

What Are You Wearing? Natural vs. Synthetic Material

Unit: Matter and Energy Interact in the Physical World Chemistry 8.1.4 Natural vs Synthetic	Utah SEEd Standard / NGSS Performance Expectation: Obtain and evaluate information to describe how synthetic materials come from natural resources, what their <u>functions</u> are, and how society uses these new materials. Examples of new materials could include medicine, foods, building materials, plastics, and alternative fuels. (PS1.A, PS1.B, ESS3.A)	Time: 75 – 100 minutes
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Access to all material for this lesson: [Lesson Folder](#)





Anchor Phenomenon	The clothes we wear are composed mostly of plastic material. What did people in the past think we would use to make our clothes today? Phenomena handout (teacher slide 2)
Driving Question(s)	Is the function of the material in fabrics determined by its structure?
Performance Task	Plan and carry out an investigation about the structure and function of different types of fabrics to determine why our clothing is made from the material it is.



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Lesson Summary: Plan and carry out an investigation about the structure and function of different types of fabrics to determine why our clothing is made from the material it is.

	Time	Guiding Question / Learning Objective	How are students answering the guiding question or meeting the learning objective?
 Engage	5 min.	<ul style="list-style-type: none"> - Show 80's movie picture reference of futuristic clothing ("Back to the Future"). - Students observe the types of fabric they have by looking at their tags. - See that fabrics are made of natural and synthetic substances. Phenomena handout	
 Explore	25 min.	<p>Students plan and carry out an investigation to determine some of the properties of the provided fabric.</p>	<p>Students will have a classroom discussion guided by the teacher to determine what experiments they can perform to learn the properties of different fabrics.</p>
 Explain		<ul style="list-style-type: none"> - After students conduct their tests, they will explain the properties of the different fabrics. - Students will also examine images of the fabric fibers under a microscope to determine the different structures of the fibers. - Finally, students will visit https://textileexchange.org/synthetics/ and answer questions about the information on this website. 	
 Elaborate		<ul style="list-style-type: none"> -Utilize a microscope to see actual fibers from different materials -Test/Study several different types of material that extend past the original 3. 	

Three Dimensions Focused on in This Lesson		
<p>Disciplinary Core Idea: NGSS Appendix E</p> <p>DCI: Standard 8.1.4</p> <p>Obtain and evaluate information to describe how synthetic materials come from natural resources, what their <u>functions</u> are, and how society uses these new materials. Examples of new materials could include medicine, foods, building materials, plastics, and alternative fuels. (PS1.A, PS1.B, ESS3.A)</p>	<p>Science and Engineering Practices: NGSS Appendix F</p> <p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. 	<p>Crosscutting Concept: NGSS Appendix G</p> <p>Structure & Function</p>
<p>Learning Objectives</p> <ol style="list-style-type: none"> Students will be able to determine why we use synthetic substances and how the structure of synthetic substances determines their functions. 		
Related Knowledge and Skills from Prior Grades		
<p>Disciplinary Core Idea: NGSS Appendix E</p> <p>Students need to have been introduced to natural and synthetic substances. Students need to have been introduced to chemical and physical properties.</p>	<p>Science and Engineering Practices: NGSS Appendix F</p> <p>Planning and Carrying Out Investigations</p>	<p>Crosscutting Concept: NGSS Appendix G</p> <p>Structure & Function</p>

Materials		
Handouts	Lab Supplies	Other Resources
What are you wearing? (PowerPoint) Phenomena handout (teacher slide 2) Microscopic Fabri Pictures (pdf) Final Analysis Rubric	3 Different Types of Fabric <ul style="list-style-type: none"> • Cotton samples • Polyester samples • Cotton-Poly samples Other Lab Supplies <ul style="list-style-type: none"> • Wood blocks or other hard objects to lay fabric against • Long handle lighters • Pie tins or foil • Sandpaper • Detergent • Droppers • Tongs • Hot Pads • Goggles 	Extension: Textile Website Worksheet Textile Website Worksheet Answer Key Fabric Data Website (https://textileexchange.org/synthetics/)

ENGAGE		
Students will be able to determine why we use synthetic substances and how the structure of synthetic substances determines their functions.		
<p>Step 1: Explain the premises of <i>Back to the Future 2</i>. For example, you could say, “The main character, Marty, is from 1985 when he travels into the far distant future of 2015.” Then, show the picture references and ask students to observe the clothing the characters wear.</p> <ul style="list-style-type: none"> • Example questions: Why are they wearing clothes that look like that? What materials do the clothes look like they are made out of? They are supposed to represent future clothing—why aren't you wearing clothes like that? <p>Step 2: Ask students to make 3 observations based on the images from Step 1.</p> <p>Step 3: Discuss students' observations on the images</p> <ul style="list-style-type: none"> • During your discussion, students should notice that most of the clothes appear to be made of plastic. Once they have made that connection, you will ask them what they think about plastic clothes. • Ask students if they would ever wear plastic clothing like the people in the images. 	<p>Teacher Tips Prior to this lesson, students should know the difference between synthetic (artificial) and natural materials and the difference between “man-made” and “man-altered” (natural items can be man-altered without being considered man-made)</p> <p>What are you wearing? (Slides) Slides with notes</p> <p>*Be aware of students who are</p>	

<p>Step 4: Invite students to check their clothing tags and write down the different materials their clothes are made of on the handout on slide 3.</p>	<p>concerned about their personal space. If students are comfortable with another student helping them check their tags, do so in a respectful manner. You can bring clothes made of different fabrics for students to check tags.</p>
<p>Needed resources: What are you wearing? (Slides)</p>	<p>If students fill out the slides digitally, the boxes will expand as students continue to type. If you print off the slides, you will want to expand the “why” boxes on slide 7 before printing.</p>

EXPLORE

Students will be able to determine why we use synthetic substances and how the structure of synthetic substances determines their functions.

Step 1: Begin a conversation with your students to help them plan and carry out their own investigation.

Step 2: Have students brainstorm the best properties in their clothing. (See list of properties below)

Step 3: After you have made a list of properties, you will narrow the list down to 4 that you will test with the fabric samples. Some tests might be able to be combined, such as stain resistance and time to dry. (See Test options below)

Step 4: Conduct the test on the chosen fabrics with the selected tests they have decided to use.

Properties students may suggest

- Durability, flammability, comfort, sound, resistance to stains, ability to be cleaned repeatedly, elasticity (ability to return to original form), Maintain color, water resistance, wrinkle resistance, and how quickly it dries

Tests

- Durability = Rub with sandpaper
- Flammability = Burn with a lighter and make observations about the flame and smoke
- Texture = Rub on face or forearm
- Sound = How loud is it when you rub it together
- Stains = Stain with something and wash by hand
- Cleaned repeatedly = Wash multiple times
- Elasticity = Stretch and deform while wet and see if it changes
- Maintain color = Color change with repeated washes

Teacher Tips:

You will probably need to ask students leading questions to prompt them to come up with the properties you have prepared for them to test.

Questions you could ask:

- What properties do you look for in your clothes?
 - Maybe make some suggestions like, how does it do in the wash? Or do you want it to keep stains?
- What do you use your clothes for?
 - Sports, comfort, protection, etc.
- How can we test for these properties?

Fabric should be small squares, about 4” squares.

Cut a small piece off each fabric for the burning test.



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- Water resistance = Drops of water to see if they are absorbed
- Wrinkle resistance = Wet the fabric and crinkle it up before flattening it back out.
- Dry time = Wet the fabric and time how long it takes to dry as it is hanging up
- Breathability = Put fabric to mouth and attempt to breathe through the fabric

EXPLAIN

Students will be able to determine why we use synthetic substances and how the structure of synthetic substances determines their functions.

Have a classroom discussion where you use terms like **structure** and **function** and emphasize that natural and synthetic materials have different properties.

Teacher Tips

ELABORATE

Students will be able to determine why we use synthetic substances and how the structure of synthetic substances determines their functions.

Once students understand how different fabrics have different properties and how those properties affect their potential uses, have them examine samples under the microscope to help them better understand and elaborate on how the structure of the fibers is different, leading to different functions.

Teacher: [Slides 8-10]

1. Students will be organized into groups.
2. Using the materials from Explore, students will now elaborate on their findings of the materials using a microscope. Ensure you have the following materials:
 - 2 Natural Fibers
 - 2 Synthetic Fibers
 - 1 Natural/Synthetic Blend Fiber
3. Students will be provided a copy of the Microscopic Fabric Images Handout [Microscopic Fabric Images](#)
4. During this activity, the teacher should circulate and listen to the conversations and the elaborations made by the students in each group.

Teacher Tips

This website shows some sketches of different fibers under a microscope. You could use it if you do not have microscopes or want a study help.

<https://www.textileschool.com/330/microscopic-appearance-of-fibres/>



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<p>5. Provide instruction to students on assessing each other with the provided rubric.</p> <p>Student: [Slides 8-10]</p> <ol style="list-style-type: none"> 1. Students will get into their groups. 2. Students will look at the materials provided under the microscope. Using Slides 8-10, they will draw and explain what they see under the microscope. 3. Using the provided copy of the Fibers Under The Scope Worksheet, the students will work with their group to answer the questions. 4. After each question is answered, the student will give their paper to another student in a different group. 5. Students will use the provided rubric to assess each other and provide feedback on their answers. 	
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EVALUATE	
Students will be able to determine why we use synthetic substances and how the structure of synthetic substances determines their functions.	
<ol style="list-style-type: none"> 1. Use the hand out (refer to the Google Slides links above in this lesson) and classroom discussion to evaluate effective learning. 2. Use the following rubric to assess the final analysis of student learning from the last slide in the Google slide presentation. <ul style="list-style-type: none"> • Final Analysis Rubric 	Teacher Tips

POSSIBLE EXTENSION / ALTERNATIVE ADAPTATIONS
<p>Exploring Synthetic Fibrics (GoogleSlides)</p> <p>In order to further understand and explain how the structure of fabric determines its function, students will:</p> <p>Step 1: Click on the following link: (https://textileexchange.org/synthetics/)</p> <p>Step 2: Read through the website and then,</p> <p>Step 3: Complete this student worksheet called Textile Website Worksheet: Textile Website Worksheet</p> <p>Step4: Answer key for textile website worksheet.</p>

This lesson was created by Valorie Draper, Luis Hernandez, Tyrel Hanson, & Karen Pineda



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