

CLOTHING AND TEXTILES INTERMEDIATE PROJECT GUIDE

Unit VI. Understanding Textiles (Fabrics)

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Clothing and Textiles Intermediate Project Area Guide

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<u>Activity 22 - What's That Fabric?</u>
<u>Activity 23 - Investigating Fabrics that Keep You Warm</u>
<u>Activity 24 - The Science Behind Fabrics that Protect</u>
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Activity 22 - What's That Fabric?

Project Outcomes:	Identify fabric names based on specific woven and knit structures. Identify which fabrics are most suitable for specific garments based on their structure.
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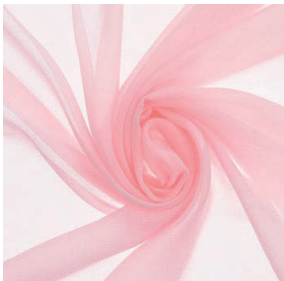


As you begin to sew, you will use different types of fabric. It's important to know fabrics by name and their qualities before you purchase them. This will help you choose the right fabric for what you want to make. In this activity you will learn about fabrics and their names as well as which fabrics are best to use for what garment.

To Get Started

There are a few basic fabrics that you probably already know. So, test your knowledge by matching these fabrics with their name and description.

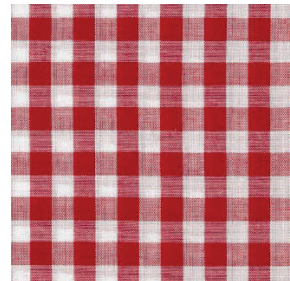
A



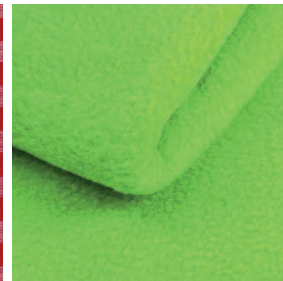
B



C



D



____ 1. **Gingham** - medium weight fabric that is woven to form checks.

____ 2. **Chiffon** - see-through fabric used in layers to make blouses and ballet skirts.

____ 3. **Denim** - fabric is typically used to make jeans.

____ 4. **Fleece** - a heavy fabric that is great to make no-sew blankets and warm jackets.

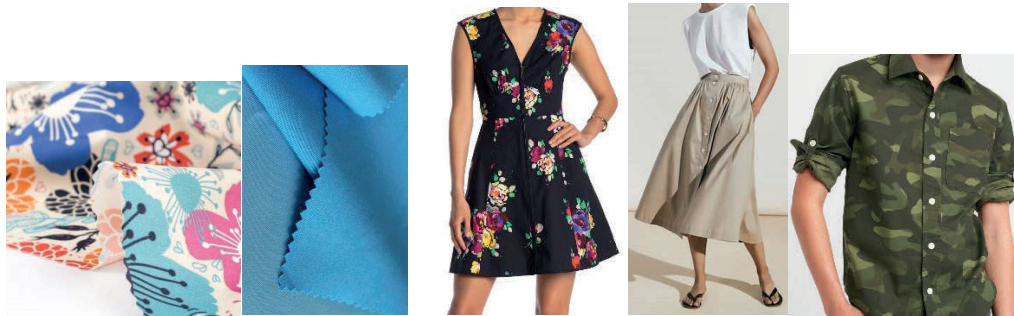
Answers: 1-C; 2-A; 3-B; 4-

Fabric Know How

Calico Print. Calico printed fabric is a plain weave fabric of medium weight that is printed with a variety of small designs. It can be used for a wide array of garments, from shirts to dresses to skirts. This is a great fabric to use for beginning sewers.



Poplin. Poplin is a plain-weave cotton fabric with very fine horizontal “ribs,” or yarns, that results in a strong, crisp fabric with a silky, lustrous surface. Poplin is commonly used in men’s and women’s shirts, dresses and skirts, and sportswear.



Denim and Chino, Gabardine. These fabrics are made using a twill weave. The distinguishing characteristic of the twill weave is a diagonal rib pattern which makes it very durable. Common garments made from these fabrics include pants, jeans and jackets.



Corduroy. Corduroy is a heavier weight fabric, usually made of cotton. It is called a pile-weave fabric because an extra yarn is used in the weaving process which is cut to make the ridges called wales. The tufted cords which result give the textile a fuzzy hand that's perfect for fall and winter. Corduroy can be made into pants, skirts and overshirts.



Flannel. Flannel is a soft, medium-weight cotton fabric that has a napped, or fuzzy, finish on one or both sides. Its soft, cozy feel makes it the perfect fabric to keep you warm and comfortable all winter long. It's often woven with patterns, especially plaids. Be careful if you are a beginning sewer since plaids need to be matched at the side seams.



Canvas (sometimes called duck cloth). Canvas is a woven fabric typically made of heavy cotton yarn. Canvas fabric is known for being durable, sturdy and heavy duty. By blending cotton with synthetic fibers, canvas can become water resistant or even waterproof, making it a great outdoor fabric. Since it is a heavier, stiffer fabric, select a pattern that is less structured with minimal seams.



Jersey. Jersey is a soft, stretchy knit fabric. The fabric is usually light-to-medium weight and is used for a variety of clothing items like T-shirts, sweatshirts, leggings or dresses. Since jersey stretches, you don't need zipper or button/buttonhole openings. Be sure to pin pieces in place before sewing since knits do tend to move around. Use a small zigzag when sewing knit fabric or a serged stitch to allow for stretch.



TO DO

From what you have learned about fabrics and their use, match the image of fashions with the most appropriate fabric that should be used to make it.

A.

B.

C.

D.



- _____ 1. Calico
- _____ 2. Jersey
- _____ 3. Flannel
- _____ 4. Denim

Answers: 1-D; 2-A; 3-C; 4-

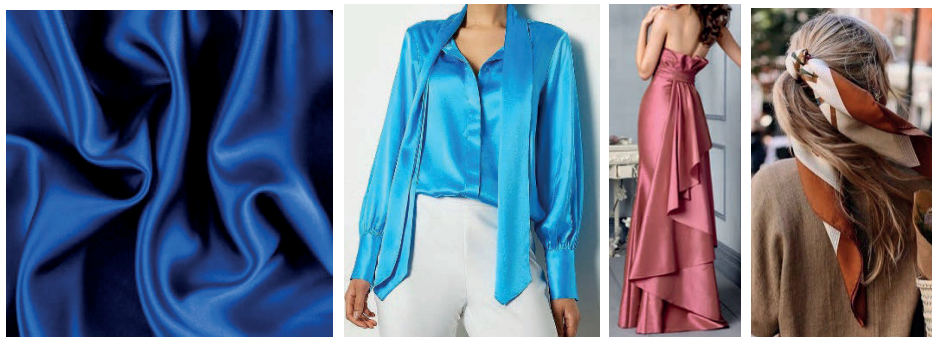
SPECIALTY FABRIC

The following fabric should be reserved for the medium to advanced sewer since the fabrics are somewhat slippery and require special seam finishes.

Organza. Organza is a lightweight, sheer, plain-woven fabric. Organza is extremely popular for party and evening wear because it is crisp, shimmery and has a translucent quality.



Silk. Silk, a natural fiber produced by the silkworm, is known for its shine and softness as a fabric. It is an incredibly durable and strong material with a beautiful drape and sheen. Silk is used to make blouses, formal attire and scarves.



Taffeta. Taffeta is a crisp, plain-weave variation fabric using thin yarns in one direction and thick yarns in the other to create small ridges. Taffeta fabric typically has a lustrous, shiny appearance. Taffeta can vary in weight from light to medium. Taffeta is desired for party and formal wear. It does ravel and is slippery.



TO DO

In this activity, you have learned about a few fabrics and garments that are great to make from these fabrics. Now it's time for you to explore other fabrics and their characteristics.

Research the following fabric by completing the chart. A good resource is <https://thefabricofourlives.com/cotton-fabrics>.

FABRIC	CHARACTERISTICS	GARMENT(S) YOU WOULD MAKE FROM THIS FABRIC
Seersucker		
Challis		
Linen		
Rib Knit		
Velour		

Activity 23 - Investigating Fabrics that Keep You Warm

Project Outcome:	Compare thermal function of various fabrics for warmth.
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STEM concepts you will learn:

- the physics and chemistry behind why certain fabrics keep you warmer than others.
- the engineering behind how products are designed by industry to keep you warmer.
- through mathematical evaluations, the insulative performance of various fabrics by completing a thermal wrap activity.



When there is a chill in the air, we begin to pull out our jackets and sweaters to stay warm. In general, fabric tends to insulate us and reduce heat loss by trapping air. This may be due to the fiber used, the way the fabric is knit or woven or the texture or bulkiness of the fabric. (Fibers are the smallest part of a yarn which is used to weave or knit to make fabrics.)

In this activity you will learn the specifics of how different fabrics keep you warm.

To Get Started

Make a list of four garments you have that keep you warm and their fiber content:

Garment	Fiber Content
1. _____	- _____
2. _____	- _____
3. _____	- _____
4. _____	- _____

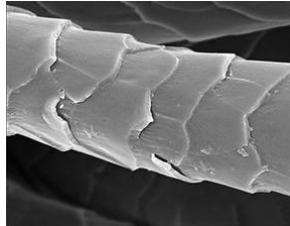
What Determines the Insulative Value of Certain Fabrics?

When taking a closer look at the fabrics that are used to make the clothes we wear, there are many factors that determine the insulative value of any particular garment. Note: a garment has good insulative value if it keeps the heat generated by your body from escaping.

Let's look at some specific examples to better understand this concept.

FIBERS WITH BULK

Some fibers, such as wool, are bulky which allows air to be trapped between the fibers in the yarn. In fact, if you take a really close look at a wool fiber under the microscope, you will see what is called scales. This makes the fiber a good insulator which holds in the heat your body generates. Wool fibers also have a special quality in that they do not absorb moisture and the overlapping arrangement of the scales cause them to shed water like the shingles of a roof. Some water particles can slip in between the scales causing the fabric to feel wet on the outside while being dry on the inside. (weatherwool.com/pages/the-science-of-wool)



WOOL FIBER

TO DO

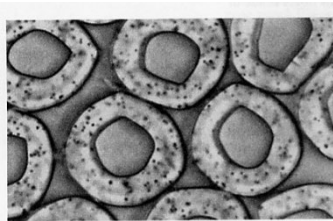
If you have any garments which contain WOOL, list them here.

Do these garments keep you warm? _____

MANUFACTURED FIBERS WITH INSULATIVE VALUE

Hollow Fibers: Some manufactured fibers (fibers made in a laboratory) are made with spaces within the fiber filled with air. Thermolite™ is a brand of the fabric made from these fibers. Fabric made from these fibers work by speeding up the process of moving moisture from the skin to the fabric's exterior so it can evaporate quickly. Keeping your skin dry is important in staying warm. It is recommended to use Thermolite™ clothing with other garments for a layered effect. Thermolite™ fabric is used to make jackets, socks, gloves and ski wear.

Here's a fun fact: DuPont, the fiber manufacturer who invented Thermolite™, got the idea by studying the hairs of polar bears which are hollow.



TO DO

Check your garments to see if any contain Thermolite. Describe them here if you do:

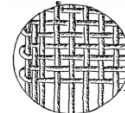
WHAT A DIFFERENCE THE WEAVE MAKES!!

If you take a closer look at the fabric your clothes are made of, you will find that the fabric is either woven or knit. As a general rule, woven fabric does not stretch while knit fabric does. Woven fabric is made using various types of weaving patterns. The closer the weave in the fabric the higher the insulative value and the warmer you will stay.

Here is an example: a woven shirt is most often made using a plain weave, which is an 'over-one-under-one' pattern, while denim jeans are made using a twill weave fabric that creates a diagonal effect. The twill weave is the strongest and tightest weave of all the weaves. Therefore, a garment made using a twill weave fabric will keep you warmer than one made from plain weave fabric.



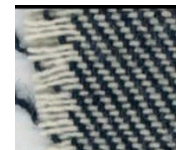
Woven
Shirt



Plain
Weave



Denim
Jeans



Twill
Weave

TO DO

Look in your closet and select a firmly woven shirt/blouse and a pair of jeans.

Hold each one up to the light and describe the amount of light that comes through.

Shirt/blouse: _____

Jeans: _____

Which lets more light through? _____

Which keeps you warmer? _____

What have you learned by doing this exercise? _____

THE INSULATIVE VALUE OF KNIT GARMENTS

If you think about why you wear knit-based garments, there are probably three main reasons:

- 1) they stretch, so they are easy to get off and on.
- 2) they are comfortable because they don't bind the body.
- 3) the fabric is usually soft.

Look at the garments you have that are knits and you will find a variety from T-shirts to sweaters. Which keep you warmer? Probably your sweaters. Part of the reason is that sweaters are bulkier which creates more air space to trap your body heat.

Some sweaters are 3-dimensional which further traps air. A sweater made using a cable knit design, as shown to the right, is an example. Think of your T-shirts. They are usually thin, so you must add layers to help create air space to keep you warmer. Another tip related to T-shirts: if you use T-shirts as part of layering, check your labels and make sure you are not wearing 100% cotton T-shirts, as cotton absorbs moisture from your skin and retains it which will make your skin feel clammy, damp and cold. Instead choose T-shirts that are 50% cotton and 50% polyester. Polyester does not absorb moisture.



T-Shirt



Cable Knit
Sweater

TO DO

Look at the sweaters you have and describe one that keeps you warm and why:

OTHER FABRICS THAT KEEP YOU WARM

Fleece: Anyone that spends any time outdoors has heard of fleece fabric. Fleece is a soft insulating fabric made from a thermoplastic polymer resin of the polyester family used in synthetic fibers. Plastic bottles are often recycled to make fleece. These synthetic fibers are used to create an extremely lightweight fabric that is superior to the insulating properties of wool. The fabric is made up of many lofted synthetic fibers that trap air and of course that will keep the heat from your body close to you.



Fleece Jacket

Quilted Fabric: As stated earlier, if you wear layers of clothing, this will keep you warmer. In looking at quilted fabric that might be used for a vest or jacket, there are three layers of fabric that are stitched together. It consists of two layers of fabric with some kind of thick fiber layer in between. This layer is usually nonwoven fibers/fabric but could also be down feathers. Sometimes ripstop nylon is used for the outer layer, which keeps wind and rain from penetrating. So, in addition to keeping heat in, quilted fabric can keep the elements of weather out.



Quilted Fabric Vest

TO DO

Look in your closet and find either a fleece jacket or quilted vest. Put it on and run around the room for two minutes. Do you feel warmer after doing this? _____

Explain why:

TEST YOUR KNOWLEDGE

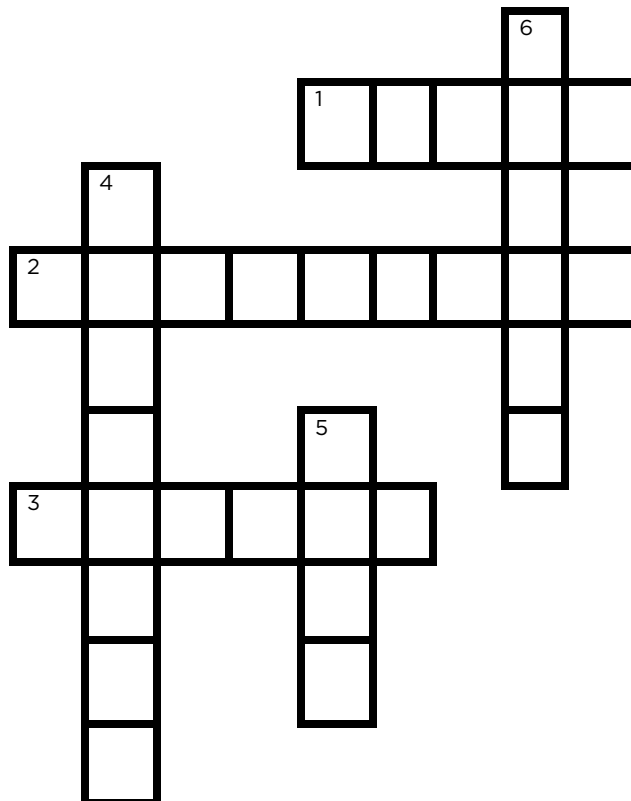
Now find out what you have learned about how fabric keeps you warm by completing this crossword puzzle:

ACROSS

1. The name of the weave that is the tightest weave, thus keeping you warmer.
2. To aid in keeping you dry when you sweat and are wearing layers, a T-shirt should be 50% cotton and 50% _____.
3. Thermolite™ clothing keeps you warm because the fibers they are made from are _____.

DOWN

4. The fibers often used on the inside of quilted fabric.
5. The fiber that has 'scales' which is water repellent and keeps you dry and warm.
6. The name of the fabric that is sometimes made from recycled plastic bottles.



Answers to crossword: 1. Twill 2. Polyester 3. Hollow 4. Nonwoven 5. Wool 6. Fleece

Next Step: Experiments for 4-Hers and Project Groups

HANDS-ON EXPERIMENT THERMAL QUALITIES OF FABRICS FOR WARMTH

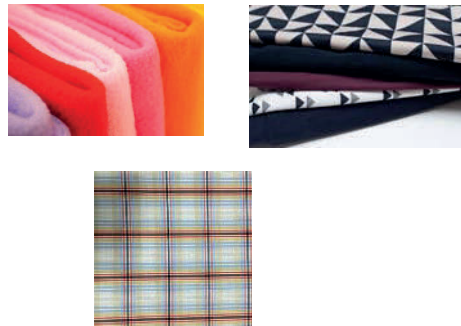
Fabrics can be good **insulators** against **conductive** heat loss because fibers and fabrics often trap air within their structures. Some manufactured fibers have interior spaces filled with air, while fibers, such as wool, have a bulky texture that traps air between fibers in yarns and fabric. Fabric construction (woven vs. knit), thickness, weight, density, and surface texture affect the amount of trapped air, and therefore a fabric's effectiveness as an insulator. Layering multiple fabrics can increase the insulative performance of a garment as well by trapping additional air between layers or blocking airflow through fabrics.

Goal: To compare the insulative performance of different fabrics through personal experimentation.

Supplies needed:

- 3 yards each of different fabrics, different weights and weaves – shirt weight woven fabric, fleece, jersey knit, etc. (Clothing of different fabric could be used but needs to be large enough for everyone to wear.)
- infrared laser temperature gun
- timer
- magnifying glasses

Note for Group Leaders: These supplies may be available through your 4-H agent through the Extension Family and Consumer Sciences Regional Office

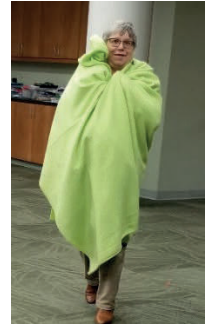


If you don't have fabric you can use a fleece hoodie, T-shirt and dress shirt. The results may not be as different.

ALERT! Caution participants NOT to point the laser gun at anyone's eyes. Groups may prefer recording data on a large communal chart (poster, newsprint, chalkboard or Smart Board) for easier viewing and discussion.

What to do:

1. Touch the fabric noting the thickness, weight and surface textures.
2. Next, examine the fabric with a magnifying glass to identify the fabric structures (woven or knit) as well as the density (thickness) of the construction. Record these observations in the FABRIC DESCRIPTION column of the Thermal Wrap Activity Sheet.
3. Based on observations in Step 1, predict the fabric's performance by ranking the samples from 1 (warmest/best insulator) to 5 (coolest/worst insulator). Record those numbers in the PREDICTION column.
4. Using the temperature gun, read the subject's body temperature at rest (point the device at the back of the neck. Note: have all but the person doing the experiment stand to the side or behind the subject.) Record that temperature in the BEFORE EXERCISE column.
5. Participant will wrap themselves in the fabric they are testing and jump up and down or run around for three minutes.
6. Using the temperature gun, read the subject's body temperature (point the device at the back of the neck) while she/he is still wrapped in the test fabric. Record that temperature in the AFTER EXERCISE column.
7. Repeat Steps 1-6 for the other fabrics and other participants.
8. Make two of the fabrics and create a layered effect by putting them together and repeating steps 2-6. Do this with the different fabric combinations. Repeat the steps 2-6.
9. Calculate the change in temperature for each of the samples and write that value in the TEMPERATURE CHANGE column. Use this equation: **After exercise temperature - Before exercise temperature = Temperature change**
10. Review the temperature change for each sample and rank its insulative performance from 1 (warmest/largest temperature increase) to 5 (coolest/smallest temperature increase). Record that number in the RESULTS column.
11. Discuss results for individual fabrics and for the layered systems. Compare the prediction rankings of insulative performance to the results rankings.



THERMAL WRAP EXPERIMENT WORKSHEET



Fabric or Fabric Layers	Insulative Performance PREDICTION Rank 1 (best/warmest) to 5 (worst/coldest)	Temperature Before Exercise	Temperature After Exercise	Temperature Change Formula: After-Before = Change	Insulative Performance RESULTS Rank 1 (best/largest increase) to 5 (worst/smallest increase)

BASED ON YOUR EXPERIMENTS, ANSWER THE FOLLOWING QUESTIONS:

1. Did the results agree with the predictions?

Where were you close and where were your predictions off?

2. Which fabric structures held the body heat better: wovens or knits?
3. Did thickness, weight and texture affect the insulative ability of particular fabrics? How?
4. What changes occurred when two fabrics were used together and how did this compare to those same fabrics used in single layers?

Activity 24 - The Science Behind Fabrics that Protect

Project Outcome: Compare protective function of various fabrics.

STEM concepts you will learn:

- *the chemistry of how synthetic fibers are produced.*
- *why chemical finishes are added to fabrics for extra protection against the environment.*
- *the technology behind how nonwoven fabrics are made.*

Have you ever wondered how special fabrics work that protect us and professionals in various situations? Here are some examples to think about:

- How do raincoats and umbrellas keep us dry?
- How do bullet proof vests protect police officers?
- How do surgical masks keep germs from spreading?

In this activity, you will explore the science behind these special fabrics and more.

NYLON

Nylon is often used in products that protect you against the rain. Products include raincoats, umbrellas, and tents. Nylon has many desirable properties including being:

- tough (strong)
- lightweight
- water resistant
- easy to wash
- dries quickly

To make nylon truly waterproof for outerwear, tents, etc., it is given a coating of resin. (A resin is a sticky substance that is not soluble in water used to protect a fabric.)

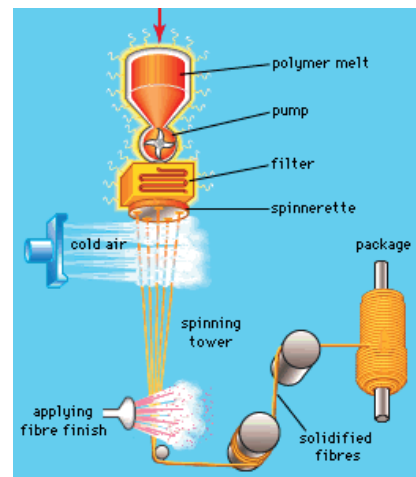
Unfortunately, nylon does not let water vapor pass through it either. This means nylon water resistant clothing traps sweat, so that after a while the inside of the clothing becomes wet and unpleasant to wear.



Nylon Production

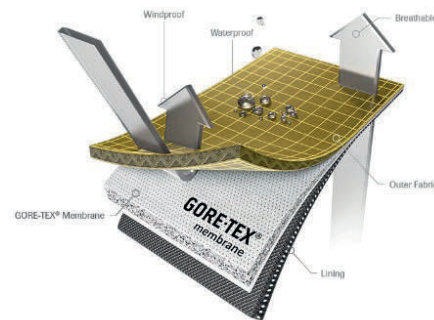
Nylon fiber is produced by pushing molten (liquid) nylon through tiny openings in a device called a spinnerette. The nylon pieces then harden into a filament (string type substance) after they are exposed to air. These filaments are collected and stretched once they have cooled down. A process known as drawing further stretches the filaments or yarn which are then wound onto a spool. This procedure makes the molecules in the filament form parallel lines, which provides the nylon fiber with its elasticity and strength.

(<https://sciencing.com/nylons-properties-uses-8627049.html>)



GORE-TEX®

GORE-TEX® is a breathable, waterproof fabric used in clothing worn for outdoor activities. It stops rain from getting in but lets perspiration out. So it keeps you dry on the outside and dry on the inside at the same time. GORE-TEX® isn't one material; it's actually a sandwich of three layers. There are two layers of nylon and a layer of microporous Teflon® in between. How can GORE-TEX® be both waterproof and breathable at the same time? Here's the science behind this. Steam caused by perspiration passes out easily because the water molecules are smaller than the pores in the GORE-TEX® liner; water droplets can't get in the other way because they're much bigger.



Pull out the jackets you have that are water resistant. Check the labels to check the fiber content. List them here.

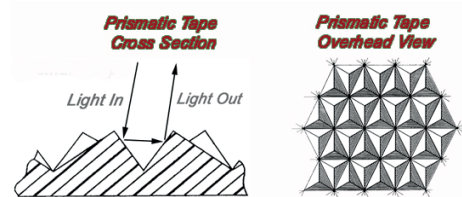
Describe Garment	Fiber Content

Which garment keeps you warmest and why? _____

REFLECTIVE STRIPS

Have you ever wondered how reflective strips (tape) actually work? It is as if it lights up in the dark. So here is the science behind it:

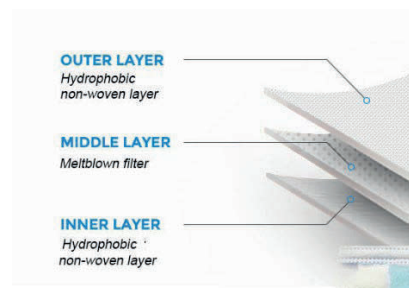
- Reflective tapes reflect light through small microprisms built into the tape.
- These tapes use small prisms that reflect light. (Look at the pictures to the right.)
- The angle of reflection can be changed depending on the desired results.
- The brightest tape reflects most of its light back to the source. This makes the tape brighter. For more information go to:
www.colebrothers.com/articles/reflective_tape.html



HOSPITAL SURGICAL MASKS

Hospital surgical masks function by stopping microbes (germs) from entering or exiting the mask. Here's how it works:

- The filters that make up the mask must allow the wearer to breathe while trapping particles.
- The design of the surgical masks usually includes three layers made up of **non-woven** fabric with the middle layer being melt-blown material that is what actually stops germs. Melt-blown means the fibers start as small 'plastic' beads, are melted and formed into short fibers, then actually blown onto a surface to create fabric.



Homemade masks for consumer use



- Most surgical masks feature pleats or folds. The mask's three-ply structure is made into a single mask by the use of an ultrasonic heat-sealing machine, that seals the outside edges of the three-ply layers.
<https://www.nap.edu/read/11637/chapter/4>

TO DO

Describe a face mask you have worn if you have worn one.

How does it compare to the surgical face mask?

PROTECTIVE CLOTHING

Protective clothing is used by **agricultural workers** when applying **pesticides**. In the agriculture production industry, pesticides are often used for weed and pest control. It is important to cover the whole body with a protective covering in order to prevent the pesticide from being absorbed through the skin. The labels on the pesticides will specify that the user wear personal protective equipment (PPE) such as gloves, clothing, eye protection and respirators (face masks). Chemical-resistant clothing is either reusable or disposable.

Reusable clothing is most often made of laminated woven or non-woven fabric (like rubberized rainwear). This provides excellent protection against most pesticides. Reusable clothing is sometimes heavy and uncomfortable in hot conditions.

Disposable protective clothing is made of spun-bonded (non-woven) fabrics that do not absorb pesticides as quickly as woven materials. The term spun-bonded means that continuous strands of synthetic fiber are blown on a surface and in the process tangled together and bonded with a sticky substance. The most popular type of spun bonded disposable clothing is made of Tyvek®. This type of material provides an effective barrier from several pesticide sprays and dusts.



(Source: Texas Cooperative Extension)

BULLET PROOF CLOTHING

To provide police officers and military with protection, special bullet proof fabric is used. The process of producing such fabric begins by using a chemical blend and spinning it into a solid thread. Here are the basic steps:

Step 1: Raw Materials - Synthetic fibers that are lightweight but strong are used. One of the most well-known is Kevlar®.

Step 2: Yarn Production - Large spools of the basic fiber are used to weave those individual fibers into cords and yarn.

Step 3: Sheet Materials - The yarns are then woven into a layer of material that is capable of stopping bullets.

Step 4: Cutting the Material - Using large industrial cutting machines, multiple layers of ballistic material are cut at once. Generally, bulletproof clothing consists of front and back panels that are a slightly different shape and size. The panels used in bulletproof clothing consist of multiple layers of this material.

The proper thickness of the fabric layers is assembled to create the ballistic panel and stitched together.

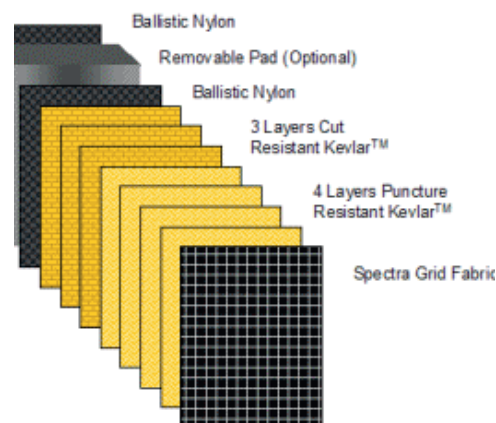
Step 6: The Cover - The sewn layers of ballistic material then need to be put into a protective envelope which is heat-sealed to protect the ballistic material inside against water and humidity.

Step 7: Carrier - These panels are then fitted into a specially designed carrier with pockets in which the ballistic panels can be inserted.

(<https://www.bodyarmornews.com/how-is-bulletproof-clothing-made/>)



Examples of Layers in Bullet Proof Vest



WET SUITS

When you think of a wet suit, the first thing that comes to mind is probably scuba diving. Wet suits are used for scuba diving, whether for sport or as part of industry related jobs where individuals are in the water to keep them warm and dry.



What is the chemistry behind how the fabric used in a wet suit keeps you dry?

1. The fabric is made up of carbon and hydrogen atoms called polychloroprene which form long-chained molecules that are linked together.
2. Other substances are added to add bulk, adhesion, color, etc.
3. This results in a doughy mixture that is pressed together using heat, forming a “sheet” of fabric. This results in a fabric called neoprene which is waterproof and stretches.

(<https://sciencing.com/neoprene-made-6587118.html>)

Note: Certain types of wet suit material are not waterproof but trap a thin layer of water against a diver's body. While the diver still gets wet, his body rapidly heats up the thin layer of water trapped against his body to nearly body temperature. If the suit fits properly, the warm layer of water does not circulate away from the diver's body.

FIRE PROTECTIVE FABRICS

There are many jobs today that require individuals to wear garments that are flame resistant or fire retardant. This includes fire fighters, welders, workers in the oil and gas industry, chemical plants and others.

What makes the fabrics from which these garments are made resistant to catching on fire?

Here are the facts:

Certain fabrics are manufactured to be fire retardant. An example is NOMEX®, which is made from a fiber called Aramid. For other fabrics that need to be flame-resistant, chemical finishes are applied. This is done in one of two ways:

- a) Special chemicals are applied to a manufactured fiber as it is made changing the molecular structure of the yarn that will last for the life of the garment.
- b) For cotton and cotton blends, the finish is applied after the fabric is made either through a gas infusion process or by applying heat to the fabric after the special chemical substance is applied.

For more about this process go to <https://www.textilemates.com/manufacturing-flame-resistant/> or search on the internet for flame-resistant fabric process.



What to do with what you have learned

- Perform the experiments that follow.
- Learn more about these specialty fabrics by exploring information on the internet and talking to people who use these products.
- Make a poster for an exhibit with pictures and information to share.
- Organize a project group and have a fire fighter, scuba diver or other professional who uses protective garments come and talk to the group.

Next Step: Experiments for 4-Hers and Project Groups

Discovering Fabrics with Protective Functions

Note for Group Leaders: the supplies for these experiments may be available through your 4-H agent through the Extension Family and Consumer Sciences Regional Office.



HANDS-ON Experiment 1

Don't Get Wet - Nylon Can Protect You

Nylon is considered the most versatile manufactured fiber. Generally, nylon is a silky, smooth **thermoplastic** (which means it melts and turns runny when you heat it up) that's strong, tough and durable. It's reasonably waterproof and resists sunlight and weathering.

Goal: To test nylon to show its waterproof capacity.

Supplies Needed:

- 8-inch by 10-inch piece of ripstop nylon fabric 8 inches by 10 inches (NOTE: You can use an umbrella for this experiment.)
- Spray bottle
- Plastic tub

What to do:

1. Have one person hold each side of the nylon fabric sample so that it is held vertically over the plastic tub.
2. Fill the spray bottle with water and hold it 8-10 inches away from the fabric. Spray the nylon with a fine mist 3-4 times to simulate rain.
3. Have participants feel the back side of the nylon for dampness.
4. Ask participants why they think the fabric stays dry based on what they know.
5. Continue to spray the fabric to see what level of saturation will cause dampness on the back. Results will be dependent on the fabric used.

While nylon is not completely waterproof, it is water resistant because:

1. Nylon is made of a synthetic substance that repels water naturally.
2. The weave of the fabric is tight (close together) which keeps water out.
3. Coatings are often applied to nylon fabric that is intended for use to make raincoats, umbrellas, etc. in order to make the fabric truly waterproof.

HANDS-ON Experiment 2 Want to Go Scuba Diving? Will You Get Wet?



Goal: To test fabric used in wet suits.

Supplies Needed:

- Sample of wet suit fabric (Neoprene)
- Spray bottle
- Plastic tub

What to do:

1. Have one participant hold one side of the Neoprene fabric and another participant hold the other side of the fabric, holding it vertically.
2. Fill the spray bottle with water and spray the Neoprene 3-4 times.
3. Have participants feel the back side of the material for dampness.
Ask participants why they think the fabric stays dry based on what they know.
4. Take a cup of water and pour it on the same side of the fabric.
5. Have participants feel the back side for dampness.
6. Have the participants come to a conclusion based on this experiment.

HANDS-ON Experiment 3 Let's Test Aramid for Flame Retardancy



Goal: To determine the flammability of Aramid.

Supplies Needed:

- Small squares of Aramid fabric (can be purchased online)
- Tweezers
- Candle or flame source

Note: Use caution when using a candle indoors. Consider doing this experiment outside.

What to Do:

1. Have participants gather around to observe this experiment.
2. Place a fabric square of Aramid between tweezers.
3. Light a candle and move the fabric into the fire, removing it after it ignites.
4. Ask the participants to talk about what they observed. (The fabric will ignite slightly while in the flame but will extinguish itself when removed. The sample does not actually burn like other fabrics and will keep its basic structure.)

HANDS-ON Experiment 4

How Does That Mask Work?



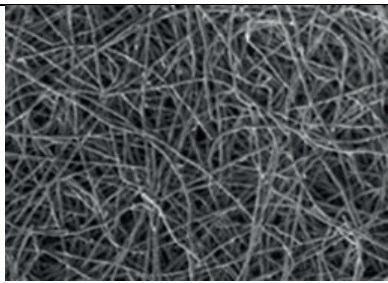


Goal: To examine a surgical mask and learn more about nonwoven fabrics.

Supplies Needed:

- Surgical mask cut in half.

What to Do:

1. Have the participants talk about what a surgical mask is used for and how it works based on the information in STEM Activity 4, Protective Function of Fabric.
2. Discuss the differences in nonwoven, woven and knit fabric using the information below. You may also show images of each.
3. Have the participants examine the inside of the surgical mask and talk about the different layers.

<p>The fibers of NONWOVEN FABRIC are <i>bonded together</i> by mechanical bonding (fiber entanglement), chemical bonding (fibers are chemically bonded together with glue-like compounds), or thermal bonding (where low-melt fibers are used and heat melts the fiber to each other). Nonwoven fabrics are lighter and weaker than woven or knit fabrics.</p>	 A microscopic image showing a dense, tangled network of thin, grey fibers, characteristic of nonwoven fabric.
<p>WOVEN FABRICS are produced on a loom. The loom joins two sets of yarns by weaving one set between the other. Woven fabrics are durable and can be finished to yield many different properties (like being flame-retardant or water-repellant). They do not have much stretch because of the tightness of the yarns in the fabric.</p>	 A close-up photograph of a woven fabric, showing a distinct, regular grid pattern of yellow and brown threads.
<p>KNIT FABRIC Knitting is defined as forming a fabric by means of interlooping the yarn. Knitting machines do the same interlooping of yarn that a hand knitter does. Knit fabrics have stretch because of the looseness of the fabric's yarn structure (compared to wovens and most nonwovens). Because of this looseness, the fabric can tighten up due to the mechanical action in laundering. That's why knit fabrics shrink. Knit fabrics are comfortable and warm.</p>	 A close-up photograph of a knit fabric, showing a distinct, regular pattern of interlocking loops in a reddish-pink color.



HANDS-ON Experiment 5 Why Do We Wear Camouflage?

Goal: To learn about forms of camouflage.

Supplies Needed:

- Clothing made of camouflage fabric.

What to Do:

1. Ask participants to answer the following questions and discuss:
 - a. What is camouflage?
 - b. Do certain animals use camouflage and if so which ones?
 - c. Why is camouflage worn by humans?
2. Show camouflage shirt or other items.

Use the information below as a guide:

Camouflage is the use of any combination of materials, coloration or illumination for concealment, either by making animals or objects hard to see or by disguising them as something else.

Examples of camouflage include the **leopard's** spotted coat, the **battledress** of a modern **soldier** and the **leaf-mimic katydid's** wings.

The majority of camouflage methods aim for concealment, often through trying to resemble the background. Some animals, such as **chameleons** and **octopuses**, are capable of actively changing their skin pattern and colors, whether for camouflage or for signaling. It is possible that some plants use camouflage to avoid being eaten.

Military camouflage was spurred by the increasing range and accuracy of firearms in the 19th century. On land, camouflage is designed so the wearer will blend in with the surroundings, such as trees and foliage or desert.

Non-military use of camouflage includes making **cell phone towers** less obtrusive and helping hunters to approach wary game animals.

Activity 25 - How Designs are Made on Fabric

Project Outcome: Analyze applied design (printing) in fabrics.

STEM concepts you will learn:

- *the science behind resist and direct printing.*
- *the technology use in direct printing.*

When we think of the clothes we wear, often we do not consider how the fabric is created or how the color or design on the fabric gets there. In this activity you will explore what is called applied design. The design that you see on the fabric is actually put there after the fabric is made using one of several processes.



TO GET STARTED

Take a look in your closet at your clothes. Notice how many clothes you have that are solid colors and how many have different printed designs.

Which do you have more of: SOLIDS or PRINTS?

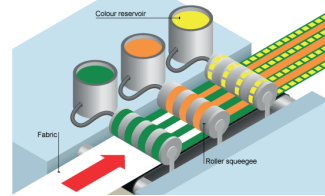
There are two basic categories of applied design: direct printing and resist printing.

Direct printing is the process by which a pattern is created on fabric by applying the pattern right on the fabric. Have you ever used an ink stamp to stamp a date on a piece of paper? The concept is the same. In producing fabric, there are several different pieces of equipment that can be used to directly print a design on fabric.

Block printing is one of the oldest forms of printing. It uses wooden blocks that have a design carved into them. Then dye is applied and the block is pressed into the fabric. This is repeated to create the design throughout the fabric. In India, this technique is used quite often. It is not easy to repeat patterns using block printing. This takes great precision.



Roller printing is more often used to produce designs/patterns on fabric. This process uses a huge roller the width of the fabric. The design is engraved on the roller. Dye is applied to the roller which is then rotated on top of the fabric. A separate roller is used for different colors and different parts of the pattern. The result of using roller printing is a very precise print since the rollers are set up on a machine to repeat the design at the proper distance from the first design to produce an overall pattern.



Experiment 1: Now that you have learned about direct printing, it's time to apply what you have learned. Here are some suggested activities (Check at the end of this lesson for 'The Basics of Block Printing'):

1. Examine a garment you have with a design or pattern on the fabric. Look to determine what the pattern is and see if you can determine where the pattern is repeated. Take it one step further and get a piece of fabric that has a design/pattern on its surface. Determine what the pattern is and where the design is repeated.
2. Create your own block under the supervision of an adult by taking a raw large white potato. Cut it in half long ways. Draw a simple geometric pattern on the surface and carefully cut away the part of the potato that is not in the pattern. Now you can take fabric paint and either paper or plain fabric and create your own design by applying paint to the pattern and pressing it in place; repeat the process.
3. Ask your 4-H leader or parent to purchase a wooden block with a design carved on it or rubber stamps and use this to create your own designed fabric.

RESIST PRINTING: Resist printing occurs when an area of the fabric is covered or protected when dye is applied. The following are examples of resist printing techniques.

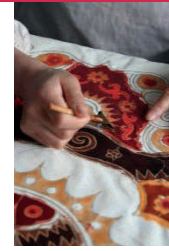
Screen printing is a type of resist printing that uses a pattern with gaps in it for the design, which is burned onto a screen using a special exposure light. Ink (dye) is pushed into the pattern, leaving color on the fabric through the gaps in the pattern. A separate screen must be used for each color which is part of the design. The designs on many of the T-shirts you wear today that have a slogan or design on the front are made by screen printing.



Stencil printing is printing involving the use of stencils cut in the shape of the desired designs. The stencils can be made of metal, wood, paper, or plastic. The dye/color is applied with a brush on the spaces cut in the stencil. This is a very easy method of printing on fabric.



Batik is another example of resist printing that uses wax to cover the area of the fabric the artist does not want the dye to penetrate. The fabric is immersed in a dye bath. The areas without wax are dyed, while the design covered in wax remains white. From here, this process can be repeated depending on the design desired. By applying wax to different areas and dipping the fabric in different colored dyes, the artist can achieve complex multi-colored designs. Batiking is a folk-art technique used in many countries to create wall hangings and other crafts that reflect the culture and/or traditions of that country.



Experiment 2: Resist printing is more complicated than direct printing, needing specialized equipment. The easiest form to try is stencil printing. Your local craft store has a large selection of stencils from which to choose. You will need to also buy stencil brushes and paint and of course plain fabric (100% cotton is best). Read the “Tips for Successful Stenciling” at the end of this activity sheet before starting your project. Have fun experimenting with creating repeated designs with your stencil or one design. You can also stencil on T-shirts or other clothing items but be sure to slip a piece of cardboard between the front and back of a garment, so the paint won’t go through. You need to work on a hard surface.

OTHER WAYS OF PRINTING FABRIC

With advanced technology, there are many new ways being discovered to print fabric. Among these include:

Heat transfer or thermal transfer printing involves using a printing machine and a heat press machine to transfer designs on fabric. This involves printing the design on paper first and then the design is transferred to the fabric by passing both through hot rollers.

Digital textile printing or direct-to-garment printing involves printing on fabric using modified inkjet technology (similar to how a copy printer works).

Photo printing takes place by coating the fabric with a chemical that is sensitive to light and then printing a photograph onto the fabric.

BASICS OF BLOCK PRINTING

1. Choose Your Fabric and Supplies

You will need fabric paint, a foam brush, purchased block or rubber stamp. For extra creativity make your own block using a potato. Use 100% cotton fabric. Heavier weight fabric works best. (Canvas fabric is an example.)



2. Prepare the Fabric

To remove sizing, prewash your fabric in hot water using water and detergent. Iron while damp for a smooth working surface. Be sure to do this especially if you are block printing on something you will wear or use in your home (like a pillowcase).

3. Reinforce Your Work

Place fabric on a flat surface such as smooth glass or cardboard. Place protective material between your artwork and the flat surface.

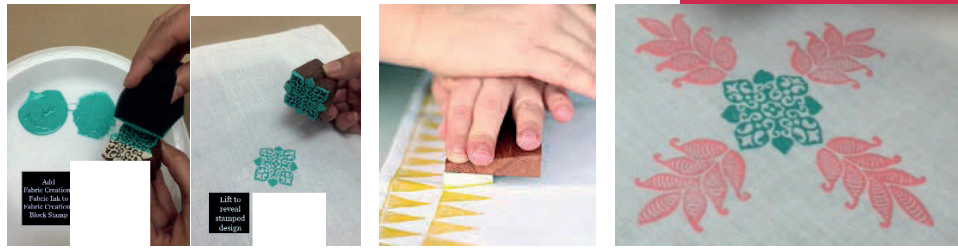
4. Adjust Paint Consistency

Put a small amount of paint on a plastic or Styrofoam plate. Apply paint evenly onto a piece of foam or foam brush. If the paint is too thick, spritz it lightly with water. Before applying to fabric, check the image by applying on paper and then a scrap piece of fabric. Continue until you are pleased with the results.



5. Stamp the Fabric

When you are ready to apply your design to your fabric, first apply the paint to your block with the foam brush, then press onto the fabric and wait a second for the fabric to absorb it. Repeat the process.



6. Clean Between Colors

Thoroughly clean the block between colors. A coarse fabric combined with the cleaning solution makes a great stamp cleaner. Use a toothbrush to clean recessed areas of the stamp. To protect your stamps, clean them before storing.

7. Save Your Paint for Later

If you must leave your project for a while, don't forget to save your paint for later. Close your paint container. Place your plate and foam brush in an airtight container or bag. When you're able to get back to your project just spritz the paint with water. You will need to clean your block as the paint will dry quickly.

8. Let It Dry and Heat-Set Your Work

Follow the paint manufacturer's instructions and let your work dry completely. If the manufacturer recommends heat-setting your work, you'll want to make sure that the paint is completely dry so you don't spread wet ink/paint with the iron and always use a piece of fabric between your work and the iron.

TIPS FOR SUCCESSFUL STENCILING

1. **Use the right fabric.** Cotton is a great choice – it has a smooth surface but absorbs a good amount of paint. That's why you see so many projects on canvas bags, T-shirts and quilting cotton. When you move into synthetic fibers, things get tricky. The paint slides around on the surface, doesn't want to adhere to the fabric and wants to bleed under the stencil. So, know your fabric.



2. **Make it stick.** Fabric moves and shifts. If this happens you will have blurred edges.

So, what to do? Two things:

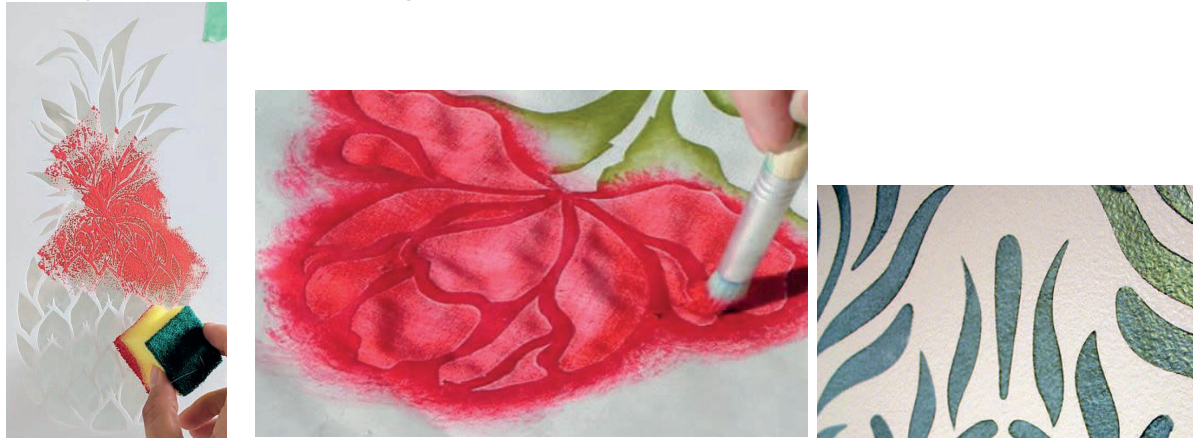
- Secure it to your surface with some tape. You can use a piece of cardboard or other stiff surface for this.
- Tape stencil to the fabric using painter's tape. You might also spray the back of the stencil lightly with temporary adhesive that will further hold it in place. One recommendation is using 505 adhesive spray but make sure you spray **LIGHTLY**.



3. **CAUTION: Don't use too much paint.** The goal is to get some color on the fabric without overloading it. If you glob on the paint, it has to go somewhere and most of the time it is going to bleed under the edges of the stencil onto the fabric. You need to load the brush with paint and then get rid of the excess before you start applying it. So, dip your brush in the paint a few times and then tap (lightly brush) it on a paper towel to get all the excess paint off. This is called offloading. Your brush should be almost dry before you start putting down the paint. You only want to apply a thin coat by stippling – using an up and down motion or small tight swirls. Try to work your way in from outside the stencil. You do not want to push paint under the edges when you stipple. You can find some videos on YouTube demonstrating this if you search for stenciling tips. **Practice your technique** on a scrap of fabric to test the paint level and perfect your technique. Watch to see that the imprint looks uniform and fairly dry (see item 6 below).

4. **Apply the paint,** holding your brush vertically and touch the fabric with an up and down motion (which is stippling). The result will be a series of touches that bleed together in a process. Keep going until the entire area is the color you desire.

- If the fabric looks a little wet as you continue, that is okay. It will even out as it dries.
- To create crisp edges, do a gentle swirling motion. This will fill in these spaces with paint without leaving lines.



5. **Let it dry.** After you stipple, there should be a thin layer of paint on the fabric. Sometimes that is enough. If so, great! But sometimes it looks uneven or you want more coverage. Don't do anything until you are sure your project is dry. Otherwise, if you add more paint now, you will just mush it all around and probably end up bleeding the stencil edges. So, wait at least until the paint has set before going back and adding another coat.

6. **Practice, practice, practice.** Do not just jump right in and start stenciling your main piece before testing everything on some scrap fabric; especially if you are dealing with materials, tools or techniques that are new to you. No one does everything right the first time! So, don't mess up your project just because you want to get it done quickly! A good piece of scrap fabric lets you work out any kinks in your technique without the pressure of possibly messing everything up.

Activity 26 - How Fabric is Made from Natural Sources

Project Outcome: Explain how fabrics are made from various natural resources.

STEM concepts you will learn:

- *technology used to harvest and process fibers used to make fabric.*
- *the engineering involved in processing fibers to make fabric.*
- *the science behind what fibers look like and why.*

Have you ever wondered how the fabrics that your clothes are made from are formed?

It all starts with fibers. **Fibers** are the smallest part of a fabric that can be categorized into two major categories, natural or manufactured. In this activity, you will learn about natural fiber sources and how these fibers are converted through modern technology to make fabrics.



Let's first look at which fibers fit into each category. Below you will find a list of common fibers used in clothing divided into each category:

Natural Fibers

Cotton
Wool
Silk
Flax

Manufactured Fibers

Polyester
Nylon
Acrylic
Rayon

To begin this exploration, do the following:

Look in your closet and pull out ten garments that you wear often but make sure you select those that are for different occasions (Ex: school, playing sports or exercising, relaxing at home, wearing for a special occasion, etc.). This will give you a better picture of the variety of fibers used in making your clothing. Look at the labels of each and write down the fiber content of each garment. For example: 50% polyester, 50% cotton.

- | | |
|----|-----|
| 1. | 6. |
| 2. | 7. |
| 3. | 8. |
| 4. | 9. |
| 5. | 10. |

From the list on the last page, determine how many of your clothes fall in each category below:

Natural Source _____

Manufactured Source _____

Combination of Natural and Manufactured _____

From your summary, which category contains more of your clothes?

Natural or Manufactured

Why do you think this is so? List all the reasons you can think of by examining your clothes and the qualities they have that make you want to wear them. For example, are they soft or stretchy?

- 1.
- 2.
- 3.
- 4.
- 5.

As you explore the process of making your clothes from natural sources, reflect back on what you have discovered about what you wear.

SOURCES OF NATURAL FIBERS

There are two major sources of natural fibers, plant and animal. As you explore these sources you will learn the science and engineering behind what it takes to transform each fiber into yarn and then fabric that is used for the clothing you wear.

PLANT SOURCES:

COTTON

- Cotton is the most used fiber in the world.
- Cotton accounts for half of fiber used worldwide for clothing.
- 40% of our clothing is made of cotton.
- Cotton fibers are found around the seed of the cotton plant.
- The length of fibers determines the quality of the cotton. The longer the fibers, the smoother the feel of the cotton.

So how does cotton get from the field to your back?

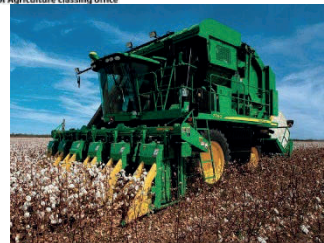
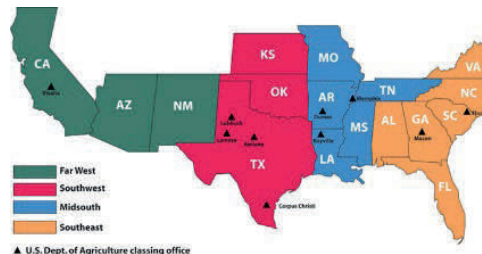
BASIC PROCESS FOR MAKING CLOTH FROM COTTON:

Growing cotton:

- Where is it grown? Look at the map at the right to discover where cotton is grown in the U.S. China and India are among other countries that grow cotton.
- One of the machines used to harvest cotton in the U.S. is the stripper harvester which has rollers or mechanical brushes that remove the entire boll from the plant.
- From the field, seed cotton moves to nearby gins for separation of lint and seed. The lint is the actual cotton fiber, which is formed into bales.
- Several bales are mixed and blended together to provide a uniform blend of fiber properties.
- The blended lint (cotton fiber) is blown by air from the feeder through chutes to cleaning and carding machines that separate and align the fibers into a thin web.



Cotton Boll



Stripper Harvester



Bale of Cotton Ready to be Processed

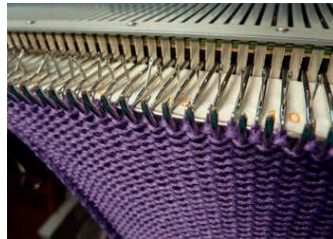
- This is further refined through several processes and then spun into yarn.
- Then it's time for the fabric to be made. Depending on the end product, the yarn will either be woven or knit using automated machinery.
- After the fabric is made and finishes applied, the fabric is dyed and is ready for making the clothes you wear. This happens in a clothing manufacturing plant.



Carding Cotton Fibers



Weaving Yarn into Fabric



Knitting Yarn



Spinning Cotton into Yarn



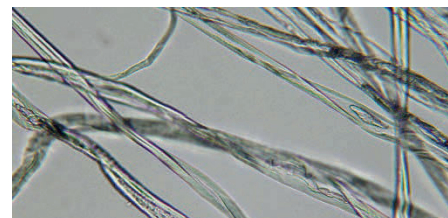
Shirt made of Woven Fabric



Shirts made of Knit Fabric

What does the cotton fiber look like? Under the microscope, cotton fibers look like twisted ribbons. When the fibers are growing in the field, they are round and hollow. After they are harvested, the fiber collapses creating a flat fiber. Cotton clothing is usually soft to the touch and feels very comfortable to wear. It is very breathable.

For more information about cotton go to Cotton Incorporated web site at <https://www.cottoninc.com/>



Cotton Fibers under the Microscope

TO DO:

Find two different types of garments in your closet that are made of 100% cotton.

(Ex: t-shirt and jeans or dress shirt and t-shirt.)

Compare the similarities and differences in these two clothing items.

	Item 1: _____	Item 2: _____
Describe the feel of the fabric		
With the item on, describe the comfort		
Describe the major differences in the two garments:		
Describe the major similarities in the two garments:		

FLAX

Another plant fiber that is not as common as cotton is flax. Flax is used to produce a fabric called "linen." Because cotton and flax are both plant materials, they are alike in many ways. They are called cellulosic fibers.

Flax is one of the oldest fibers known to man and has been found in ancient mummy burial sites.

It comes from the stem of the flax plant. Fibers come in small bundles from beneath the outer covering of the stem.



Flax Plant

BASIC PROCESS FOR MAKING CLOTH FROM FLAX:

- Harvesting is still done by hand.
- The plants are gathered and dried in the field.
- A process called retting takes place to get the fiber from the inside of the plant, getting a bark like substance off the outside.
- Further processing is done before spinning the fibers into yarn.
- Fibers/yarn can be up to 12 inches long.
- The yarn is then woven into fabric and then made into garments and home products such as table clothes.



Flax being Processed to make into Yarn



Flax Drying in Field



Flax Fiber



ANIMAL SOURCES

SILK

One of the softest fabrics on the planet, shiny, breathable and comfortable, **silk** has been a highly prized cloth since it was first harvested thousands of years ago. Silk is classified as a protein fiber, since it comes from an animal source.

PROCESS OF MAKING SILK FIBERS INTO CLOTH:

- The fiber is harvested from the cocoons of silkworms. Silkworms are caterpillars of the *Bombyx mori* moth. The silkworm secretes a sticky liquid protein from its special salivary glands. Pushed through a spinneret (opening on the mouth), the twin pair of continuous threads harden when they come into contact with air.
- To harvest the silk, the cocoon is placed in either boiling water, or blasted with steam or hot air. The silk is reeled from the cocoon before the worm matures into a moth. This results in an undamaged (unopened) cocoon that gives a single, long, fine fiber.
- Raw silk strands are twisted together to make a relative strong yarn.
- The silk yarn is woven into fabric.



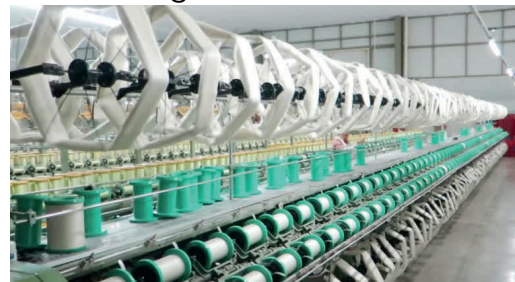
Silk fibers are very small compared to other fibers. Under the microscope they resemble spaghetti noodles, smooth and stringy. That is why silk fabric feels smooth and slippery. Clothes made of silk are usually dressy clothes.



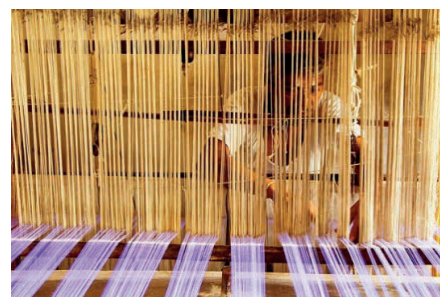
Silk Worms



Reeling Silk from Cocoon



Silk Yarns



Silk Fibers



WOOL

Wool is another very old fiber and the first to be spun into yarns and woven.

It comes from the soft fleece of sheep that are shaved (sheared) once or twice a year. The softest part of the fleece is the part next to the sheep and the outer edges are used for rugs and felt.

The best quality wool is a product of Merino sheep. They tend to grow thinner fibers that are longer.

Countries that are major wool producers are Australia, Russia, New Zealand, China and Argentina. The United States is 10th in wool production.



HOW DOES WOOL GET FROM THE SHEEP TO A JACKET?

Steps include:

- Sheep are sheared once or twice a year.
- The fleece (which is what comes off the sheep) is cleaned.
- An oily substance called lanolin is removed from the wool fiber.
- The wool fibers are carded (aligned in straight rows).
- These fibers are spun into yarn.
- The yarns are dyed into the desired colors.
- Next the yarns are woven into fabric.
- To make the surface become fuzzy (napped) and provide more warmth, the surface is 'roughed up' using teasel (the top of the teasel plant that is dried).
- The fabric is ready to use to sew jackets and other clothes you wear.
- If the wool yarn is used to knit sweaters, after step 6 (above) the knitting takes place.



Shearing Sheep



Fleece from Sheep



Washing Wool Fibers



Lanolin



Carding Wool Fibers



Spinning Wool Fiber into Yarn
Yarn



Dyed



Weaving Wool Yarn into Fabric



Woven Wool Fabric

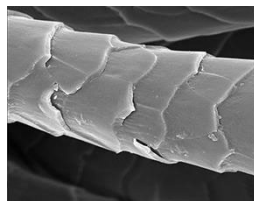


Napping Machine with Teasel



Teasel used to create Nap in Fabric

Wool fibers have special qualities that keep you warm and dry. If you take a really close look at a wool fiber under the microscope you will see what is called scales. This makes the fiber a good insulator which holds in the heat your body generates. Wool fibers also have a special quality in that they do not absorb moisture and the overlapping arrangement of the scales cause them to shed water like the shingles of a roof. Wool fabric is usually heavier and sometimes scratchy to the touch.



TO DO

Find a garment, coat or scarf in your house that is made of wool. Examine it and answer the following:

How does it feel (Ex. Smooth, soft, scratchy...)

Put the item on and describe if it makes you feel warmer or cooler and explain why:



Take a closer look at the list you made at the beginning of this activity and the fiber content of the clothing you most often wear. Choose three items that contain one of these fibers: cotton, flax, silk, wool. Try to select items to represent at least two of the fibers listed.

Item 1:	Fiber Content:
Describe the characteristics of the natural fiber based on what you have learned:	
Describe how the fabric feels:	
Does this garment perform the way it is supposed to based on your experience and the characteristics of the fiber? Explain why or why not.	

Item 2:	Fiber Content:
Describe the characteristics of the natural fiber based on what you have learned:	
Describe how the fabric feels:	
Does this garment perform the way it is supposed to based on your experience and the characteristics of the fiber? Explain why or why not.	

Item 3:	Fiber Content:
Describe the characteristics of the natural fiber based on what you have learned:	
Describe how the fabric feels:	
Does this garment perform the way it is supposed to based on your experience and the characteristics of the fiber? Explain why or why not.	

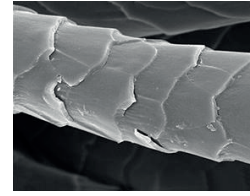
More ideas to use your knowledge:

1. Complete the experiment that follows.
2. Visit a fabric store and find fabrics with the fiber content you learned about in this lesson.
3. Create a poster display focusing on one of the natural fibers in this activity and share it with others.

Source: Textiles: Concepts and Principles

Next Step: Experiments for 4-Hers and Project Groups

HANDS-ON EXPERIMENT: TAKE A LOOK UNDER THE MICROSCOPE AT FIBERS



Goal: To discover what natural fibers look like under .

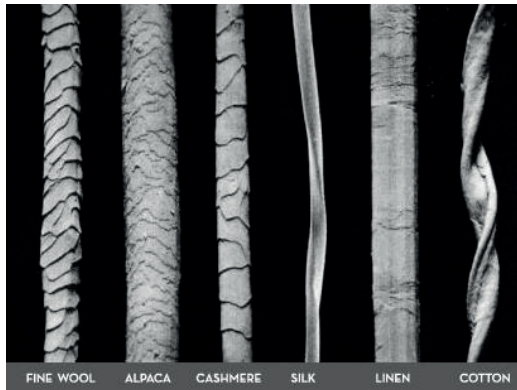
Supplies needed:

- Microscope
- Slides
- Slide covers
- Tweezers
- Medicine dropper
- Fibers or fabrics of cotton, wool, silk

Project leader: This may be available through your 4-H agent and/or Regional Extension Office. You may want to work with your local school and do this activity after school in a laboratory where they will have the supplies you need except fibers. The fibers can come from fabric that has the fiber content listed by pulling a thread and twisting the end with tweezers.

What to do: For this activity you will create a slide for each of the fibers: cotton, wool and silk. Use the image below to verify what you are seeing. Remember that there will be several fibers on one slide (below shows what just one fiber of each kind looks like).

Record what you see in the chart below.



How to Make Wet Mount Microscope Slides

To make a wet mount, first obtain a sample of fibers and place on clean slide with tweezers. Place a few drops of water on the slide. (If using a thread from fabric, use tweezers to untwist the end of a thread and fluff it up. Place that end of the thread on the slide and follow procedures above.)

Next apply the cover slip. This is done very gently to avoid the formation of air bubbles. Slowly lower the cover down at an angle, and it will eventually be held in place by surface tension.

FIBER NAME	DESCRIBE WHAT YOU SEE
COTTON	
WOOL	
SILK	
Mystery fiber (provided by leader) Identify the fiber by what you see:	

Discuss what you see and what you have learned:

Congratulations!

You have now completed the sixth and final unit of the Intermediate Clothing and Textiles Project Area Guide. Throughout this project guide, you have learned about tools, materials and ways to be successful in your project area.

More information can be found on the Tennessee 4-H Clothing and Textiles project page, including the project outcomes. You may now move on to the Advanced Project Guide in Clothing and Textiles. Ask your 4-H agent for information that is available.



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