different materials to use for clothes. Primitive humans wore fur and leather, the Chinese used felt, and much later the Indians began to grow cotton for cloth. Since that time, humans have developed a long series of new fabrics: rayon; nylon; and polyester from organic (oil) sources and genetically engineered variants on the old crops. Now we have another option, recycled water bottles. In this activity you will test and compare the properties of natural fibers, synthetic and recycled fabrics

### Materials:

- 4 samples of fabric (1 natural, 1 synthetic, 1 recycled, 1 unknown)
- Goggles for eye protection
- Eye droppers
- Forceps
- Iron
- Dark coffee
- 50/50 laundry detergent solution/water
- bleach
- water
- isopropyl alcohol
- dilute acetone
- thermometer
- heat lamp
- single hole punch
- 4 microchemistry test plate (dish with 3 separate cells)

### Preparation:

- Wear your goggles while performing all of the tests.
- Follow all safety precautions as directed by your teacher.

### Part 1: Collect Data

1. Before beginning, consider what procedures you will need to have in place to ensure that your tests are fair and your results valid. Read through the tests you will be performing and discuss some of these measures with your teammates.
2. Perform the tests!

#### Wrinkle-Resistance

- Crush each sample of fabric into a ball.
- Place the crushed fabric under a stack of books for 5 minutes.
- Remove and record your observations.

### Strength

- Develop a test to compare the durability of your samples.
- Use firm clamps to attach them to a spring scale or pressure probe. Add masses or pull until the fabric distends or tears. (Make sure you use an objective measure to mark the “end point” of this measurement.)
- Record it on the chart below.

### Heat Resistance

- Use a commercial iron or (hair) curling iron to compare the heat resistance of your samples. Chose one or two settings (low vs. high)
- Note any changes in the fabric, such as scorching or melting.
- Record any changes.

### Resistance to De-colorization

- Put one drop (~1/20 ml) of commercial liquid bleach on each sample.
- Record any de-colorization.

### Solvent Reaction

- Used the hole punch to make three 2 mm dots of each fabric
- Place each sample in a microchemistry test plate.
- Add several drops of each of the solvents, water, isopropyl alcohol and acetone, in each of the different wells.
- Observe and record any sign of the fabric sample being destroyed, dissolved or distorted.

### Insulation Capacity

- Note the start temperature degrees Celsius.
- Take the large piece of each fabric and use it to wrap the end of a temperature probe or alcohol thermometer.
- Expose all of the samples simultaneously to heat lamp or to another heat source for two minutes.
- Record the change in temperature over time.
- Rank the fabrics (high to low) with respect to their capacity to help the wearer maintain temperature control.

### Stain Resistance

- Put two drops of concentrated coffee on each piece of fabric.
- Allow drying.
- “Wash” the fabric using dilute laundry detergent.
- Was the stain removed? Record your results

## Reflect and Apply

- Think of each property that you measured. Were any of them more important than others when determining the value of the fabric?
- Were there generic differences between natural materials and synthetics? What properties of synthetic fabrics might explain these differences?
- Were there differences between primary synthetic fabrics and recycled synthetic fabrics? How would you explain these differences?
- Were you able to determine the identity of your mystery fabric? Support your conclusion with evidence.

## Extension

When people shop for clothing, they seldom think about the way the item will wash or resist wrinkles. Instead, they think about how they will look. But it's vitally important that we re-use and recycle. Develop a short video advertisement that features the popular appeal of a fabric and sells recycling at the same time. Here are some facts you might use:

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Student Name: \_\_\_\_\_

Period: \_\_\_\_\_

### Fabric Test Observations

	Sample 1	Sample 2	Sample 3	Sample 4
Classification: Primary fiber, primary synthetic, recycled				Mystery Sample
Wrinkle Resistance				
Strength				
Heat Resistance				
De-colorization				
Solvent Reaction				
Insulation Capacity				
Stain Resistance				