NO PREP

How Fabric Is Made

Woven, Knit, and Nonwoven

Includes: Student reading, case study, differentiated questions, teacher key

Name: Period: Date:

How Fabric Is Made: Woven, Knit, and Nonwoven

From Loose Fiber to Usable Cloth

Fibers alone are not fabric. A pile of raw cotton is closer to a handful of dryer lint than to a shirt, and turning one into the other takes two more steps. First, short fibers are cleaned, combed so they lie parallel, and then twisted together into yarn, a process called spinning. The twist is what holds the whole thing together, because friction between the fibers keeps them from sliding apart under tension. Fibers that come in short pieces are called staple fibers, and every natural fiber except silk is a staple fiber. Fibers that arrive as one continuous strand are called filament fibers, which includes silk and every synthetic that comes out of a spinneret. Staple yarns have tiny fiber ends sticking out along their length, which is why cotton feels warm and slightly fuzzy and why it eventually pills. Filament yarns are smooth and lustrous,

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Weaving: Two Directions, Locked Together

Woven fabric is made on a loom by interlacing two sets of yarn perpendicular to each other. The yarns running the length of the fabric are the warp; they are held under tension on the loom, which means they must be strong, and they run parallel to the finished edge of the fabric called the selvage. The yarns running across, over and under the warp, are the weft or filling. Because the two sets lock each other in place, woven fabric barely stretches along either yarn direction, holds its shape well,

and frays when cut because the cut ends of the yarns are no longer anchored. How the weft crosses the warp defines the weave structure. In a plain weave, the weft passes over one warp yarn and under the next in a simple checkerboard, producing a flat, durable, reversible fabric such as muslin, broadcloth, chambray, and gingham. In a twill weave, the weft crosses two or more warp yarns before going under, and shifting that pattern one yarn over on each row creates the diagonal ridge, called a wale, that you can see on any pair of jeans. Twills are strong, drape well, and hide soil better than plain weaves, which is a large part of why denim became work clothing. In a satin weave, yarns float over four or more before interlacing, which produces a smooth, shiny surface and a fabric that snags easily because those long floats have nothing holding them down.

Knitting: One Yarn, Endless Loops

Knit fabric is built from loops rather than crossings, and that single structural difference explains everything a knit does. Because a loop can elongate and recover, knits stretch in ways woven fabric cannot, which is why t-shirts, socks, sweatshirts, and leggings are knitted while dress shirts and jeans are woven. Knits also resist wrinkles, because a bent loop simply springs back, and they conform to the body without needing the shaping seams a woven garment requires. The trade-off is stability. A knit can stretch out of shape, it can curl at a cut edge, and if one loop breaks the neighboring loops can release in sequence, which is the run that ends the life of a pair of tights. There are two families. Weft knits are made by feeding one yarn across the fabric, and they include jersey, which is smooth on the front and looped on the back and curls at the edges, and rib knit, which alternates raised and recessed columns and stretches strongly across its width, making it the standard for cuffs, waistbands, and collar bands. Weft knits are the ones that run. Warp knits use many yarns at once, each looping down its own column, and they resist running almost entirely. Tricot, used in linings and swimwear, and raschel, used in lace and mesh, are warp knits. Machine knitting is fast and cheap, which is why the majority of casual clothing sold today is knitted.

Nonwovens: Skipping the Yarn Entirely

The third construction method throws out the middle step. Nonwoven fabrics are made by bonding loose fibers directly to each other with heat, pressure, chemicals, moisture, or needle punching, with no yarn and no interlacing at all. Wool felt is the

oldest example and is made by exploiting the same scale structure that ruins a sweater in a hot wash, deliberately matting the fibers into a dense sheet. Modern nonwovens are everywhere in a sewing lab and in daily life: interfacing that stiffens a collar or a waistband, disposable surgical masks, dryer sheets, tea bags, reusable grocery totes, disposable wipes, and most fusible stabilizers. Nonwovens have two properties that make them useful and two that limit them. Because there are no yarns running in any particular direction, they have no grain, so they can be cut in any orientation without affecting how they hang, and they do not fray or ravel at a cut edge, which is why interfacing can be trimmed without finishing. On the other hand they are generally weaker than woven or knitted fabric of the same weight, and they usually cannot be repaired, because there is no yarn to catch a stitch. This is why nonwovens dominate disposable products and support roles inside garments, and almost never appear as the main fabric of clothing meant to last.

Grain: The Concept That Ruins the Most Projects

Every woven fabric has grain, and misunderstanding it is the single most common reason a home-sewn garment hangs wrong. The lengthwise grain runs parallel to the selvage, along the warp yarns, and it is the most stable direction with almost no stretch, which is why pattern pieces are almost always aligned with it. The crosswise grain runs along the weft, from selvage to selvage, and it has slightly more give. The true bias is the diagonal at forty-five degrees to both, and it is where woven fabric stretches most, because pulling on the diagonal lets the yarn crossings shift like a hinge rather than resisting directly. Designers exploit this deliberately. Bias-cut dresses drape and skim the body in a way straight-grain cutting cannot achieve, and bias tape is cut on the diagonal precisely so it can curve smoothly around a neckline or an armhole without puckering. Fabric can also be off-grain, meaning the warp and weft are no longer at true right angles because the cloth was stretched or rolled crookedly at the mill. A garment cut from off-grain fabric will twist on the body after the first wash, and the side seam of a pant leg will spiral toward the front no matter how carefully it was sewn. Checking grain before cutting takes about a minute and prevents a problem that cannot be fixed afterward. The check itself is straightforward. Look at the selvage, which runs along both lengthwise edges and is denser and slightly different in texture because the weft yarns turn around there. Lay the fabric flat, fold it selvage to selvage, and see whether the crosswise cut

edges line up square. If the fold will not lie flat without a ripple, the fabric is off-grain, and on many natural fibers it can be pulled gently on the diagonal in the opposite direction until it squares up. Knits do not have grain in the same sense, since they have no warp and weft crossing, but they do have a lengthwise column direction called a wale and a crosswise row direction called a course, and pattern pieces still have to respect them because a knit stretches far more across the courses than along the wales.

Key Information: Fabric Construction at a Glance

Detail	Information
Spinning	Twisting fibers into yarn; friction holds the strand together
Staple vs. Filament	Short fibers vs. continuous strands; silk is the natural filament
Warp	Lengthwise yarns held on the loom, parallel to the selvage
Weft	Crosswise yarns that pass over and under the warp
Plain Weave	Over one, under one; flat and durable (muslin, gingham)
Twill Weave	Diagonal wale; strong and hides soil (denim)
Knit	Interlocking loops; stretches, resists wrinkles, can run
True Bias	45-degree diagonal; the direction of maximum stretch

Case Study: Nia's Tote Bag Falls Apart

Nia is in her first sewing class and picks fabric for a tote bag on looks alone. She chooses a heavy satin-weave home decor fabric because it is shiny and the color is perfect. Her teacher raises an eyebrow and says only, tell me what you notice when you cut it. Nia cuts the panels and the edges immediately shed loose threads across the cutting table. She sews the bag anyway. Within a week the handles have pulled a long snag across the front panel, and one seam has frayed back almost to the stitching line. Frustrated, she takes it to her teacher, who lays a scrap of denim next to the satin scrap and asks her to look closely at both surfaces. Nia writes in her project log, the satin has long floats sitting on top with nothing over them, and the denim has a diagonal where everything crosses constantly. She adds one line at the bottom: I picked a weave built for looking at, not a weave built for carrying textbooks.

1. Use the reading's description of satin and twill weaves to explain why Nia's bag snagged and frayed while denim would have held up.

2. Nia's edges shed threads the moment she cut them. Explain what the reading says causes fraying, and why a nonwoven would not have done that.

Multiple Choice

1. Which yarns run lengthwise on the loom, parallel to the selvage?

    a) The bias yarns

    b) The filling yarns

    c) The warp yarns

    d) The weft yarns

2. What structural feature explains why knit fabric stretches and resists wrinkles?

a) It is built from loops that elongate and recover

b) It is always cut on the true bias

c) Its yarns are interlaced at right angles

d) Its fibers are bonded with mechanical pressure and heat

3. In which direction does a woven fabric stretch the most?

a) Across the crosswise grain of woven fabric

b) Along the lengthwise grain

c) Along the selvage edge

d) On the true bias, at 45 degrees

Matching

Write the letter of the correct definition on the line next to each term.

Term	Definition
1. ___ selvage	A) The diagonal ridge produced by a twill weave
2. ___ wale	B) A fiber that comes in short pieces rather than a continuous strand
3. ___ nonwoven	C) The 45-degree diagonal where woven fabric stretches most
4. ___ true bias	D) The finished lengthwise edge of woven fabric that does not fray
5. ___ staple fiber	E) Fabric made by bonding loose fibers without any yarn

Fill-in-the-Blank

1. Twisting fibers together into yarn is called _____.

2. A weave with a diagonal ridge is a _____ weave.

3. Fabric stretched crooked at the mill is called _____.

Short Answer

Answer each question in 2-4 complete sentences.

1. Why does the reading say weft knits run but warp knits mostly do not?

2. Explain why bias tape is cut on the diagonal instead of along the grain.

3. Why are nonwovens used for interfacing but almost never for a whole garment?