

Material Properties

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Host Organization: Stanford University

ETP Type: Classroom

Subject/Grade: Science/2nd Grade



Abstract

Matter is all around us. Many students intuitively know that wood is harder than dough. This lesson gives them the starting foundation for understanding how scientists look at materials and decide what category they fit into. First, students examine what the ways that scientists look at and organize materials and what those labels mean. Then, they start to organize the materials themselves into different categories. The lesson is part of a unit on materials science or the properties of matter that will culminate with students creating a model to withstand the various levels of wind from a fan (or the breath of the Big, Bad Wolf!).

Focal Content & Supporting Practices

21st Century Skills and Applications

Obtaining, evaluating and communicating information -- Students will find items around their house to describe the material properties of. Then they will evaluate those materials given the worksheet. Finally, they will present their findings from their homes to their classmates whenever they return to class.

Measurable Objective(s)

SWBAT organize materials based on given criteria.

NGSS:

2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. [Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]

2-PS1-2 Analyse data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.]

Formative Assessment(s)

Worksheet filled out in class

Summative Assessment(s)

Worksheet filled out at home on their own

Fellowship Description

I am working with the Hong Neurotechnology Lab on Neural Interface technologies. The lab works on developing new tools based on the latest materials to figuring out a way to interface the brain's neurons at the single neuron level as a way to better understand brain functioning and the ultimate goal of interfacing the brain and computers for use in patients suffering from Alzheimer's and Parkinson's

diseases as well as applications for those with traumatic brain injuries. One of the papers out of the lab spoke about how the lab created a mesh interface to deliver light impulses to the eyes to stimulate the nerves.

During my fellowship, I am learning about the group's inner workings, reading about the basics of neural science and materials science as well as participating in conversations on current research available. I am learning a lot about the fields of both neural and materials science. One of my goals is to be able to translate this information through relevant lessons to lower school students to get them excited about neuroscience and/or materials science as a possible career.

In addition, I am witnessing 21st Century skills in the actions of the group -- attention to detail, group work, building on known strengths for each person, information analysis, flexibility and adaptation (given the current coronavirus constraints), as well as initiative and self-direction.

Fellowship Connection to School/Classroom

In the second grade, students study the properties of materials.

There are many 21st Century skills that are used in the lab that I will continue to emphasize and use in my classroom -- communication in group work where each person is respected for what they can bring to the project; flexibility in an environment that is a new normal for us all and the creativity needs to adapt your work to that environment; and the importance of taking initiative and self-direction.

I would also like to get at least one researcher from the lab to speak to the students virtually about their journey into their field and their work in materials science. Being able to see and hear from researchers like them in the field doing such incredible work will be exciting and inspiring!

Host Organization Engagement

As I am uncertain how the year is unfolding as of yet in terms of timing of classes as I will be embedded with a different grade level every 4 to 5 weeks, I would like to have a member of the lab speak to the students about their experiences and work with materials science.

Instructional Plan

Understanding by Design Lesson Plan by Marcia Tate (40-minute lesson)	
Unit Title: Material Properties	Lesson Title / Number: Material Properties
UNDERSTANDING(S) in lesson: Different materials have different properties. NGSS - 2-PS1-1 Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties (i.e., color, texture, hardness, flexibility.) Look for patterns	ESSENTIAL QUESTION(S) in lesson: How are materials the same and different?
KNOWLEDGE in lesson: Vocabulary for new terms How to observe objects	SKILLS in lesson: - Planning and carrying out investigations - NGSS Science and Engineering practices - Patterns - CCC - Different materials have different properties, such as melting points. - DCI

ASSESSMENT: <i>Describe connection to unit performance task/summative</i> At the end of the unit, students will be asked to build a house that can withstand the breath of the Big Bad Wolf (a fan at high speed) from the story of “The Three Little Pigs.”		ASSESSMENT: <i>Formative / checks for understanding</i> SWBAT complete a list of properties for materials and describe patterns they see.
HOOK for lesson: <i>How will you gain and maintain students’ attention? (Consider need, novelty, meaning, or emotion)</i> Gallium is a metal whose melting point is 29 degrees Celsius. Bring out shapes of Gallium for the students to observe first and have them look at it carefully while holding it in their gloved hands. It will melt. Seeing a metal melt in their hands is unique for most students.		
CHUNKS for lesson: <i>How will you divide and teach the lesson to engage students’ brains?</i>		
Lesson Segment 1 Activities:	Open by telling students that today we are going to look at the properties of materials. Hand out the list of new vocabulary and review it with students. Have the lists pre-cut so that they can just glue it in their science notebook. Have them draw pictures of each property as you work through them.	
Process / Movement		
Lesson Segment 2 Activities:	As students are finishing gluing in their vocabulary words, hand out a sheet with the characteristics and five items for them to investigate. Tell them you are going to do the first item together -- make that item the gallium shape you have chosen. (Make gallium any shape you want at its melting point, then place it in the refrigerator before giving it to students.) Hand out gloves to students who will be holding it in their hands. The Gallium will melt. Watching what a metal melt in their hands will be a unique hook for most students. Talk about the properties of that material. Have students make the notes on their sheet of paper.	
Process / Movement		
Lesson Segment 3 Activities:	Have students continue to observe and classify the different objects you have put on the table. Walk around to observe how they are talking about the materials. Question their observations. See if they notice any patterns. Allow students to look at materials for 15 minutes.	
Process / Movement		
Lesson Segment 4 Activities:	Bring students back together and talk about patterns among the items they may have noticed, i.e., Which ones are hard? Which ones are soft? Which ones bend easily? Which ones might be good to build with? etc.	
Closure:	Have students gather the materials and return them into the containers that you put them out on at the center of the table.	
Materials/Resources:	● Gallium 50 grams with science info silicon molds \$24.99 https://www.amazon.com/Gallium-Liquid-Metal-99-99-Melting/dp/B07MM31R3W/ref=sr_1_2?dchild=1&keywords=gallium&qid=1594333515&sr=8-2 ● Dinosaur cookie cutters \$10 (to mold Gallium) https://www.amazon.com/Dinosaur-Cookie-Cutter-Recipe-Book/dp/B07JPKMGD/ref=sr_1_4?dchild=1&keywords=small+dinosaur+cookie+cutters+for+kids&qid=1594333473&sr=8-4 ● Gloves for each student ● Sticks (from your backyard if possible) ● Bricks and/or rocks ● Aluminum foil ● Feathers ● Clay	

	• Sponge • Trays or bins to put materials in for each desk • Copper Foil Reference: https://www.thoughtco.com/melt-gallium-metal-in-your-hand-607521
Homework/estimate time to complete:	Have students observe and categorize three items in their house using the materials sheet and upload it to SeeSaw. Next time we are together, have a scientist come to speak with the students about materials science.

Brain-Compatible Strategies: *Which will you use to deliver content?*

- | | |
|---|---|
| ☒ Brainstorming/Discussion | ☐ Drawing/Artwork |
| ☐ Field Trips | ☐ Games |
| ☐ Graphic Organizers/Semantic Maps/Word Webs | ☐ Humor |
| ☒ Manipulatives/Experiments/Labs/Models | ☐ Metaphors/Analogies/Similes |
| ☐ Mnemonic Devices | ☐ Movement |
| ☐ Music/Rhythm/Rhyme/Rap | ☐ Project/Problem-Based Learning |
| ☐ Reciprocal Teaching/Cooperative Learning | ☐ Role-play/Drama/Pantomime/Charades |
| ☐ Storytelling | ☐ Technology |
| ☐ Visualization/Guided Imagery | ☐ Visuals |
| ☐ Work Study/Apprenticeship | ☒ Writing/Journals |

In-Person Enhancements

Have students hold gallium to have it melt in their hands and have them bend copper foil to see how its strength actually increases not decreases.

Supply List

If in-person:

- Gallium 50 grams with science info silicon molds \$24.99
https://www.amazon.com/Gallium-Liquid-Metal-99-99-Melting/dp/B07MM31R3W/ref=sr_1_2?dchild=1&keywords=gallium&qid=1594333515&sr=8-2
- Dinosaur cookie cutters \$10 (to mold Gallium)
https://www.amazon.com/Dinosaur-Cookie-Cutter-Recipe-Book/dp/B07JPKKMGD/ref=sr_1_4?dchild=1&keywords=small+dinosaur+cookie+cutters+for+kids&qid=1594333473&sr=8-4
- Gloves for each student
- Sticks (from your backyard if possible)
- Bricks and/or rocks
- Aluminum foil
- Feathers
- Clay
- Sponge
- Trays or bins to put materials in for each desk
- Copper Foil

References

Anne Marie Helmenstine, Ph.D. "How to Melt Gallium Metal in Your Hand (Safely)." ThoughtCo, 11 Feb. 2020, www.thoughtco.com/melt-gallium-metal-in-your-hand-607521.

Pulled lesson followup from Generation Genius video on Material Properties and Purposes

<https://www.generationgenius.com/?share=8909D>

<https://www.generationgenius.com/videolessons/material-properties-and-purposes-video-for-kids/>

Keywords

Properties of Materials, Properties of Matter

Links to Files in this ETP

Vocabulary for Properties of Matter:

https://docs.google.com/document/d/1tM_ipdGaVucMSdCP8AHwhdGQObqUMoZ2PtXpj1xAodg/edit?usp=sharing

Properties of Matter sheet for class:

https://docs.google.com/document/d/1YPIJXCiA93xnGVmG9WNIY_LmAT6tMo4uuy6gOM06DEs/edit?usp=sharing

Properties of Matter sheet for home:

<https://docs.google.com/document/d/1WEVDrJ7RCdDjBfidQIOKSHCwNwyow5symD6wBEoJHa4/edit?usp=sharing>