Natural Fibers

Fibers are the raw material of the textile industry. All fabrics begin with one or more fibers from a plant, an animal, or a laboratory. Fibers must be spun into yarn before they can be used in making fabric. Perhaps you have observed a primitive example of this spinning process if you have visited a museum where spinning was demonstrated on an old-fashioned spinning wheel.

Today spinning is done with sophisticated machinery in modern factories. The yarn is then woven or knitted into cloth. You may have also seen this demonstrated at a museum or craft demonstration. Perhaps you have even tried a bit of knitting yourself.

Long fibers are called filaments and short fibers are called staple fibers. You will learn about the natural fibers in this section.

Cotton comes from the cotton plant. Until the invention of the cotton gin by Eli Whitney in 1793, it was a rather expensive fabric because of the tedious labor required to remove the seeds from the cotton boll. Since then, cotton has become the most useful fiber in the world. More products are made from it than from any other fiber. Three of every four people in the world wear cotton.

Cotton fiber is called *lint*. The lint fibers of American upland cotton, the most common variety, are 7/8″ to 1¼″ (2 to 3 cm) long. This is the variety of 90 percent of the world's cotton. Cotton fibers have a natural twist which makes it easy to spin them into yarn.

Cotton is a strong, durable fiber which makes it suitable for work clothes, rugs, towels, sheets, and upholstery for furniture. It can also be spun into fine yarns for making suitable formal wear like men's suits and ladies' fine dresses. It is absorbent and it has the quality of breathing, which makes it a good choice for clothing in warm weather.

Most cotton fabrics have a crisp, smooth look; yet they are soft and gentle to the skin. Cotton washes easily, but tends to shrink in hot water. It also wrinkles easily. For these reasons, it is often blended with synthetic fibers to prevent shrinking. Cotton blends well with other fibers, which gives it great versatility.

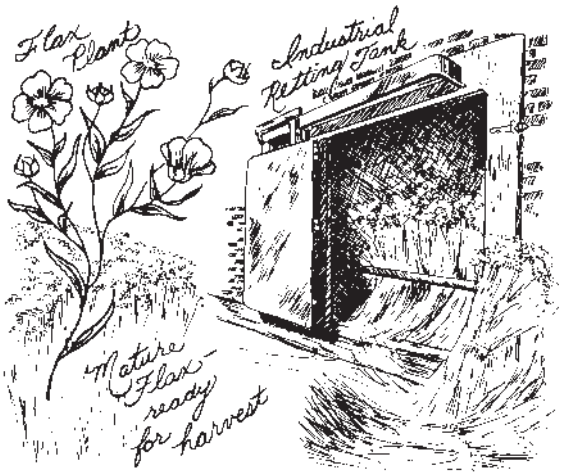
You will find many kinds of cotton cloth in fabric stores. Each kind is suitable for different kinds of clothing. Here is a list of some common types of cotton cloth:

batiste	flannel	muslin
broadcloth	gabardine	percale
calico	gingham	terry cloth
corduroy	lace	voile
denim		

Linen is made from fibers in the stems of the flax plant. The stems are soaked in water in a process called *retting*. This process rots away the woody stem of the plant to expose the fibers on the inside. The fibers can then be spun into yarn and made into cloth. Yarn weights can vary from very light to very heavy.

Linen is a strong cloth but the yarn is nonelastic and tends to be brittle. When linen is folded, it will wear along the crease.

Linen also wrinkles easily. It is usually dry-cleaned to retain crispness. It becomes soft when it is washed.



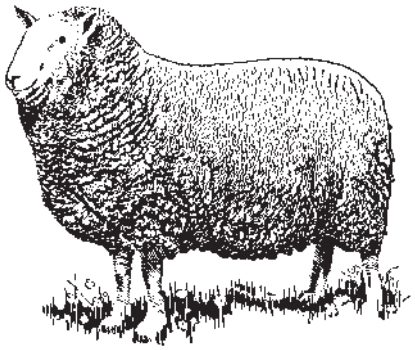
Linen absorbs water. In the past this property made it a popular choice for towels, napkins, and tablecloths. Although not all of these articles are made from linen today, they are still called *linens,* and many homes have a linen closet where such things are stored. Today linen yarn is often blended with other yarns in making fabric.

Linen clothing seems to have been developed in ancient Egypt and was considered a fabric for fine clothing in Bible times. It was the cloth of the wealthy. It was tedious to produce which made it expensive. It could also be made into thinner, softer, more luxurious fabrics than wool, which was used for the clothing of the common people.

Wool comes from animals. Most wool comes from sheep, but the wool of camels, goats, alpacas, and llamas as well as lesser-known animals is used to make the fabric. Wool fibers are from 2″ to 12″ (5 to 30 cm) long. The longer the fiber, the finer the wool. Some of the finest wools are cashmere and mohair from goats.

The best wools come from young, healthy animals. Lamb's wool comes from 6- to 12-month old sheep and is the softest and finest. You may also find the term *virgin wool* on a garment label or fabric bolt. This means that the wool was never spun into yarn before. Reprocessed wool comes from wool products that have never been used by a consumer. Reused wool comes from products that have been used.

Shorter wool fibers are made into woolen yarn which is bulky and fuzzy. Longer fibers receive an extra combing and are called *worsted*. Worsted yarns are smooth and highly twisted. They are used to make fabrics such as broadcloth, crepe, gabardine, and serge.



Wool fibers are nearly cylindrical in shape. They also have overlapping scales which provide insulation against both cold and heat and also give absorbency. These scales cause the fibers to mat under heat, moisture, and pressure. This property is called *felting*. Wool fabrics clean easily, resist wrinkling, and hold their shape well. Because wool has a tendency to shrink and mat, it is best to dry-clean garments that contain wool. Wool garments need to be stored carefully since certain moths are attracted to wool and their larvae will eat holes in the wool. Mothballs or cedar are a good deterrent to these moths.

Wool is popular for warm clothing such as coats, sweaters, socks, and gloves. Wool combined with other fibers makes good fabrics for men's suits and women's jackets. Wool's strength and warmth also make it ideal for rugs and blankets.

Wool is used to make flannel, tweed, jersey, and fleece.

Silk is made from the fiber of the cocoon of the silkworm. Today it is produced by a meticulous process on silk farms mainly in Japan and China. The worms are the larvae

of the *Bombyx mori* moth, which lays eggs on frames provided by the farmer. After the worm hatches, it eats mulberry leaves almost continuously for four or five weeks. Then it fastens to a twig and begins swinging its head from side to side in a figure eight. As it does this, two glands give off a fluid that hardens into silk threads when it hits the air. The worm spins the silk around and around its body until it uses all the fluid. This takes about three days. In the cocoon, the worm changes into a pupa. Meanwhile every effort has been made to keep the environment clean and the worms free of disease.

If permitted to live, the pupa will become a moth and emerge from the cocoon in about three weeks. Only a few are permitted to leave their cocoons since this breaks the long, continuous silk thread into many short pieces. To save the silk, the pupae are killed using hot water or high heat. The cocoon is then carefully unwound. The strand of silk will be from 200–1,600 yards (183–1,463 m) long. This makes it the only natural fiber that is a filament rather than a staple.

Silk is the strongest natural fiber. In fact, a thread of silk is stronger than the same size thread of some types of steel. Silk is highly elastic and will return to its original state after stretching. Silk garments are soft and very lightweight but are warmer than cotton, linen, or rayon. Silk fabric can be ironed easily and resists wrinkling. It resists soiling and absorbs moisture easily. It is destroyed when exposed to sunlight. It is best to dry-clean silk.

Silk cloth is easily dyed. When dyed it has a deeper, richer, more brilliant appearance than other fabrics. From ancient times, silk has been considered the cloth of luxury. Even today, it is very expensive compared to many other fabrics. This is because it is much more difficult and time-consuming to produce. Silk may be used alone or in combination with other fibers for fine clothing. It is also used for its strength and brilliant color in upholstery.

Examples of silk fabric are brocade, chiffon, crepe, satin, and jersey.

Write *cotton, linen, wool,* **or** *silk.*

1. _____ _____ wrinkles easily
2. _____ most widely used fiber; worn by ¾ of the world's people
3. _____ the cloth of luxury
4. _____ strong, non-elastic cloth
5. _____ very warm

Follow the directions.

6. Name three advantages of cotton. _____

_____

7. Name two disadvantages of linen. _____

_____

8. Why is wool a good fiber for outerwear in northern climates? _____

_____

9. List three types of cloth made from cotton. _____

_____

10. List two characteristics you should remember when cleaning and storing a wool sweater.

_____

_____

11. Explain why silk is an expensive fabric. _____

_____

12. Three natural fibers are mentioned in the Bible, although all four were known and used in Bible times. Look up the Scriptures mentioned and answer the questions.

    a. Proverbs 31:13—What did the virtuous woman use to make cloth? _____

    _____

    b. Proverbs 31:22—What did she use for her own clothing? _____

    c. Ezekiel 16:10—What fibers did God use as examples of His care for His people?

    _____ .

    d. What did He provide for their shoes? _____

    e. 2 Kings 3:4—This fiber was used to pay taxes. _____

◯ 13. Pioneers in North America wore cloth called *linsey-woolsey*. Research this cloth and how it was made. Write what you learn in a short paragraph.

_____

_____

_____

_____

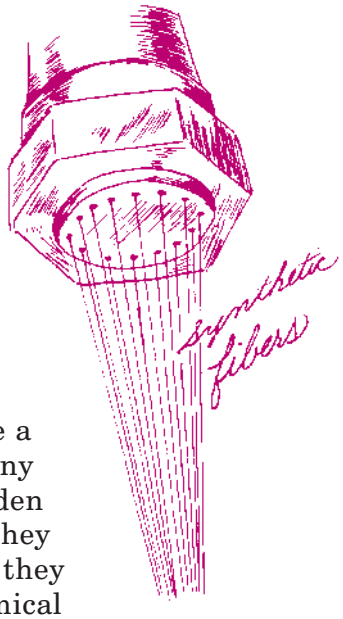
_____

_____

Lesson 2 Synthetic Fibers; Yarns; Choosing Fabrics

Synthetic Fibers

Synthetic fibers are made from artificially created substances. Two or more elements are chemically combined to make a new compound. Most synthetics have been developed when natural products became scarce or were inadequate to meet a need in industry. Synthetic fibers are produced when a liquid compound is forced through tiny holes in a spinneret which looks quite like a shower nozzle. The tiny streams of liquid harden into filaments when they meet the air or when they are forced into a chemical solution. They can then be spun into yarn or thread and made into cloth.



Rayon was the first synthetic fiber. It was invented by Hilaire Chardonnet in 1884. He called it artificial silk because it had the luster, softness, and durability of silk. Its long filaments produce this effect. By 1924 it became known as rayon in the United States. *Ray* indicates the sheen of the fiber and *on* indicates its cotton-like qualities. *Avril*® and *Zantrel*® are two trade names for rayon.

Rayon is manufactured from the cellulose fibers of wood or cotton. The fibers are soaked and "ripened" in several chemical solutions before they are pumped to a spinneret to form filaments. The filaments may be cut into short lengths, then combed and twisted to form yarns. The yarns can be woven into fabrics that look like cotton, wool, or spun silk.

In addition to its lustrous sheen and slippery soft texture, rayon dyes easily, like silk. It loses its strength when wet, but regains it when dry. It can be easily burned, so caution must be used when ironing rayon fabric. It can be treated so that the fabric has permanent pleats.

Rayon is often combined with other fibers such as cotton or polyester to produce blends. Clothing made from these combinations is durable and soft. It can be treated so that it does not wrinkle easily. Rayon's luster and dyeability make it desirable also for upholstery, draperies, and decorator fabrics. Rayon's slippery texture makes it a good choice for linings in suits, coats, and jackets.

Acetate is not as strong as rayon. It is soft and drapable. It can be made into luxurious silk-like fabrics with a deep luster. These qualities make it suitable for dresses, women's underwear, and draperies. Dry cleaning is usually best for acetate fabrics. Caution must be used when ironing since acetate melts at high heat. *Avisco*® and *Estron*® are trademark names for acetate.

Acrylic fibers are a group of synthetic products made primarily from petroleum. They are made from a synthetic chemical called acrylonitrile. When forced through the tiny openings of the spinneret, the molecules form a long chain in a process known as polymerization. They form hairlike strands which are then stretched into tough fibers. Long filaments of acrylic have a silky look, while the short fibers look like wool.

Acrylic fibers are lightweight and warm, which makes them a good substitute for wool. They dry rapidly and resist fading, wrinkling, and mildew. They are not absorbent, so they hold in body heat. They are often blended with other fibers. They can be machine washed and often need no ironing. They are used extensively for blankets, sweaters, coats, carpets, sportswear, and artificial fur.

Orlon® and *Acrilan*® are trademark names for acrylic.

Nylon is a family name for a group of synthetic products. It is one of the most important chemical discoveries. It is one of the toughest, strongest, and most elastic substances. Nylon resists wrinkling, soil, mildew, and moths. It tends to produce static electricity. One way to combat this tendency is to use fabric softener in the rinse water when washing it. Nylon fabrics are not harmed by oil and grease or household cleaning fluids. Nylon must be ironed at a low temperature; it often needs no ironing at all if the garment is hung up before it is completely dry. Nylon absorbs little water, which is why clothing made from it is hot and sticks to the skin in warm weather.

Nylon was first made into hosiery in 1937. Since then, many uses have been found for it. Now it is used in dress fabrics, underwear, lace, carpets, and upholstery.

When forced through the spinneret, the streams of nylon filaments harden when they hit the air and are wound onto huge spools. In a process called *drawing*, the filaments are wound onto a second spool which is winding at least four times as fast as the unwinding spool. This stretching process gives the nylon fiber strength and elasticity.

The fineness of nylon yarn is measured in *deniers*. A denier is a unit measurement of yarn weighing one gram for each 9,000 meters. If 9,000 meters of nylon yarn weighs 15 grams, it is called 15-denier yarn. That is the weight of most nylon hose. You may want to check a package of hose to see if it designates the weight of nylon yarn used.

Some trademark names for nylon are *Antron*®, *Cantrece*®, and *Qiana*®.

Polyester fibers are probably the most popular and most widely used synthetic fabrics. They begin as a synthetic compound called a *resin*. Like nylon, they are stretched after being forced through the spinneret. They are spun into yarns that produce strong, tough materials. They tend to produce static electricity unless treated with an antistatic finish.

Polyester fabrics are easy to care for because they resist fading, wrinkling, mildew, and shrinking. They are machine washable and need little ironing. They are somewhat elastic and hold their shape well. They dry quickly, will not absorb water, and retain heat. They are often combined with natural and synthetic fibers to increase their strength and reduce the possibility of wrinkling and shrinking.

Trademark names for polyester include *Dacron*®, *Kodel*®, *Fortrel*®, and *Trevira*®.

Write *nylon, rayon, acetate, acrylic,* **or** *polyester.*

1. _____ originally called *artificial silk*
2. _____ made from petroleum
3. _____ one of the toughest and most elastic substances
4. _____ has qualities of both silk and cotton
5. _____ most popular synthetic fibers
6. _____ used often with cotton and polyester to produce blends
7. _____ soft and drapable
8. _____ used for hosiery and other fabrics
9. _____ used in linings, drapery, and upholstery.

Fill in the blanks.

10. Synthetic fibers are produced when a liquid compound is forced through a _____ .
11. The fineness of nylon yarn is measured in _____ .
12. Stretching fibers from one spool to another is called _____ , and increases strength and elasticity.

YARNS

Most people think of yarn as the heavy, fuzzy yarns that are sold in skeins to crochet or knit into afghans and sweaters. That is not what is meant by the term in the textile industry. Rather, *yarn* indicates a strand of fiber that has been prepared for weaving and knitting. It may be thinner than a hair for fine fabrics or it may be heavy and rope-like for making rugs and carpets. Most yarns are made from staples or filaments that have been spun together. They may be made from one fiber or from a combination of fibers.

There are four types of yarns.

Spun yarn is composed of staples twisted together into a continuous strand. The strand may contain one fiber type or two or more fibers blended together during the spinning process. The smoothest and strongest spun yarns are made from longer staples that have been given a high degree of twist.

Filament yarn is a long, smooth strand unreeled from a silkworm's cocoon or extruded from a spinneret. It may be formed from a single strand called a *monofilament,* two or more strands twisted together called *multifilaments,* or short lengths of filaments called *staples* that can be spun into spun yarn.

Ply yarn is made from two or more spun yarns twisted together. The number of strands is indicated by the terms *two-ply, three-ply,* etc.

Textured yarn is synthetic filament that has been given special chemical treatments to give its surface a coiled, crimped, curled, or looped shape. Some are used to make woven cloth. Others have a softness and bulk more closely resembling wool.

CHOOSING FABRICS

When a seamstress plans to sew an article for herself, her home, or for others, she needs to consider what type of fabric will be most suitable for use. Sometimes a fabric that is made of 100% natural or synthetic fiber may be best, but often *blends* are the best choice.

Blends are made from two or more fibers. Blending fibers increases the positive qualities and reduces the undesirable characteris-

tics in each one. This means, for example, that a cotton-polyester fabric would be fairly cool for summer wear, but would resist wrinkling and shrinking. One disadvantage of cotton-synthetic blends is that they may have a tendency to pill, which means that tiny fiber balls develop on the surface of the fabric where it rubs against itself or against the body.

Polyester is also blended with wool for men's suits. It produces a fabric that is lightweight, warm, and shrink-resistant.

Define these terms.

13. blends _____
14. pilling _____
15. ply yarn _____

Looking Back . . .

Answer these questions.

16. What property of linen made it popular for towels, napkins, and tablecloths?

    _____

17. What do we mean when we say a fabric *breathes* well? Why is this a good quality?

    _____

18. What does exposure to the sun do to silk?

    _____

19. How does the length of wool fibers relate to the quality of the fabric?

    _____

Lesson 3 — How Fabric is Produced

How Fabric is Produced

In the first two lessons we learned how natural and synthetic fibers are used to produce yarns to make fabric. Now we will discover how fabrics are made from these yarns.

About 90 percent of the fabrics manufactured in the United States are produced by weaving or knitting. In producing fabrics, mills may use yarns finer than sewing thread or as heavy as rug yarn.