Fabrics: Natural Fibers

Unit: Clothing & Textiles

Problem Area: Caring for Clothing: Natural and Manufactured Fabrics

Lesson: Fabrics: Natural Fibers

Student Learning Objectives.

Instruction in this lesson should result in students achieving the following objectives:

1. **Classify natural fibers.**
2. **Describe natural fiber fabric characteristics.**

Resources.

The following resources may be useful in teaching this lesson:

E-unit(s) corresponding to this lesson plan. CAERT, Inc. http://www.mycaert.com.

James, Janis M. "A Short History of Linen," *Timeless Creations.* Accessed May 28, 2019. http://www.timeless-creations.ca/Linen.pdf.

"The History of Linen," *Ulster Linen.* Accessed May 28, 2019. https://ulsterlinen.com/history-of-linen/.

"Natural Fibers and What They're Good At," *Justine Leconte*. Assessed May 28, 2019. http://www.youtube.com/watch?v=PzdgT1xBZC8.

"Silk History," *Silk-Road.com*. Accessed May 28, 2019. http://www.silk-road.com/art/silkhistory.shtml.

"The Story of Cotton," *Cotton Counts.org*. Accessed May 28, 2019. http://www.cotton.org/pubs/cottoncounts/story/.

Weber, Jeanette CFCS. *Clothing: Fashion, Fabrics & Construction*, 5th ed., McGraw-Hill Education, 2006.

Equipment, Tools, Supplies, and Facilities

- ✓ Overhead or PowerPoint projector
- ✓ Visual(s) from accompanying master(s)
- ✓ Copies of sample test, lab sheet(s), and/or other items designed for duplication
- ✓ Materials listed on duplicated items
- ✓ Computers with printers and Internet access
- ✓ Classroom resource and reference materials
- ✓ Fashion magazines

Key Terms. The following terms are presented in this lesson (shown in bold italics):

- ➤ cellulosic fibers
- ➤ cotton
- ➤ fiber
- ➤ filaments
- ➤ felting
- ➤ generic name
- ➤ hand
- ➤ linen
- ➤ manufactured fibers
- ➤ natural fibers
- ➤ noncellulosic fibers
- ➤ pilling
- ➤ polymers
- ➤ retting
- ➤ sericulture
- ➤ silk
- ➤ staple fibers
- ➤ tensile strength
- ➤ textile
- ➤ trade name
- ➤ virgin wool
- ➤ wicking
- ➤ wool
- ➤ yarn

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Ask your students to think about the clothes they are wearing today. Why are they wearing these particular garments today? What fabrics are their garments are made from? Did the feel of the garment have any effect on their choice to wear it today? Did the fact the item didn't need ironing have any effect on their garment choice today? This lesson is about the uses of natural fibers: cotton, linen, silk, and wool. Each type of natural fabric has specific characteristics that make it a compelling choice based on the weather, the event, etc. Project VM–A to illustrate the four main types of natural fibers: cotton, flax (linen), silk, and wool.*

CONTENT SUMMARY AND TEACHING STRATEGIES

Objective 1: Classify natural fibers.

Anticipated Problem: What are fibers? How are they made? How are they different?

I. A ***textile*** is a woven cloth or fabric made of natural or synthetic fibers: it may be and animal- or a plant-based fabric. A ***fiber*** is a natural or chemical structure than can be spun into yarn. To the naked eye, fibers look like small threads. A ***yarn*** is a group of textile fibers that are grouped and twisted together: weaved, knitted, or bonded into fabrics. Fibers are classified by their origin and there are two major types: natural and manufactured. Because no single fiber's characteristics are perfectly suited to a task, more blends are available today than ever before. For example, cotton blends include: cotton/polyester fabrics are soft and absorbent and have fewer wrinkles than cotton alone. And polyester/rayon fabrics are more durable and retain their shape better than rayon alone.

A. NATURAL FIBERS. ***Natural fibers*** are made from plant and animal sources including: cotton, flax (linen), silk, and wool. Natural fibers are usually measured in inches or centimeters and are shorter fibers than those produced for manufactured textiles. Silk is a filament fiber and is also a longer fiber than the other natural fibers: it is measured in yards or meters. Natural fibers that are twisted together form yarns called ***staple fibers***.

1. Common Fibers and Fabrics: Cotton and linen fabrics are made from plant fibers (from cellulose) and wool and silk fabrics are made from animals (from protein). Wool comes from fleeces and silk is made from the silkworm's (the

caterpillar of the silk moth) cocoon. Spider silk is occasionally used for textiles, too.

2. Expensive Fibers and Fabrics: Cashmere and angora wools are other animal fibers. Angora is from rabbit fur and cashmere is from goats. Fibers from camels, yaks, llamas, alpacas, and musk oxen are also used for textiles. [NOTE: The hair from these animals is rare (rarer than other natural fibers) and their fibers and textiles are more expensive than other natural fibers and textiles.]
3. History: Humans have used natural fibers for textiles for centuries. Cotton was used in ancient China, Egypt, India, Mexico, and Peru and the American colonies grew cotton as long ago as the 1600's.
    a. Cotton: Eli Whitney was a tutor on one of the cotton plantations in Savannah, GA when he invented the cotton gin. This machine separates the cotton fibers from the seeds allowing more fibers to be separated at a greater speed.
    b. Linen (Flax): Linen was used as early as 30,000 BC as a fabric for the wealthy. Archeologists have uncovered mummies that were wrapped in linen.
    c. Silk: Silk was discovered in 27th century BC. ***Sericulture*** is the study of the production of silk worms and silk and was a guarded secret for many years. Silk was traded for other goods and that is how it spread from nation to nation.
    d. Wool: Northern European tribes used wool fabrics as early as 10,000 BC. Then, the inventions of the industrial revolution enabled wool to be produced into fabric at a greater quantity for lower prices. Wool has been used for clothing and other items continually since this time.

B. MANUFACTURED FIBERS. ***Manufactured fibers*** are synthetic textiles produced by scientists in a lab. Manufactured fibers were successful produced in the early 1800's. Today manufactured fibers are produced from petroleum, paper, wood pulp, and plastics. Many manufactured fibers mimic today's natural fiber fabrics. Technology is being infused in some of these manufactured fibers to keep us warmer and to register heart rates. Most new manufactured fibers repel rather than absorb water, dry quickly, and have minimal shrinkage when laundered. Manufactured fibers tend to wrinkle less than natural fiber fabrics. There are two major categories of manufactured fibers: cellulosic and non-cellulosic.

1. ***Cellulosic fibers*** are made from wood pulp and produce the following textiles: rayon, lyocell, (trade name Tencel), acetate, and triacetate. Cellulosic fibers require a minimal number of chemical stages during production.
2. ***Noncellulosic fibers*** are synthetics made from carbon, hydrogen, nitrogen, and oxygen molecules. These molecules form ***polymers*** ('poly' means many and 'mer' means unit) are large molecules composed of many repeating monomers.

3. All manufactured fibers have two names: a generic name and a trade name. A ***generic name*** is a common name for a group of similar fibers. A ***trade name*** is the name the manufacturer uses. For example:
    a. Aramid is the generic name for the trade names Kevlar and Nomex.
    b. Nylon is the generic name for the trade names Anso, Antron, and Zafran.
    c. Polyester is the generic name for the trade names Dacron, Fortrel, and Trevira.
    d. Spandex is the generic name for the trade name Lycra.

C. GENERAL FIBER CHARACTERISTICS: A fiber's characteristics influence its use in fabrics. Fiber characteristics include:

1. ***Tensile strength***: ability to withstand tension or being pulling apart
2. Durability: ability to resist wear
3. Resiliency: ability to spring back into shape
4. Elasticity: ability to return to form after stretching
5. Abrasion resistance: ability to withstand wear (scraping, scuffing)
6. Shape retention: ability to keep its form after wearing
7. Wrinkle resistant: ability to repel creasing
8. Luster: ability to retain sheen
9. ***Wicking***: the ability to draw moisture from body
10. Absorbency: ability to attract moisture

Teaching Strategy: *Many techniques can be used to help students master this objective. Use VM–A to illustrate natural fiber sources. Ask students to research how fibers are made into fabric and record 8 things they learned about how fabrics are produced. Divide students into groups of four to share their fabric facts. Lead a class discussion of the fabric facts they collected.*

Objective 2: Describe natural fiber fabric characteristics.

Anticipated Problem: What are the characteristics of the four common natural fiber textiles?

II. Cotton, flax (linen), silk, and wool are the four common natural fibers. Cotton is the most widely used natural fiber. Ramie, specialty animal fibers, and natural rubber are also considered natural fibers.

A. ***Cotton*** is a textile made from soft, fluffy plant fibers from the lint in the boll. Cotton has many "feels" and, as such, is used for many different garments. Cotton is a cellulosic fiber (a material that comes from a plant). Cotton is separated from the seed in the ginning process where the lint is gathered. Long cotton staple fibers are desired because the length makes it easier to spin and to be twisted with other fibers to form yarns.

1. Characteristics of cotton fabrics include:
   a. Comfortable (breathable, releases heat)
   b. Highly absorbent (athletic wear, baby clothes, towels)
   c. Easy to launder
   d. Easily accepts dyes
   e. Can be made into high or low luster textiles (attractive)
   f. Hand can be stiff, smooth, or rough (***Hand*** is how the fabric feels.)
2. Uses. Cotton is adaptable to many garments and linens: baby clothes, t-shirts, sheets, window coverings, rugs, and blue jeans.
3. Appearance. Cotton does wrinkle easily unless a finish is applied. Cotton has an appropriate appearance for casual, athletic, as well as for evening events.
4. Care. If cotton isn't preshrunk it will shrink. The softness of cotton allows the fabric to stretch and it will continue to stretch over time. Cotton can be machine or hand washed in cold water and dried on a line or on low heat in a dryer.

COTTON Advantages	COTTON Disadvantages
Soft	Wrinkles unless treated
Breathable and comfortable	Shrinks
Absorbent	Will mildew
Strong and durable fiber	Flammable

B. ***Linen*** is a textile made from the stems of the flax plant: a cellulosic fiber. It is used to make twine, rope, fabric, damask, etc. Flax plants are pulled up by hand or are machine harvested. ***Retting*** is the separation of the fibers from the stem. Then, flax stalk are submerged in water and the moisture and microorganisms cause the woody portion to swell, thereby loosening the bask (outer) fibers.
   1. Characteristics of linen fabrics include:
      a. Light and cool, perfect for high temperature areas
      b. Flax is very absorbent but linen dries very quickly
      c. Able to be ironed at high temperatures without scorching
      d. Wrinkles very easily (deciding which garments are made from linen is important)
   2. Uses. Linen is used in high fashion apparel, furnishings and some upholstery, table linens, and bags and purses.
   3. Appearance. Linen is often used for dresses and dressy clothes. It has an excellent luster that it is great for evening garments. The texture ranges from thick to thin and it has a stiff hand. Because linen wrinkles easily it is not a good choice for all garments.
   4. Care. Linen can be hand or machine washed or dry-cleaned. Linen upholstery is steam cleaned. When ironing linen a very hot temperature is needed.

LINEN Advantages	LINEN Disadvantages
Strong and durable fiber	Wrinkles
Absorbent	Low resilience
Lint free	Shrinks
Breathable and fast drying	Mildews
Does not scorch at high temperatures	Hard to remove the creases

C. ***Silk*** is a textile made from protein fiber ***filaments*** (threads) spun by moth larvae. Silk is an animal (protein) fiber. The silk fiber resembles a glass rod with an irregular surface when looked at through a microscope.

1. Characteristics of silk fabrics include:
   a. Accepts dyes easily including brilliant colors
   b. Soft luster
   c. Generally smooth appearance
   d. Soft hand
   e. Strongest of the natural fibers
   f. Comfortable (absorbs body perspiration and resists wrinkling)
2. Uses. Silk is used in a variety of garments due to the beautiful colors and its wrinkle resistance. It is a good choice for dress/evening clothing, handbags, and scarves. It is also used in window treatments, upholstery, pillow covers, linens, etc.
3. Appearance. The high luster and bright colors enhance many fashion choices. Hand is soft and smooth.
4. Care. May be hand laundered or dry-cleaned. Silk will shrink if laundered incorrectly. Due to the brilliance of some colors, silk colors may bleed. Silk scorches easily (a press cloth is a must).

SILK Advantages	SILK Disadvantages
Natural luster	Weakened by sunlight
Strong while being light weight	Shows perspiration
Smooth	May spot with water
Accepts dyes easily	

D. ***Wool*** is a textile made from animal fur staple fibers (usually from sheep or lamb fleece). Wool fibers have a long staple length: 2 to 8 inches. Sheep are the main wool producers but some wool is gathered from goats, camels, alpacas, etc. Wool is valued for its warmth. Woolen fabrics are recorded as far back as 10,000 BC. Wool is processed in a 5-part process: shearing, sorting and grading, washing, carding (to straighten the fibers), and yarn making. ***Virgin wool*** is fibers and yarns that have never been processed, used, or woven. Wool is sometimes felted.

Felting is the application of heat, moisture, and pressure to wool that causes the tiny wool fiber scales to open up, lock together, and shrink. This process makes the wool fibers and yarns smaller, stronger, and warmer.

1. Characteristics of wool fabrics include:
   a. Resists wrinkling
   b. Resilient (returns to its original size and shape after stretching)
   c. Naturally flame resistant (e.g., A wool blanket can be used to put out a fire.)
   d. Can be worn in all seasons
   e. Dry cleanable (helps keep size and shape from changing)
2. Uses. Wool is a good fiber for garments that keep a person warm: coats, jackets, hats, gloves, scarves, sweaters, blankets, etc.
3. Appearance. Wool's appearance is versatile. It can be rough or smooth or soft and crepe-like. Wool fabrics are subject to pilling. ***Pilling*** is a tangled ball of fibers on the surface of the fabric. Pills are usually the result of wear, rubbing, or abrasion. Woolen fabrics are also subject to matting (compressed fibers).
4. Care. Wool loses strength when it is wet and must be handled carefully to avoid shrinkage. Some cleaning detergents can harm wool so reading all laundry symbols and care instructions is recommended. Wool scorches easily and becomes brittle when dry heat is applied.

WOOL Advantages	WOOL Disadvantages
Very versatile	Damaged by insects, moths
Warm	Shrinks and loses strength when wet
Durable and resists abrasion	Dry clean only
Resilient and resists wrinkling	Matting and pilling
Flame resistant	Absorbs odor
Absorbent	

Teaching Strategy: *Many techniques can be used to help students master this objective. Use VM–B to illustrate natural fiber advantages and disadvantages. Use VM–C to illustrate fabric properties.*

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. If a textbook is being used, questions at the ends of chapters may also be included in the Review/Summary.

Application. Use the included visual master(s) and lab sheet(s) to apply the information presented in the lesson.

Evaluation.

Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is provided.

Answers to Sample Test:

Part One: Matching

1. d
2. g
3. e
4. a
5. c
6. h
7. f
8. b

Part Two: True/False

1. T
2. T
3. F
4. F
5. T
6. T

Part Three: Short Answer

1. Cotton, wool, linen (flax) and silk.
2. Wool is processed in a 5-part process: shearing, sorting and grading, washing, carding (to straighten the fibers), and yarn making.

Sample Test

Name _____

Fabrics: Natural Fibers

Part One: Matching

Instructions: **Match the term with the correct definition.**

a. cotton
b. fiber
c. hand
d. linen
e. natural fibers
f. silk
g. wool
h. yarn

_____1. A textile made from the stems of the flax plant

_____2. A textile made from animal fur staple fibers (usually from sheep or lamb fleece)

_____3. Made from plant and animal sources including: cotton, flax (linen), silk, and wool

_____4. A textile made from soft, fluffy plant fibers from the lint in the boll

_____5. How the fabric feels

_____6. A group of textile fibers that are grouped and twisted together

_____7. A textile made from protein fiber filaments (threads) spun by moth larvae

_____8. A natural or chemical structure than can be spun into yarn

Part Two: True/False

Instructions: **Write *T* for true or *F* for false.**

_____1. Felted wool is warmer than woven wool.

_____2. Cotton is naturally a soft fabric.

_____3. Wicking pulls heat from the body.

_____4. One advantage of cotton is that it does not wrinkle.

_____5. Insects can damage wool fabrics.

_____6. Pilling is a tangled ball of fibers on the surface of the fabric.

Part Three: Short Answer

Instructions: **Answer the following.**

1. List the four basic natural fibers.

2. List the 5-part wool fabric process.

NATURAL FIBERS

Natural fibers are primarily made from plant and animal sources including: cotton, flax (linen), silk, and wool. Which natural fiber are your jeans made from?

VM–B

CHARACTERISTICS OF NATURAL FIBERS

COTTON Advantages	COTTON Disadvantages
Soft	Wrinkles unless treated
Breathable and comfortable	Shrinks
Absorbent	Will mildew
Strong and durable fiber	Flammable

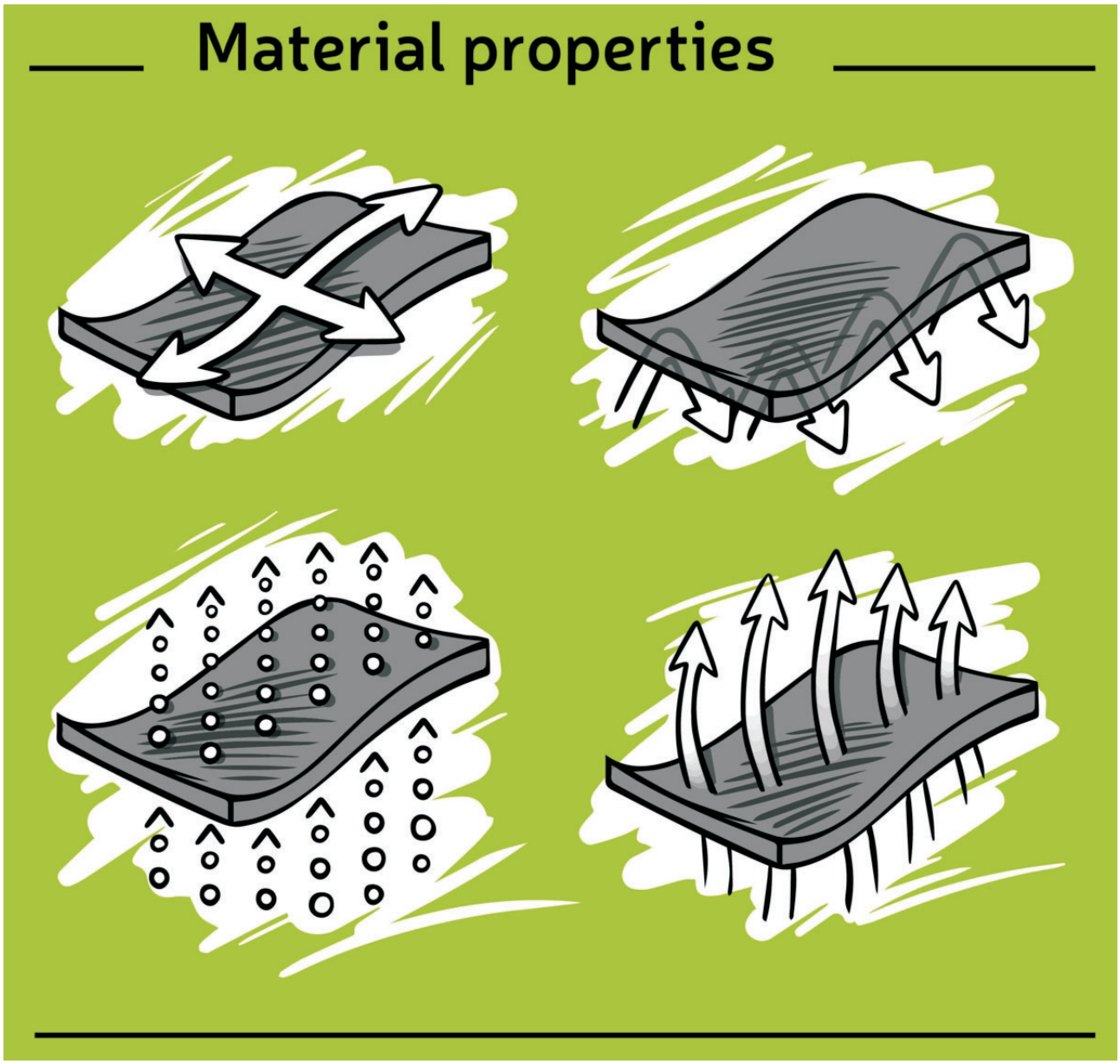
LINEN Advantages	LINEN Disadvantages
Strong and durable fiber	Wrinkles
Absorbent	Low resilience
Lint free	Shrinks
Breathable and fast drying	Mildews
Does not scorch at high temperatures	Hard to remove the creases

WOOL Advantages	WOOL Disadvantages
Very versatile	Damaged by insects, moths
Warm	Shrinks and loses strength when wet
Durable and resists abrasion	Dry clean only
Resilient and resists wrinkling	Matting and pilling
Flame resistant	Absorbs odor
Absorbent	

SILK Advantages	SILK Disadvantages
Natural luster	Weakened by sunlight
Strong while being light weight	Shows perspiration
Smooth	May spot with water
Accepts dyes easily	

FABRIC PROPERTIES

Name the natural fabrics that have each of the fabric properties pictured here: breathability, wicks moisture, stretches, and retains heat.



LS–A

Name _____

Natural Fabric Garment Uses

Purpose

The purpose of this lab activity is to research garments made from the four common natural fibers.

Objectives

1. Research the four common natural fibers.
2. Record three garments made from each fiber.

Materials

- lab sheet
- device with Internet access
- pen or pencil

Procedure

1. Work independently to complete this lab activity. Review your class notes.
2. Research the four common natural fibers. Record four garments or accessories made from each natural fiber fabric in the table.

Natural Fiber FABRIC	Example #1	Example #2	Example #3	Example #4
Cotton				
Linen (Flax)				
Silk				
Wool				

3. Based on what you researched, list the best use for each natural fiber fabric and briefly say why you selected that use.

   a. Cotton:

   b. Linen:

   c. Silk:

   d. Wool:

4. Summarize your take as to which fiber is best for which garments and why.

5. Turn in your completed lab sheet and best use selections in to your teacher.