Lesson 5.3: Fibers, Natural and Manufactured

Unit: Unit 5, Make It, Mend It, Wear It (Apparel and Textile Production and Design) **Topic:** 5.1 What We Wear and Why **Grade:** 6 to 8 (written at grade 7; see Differentiation for the grade 6 support and grade 8 stretch) **Days:** 1 class period of 40 minutes (day 118 of the year) **Room:** FACS lab, three stations, water access preferred (a no-water version is below)

Today the unit turns physical. Students put their hands on six fabrics and record what they find out. The burn test is a teacher demonstration only, done once, at the front, with the class seated behind the line, or it is not done at all and the video and the wet-drop test replace it. There is no version of this lesson where a student holds a flame.

Standards

- NYS module line: NYS ATPD 1. Selection a) Determine personal needs, wants, and values
- NYS module line: NYS ATPD 3. Maintenance a) Identify care procedures which may extend the wear of an apparel item
- CTE theme line: CTE HSW 4. Classroom and Workplace Safety a) List and describe the purpose of safety rules specific to classroom and workplace settings
- CTE theme line: CTE SUS 2. Environmental Management e) Explain factors to consider when assessing the environmental impact of purchasing decisions for everyday goods
- NYS FACS Learning Standard 2 (Intermediate), Key Idea: Students will know the basic principles of home and community safety. They can demonstrate the skills necessary to maintain their homes and workplaces in a safe and comfortable condition. They can provide a safe and nurturing environment for themselves and others.; Performance Indicator: Students use age-appropriate techniques to select and maintain clothing.
- CDOS Standard 3a Universal Foundation Skills: Basic Skills. Students listen to and read the ideas of others and analyze what they hear and read; acquire and use information from a variety of sources; and apply a combination of mathematical operations to solve problems in oral or written form.
- National FCS 3.0: 16.2.1 Use correct terms to identify, compare, and examine the common generic textile fibers and fabrics.
- National FCS 3.0: 16.2.2 Judge how textile fibers and fabrics perform.
- National FCS 3.0: 16.2.4 Examine how a textile's components affect its design, construction, care, use, upkeep, and disposal or recycling.

Note on the citations: the crosswalk's ATPD 1. a) row pairs with SUS 2. e), and its 3. Maintenance a) row pairs with SUS lines on stewardship; SUS 2. e) is used here because the station record ends with a purchase decision. The HSW safety line the task asked for is 4. a), the purpose-of-safety-rules line, because the burn demonstration is run under restated rules rather than by students using a tool; HSW 4. c) on tool safety arrives in Lesson 5.5 where students actually pick up shears. National FCS 16.2.1 and 16.2.2 are the fiber identification and performance lines and are confirmed verbatim in the web research file; 16.2.4 carries the care connection into Lesson 5.4.

Enduring understanding and essential question

Big idea: Every fabric is made of fibers, and the fiber decides what the fabric can do: how warm it is, whether it breathes, whether it stretches, whether it wrinkles, what it costs, and how you have to wash it. You can find most of that out with your hands in thirty seconds.
Essential question: How do I find out what a fabric will do before I buy it, wear it, or sew with it?

Objectives

By the end of this lesson, students will be able to:

1. (Low: remember or understand) Sort eight named fibers into natural and manufactured, and name the source of each of the four natural fibers.
2. (Mid: apply or analyze) At three test stations, test six labeled swatches by feel, stretch, and water drop, and record for each swatch what it does and one use it would be good for.
3. (High: evaluate or create) Given a use (a winter hat, a soccer jersey, a dress shirt for a job interview, a swimsuit), evaluate which of the six swatches is the best choice and defend it with two performance characteristics from their own test data.

Vocabulary

Tier 2 (general academic): property, characteristic, source, absorb, compare, evidence Tier 3 (FACS): fiber, natural fiber, manufactured fiber, cotton, wool, silk, linen, polyester, nylon, rayon, spandex, blend, wicking, absorbent, breathable, static. See the unit vocabulary list (Vocabulary 05.md) for Turkish, Portuguese, and Spanish.

Materials and setup

Three stations of about seven students. Each station runs the same three tests on the same six swatches, so nothing has to rotate between stations except students' attention.

Per station:

- Six labeled swatches, about four inches square, one of each: cotton (an old T-shirt or muslin), wool (a thrifted sweater or felt made of wool), silk or linen (a thrifted blouse or a linen napkin), polyester (a fleece or a cheap dress shirt), nylon (a windbreaker or tights), spandex blend (leggings or a swim fabric). Label each with a letter A to F on masking tape, not with the fiber name. *[Sal: cut these from thrifted garments once and they last for years. Keep a master set in a labeled bag in the Unit 5 bin. One thrift store bag of six garments at about $2 each gives you twenty sets.]*
- One small cup of water and one eye dropper or pipette
- One paper towel
- One magnifier or a phone camera on zoom, optional but good for the weave
- One answer envelope, sealed, with the six letters and their true fibers inside, opened only at Step 4

For the whole class:

- Handout, one per student: Handout 05.03 - Fiber Test Station Record.md
- Slides: Slides 05.03 - Fibers Natural and Manufactured (outline in 05 Materials; the site renders it as a deck)
- The burn demonstration kit, teacher only: a metal pie pan or a ceramic dish, a long lighter or matches, metal tweezers or tongs, a cup of water, the room's fire extinguisher within reach, one two-inch snip of each of three fibers only (cotton, wool, polyester). The room's exhaust fan or an open window. *[Sal: check the building's policy on open flame in a classroom before you plan on this. Many buildings say no, and the lesson works without it.]*
- Index cards for the closure
- Timer visible to the class
- Setup notes: cut and label swatches the day before. Fill the water cups at the start of the period, not before, so nothing spills overnight. If the burn demonstration is running, clear a three-foot radius at the front table, move the class's chairs behind a taped line on the floor, and tell the class the day before that there will be a small flame at the front, because a student with a trauma history or an asthma trigger needs a chance to tell me quietly. That student sits at the back with the video version and no comment is made.

Pre-assessment

The do now sorts fiber names before any teaching. Scan for two things: who knows that polyester is made in a factory, and who thinks cotton comes from an animal. Those two answers tell me how much of Step 1 is review. Yesterday's optional homework (the words off a care label) also arrives today; ask for a show of hands on who has one, and read two aloud.

Do now and hook (Time: 5 min)

On the board as students enter: "Here are eight words: cotton, wool, silk, linen, polyester, nylon, rayon, spandex. Four come from a plant or an animal. Four are made in a factory. Sort them into two lists. Guess if you do not know."

Debrief in ninety seconds: take the natural list from one student, the manufactured list from another, correct with the slide (rayon is the tricky one: it starts as wood pulp and gets made into fiber in a factory, so it counts as manufactured). Then the hook: hold up a fleece jacket and a wool sweater. "One of these is made from a plastic bottle. One is made from a haircut. Both keep you warm. By the end of the period you will be able to tell them apart with your hands."

Procedure

Step	Teacher will	Students will	Time
1. Direct instruction: the two families and	Two slides and one table. Natural:	Fill in Part 1 of the handout: the sort,	10 min

what each fiber is good and bad at	cotton (plant, soft, absorbent, breathable, wrinkles, shrinks, slow to dry), wool (animal, warm even when damp, springs back, itchy to some people, shrinks and felts in hot water), silk (insect, strong and smooth, expensive, marks with water, hand wash), linen (plant, coolest in heat, wrinkles the most, gets softer with age). Manufactured: polyester (strong, holds shape, dries fast, cheap, does not breathe, holds odor, melts), nylon (very strong, slick, used for windbreakers and tights, melts), rayon (made from wood pulp, drapes like silk, weak when wet), spandex (stretches and recovers, always blended, ruined by heat). Build the class table on the board with five columns: warmth, wicking or absorbing, wrinkles, stretch, cost and care. Say the reason this matters twice: the fiber decides the care, and the care decides how long	the sources, and the five-column table.	

	the garment lasts.		
2. Practice: the hand test rotation	Send students to the three stations. Explain the three tests once, with a swatch in hand. Test 1, feel: rub it between finger and thumb, say smooth or rough, warm or cool, thick or thin. Test 2, stretch: pull it gently across the grain and then let go; does it come back, or does it stay stretched? Test 3, water drop: one drop on the swatch, count to ten; did it soak in, bead up, or spread? Rules: one drop, not a puddle; swatches stay at the station; wet swatches go on the paper towel, letter side up. Run 90 seconds per swatch on the timer, six swatches. Circulate with the clipboard.	At each swatch A to F: fill the three test columns on the station record, then write a guess at the fiber and one use the fabric would be good for.	12 min
3. Teacher demonstration: the burn test (or the alternative)	Class seated behind the taped line. Restate the fire rules from Lesson 1.3 out loud, in the same words: the extinguisher is for adults, PASS is pull, aim at the base, squeeze, sweep, and students get out and tell the teacher. Add today's rules: I hold	Watch and record in Part 3: for each of the three fibers, what the flame did, the smell in one word, and what the ash or bead looked like. Then one sentence: "A fiber that melts is dangerous near heat because ___."	5 min

	the tweezers, the flame is on for under three seconds, nobody stands up, nobody films it. Then burn three snips over the pie pan, one at a time, and narrate what to watch: cotton catches fast, smells like burning paper or leaves, leaves a soft gray ash that crumbles. Wool burns slowly, curls away from the flame, smells like burning hair, leaves a black bead you can crush, and often puts itself out. Polyester does not burn, it melts and shrinks away, smells sweet and chemical, drips, and leaves a hard bead you cannot crush. Say the safety consequence out loud: a fabric that melts sticks to skin, which is why firefighters and welders wear natural fibers or treated fabrics and not fleece. Drop each snip in the water cup when it is done. If the building says no flame: play the same three burns on video and		

	run the wrinkle test instead (crush each swatch in a fist for ten seconds and rate how much wrinkle stays), then discuss the melt-versus-burn safety point from the video.		
4. Share and debrief: open the envelope	Open the station envelopes. Read the six true fibers. Take a class count on how many students got each one right. Then run the four use questions fast, one at a time, taking one answer each with evidence: a winter hat, a soccer jersey, a dress shirt for a job interview, a swimsuit. Push for the words from their own data: absorbed, beaded, came back, stayed stretched. Close by connecting to tomorrow: the label inside the garment is where the fiber and the care rules are printed, and tomorrow we read them.	Check their guesses, mark right or wrong on the record, and answer the four use questions in Part 4 with two pieces of evidence each.	4 min

Day total: 5 (the do now) plus 10 plus 12 plus 5 plus 4 plus 4 (the closure) = 40 minutes.

Questions to ask

Monitor understanding:

- Which four of the eight are natural? Where does each come from?
- Swatch C beaded the water. Is that good or bad for a raincoat? For a towel?

- Which swatch came back after you stretched it? What is in it?
- Which one wrinkled the most in your fist?

Deepen learning:

- A polyester shirt dries fast and a cotton shirt breathes. Which do you want for a soccer game in August, and why is the answer not the same for a job interview in the same weather?
- Wool is warm even when it is damp. Why does that matter more to a hiker than to somebody riding a bus to school?
- Fleece is made from plastic. Every wash sends tiny plastic fibers down the drain. Does that change what you would buy? What else would you have to give up?
- Silk costs more than polyester and a polyester blouse can look almost the same. What is the buyer paying for?
- A firefighter's gear is not fleece. Now that you have seen polyester melt, say why in one sentence.

Check for understanding

Clipboard during Step 2: for each student, a yes or no on "all three tests filled for at least four swatches" and "the use column names a real use, not a color." At Step 4, the count of correct guesses per swatch tells me which fiber the class cannot feel yet. The one they miss is almost always rayon or the silk-versus-polyester pair; that becomes the two-minute review before Assessment 05.1.

Closure (Time: 4 min)

3-2-1 exit card: 3 things you learned about a fabric with your hands today; 2 fibers you can now tell apart and how; 1 question about fibers or care. Three students read one line aloud. Sort into "got it" and "needs more." Any card that cannot name a single test result gets a one-minute check-in during Lesson 5.4's do now.

Differentiation and supports

- ELL: the six swatches are the vocabulary; a student can point and use one word (rough, smooth, wet, back) instead of a sentence. The handout's test columns are checkboxes and circles, not writing. The word bank on the handout carries fiber, natural, manufactured, absorb, stretch, wrinkle, warm in Turkish, Portuguese, and Spanish (see Vocabulary 05.md). The burn narration gets a word on the slide for each result (ash, bead, melt, smell) as it happens.
- IEP and 504 (general): a student who cannot tolerate certain textures does the stretch and water tests only and takes the feel column from a partner's report, with no comment; a student with a sensitivity to smoke or a trauma history around fire sits at the back with the video version, arranged quietly the day before; extended time means Part 4 can be finished at the start of Lesson 5.4; printed station steps sit at each station so nobody depends on hearing the directions once; the record sheet accepts a drawn mark instead of a word in every column.

- Grade 6 support: four swatches instead of six (cotton, wool, polyester, spandex) and two use questions instead of four.
- Grade 8 stretch: add a blend swatch (a 60 percent cotton, 40 percent polyester shirt) as swatch G and have the student explain what each fiber contributes to the blend and why a manufacturer would pay for the mix; also predict, before the demonstration, what the blend would do in a flame, then check it against the two pure results.
- UDL checkpoint used: multiple means of representation (the fiber content arrives as a slide table, as a physical swatch, and as a demonstration) and multiple means of action and expression (the record can be filled with circles, words, or a partner's dictation).
- No-kitchen or no-machine alternative: no kitchen and no machines are needed. No-water version: skip the drop test and run the wrinkle test (fist for ten seconds, rate 1 to 3) plus a breath test (hold the swatch to the mouth and breathe out; a breathable fabric lets the air through). No-flame version is written into Step 3 above and is the default until the building says otherwise.

Assessment

Objective	Standards met	Learning task	Assessment (formative or summative; tool)
1. Sort eight fibers and name the four natural sources	ATPD 1. a); National FCS 16.2.1	Do now and handout Part 1	Formative; the sort checked at the board; summative on Assessment 05.1 items 1 to 5
2. Test six swatches and record properties and a use	ATPD 3. a); HSW 4. a); Std 2 PI C; National FCS 16.2.2, 16.2.4	The station rotation, Step 2	Formative; clipboard check on three tests for four or more swatches; the station record scored complete, partial, or missing for daily work
3. Choose the best fabric for a use and defend it with two characteristics	ATPD 1. a); SUS 2. e); CDOS 3a Basic Skills; National FCS 16.2.2	The four use questions, Part 4 and Step 4	Formative; two pieces of evidence per answer; summative on Assessment 05.1 item 11b

Homework

None. Optional: find the fiber content tag in one thing you own (it is usually near the care label or in a side seam) and write down the words and the percentages. Bring the words, not the garment.

Connections

Science: the burn test is a materials science demonstration, and the science teacher may already have a fume hood, which is a better place for it than a FACS room; trade the fiber swatches for ten minutes at their hood. Health and PE: wicking versus absorbing is why the PE teacher tells students not to wear a cotton shirt for the mile run, and PE can say it in one sentence at the start of that unit. Community: a local dry cleaner or tailor will usually give a bag of fabric scraps and thirty seconds on which fiber gives them the most trouble; they get a class that stops bringing them ruined wool. *[Sal: ask the cleaner near the school; scraps are free and they have plenty.]*

Sources

- NYS Middle Level CTE FACS Content Module 03, Apparel and Textile Production and Design (nyctecenter.org, June 2018), lines 1. a) and 3. a). Copy in 02 Standards/NYS Module PDFs/.
- NYS Middle Level CTE Theme Module 04, Health, Safety, and Wellness, line 4. a); Theme Module, Sustainability, line 2. e). Text per 02 Standards/NYS ML CTE FACS Modules - verbatim extract of all twelve.md.
- NYS Learning Standards for Health, Physical Education, and Family and Consumer Sciences (1996), Standard 2, Intermediate, Key Idea and PI C. Wording per the crosswalk, Part A.6.
- National Standards for Family and Consumer Sciences Education 3.0 (LEAD FCS Education, 2018), competencies 16.2.1, 16.2.2, and 16.2.4, per 02 Standards/STANDARDS SOURCES - web research.md, section 4.16.
- Burn test results (flame behavior, odor, and residue for cotton, wool, and polyester) are the standard identification results published in textile science references and in cooperative extension fiber identification guides. *[Sal: pick one source and put it on the slide; a university extension fiber burn chart is the cleanest citation and is usually a free PDF.]*
- Fire response wording is carried over verbatim from Lesson 01.03 - Fire, Burns, Cuts, and What To Do.md so students hear the same rules in the same words.

Teacher notes

- If the period runs short, cut Step 3 to two fibers (cotton and polyester); those two show the burn-versus-melt difference by themselves. Never cut Step 2; the hands are the lesson.
- Get building permission for an open flame in writing before you plan on it, and if the answer is no, say so to the class plainly. “The building says no flame in this room, so we are watching the video and doing the wrinkle test” costs you nothing and teaches them that rules apply to me too.
- Common mistake: students flood the swatch. Say “one drop” and demonstrate the dropper once. Put a count on it: one drop, count to ten, then look.
- Common mistake: students decide a fabric’s fiber by its color or by whether they like it. Push them back to the three test columns every time.

- Label the swatches with letters, not names, and keep the answer envelope sealed. The guess-then-check is the reason students care about the test data.
- The spandex swatch is the one everybody gets right and the silk-versus-polyester pair is the one nobody does. Plan the two-minute review around that pair.
- *[Sal: your room, your materials. If you have a scrap bin from the sewing stations, use it for the swatches and save the thrift trip. Keep one swatch of each for the Lesson 5.4 laundry sort.]*