

Aligning Indigenous Knowledge with Montana's Middle School Physical Science Standards

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Lesson Plan 3:

Natural Resources, Synthetic Materials

Date 6/29/26	Length of Lesson 10 days (50-minute class periods)
Course 8th Grade Physical Science	Unit/Theme Synthetic Materials
Teacher Name Heidi Schuster	Standard(s) MS-PS1-3 gather information to describe that synthetic materials come from natural resources and impact society.
Key Vocabulary Natural resource: Anything from nature that people use, like water, trees, sunlight, and minerals. Synthetic material: A man-made material created by changing natural resources with chemicals. Petroleum: A dark, oily liquid pumped from the ground. It is a natural resource	Content Objective(s) ● I can identify natural resources used to create synthetic materials. ● I can describe how synthetic materials impact society. ● I can evaluate the benefits and drawbacks of synthetic materials. ● I can explain how human choices about materials affect communities and the environment.
	Essential Questions ● Where do synthetic materials come from? ● How do natural resources become synthetic materials? ● How have synthetic materials changed society? ● What are the benefits and drawbacks of synthetic materials? ● How do people balance convenience, cost, culture, and environmental impacts when choosing materials?
	Materials Various everyday items representing natural and synthetic materials (wool sweater, potting soil, plastic bottle, spandex, silk shirt, Dr. Pepper,

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used to make fuel and plastic. Plastic: A flexible, durable, and moldable synthetic material usually made from petroleum. Nylon: A strong, stretchy synthetic fiber often used to make clothing, ropes, and parachutes. Polyester: A tough, wrinkle-resistant synthetic fiber commonly used to weave fabrics. Manufacture: To make large amounts of goods or materials, often in factories using machines. Sustainability: Using Earth's resources carefully so they are not destroyed and will last for the future.	cheese, wooden bat, silicon spatula, gold chain, agate, glass, lemonade, etc) Natural ● Wool felt ● Cotton fabric ● Feathers ● Cork ● Leather strips ● Jute twine ● Wood craft sticks ● Paper towel Synthetic ● Polyester fleece ● Acrylic felt ● Styrofoam ● Bubble wrap ● Nylon fabric strips ● Polyester fabric strips ● Nylon cord ● Plastic craft sticks ● Plastic sheet ● Vinyl Other ● Beakers ● Thermometer ● Graph paper ● Colored pencils ● Clamps
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Renewable resource: A natural resource that nature replaces quickly, like sunlight, wind, or plants. Nonrenewable resource: A natural resource that exists in a limited amount and cannot be easily replaced, like petroleum and coal.	● Supports ● Weights ● Digital scales ● Cornstarch ● Vegetable oil ● Water ● Ziplock bag ● Spoon ● Tablespoon measuring spoon ● Dropper ● Microwave ● Plastic plate
Regalia: Special clothing, emblems, or traditional ornaments worn to show an important office, status, or cultural heritage. Innovation: A brand-new idea, invention, or method that changes how we do things.	Resources Natural and Synthetic Materials - How Humans Transform Nature's Resources (Miacademy & MiaPrep Learning Channel, 2026) Article: "Exploring Synthetic Materials, Environmental Impact, and Native American Wisdom" (Huff, 2024) Natural Resources, Synthetic Materials Claims, Evidence, Reasoning

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Day	Lesson Sequence	Notes
Day 1 40 min	Engage (Phenomena) Students examine everyday objects and discuss whether they are natural or synthetic. Indigenous Knowledge Connection: Many Indigenous cultures traditionally used materials such as: • Animal hides • Plant fibers • Natural dyes • Wood, bone, and stone These materials were: • Sustainably gathered • Carefully processed • Used with awareness of environmental impact <i>How are these materials different from modern synthetic ones?</i> <i>What might be the advantages and disadvantages?</i> Driving Question: <i>If synthetic materials do not occur naturally, where do they come from, and how have they changed our lives?</i> Procedure 1. Display several items made out of natural and synthetic materials around the room (Plastic water bottle, Nylon backpack, Polyester fleece, traditional leather pouch, Cotton fabric, wool sweater, potting soil, spandex, silk shirt, Dr. Pepper, cheese, wooden bat, silicone spatula, gold chain, agate, glass, lemonade, etc.).	Materials: Various everyday items representing natural and synthetic materials (wool sweater, potting soil, plastic bottle, spandex, silk shirt, Dr. Pepper, cheese, wooden bat, silicone spatula, gold chain, agate, glass, lemonade, etc) Modification suggestion: Choose natural materials traditionally used in the specific community.

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	2. Students complete a quick sort of the items displayed around the room into the following categories: ○ Natural Material ○ Synthetic Material ○ Unsure 3. Introduce a challenge: ○ <i>Trace a plastic bottle back to its original source.</i> ○ Give students 10 minutes of research time. 4. Students format a sequence showing the creation of a plastic bottle. For example: Crude oil → Chemical Processing → Polymers → Melting and Molding → Plastic Bottle 5. Analyze: ○ Is a water bottle made out of natural or synthetic material? ○ Does plastic originally come from nature? ○ What makes it synthetic?	
Day 2 50 min	Elder Ask an Elder to come to class and share: ● Traditional materials used for regalia ● How materials were gathered ● Why certain materials were valued ● Introduction of manufactured and synthetic materials ● How these changes affected the community	Modification suggestion: Ask an Elder to explain how a materials used to make specific item in their culture has changed with the use of synthetic materials.
Day 3-5 150 min	Explore Students rotate through stations to sort materials and test natural materials to compare properties.	Materials Natural ● Wool felt

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Station 1: Thermal Energy Insulation Test Which materials are the best insulators? Materials Natural • Wool felt • Cotton fabric • Feathers • Cork Synthetic • Polyester fleece • Acrylic felt • Styrofoam • Bubble wrap Procedure 1. Give each student a beaker and a material, ensuring each material is tested by at least one student 2. Wrap the identical beakers of hot water with the different materials. 3. Measure starting temperature. 4. Measure the temperature every minute for 20 minutes. 5. Have students share data, ensuring that all students have data for all materials 6. Students graph the data and compare heat loss. Station 2: Strength Test Which materials can withstand the greatest force? Materials Natural • Cotton fabric strips	• Cotton fabric • Feathers • Cork • Leather strips • Jute twine • Wood craft sticks • Paper towel Synthetic • Polyester fleece • Acrylic felt • Styrofoam • Bubble wrap • Nylon fabric strips • Polyester fabric strips • Nylon cord • Plastic craft sticks • Plastic sheet • Vinyl Other • Beakers • Thermometer • Graph paper • Colored pencils
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	● Leather strips ● Jute twine ● Wood craft sticks Synthetic ● Nylon fabric strips ● Polyester fabric strips ● Nylon cord ● Plastic craft sticks Procedure 1. Clamp the material between two supports. 2. Add weights gradually. 3. Record maximum weight before stretching, bending, or breaking. Station 3: Water Absorption Test Which materials absorb the most water? Materials Natural ● Cotton ● Wool ● Leather ● Paper towel Synthetic ● Polyester ● Nylon ● Plastic sheet ● Vinyl Procedure 1. Weigh dry samples.	● Clamps ● Supports ● Weights ● Digital scales Modification suggestion: Choose natural materials traditionally used in the specific community.
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	2. Soak for 2 minutes. 3. Remove excess water. 4. Weigh again. 5. Calculate water absorbed. Water Absorbed=Wet Mass–Dry Mass Analysis • Why were synthetic materials developed? • Why would you want to use a natural material? • Why would you want to use a synthetic material? If possible, connect the analysis questions to the Elder's presentation on traditional regalia materials (leather, wool, natural fibers) compared with modern synthetic fabrics.	
Day 6-7 100 min	Explain Students learn that synthetic materials are made from natural resources and analyze differences in properties, uses, and impacts. Procedure 1. Have students watch Natural and Synthetic Materials - How Humans Transform Nature's Resources (Miacademy & MiaPrep Learning Channel, 2026) 2. Read the article: "Exploring Synthetic Materials, Environmental Impact, and Native American Wisdom" (Huff, 2024) 3. Discuss Natural and Synthetic Materials a. <i>Why do you think people create synthetic materials instead of using only natural materials?</i> b. <i>Many synthetic materials begin as natural resources such as crude oil. Does knowing where a material comes from change how you think about using it? Why or why not?</i>	Resources: Natural and Synthetic Materials - How Humans Transform Nature's Resources (Miacademy & MiaPrep Learning Channel, 2026) Article: "Exploring Synthetic Materials, Environmental Impact, and Native American Wisdom" (Huff, 2024)

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	c. <i>Why might a fleece hoodie be made from polyester instead of cotton or wool?</i> d. <i>What are some positive and negative impacts that synthetic materials have on society and the environment?</i> e. <i>What are some examples where the benefits outweigh the drawbacks, or vice versa?</i> f. <i>If you were designing a new product, how would you decide whether to use a natural material or a synthetic material?</i> g. <i>What factors would you consider (cost, durability, environmental impact, availability, cultural significance, etc.)?</i> h. <i>Should society try to replace more synthetic materials with natural materials, or are synthetic materials too important to give up? Support your opinion with evidence from the video and your own experiences.</i> 4. Make Cornstarch Plastic (Norville, Kayla, 2024) Have students explore the process of making synthetic materials by making cornstarch plastic. Many synthetic materials are made from polymers. Some of these, like bioplastics, can be created by processing and heating chemicals derived from corn. You can form a polymer called polylactic acid (PLA) when the starch from plants like corn is broken down. It forms plastic-like materials. Materials ● Cornstarch ● Vegetable oil ● Water ● Ziplock bag	Materials ● Cornstarch ● Vegetable oil ● Water ● Ziplock bag ● Spoon ● Tablespoon measuring spoon ● Dropper ● Microwave ● Plastic plate
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	● Spoon ● Tablespoon measuring spoon ● Dropper ● Microwave ● Plastic plate Procedure 1. Take a tablespoon of cornstarch and put it in a Ziploc bag. 2. Now, pour a tablespoon of water into the same bag. 3. Squish it together. 4. Add 2 drops of vegetable oil. 5. Leave the bag partially open and place it on the plastic plate. 6. Microwave it for about 20 seconds. 7. Wait for it to cool, then record observations.	
Day 8-9 100 min	Elaborate Students design a material that meets human needs while considering environmental impacts. Performance Task: Design a material for a backpack that meets human needs while reducing environmental impact. Procedure 1. Students choose materials (natural, synthetic, or a combination) 2. Students write a design proposal, answering the following: a. <i>Where do the materials come from?</i> b. <i>Why are they useful?</i>	

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	<i>c. What environmental and societal impacts do the materials have when used?</i> 3. Students create a labeled diagram. 4. Students write a comparison to existing products. 5. Students write a cultural reflection. <i>a. How might Indigenous knowledge guide better material choices?</i> <i>b. What does it mean to use resources responsibly?</i>	
Day 10 30 min	Evaluate Using the Claims, Evidence, Reasoning (CER) format, students explain how synthetic materials come from natural resources and use evidence to describe their impacts on the environment. 1. Give the students the following guiding question: <i>How do synthetic materials affect the environment?</i> 2. Give the students the following statement to use as the Claim: <i>Synthetic materials affect the environment because they are made from natural resources. Synthetic materials provide useful products for society, but they can also contribute to environmental pollution and waste.</i> 3. Using all of the information gained from this lesson, students write a statement of Evidence. They may use the sketch part of the CER to illustrate their evidence. 4. Using all the information gained from this lesson and critical thinking, students will write their Reasoning, illustrating their ideas with a drawing.	Resources Natural Resources. Synthetic Materials Claims, Evidence, Reasoning

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Article:

Exploring Synthetic Materials, Environmental Impact, and Native American Wisdom (Huff, 2024)

The New York World's Fair of 1939-40 was one of the greatest expositions the world had ever seen. It was also the first chance to see nylon, the world's first fully synthetic man-made fiber. Nylon stockings went on to become a huge success and sold 64 million pairs in their first year alone. Nylon is a synthetic material. It is used in many of the things we use today, including carpets, clothing, furniture, instrument strings, and automotive parts.

Synthetic materials are man-made. We can use many natural resources and change them into synthetic materials. For example, sand, which is natural, can be heated and made into glass. The glass comes from sand, which has been melted and cooled. The molecules that make up the glass are still the same as they were in the sand. Another example is wood, which is natural and can be made into paper. Synthetic materials can be created by combining chemicals and natural resources in a laboratory.

To create synthetic materials, a scientist regroups atoms and molecules. This regrouping causes the molecules to have a different structure. Because the molecules have a new structure, the new substance has different properties. This regrouping of atoms and molecules also causes a chemical reaction. Chemical reactions can create new substances with different properties.

Natural resources are those found in nature and have not been made by humans, such as plants, rocks, and water. Sometimes humans may have to dig natural resources out of the ground, grow them, or take them from living things. For example, an apple is a natural resource because it is not made by humans but grows on an apple tree.

If you trace what something is made of far back enough, you will find that all of the substances used to make that product come from our world. They may originally come from plants, animals, or the earth. Natural resources can be combined, mixed, heated, or treated in a combination of ways to produce synthetic materials with changed or enhanced properties.

In science, a synthetic material is one in which the starting substances are changed chemically to produce a material with different properties. A common example is plastic. To make plastic, petroleum is processed and chemically changed.

Currently, most synthetic materials come from petrochemicals. Petrochemicals are made from fossil fuels, such as coal or natural gas. Petrochemical production involves the processing of oil.

Petrochemicals are not biodegradable. When a substance is biodegradable, it means that living organisms such as bacteria can break it down in the environment. Having more synthetic

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materials that are biodegradable can reduce the negative impact on the environment and our ecosystems.

Today, many paints are synthetic materials because they are made from polymers, resins, and solvents such as petroleum. Synthetic paints are used for painting both interior and exterior surfaces. Examples include walls and ceilings in your home, automobiles, boats, kitchen appliances, and furniture.

Some supporters of the use of petrochemicals say that they create valuable consumer products that we need, including electronics, cars, and plastic containers. They argue that the economic benefits of petrochemicals include lower prices for products and higher-paying jobs for people.

Some opponents of the use of petrochemicals say that they have a negative environmental impact because animals die when they consume plastics that contain petrochemicals. They argue that products made with petrochemicals cause serious environmental hazards because they are not biodegradable and cannot be composted.

Native Americans hold a deep reverence for the environment. They believe that all objects and elements of the earth—both living and nonliving—have an individual spirit that is part of the greater soul of the universe. An important part of Native American culture is respecting and honoring the spirit of the land and everything that it provides them.

Native American communities have a strong connection to nature. They use plants and animals in a way that limits impact on the environment, always paying attention to the changing seasons and how all living things interact with one another. This mindful way of using natural resources is a big part of their culture and creation stories. They even make paint using natural resources, and they do it in a way that helps keep the environment healthy.

Native Americans made various types of paint depending on the natural resources available. The paint had a variety of daily uses, including decorating totem poles. By decorating the totem poles with natural resources, Native Americans were limiting their impact on the environment and society in a negative way.

Natural Resources, Synthetic Materials - Resources Claims, Evidence, and Reasoning Graphic Organizer

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