Unit 1 (Materials): Special Properties of Materials

Concept

Materials have properties that can be observed; elasticity is stretching and returning to original shape; shear strength is resistance to tearing; tensile strength is the ability to resist pulling forces; compressive strength is the ability to resist pushing forces.

Content Objective

Students classify materials according to properties of elasticity, shear strength, and tensile and compressive strength; teams name positive ways to communicate.

Language Objective

Explain material properties *using target vocabulary*: property, shear strength, elastic, compression, tension. Write a description of materials using target academic vocabulary. Contrast material properties using *transitions* that signal difference: *but, while, whereas, however.*

Standards

- NGSS:
 - o **2-PS1-1.** Plan and investigate kinds of materials and their observable properties.
 - 2-PS1-2. Analyze data from materials to determine which have best properties for an intended purpose.
 - **K-2-ETS1-3.** Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses.

• TEKS:

- **2E** communicate observations and justify explanations using student-generated data from simple descriptive investigations (justify explanations of own data)
- **2F** compare results of investigations with what students and scientists know about the world (compare with other findings)
- 4A collect, record, and compare information using tools, including computers, hand lenses, rulers, primary balances, plastic beakers, magnets, collecting nets, notebooks, and safety goggles; timing devices, including clocks and stopwatches; weather instruments such as thermometers, wind vanes, and rain gauges; and materials to support observations of habitats of organisms such as terrariums and aquariums (use tools)
- **5A** classify matter by physical properties, including shape, relative mass, relative temperature, texture, flexibility, and whether material is a solid or liquid (phy prop: shape, mass, temp, texture, flexibility, solid v. liquid)
- **5C** demonstrate that things can be done to materials to change their physical properties such as cutting, folding, sanding, and melting (phy changes in materials)

- ELPS:
 - **1E** internalize new basic and academic language by using and reusing it in meaningful ways in speaking and writing activities that build concept and language attainment (internalize vocabulary through meaningful use)
 - **3E** share information in cooperative learning interactions (share information in cooperative learning)
 - **5B** write using newly acquired basic vocabulary and content-based grade-level vocabulary (write using content-based vocabulary)
 - 5F write using a variety of grade-appropriate sentence lengths, patterns, and connecting words to combine phrases, clauses, and sentences in increasingly accurate ways as more English is acquired (write using a variety of patterns, connecting words, clauses)

Materials:

Stuffed animal; Cloth samples; recycleds (esp. wood, plastic, rubber); cooked and raw spaghetti and rice noodles; clay; paper clips; balloons; Nerf[™] ball; styrofoam pellets or peanuts; rubber band

Suggested Literature Connections

"Properties of Matter" by Katie Dicker "Properties of Matter" by Rebecca E. Hirsh

	Teacher Says/Does	Student Says/Does	Language requirements
1.	Using a stuffed animal, pretend to bend it, stretch it, and squeeze it. Have students think of hand motions to represent these three forces. With students standing at a safe distance from each other, perform the motions and repeat the words: <i>bend, stretch, squeeze</i> . Use handout (2.1.1) as a reference.	Students create hand motions and perform them while practicing the words: bend, stretch, and squeeze.	Vocabulary: Bend, Stretch, Squeeze
2.	 Explain that each group of four students will receive a bag of materials (recycled materials, clay, bread, rubberbands, marbles, etc.). Have students think of ways to sort the items according to the different forces (bend, stretch, squeeze). As the students work, ask questions like: <i>"Why can some things be squeezed and others can't?"</i> <i>"Are there items that could fit into more than one group?"</i> 	objects.	
3.	Using handout (2.1.2), introduce the idea of materials— that materials are used to make things, and that things often have special properties, like squeezability—because of their materials. You may show the following video of materials as well: <u>https://www.youtube.com/watch?v=xOKr462HLc0</u>		
4.	Explain that all materials have properties, <i>propiedades</i> , and that in this context, properties means something different from 'belongings' (As in, "Hey, that's my property!"). Here, properties are characteristics, <i>características</i> , meaning how a material is and how it reacts.	Students perform hand motions for bend, stretch, and squeeze.	
5.	Remind students of the hand motions for bend, stretch, and squeeze.		

Day 1: Engage/Explore Materials-Special Properties of Materials

6.	Pass out Properties of Materials Chart handout (2.1.3) and tell your class that you will fill it out as a classroom and will be using it for the next couple of days. Let them know that today they will focus on thinking of other properties aside from <i>bend</i> , <i>stretch</i> , and <i>squeeze</i> .	Student pairs discuss additions to the attribute chart.	Vocabulary: Elasticity We would add as a property because
7.	Introduce a new property: elasticity, and tell your students that elasticity is the ability to stretch or be squeezed and return to its original size and shape. Demonstrate the elasticity of a rubber band. Also, add elasticity to handout (2.1.3). (This is done on the first row).	attribute chart.	·
8.	Have students discuss with a partner what other properties they might add to the chart and add them as a class. They may use handout (2.1.2) as it also contains some examples of properties. Possible additions include: <i>Rough</i> <i>Waterproof</i> <i>Moldable</i> <i>Flexible</i> 		
9.	Recall the properties that were introduced with their corresponding gestures as well as the ones added to the chart by the students.		

Teacher Says/Does	Student Says/Does	Language requirements
 Show the students the materials available and tell them that they will look through the materials and find examples of things that have properties like the ones they identified the day before. The students should collect items from around the room, then come together after fifteen minutes and share what they have found. 	Student pairs sort objects provided and found around the room.	
 2. Have the students form teams of two. Remind the teams that partners are responsible for good teamwork, and that they must talk to each other and plan together in order to be a good team. As the students are working, note groups that have identified the following properties and encourage them to share later in the lesson: Elastic- the ability to stretch or be squeezed and return to its original size and shape Shear Strenght-resistance to tearing or shearing Compressible- the act of applying pressure Withstand tension- the act of stretching something tight 	Students record their observations on the attribute chart.	
3. Call the students back to the whole group and explain that you will continue filling out the attribute chart (2.1.3) together. Use a document camera (doc cam) or projector and fill out the attribute chart as students fill out their own paper copies. Model how to complete the chart with one item, using check marks √to show properties of the material, and X's to show properties that the material does not have.	Students describe the properties of an object.	The is so that
 4. Have the teams present one object that they found. Be sure to have at least one team demonstrate: One item that is elastic and why they think it is made to be that way; One item that has shear strength and why; 		This is a It is because it needs to

Day 2: Explore/Explain Materials-Special Properties of Materials

 An item that can be compressed, and; One that withstands tension forces. As the groups present, encourage them to use the sentence frames. 	
 Introduce the new vocabulary words using handout (2.1.4): compression, tension, shear strength when the groups discuss these properties. Have students repeat these words and record them on the attribute chart (2.1.1). 	

	Teacher Says/Does	Student Says/Does	Language requirements
1.	Review the hand motions for bend, stretch, and squeeze. Have students create additional motions for elasticity and shear strength. Ask about the difference between elasticity (can stretch and return to its original state) and stretchability (can stretch but does not return to its original state).	Students perform original hand motions and create new ones for the new vocabulary words. Student pairs discuss	Vocabulary words: but, while, whereas, however
2.	Show the video on structures and forces: <u>https://www.youtube.com/watch?v=8IN544ZKzmQ</u>	similarities and differences between their hand motions and the video.	Theis/has but the
3.	Ask how the students' hand motions compare to the animation in the video. Introduce the difference transitions: but, while, whereas, however. Tell students that they can use these words when talking about two different properties.	Students draw and write about materials in a familiar setting.	Theis Theis However, theis
4.	Tell students that they will now think about a place that they know well (i.e. their room, kitchen, a park, playground, supermarket, etc.). They will work with a friend to draw different properties of materials found in that place using handout (2.1.5).		While theis/has , the is/has

Day 3: Elaborate/Evaluate Materials-Special Properties of Materials

To bend. To stretch. To squeeze.

Bend	Stretch	Squeeze	
movement that causes the formation of a curve	the act of physically reaching or extending out	the act of gripping and pressing firmly	

Different types of Materials



Name: _____ Date: _____

Properties of Materials Chart

	Properties				
	Bend	Squeeze	Stretch	 	
ials					
ater					
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(Teacher Example)

Properties of Materials Chart*

		Properties						
		Bend	Squeeze	Stretch	waterproof	<u>soft</u>	<u>rough</u>	comestible
	Bubble gum	√	1	<i>✓</i>	√	\checkmark	×	
	Teddy Bear	×	\checkmark	×	×	\checkmark	×	×
ials	Stapler	×	×	×	1	×	×	×
ater	Journal		×	×	×	×	×	×
Ĕ	Crayons	×	×	×	1	×	×	×
	Rubber Band	×	×	<i>✓</i>		×	×	×
	Lego	×	×	×		×	×	×
	Napkin	√	√	×	×	~	×	×

*Note that this is just an example and is likely that your class will produce different charts with different materials and properties. Don't focus too much on accuracy of their labeling but rather on concept understanding-materials are around us and they all have various properties.

Engage/Explore

Additional properties



Name:	Date:
Living with Materi	als and Properties!
The place that my partner and I chose is	(Draw your place with materials and properties here)
Some of the materials located at that place are, , and 	
Several properties of those materials are, , and	