Design Technology in Engineering education for English Learners: Project DTEEL

NSF DRK-12 # 1503428

University of Texas, Austin

First Grade
Lesson Plans
Units 1-8

DTEEL First Grade Lessons

Unit 1 (Materials):
Natural, Processed, and Synthetic Materials

Concept
Materials that we use can be sorted into natural and synthetic groups according to how we think they were made. Some synthetic materials can be recycled and made into new things, while others cannot.

Content objective
Students identify and sort objects into groups according to natural, processed, synthetic and then recyclable and non-recyclable classes.
Students will identify characteristics of natural, processed and synthetic materials.
Students will sort different everyday objects into those made by people and those made by nature

Language objectives
Students will make descriptions about everyday objects
Students will be able to discuss the differences between natural, processed and synthetic materials
Students will use the words "natural", "processed" and "synthetic" when discussing everyday objects

Standards
- **NGSS**
  - **K-2-ETS1-1** Ask questions, make observations, and gather information about a situation people want to change to define a problem that can be solved with a new or improved object or tool.
- **TEKS**
  - **1C** Conducts classroom/ outdoor investigations safely; uses environmentally appropriate/ responsible practices (Conserves)
  - **4A** Uses age-appropriate tools and models to investigate the natural world (Uses tools)
  - **5A** Knows that objects have properties and patterns (Classify objects)
- **ELPS**
  - **1A** Use prior knowledge and experiences to understand meanings in English. [Prior knowledge]
  - **2A** Distinguish sounds and intonation patterns of English with increasing ease [phonological awareness]
  - **3G** Respond orally to information presented in a wide variety of print, electronic, audio, and visual media to build and reinforce concept and language attainment
  - **3D** Speak using grade-level content area vocabulary in context to internalize new English words and build academic language proficiency [Application for Acquisition]

Suggested Literature Connections:
“Beautiful Oops!” by Barney Saltzberg

Materials: Real objects, and printed pictures of objects, that represent a variety of materials. Samples may include: hardwood, softwood (pine), plywood, leaves, flowers, corrugated cardboard, plastic containers, paper, rubber eraser, plastic buttons, beads, different types of cloth, pencils, paper clips, paper cups, paper, tops of ballpoint pens, styrofoam pellets, dominoes, marbles, etc.

Day 1: Engage/Explore *Materials-Natural, Processed and Synthetic Materials*

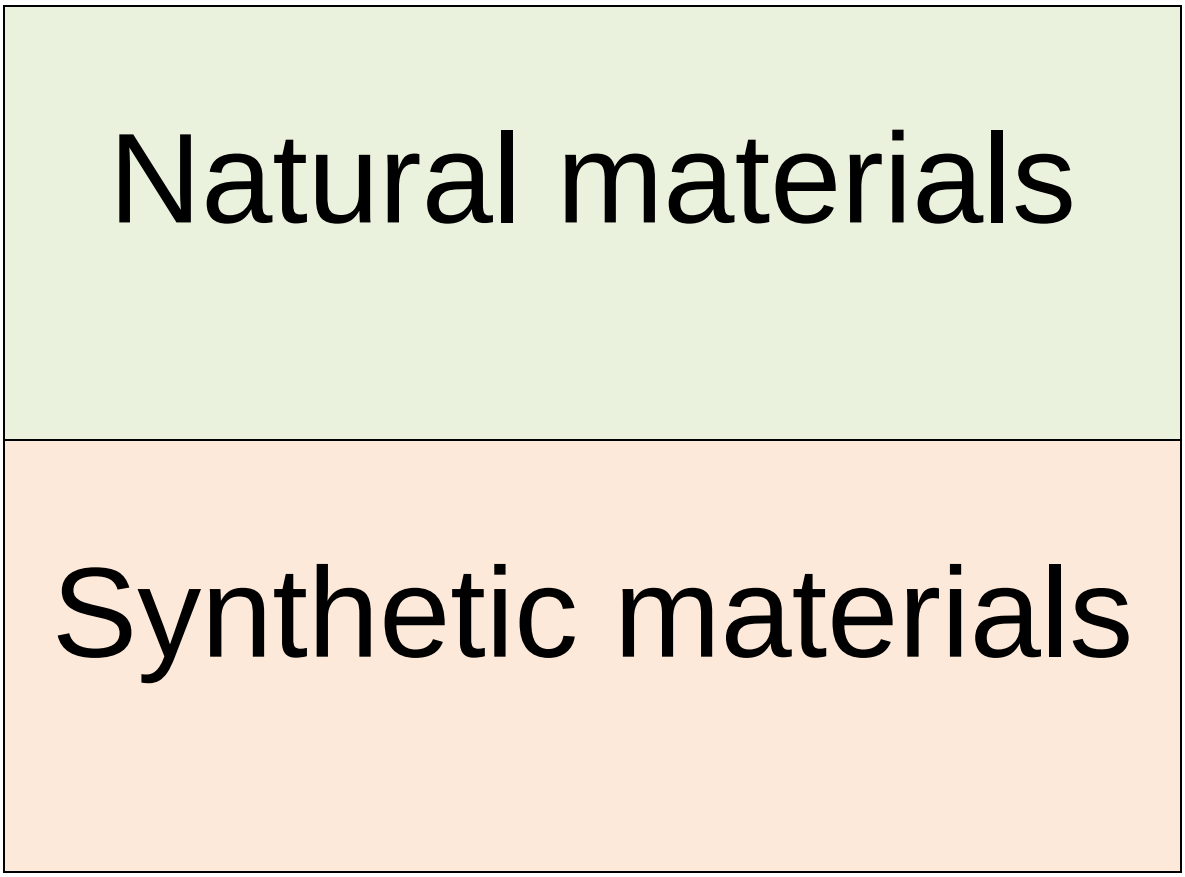
Teacher Says/Does	Student Says/Does	Language requirements
1. Show this video: https://www.youtube.com/watch?v=BF8ssC64c6A 2. Ask student pairs to identify objects in the video that are made by people, and objects made by nature. Then share with the class. 3. Discuss how some things, like wood, are made by nature, and people make others, like the plastic in a water bottle. Invite students to point out and name objects in the classroom made by people and those made by nature (things made by nature might include stones, plants, and animals such as your classroom pets). 4. Gather all students on the rug and show a few objects from the materials list. Ask questions (previously written on the board): *what is this? Is it made by nature or by people?* Tell them that materials made by nature are called *natural* materials; materials made by people are called *synthetic* materials. 5. Place category cards (**1.1.1**) at the top of a pocket chart. Divide the students into pairs and give each pair one picture (either pre-printed by you or use those in **1.1.3**). 6. Show students the sentence frames from the handout (**1.1.2**) Have pairs look at the picture, decide which sentence frame to use, and have one member share with the class using the picture given. Have the other member of the same pair put their picture under the correct category on the pocket chart.	**Whole-group**: Students talk about objects made by nature, and objects made by people. Student pairs analyze pictures of everyday objects Students pairs use sentence frames to describe objects made by nature and those made by people. Students pairs categorize objects. Students watch a video and share one thing they saw.	This is a_____ Nature made_____ People made _____ _____ is a natural material because it is made by _____. _____ is a synthetic material because it is made by _____.

Day 2: Explore/explain *Materials-Natural, Processed and Synthetic Materials*

Teacher Says/Does	Student Says/Does	Language requirements
1. Present an object or a picture of a plastic bag and a water bottle. Ask students: • *Is plastic present in the bag?* • *Is plastic present in the water bottle? what material is in both objects?* 2. Lead students to see how plastic can be present in several objects, like in a water bottle and in a shirt button. Ask volunteers to share two objects made from wood in the classroom. Say "_____ and _____ are both made from wood" 3. Organize students into pairs. Pass out one word card from handout (**1.1.4**) to each group with one of the following words: wood, plastic, metal. Tell them they will watch a video and will need to remember two objects made from the material given to their group. Show them this video: https://www.youtube.com/watch?v=WinXpFTempo 4. Ask student pairs to share two objects in the video made from the material given using the same sentence frame from earlier.	Students demonstrate understanding that one material can be present in several objects, and one object can be made of several materials. Student pairs share with a partner two objects in the video that have the same material Students individually identify two objects per category and respond to questions using sentence frames. Student pairs identify objects made of more than one material.	**Vocabulary:** wood plastic metal fabric Natural Synthetic _____ and _____ are both made from wood. _____ and _____ are both made from metal. _____ and _____ are both made from plastic. (A) _____ is made from _____ and _____.

Day 3: Evaluate *Materials-Natural, Processed and Synthetic Materials*

Teacher Says/Does	Student Says/Does	Language requirements
1. Organize students into pairs and give each pair paper and crayons. Ask students to create a poster classifying materials into "natural" and "synthetic". Try to pair ELs so they can get support from native peers. 2. Tell them they can draw or write the names of objects on their paper. 3. Have sentence frames displayed for students to use (see handout **1.1.5**). Tell them they have to use at least two sentence frames from the ones displayed. 4. Move around to support students as they prepare their presentations.	In pairs, students classify materials using new vocabulary and make presentations to the class.	Students make presentations using the following phrases: We learned that _____ materials are made by nature. We learned that _____ materials are made by people. Two examples of synthetic materials are _____ and _____. Two examples of natural materials are _____ and _____. Two objects made from wood that we found are _____ and _____ Two objects made from metal that we found are _____ and _____. Two objects made from plastic that we found are _____and_____.


Natural materials
Synthetic materials

_____ is a ***natural*** material because it is made by _____.

_____ is a ***synthetic*** material because it is made by _____.

Name: _____ Date: _____





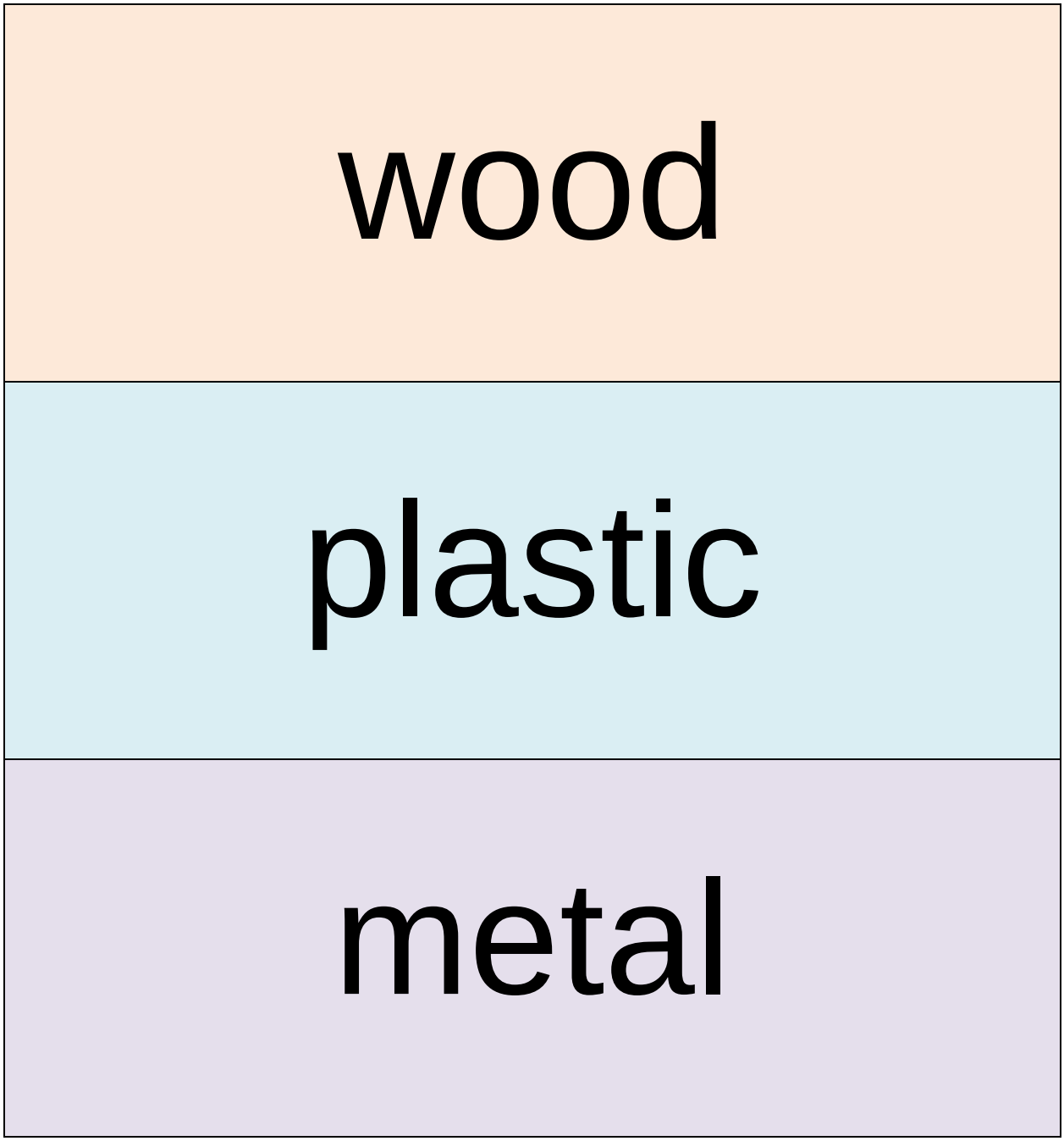











wood
plastic
metal

Name: _____ Date: _____

We learned that _____ materials are made by nature.

We learned that _____ materials are made by people.

Two examples of synthetic materials are _____ and _____.

Two examples of natural materials are _____ and _____.

Two objects made from wood that we found are _____ and _____

Two objects made from metal that we found are _____ and _____.

Two objects made from plastic that we found are _____and_____.

Unit 2 (Materials):
Properties of Natural, Processed and Synthetic Materials

Concept
Materials have properties that make them suitable for special uses. Some important properties are durability, strength and elasticity.

Content objective
Properties of durability, strength, and elasticity are explored by student teams using different natural, processed and synthetic materials.

Language objectives
Students will orally describe materials that are durable, strong, and elastic to a partner
Students will get understand the meanings of the words: durability, strength, and elasticity
Students will write sentences about the properties of objects using target vocabulary

Standards

- **NGSS**
  - **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 provide reasons for explanations using student-generated data from simple descriptive investigations (Communicate result from own data)
  - **3B** make predictions based on observable patterns (Predict from Patterns)
  - **5A** (classify objects by observable properties of the materials from which they are made such as larger and smaller, heavier and lighter, shape, color, and texture (Classify objects)
- **ELPS**.
  - **4C** Develop basic sight vocabulary, derive meaning of environmental print, and comprehend English vocabulary and language structures used routinely in written classroom materials
  - **3D** Speak using grade-level content area vocabulary in context to internalize new English words and build academic language proficiency [Application for Acquisition]
  - **3H** Narrate, describe, and explain with increasing specificity and detail as more English is acquired.
  - **5B** Write using newly acquired basic vocabulary and content-based grade-level vocabulary

Suggested Literature Connections:
"The Three Little Pigs" illustrated by Mei Matsukoa

Materials:
Magazines and catalogs to cut pictures from, scissors, objects found during previous activity; elastic bands, belts, paper cups, pens, sheets of paper; Phrase cards titled: "will last a long time", " will not break", "will bend back and forth" (or you may use the ones included in handout **1.2.2**)

Day 1: Engage *Materials-Properties of Natural, Processed and Synthetic Materials*

Teacher Says/Does	Student Says/Does	Language requirements
1. Organize students in pairs and give each pair objects (or pictures from Handout **1.2.1**). Ask them: *What do you know about these objects?* Ask a few partners to share their ideas with the large group. 2. Chorally read the three phrase cards from the Handout (**1.2.2**): "will last a long time, "will not break", and "will bend back and forth" 3. Place the cards on different places in the classroom so that they are accessible for students to read. 4. Ask students: *Which materials do you think will last a long time?* Ask students who have cards with materials that they think will last a long time put them next to the phrase card "will last a long time". Do the same for the other two phrase cards: "strong" and "will bend back and forth" 5. Have students watch this video: https://www.youtube.com/watch?v=TzR9fXL-Obo 6. Make a chart with three categories: "will not break", "will last a long time" and "can bend back and forth". Ask students questions like *How do you know if an object will last a long time?* and record students' responses under each category: *"because it is old and it looks pretty new"*. Record at least three descriptions from students under each category.	Students talk about objects or pictures. Students analyze each object or picture and decide if it "will last a long time", "will not break", or if it "will bend back and forth" Students share one thing they observed in the video Students generate explanations for each category based on their prior knowledge	

Day 2 & 3 Explore/Explain *Materials-Properties of Natural, Processed and Synthetic Materials*

Teacher Says/Does	Student Says/Does	Language requirements
1. Tell students that they will work with materials that they think will last a long time (have durability), are strong (have strength), and bend back and forth without breaking (have flexibility). 2. Organize students into groups and give each group objects made from different kinds of materials: an elastic band, a belt, a paper cup, a pen, a sheet of paper (or pictures from the Handout **1.2.1**). Tell students that they will test objects to see if they are strong, last a long time, and to see if they can bend. 3. Display cards with the words" strong", "durable" and "elastic" (see Handout **1.2.3**). Write the descriptions for each word on the chart. Tell students you can use those words to describe objects too. 4. Demonstrate examples of tests that show durability: a pair of jeans you wear for many months and they don't wear out. Talk about things from your experience that don't wear out. Use the word durable. Likewise ask the children to talk about things that are strong, and then that are flexible. 5. Ask the teams to test objects for those properties, giving each team one property to investigate. Ask each team to state the property that it will investigate and what the word means, using descriptions from the chart displayed before. They should then find three objects which they think have the property. Have the same teams investigate another property, collecting materials or pictures, then drawing or writing the name under each category in a chart. Have teams investigate the third property, again, collecting materials or pictures, then drawing or writing the name under each category in the same chart as before. 6. Ask students to identify the properties of objects using the grid from the handout (**1.2.5**). Ask students questions like:	Students talk about objects they know Students sort pictures of materials into strong, long lasting, flexible. Students analyze properties of objects	**Vocabulary:** Durability Strength Flexibility Sentence frames: "___ is durable" "___ is strong" "___ is flexible"

Teacher Says/Does	Student Says/Does	Language requirements
Which object is durable? Which is durable and flexible? Which object is flexible but not durable? 7. Ask students to describe objects using the sentence frames from handout (**1.2.4**). 8. Ask the children to talk about how they did each test on the materials and their results.	Students discuss how they did their tests.	

Day 4 Elaborate/Evaluate *Materials-Properties of Natural, Processed and Synthetic Materials*

Teacher Says/Does	Student Says/Does	Language requirements
1. Take the class for a walk to identify objects that they like. 2. Review the meaning of the words: recyclable, natural, processed, synthetic (see handout **1.2.6**) and durable, strong, flexible (see handout **1.2.3**). 3. Ask students to choose properties to invent an object, using handout (**1.2.7**). 4. If time permits, do a matching activity where one third of the students have a card with an adjective, another third has a description, and the other third has a picture, or organize into groups where they make a drawing for an object that has one property and they write a description for the object using sentence frames. Have groups rotate so they see the work of the other groups.		

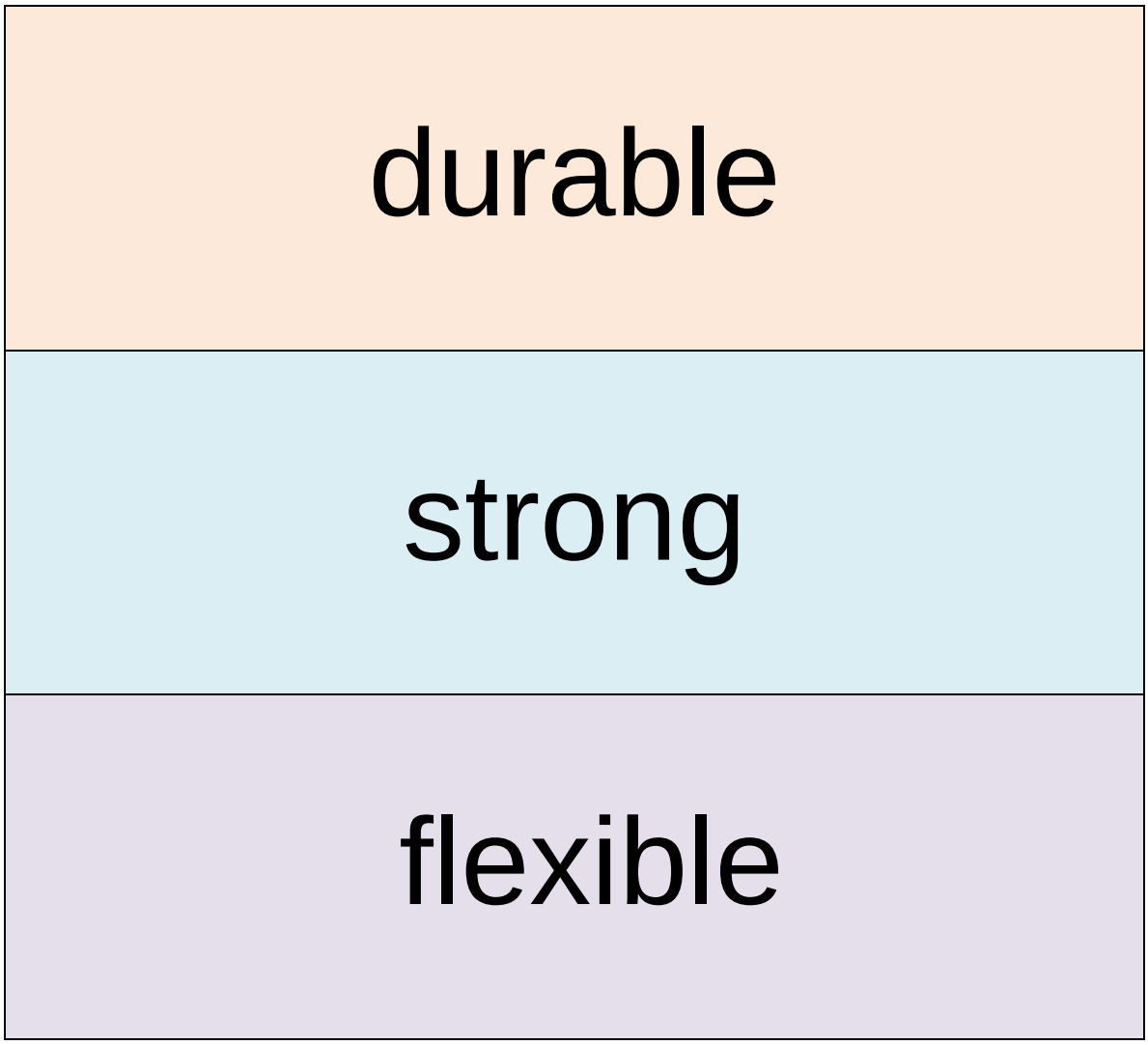
Name: _____ Date: _____








will last a long time
will not break
will bend back and forth


durable
strong
flexible

Name: _____ Date: _____

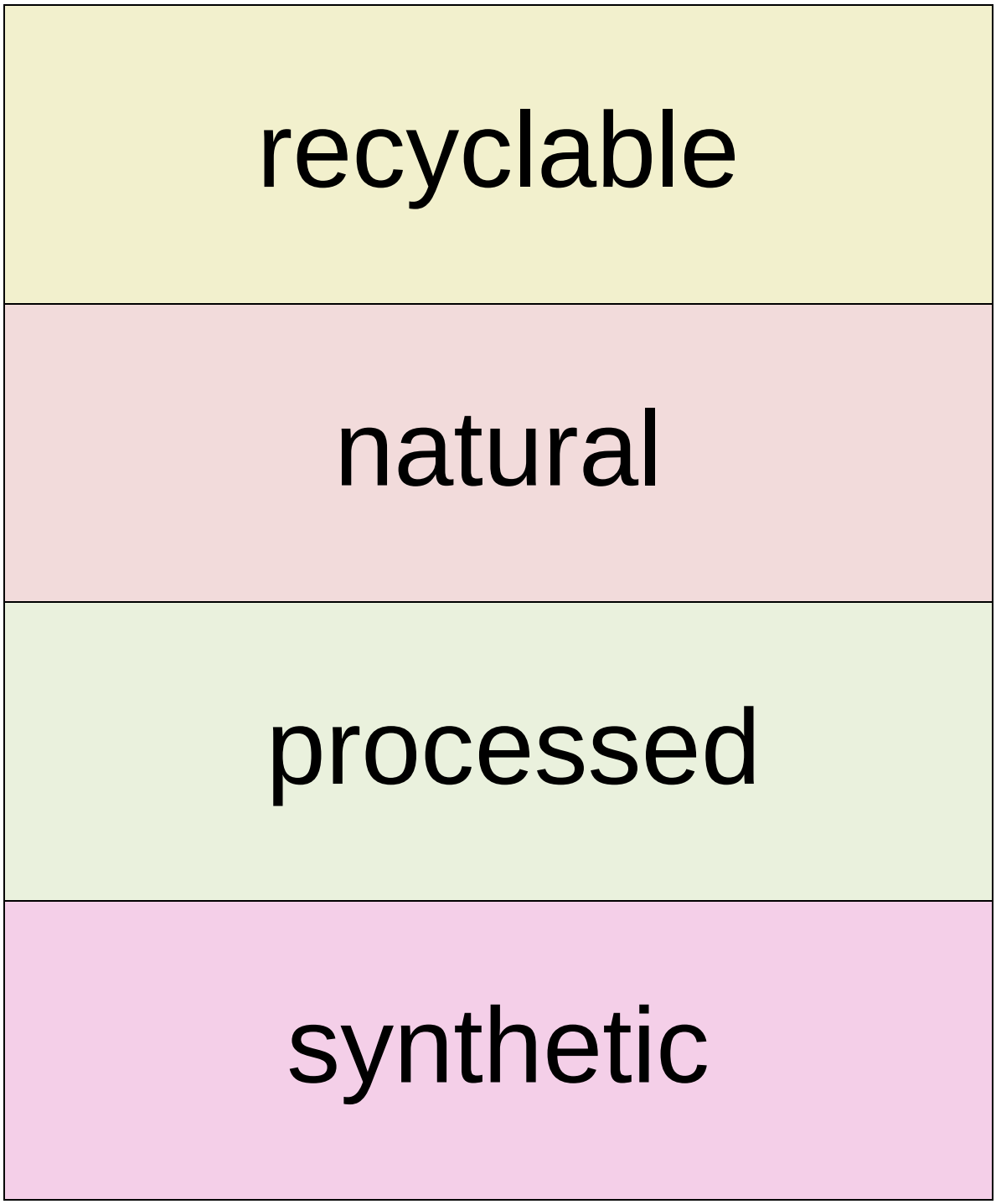
The _____ is durable.

The _____ is strong.

The _____ is flexible.

Name: _____ Date: _____

Object	will last a long time	will not break	will bend back and forth
	√	√	
			
			
			
			
			
			
			


recyclable
natural
processed
synthetic

Name: _____ Date: _____

1. Select the properties 2. Draw your object 3. Give it a name 4. Describe it

Strong?	Flexible?	Durable?	Recyclable?	Natural?	Processed?	Synthetic?	Draw it here:
Name of object:							

Write about your object: _____

_____

_____

_____

Unit 3 (Materials):
Combined Materials and their Properties

Concept
Mixtures of materials can be used to make objects that are more durable, strong, stable and flexible.

Content objective
Combinations of materials are explored, and teams find mixtures of materials around the classroom.

Language objectives
Students will orally describe mixtures of materials that show durability, strength and elasticity
Students will use the words durability, strength, and elasticity in oral discussions
Students will write sentences about mixtures of objects using target vocabulary

Standards

- **NGSS**
  - **K-2-ETS1-1** Ask questions, make observations, and gather information about a situation people want to change to define problem that can be solved with a new or improved object or tool.
- **ELPS**
  - **1C** Use strategic learning techniques such as concept mapping, drawing, memorizing, comparing, contrasting, and reviewing to acquire basic and grade-level vocabulary. [Metacognitive Strategies]
  - **3H** Narrate, describe, and explain with increasing specificity and detail as more English is acquired.
  - **3C** Speak using a variety of grammatical structures, sentence lengths, sentence types, and connecting words with increasing accuracy and ease as more English is acquired [Spoken Syntax]
- **TEKS**
  - **1A** Conducts classroom/ outdoor investigations safely; uses environmentally appropriate/ responsible practices (Demonstrate)
  - **2A** Develops abilities to ask questions/ seek answers in classroom/ outdoor investigations (Asks)
  - **3A** Knows that information and critical thinking are used in scientific problem solving (Explain problem & solution)
  - **4A** Uses age-appropriate tools and models to investigate the natural world (Uses tools)
  - **5A** Knows that objects have properties and patterns (Classify objects)
  - **6D** Knows that energy, force, and motion are related and are a part of their everyday life

Suggested Literature Connections:
"The Most Magnificient Thing" by Ashley Spires

Materials:
Labels: “metal & wood”; “plastic & metal”; “fabric & plastic”; “cloth & wood” (or you may use the ones included in handout **1.3.2**); blank pieces of scrap paper

Day 1: Engage *Materials-Combined Materials and their Properties*

Teacher Says/Does	Student Says/Does	Language requirements
1. Bring students to the rug and ask them to discuss materials they have learned about. Remind them of the words you have used so far in describing objects: natural, synthetic, flexible, strong and long-lasting materials (durable). 2. Ask students if it is possible for an object to be made of more than one material. Have them search the room for examples of objects that might be made of more than one material. 3. Pick an object, and model using the sentence frame: "A _____ is made from _____ and _____." 4. Have students share their ideas using the same sentence frame. Follow up by asking whether the materials each object is made of are *natural* or *synthetic* and how they know. 5. Show several examples of other objects made of combinations, or composite materials, such as sandpaper, plywood, metal pans with plastic handles, clothing with metal snaps or with plastic buttons, chairs with wooden seats and metal legs, or use the pictures in the handout (**1.3.1**). Ask students to mention materials the objects are made of. Give them several options of sentence frames to respond. 6. Record their answers on a chart paper. 7. Show a picture of a pan with a wooden handle to explain why the materials have been combined. Give student pairs one picture from the handouts, ask them to discuss	Students participate voluntarily in a discussion of materials they know. Students use sentence frames to respond to questions Students read their own answers written on chart paper by the teacher Students share voluntarily using property words and using sentence frames if they want to.	Sandpaper is made of _____ and _____. _____ is made of _____ and_____. _____ will last a long time so it is durable. _____is very strong. _____is flexible.

the materials in it, and make a guess as to why the materials were combined. 8. Review the property words: durable, strong, elastic and their noun counterparts, durability, strength, and elasticity.		

Day 2: Explore *Materials-Combined Materials and their Properties*

Teacher Says/Does	Student Says/Does	Language requirements
1. Use labels like "METAL AND WOOD" or "PLASTIC AND METAL", and display them in several corners of the classroom. See handout (**1.3.2**). Ask teams to find objects composed of mixtures of materials around the room, collect them and place them near the corresponding label. 2. Ask students to sort pictures from magazines of things made of mixtures of materials. Have them glue the pictures onto newsprint and label the materials using the following categories: "wood and plastic", "wood and metal", "plastic and metal", "cloth and wood", "ceramic and metal", or their own labels. 3. Give students a copy of the grid from lesson handout (**1.3.3**), containing the names of a list of objects on the first column, and different materials on the first row, and have them analyze the materials by putting a check on the corresponding cell on the row. Demonstrate how to use the grid with the first object. 4. Have students create new mixtures of materials by using the grid and then drawing what they would make the new materials into.	Students identify, classify, and create classroom materials	

Day 3: Explain *Materials-Combined Materials and their Properties*

Teacher Says/Does	Student Says/Does	Language requirements
1. Remind them of the property words you have used so far in describing natural, synthetic, flexible, strong and long-lasting materials. Ask the children to discuss materials they know about that have those properties. 2. Show them several examples of objects made of combinations, or composite materials, such as sandpaper, plywood, metal pans with plastic handles, clothing with metal snaps or with plastic buttons, chairs with wooden seats and metal legs. Ask students to identify the properties of each, and what material contributes to those specific properties. 3. Form teams of students and assign one property word to each, giving them a label: natural, synthetic, flexible, strong, durable. Have each team collect objects or make drawings of objects that have more than one material and that are an example of that property. Have each team become an expert on that property and complete a graphic organizer (**1.3.4**) for that property, with four sections: the name of the property, a description, a drawing, the name of an object that has that property. 4. As groups share, ask students to tell why the materials in the structures they are looking at have been combined. Use the property words, durable, strong, elastic and their noun counterparts, durability, strength, and elasticity.	Volunteers discuss materials they know about using the property words Teams fill out grid and talk about it with the class.	_____ is natural _____ is synthetic _____is durable _____is strong The name of our object is_____ It is made of_____ and _____ One property of our object is_____

Day 4: Elaborate/Evaluate *Materials-Combined Materials and their Properties*

Teacher Says/Does	Student Says/Does	Language requirements
1. Ask students to invent an object with combined materials (i.e. wood, metal, ceramic, plasic, or fabric) and properties (i.e. natural, processed, syntethic, flexibkle, strong, or durable). See handout (**1.3.5**). 2. Have student teams present how they made their invented object, the materials it has, and the properties. 3. Begin a class discussion of how what we know about the properties of materials can help us make the best combinations in order to make objects durable, strong, stable and flexible. Have the student teams talk about the examples they have found of mixtures of materials and what properties the different materials have given to the object	Students make presentations about objects they invented	**Vocabulary:** strong durable flexible








metal and wood
plastic and metal
fabric and plastic
cloth and wood

Name: _____ Date: _____

Object	wood?	metal?	plastic?	fabric?	ceramic?	strong?	durable?	elastic?
	√	√						
								
								
								
								

Name: _____ Date: _____

Name of the Property.

Draw the property.

Describe the property.

Give an example where the property is used.

Name: _____ Date: _____

1. Select the materials 2. Draw your object 3. Give it a name 4. Describe it

wood?	metal?	ceramic?	plastic?	fabric?	Draw your object here
Name of object:					

Write about your object:

The name of our object is_____

It is made of_____ and _____

One property it has is_____

Unit 4 (Structures):
Triangles and Trusses

Concept
We can build strong structures with just paper.

Content objective
Students find out how well different structures resist pushing and pulling forces.

Language objectives
Students will use sequencing words like first, second, next, and finally to describe structures built in class
Students will use past tense verbs correctly as part of their descriptions
Students will understand and be able to articulate the meaning of the word truss

Standards

- **NGSS**
  - **K-PS2-1** Conduct investigation comparing strengths and directions of pushes and pulls on motion of object.
  - **K-PS2-2** Use data to see if solution changes speed or direction of object.
  - **K-ESS3-1** Use a model to show relationships between needs of plants or animals and the places they live**.** (*With emphasis on real life human structures)
  - **K-2-ETS1-1** Ask questions, make observations, and gather information about a situation people want to change to define problem that can be solved with a new or improved object or tool.
  - **K-2-ETS1-3** Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses.
- **ELPS**
  - **3C** Speak using a variety of grammatical structures, sentence lengths, sentence types, and connecting words with increasing accuracy and ease as more English is acquired [Spoken Syntax]
  - **3E** Share information in cooperative learning interactions [Communicative Competence
  - **2D** Monitor understanding of spoken language during classroom instruction and interactions and seek clarification as needed [Comprehensible Input]
  - **2F**Listen to and derive meaning from a variety of media such as audio tape, video, DVD, and CD ROM to build and reinforce concept and language attainment [Listening Across Contexts]
  - **1G** Demonstrate an increasing ability to distinguish between formal and informal English and an increasing knowledge of when to use each one commensurate with grade level learning expectations [In/Formal]

- **TEKS**
  - **1A** Conducts classroom/ outdoor investigations safely; uses environmentally appropriate/ responsible practices. (Demonstrate)
  - **2B** Develops ability to ask questions, seek answers in investigations (Investigates movement)
  - **3A** Knows that information and critical thinking are used in scientific problem solving (Explain problem & solution)
  - **4A**. Uses age-appropriate tools and models to investigate the natural world (Uses tools)
  - **5A**. Knows that objects have properties and patterns (Classify objects)
  - **6D.** Knows that energy, force, and motion are related and are a part of everyday life; how objects move**.**

Suggested Literatature Connections:
"Twenty-One Elephants" by Phil Bildner

Materials:
Newspaper; dowel rods; straws; K'nex; popsicle sticks; hot glue gun; masking tape; glue dots; "sticky stuff"; or any combination of supplies students might use to construct a truss and/or bridge; zip or twist ties.

Day 1: Engage/Explore *Structures-Triangles and Trusses*

Teacher Says/Does	Student Says/Does	Language requirements
1. Have students watch the video: https://www.youtube.com/watch?v=llhSEwUE6cY 2. Present the word "truss" (a structure of connected materials usually forming triangles). Create a gesture such as fingers forming a triangle to symbolize "truss" and practice saying the new word (and gesture) with students. Note that a "truss" can also be square shaped. 3. Show the three pictures of trusses and triangles in the handout (**1.4.1**) and have students describe each of them using the sentence starters given in handout (**1.4.2**). 4. Divide students into 6 or 9 groups, have each group make one part of a bridge (either the bottom or one of the sides) following the visual instructions in handout (**1.4.3**). 5. Have students watch the video again work on building their section. 6. Groups 1-3, 4-6, 6-9 will combine their pieces to complete 2-3 bridges for the class. As they come together allow the larger teams just a few minutes (5-10) to consider ways they might make their bridge stronger. 7. Before you work as a class to compare and contrast the three products, have teams share what they did to improve their bridges using handout (**1.4.4**) as their sentence starters. 8. Finally, test the strength of each bridge with textbooks or other objects you have in the classroom, and discuss what is unique about the winner.	Students familiarize with the term "truss" Students describe the three types of structures using sentence starters Students create the same structures with provided materials. Students combine sections to create bridges. Students give oral responses to questions	Vocabulary: Truss My favorite structure is number__ This structure is made of___and___ It has _____toothpicks It has____ marshmallows The first thing we did was _____ Then, we _____ Finally, to make it stronger, we _____

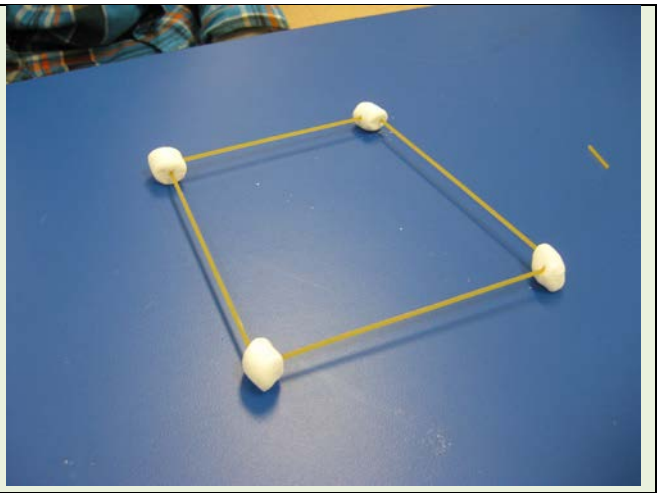
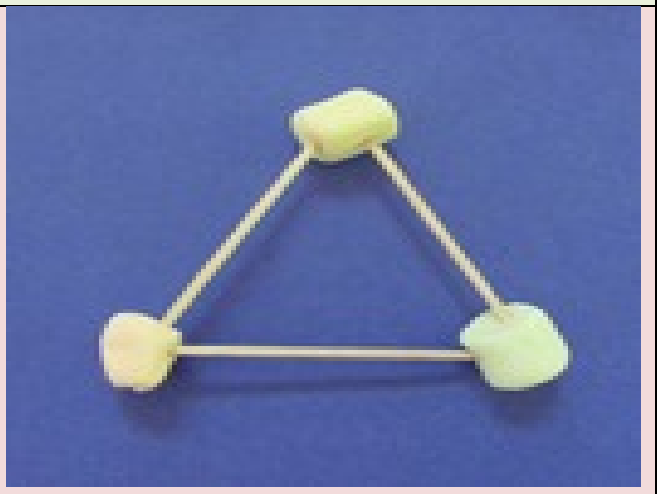
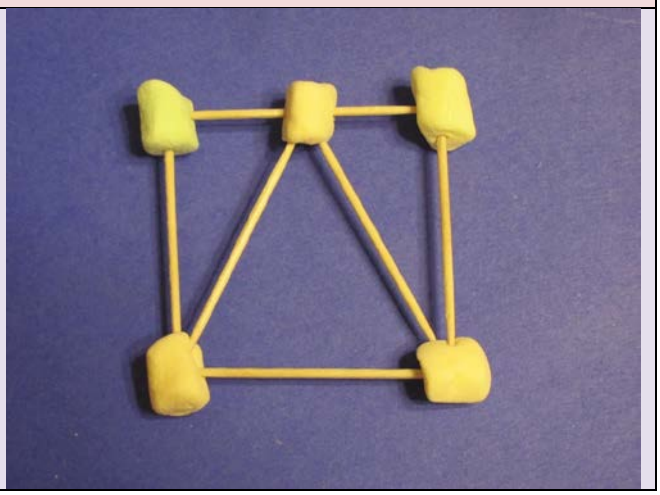
Day 2: Explore/Explain *Structures-Triangles and Trusses*

Teacher Says/Does	Student Says/Does	Language requirements
1. Display a simple truss made from newspaper and dowels. Ask students to respond kinesthetically by raising their hands if they agree: *Which structure will be stronger? A structure using two tubes joined together? (Hold up example). Or a structure using three tubes joined together? (Hold up example with the truss). Why? (Have students share in partners.)* 2. Model. Have a student model how to roll newspaper around the dowel and tape it to another already rolled dowel to review the steps. 3. Teamwork: Have engineering teams each make several simple structures by attaching three or more paper roll trusses in any way they wish. When they are mostly done, have them bring their structures to the large group. Facilitate talk amongst teams as they work by asking questions such as: *How many trusses are you making? Why?* Encourage students to speak in complete sentences and to use the word "truss" in responding. Also accept the word "triangle" but model saying the word "truss." 4. Come together to observe and analyze the structures. Ask students to place their structures down where others can see them. Discover, with students, who has structures that look similar. 5. Have students chorally count as you ask pairs: *Who created a structure with three sides?* *Four sides? Five sides? etc.* Also ask students to find out which structure holds its shape best. *How do they know? Are the structures that are the strongest the ones with triangles?* 6. Also ask: *How could you add a paper tube to a 4-tube structure to make it hold its shape better?*	Students learn how to roll newspaper around a dowel to make trusses Students learn how to roll newspaper around a dowel to make trusses	

Day 3: Elaborate/Evaluate *Structures-Triangles and Trusses*

Teacher Says/Does	Student Says/Does	Language requirements
1. Truss Walk: In partners, take the children on a walk around the building and outdoors, looking for examples of trusses and triangles that are used as braces. If visible trusses are hard to find, you may choose to have them look for structures that they think contain trusses. Come back to the classroom and have each pair share out one structure or object containing trusses that they observed or structure that they think had trusses. Ask students to answer in pairs the question: *Why do engineers use trusses?* (To make buildings, structures, things stronger; act as braces). 2. *What are some names we use for structures that are used to make other shapes stronger? (braces, supports).* (Trusses work together to make a brace or support). 3. Have student pairs create a graphic organizer for the word truss, by dividing a sheet of paper into four corners, and putting the word in one, a description in another, a picture, and an example (which can be drawn). See handout (**1.4.5**).	Students identify trusses and triangles in structures around the school Students create a graphic organizer for the word truss	Vocabulary: Truss

Name: _____ Date: _____

Truss Number 1: This structure is made of 4 marshmallows and 4 toothpicks. All together, it forms a square.	
Truss Number 2: This structure is made of 3 marshmallows and 3 toothpicks. All toghether, it forms a triangle.	
Truss Number 3: This structure is made of 5 marshmallows and 6 toothpicks. All toghether, it forms a triangle inside a square.	

Name: _____ Date: _____

My favorite truss is number ___.

The truss is made of _____ and

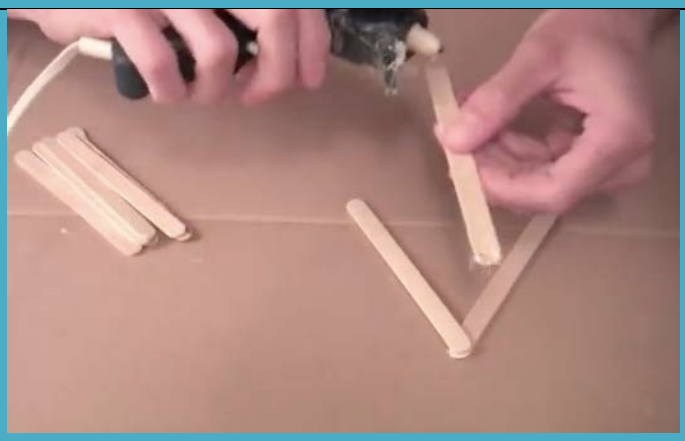
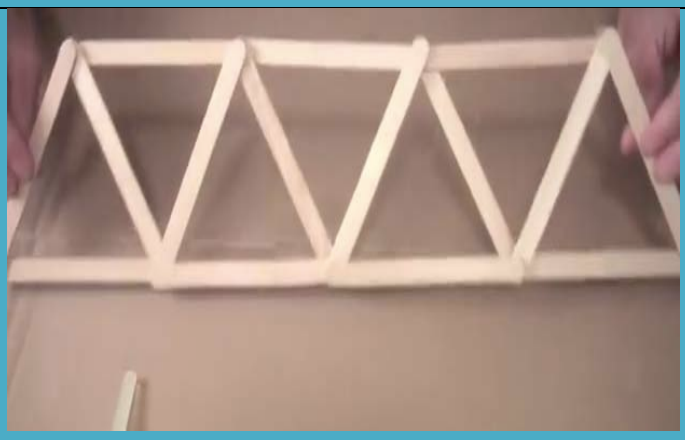
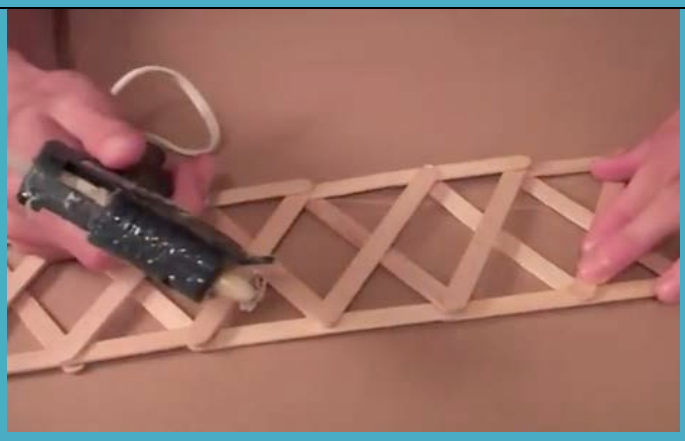
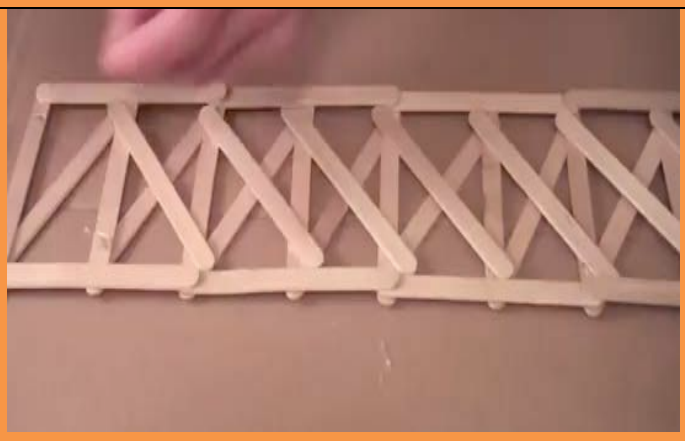
_____.

It has _____toothpicks.

It has____ marshmallows.

Name: _____ Date: _____

Instructions to build the parts of a bridge

Team A	Team B
	
	
	

Name: _____ Date: _____

The first thing we did was

_____.

Then, we _____

_____.

Finally, to make it stronger, we

_____.

Name: _____ Date: _____

Write the word:

truss

Make a drawing of a truss

Describe a truss

Give an example where a truss is used

Unit 5 (Structures):
Making Strong Structures

Concept
Structures can be made stronger and weaker by varying the shape of the materials.

Content objective
Students explore how structures can be made stronger and weaker

Language objectives
Students will use target vocabulary as part of oral discussions
Students will use comparatives to describe structures
Students will understand and be able to articulate the meaning of the words: prism and cylinder

Standards

- **NGSS**
  - **K-PS2-1** Conduct investigation comparing strengths and directions of pushes and pulls on motion of object.
  - **K-PS2-2** Use data to see if solution changes speed or direction of object.
  - **K-2-ETS1-1** Ask questions, make observations, and gather information about a situation people want to change to define problem that can be solved with a new or improved object or tool.
  - **K-2-ETS1-3** Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses.
- **ELPS**
  - **2D** Monitor understanding of spoken language during classroom instruction and interactions and seek clarification as needed [Comprehensible Input]
  - **3C** Speak using a variety of grammatical structures, sentence lengths, sentence types, an connecting words with increasing accuracy and ease as more English is acquired [Spoken Syntax]
- **TEKS**
  - **2B** Develops ability to ask questions, seek answers in investigations.
  - **2E** Develops abilities to ask questions/ seek answers in classroom/ outdoor investigation
  - **3B** Knows that information and critical thinking are used in scientific problem solving. (Predict from Patterns)
  - **4A** Uses age-appropriate tools and models to investigate the natural world (Uses tools)
  - **6D** Knows that energy, force, and motion are related and are a part of everyday life; how objects move.

Suggested Literature Connections:
"Look at That Building!: A First Book of Structures" by Scot Ritchie

Materials:
Several sheets of 8 ½ x 11 paper; transparent tape; masking tape; heavy objects for investigation (e.g., blocks, bricks, toys); really heavy objects for investigation

Days 1 & 2: Engage/Explore *Structures-Making Strong Structures*

Teacher Says/Does	Student Says/Does	Language requirements
1. Show students a heavy object (block or brick) and ask them to share in partners whether or not they think they can use a piece of 8 ½ x 11-inch paper to hold up the weight so that it is steady and above the tabletop. *2.* Teacher demonstration: Roll an 8x11 sheet of paper into a cylinder and make it stand up. Ask students to predict if the paper cylinder can hold up the weight of books. Ask a show of hands for the question: *Will the paper cylinder hold up books?* Make sure you properly present the vocabulary word: Cylinder 3. Place one book on top of the cylinder and demonstrate how the paper can hold it. Ask students to discuss with their partner how many books will the cylinder hold. 4. Have each pair roll up a sheet of paper into a cylinder and then use it to hold up books. Have each pair report how many books their cylinder could hold up. Have them use sentence frames (**1.5.1**). 5. Teamwork: Place students in engineering teams of 3-5 students. Let them use scissors and tape, one piece of paper, and the dowel rod if they wish to use it for rolling the paper tightly, and try to make a cylinder structure that will hold up the weight. They should demonstrate their cylinder structure for the whole group. Have each team put a different number of books on top of their cylinder, and then organize all the structures in ascending or descending order according to the weight they held.	Students experiment with techniques to make structures stronger	Vocabulary: Cylinder I think that the paper cylinder will hold_____ books After our test, our paper cylinder held up ___ books

Day 3: Explore/Explain *Structures-Making Strong Structures*

Teacher Says/Does	Student Says/Does	Language requirements
1. Bring the whole group together to discuss the different cylinder structures that did and did not hold up a lot of weight. Ask some of these questions: • *Does it matter which way the weight is placed?* • *Which structure will hold the weight up highest?* • *Can the children find some rule about structure shapes and strength? (The tightly rolled or folded structures might be stronger)* 2. Tell your students that, aside from the cylinder they already know how to do, they will create and test two other types of structures that can be used as bridges. 3. Demonstrate how to create the 1) cylinder bridge, 2) flat rectangle bridge, and 3) "W" shaped bridge (or accordion-pleated bridge). See Handout (**1.5.2**) for reference. 4. Additionally, let them know that they will need to test their bridges by placing them on top of 2 stacks of books as seen on handout (**1.5.2**). To test endurance, they need to put book(s) or other light objects on top and observe what happens to their structures. 5. Once done demonstrating, organize students in engineering teams of 3-5, letting each team choose which of the 3 structures they will work on: 1) cylinder bridge, 2) flat rectangle bridge, or 3) "W" shaped bridge. Let them use scissors and tape, one piece of paper, and the dowel rod if they wish to use it for rolling the paper tightly, and try to make their chosen structure. Make sure that the 3 sructures get chosen so that everyone can compare them at the end.	Students explore relationships between the shapes of objects and their strength	Vocabulary: Accordion pleating

Teacher Says/Does	Student Says/Does	Language requirements
6. Ask teams to investigate the following: • *Placing a book standing or resting-which is better?* • *How does the way you roll or bend the paper make the structure stronger?* • *Which structure has more flat space (area) and does this make it stronger?* 7. Bring together the teams to discuss answers to these questions using sentence frames. (Handout **1.5.3**). 8. They should demonstrate the structures they make for the whole group. Structures that usually work include cylinders and accordion-pleated. 9. Have each team investigate the following: put the weight of a book in different ways: vertically and horizontally, and explore what works better hold several books and decide how many books it will hold		It is better if the weight is placed_____ The_____ will hold the weight up highest It is better to place the book_____ The _____structure has more area In order to make it stronger_____

Day 4: Elaborate/Evaluate *Structures-Making Strong Structures*

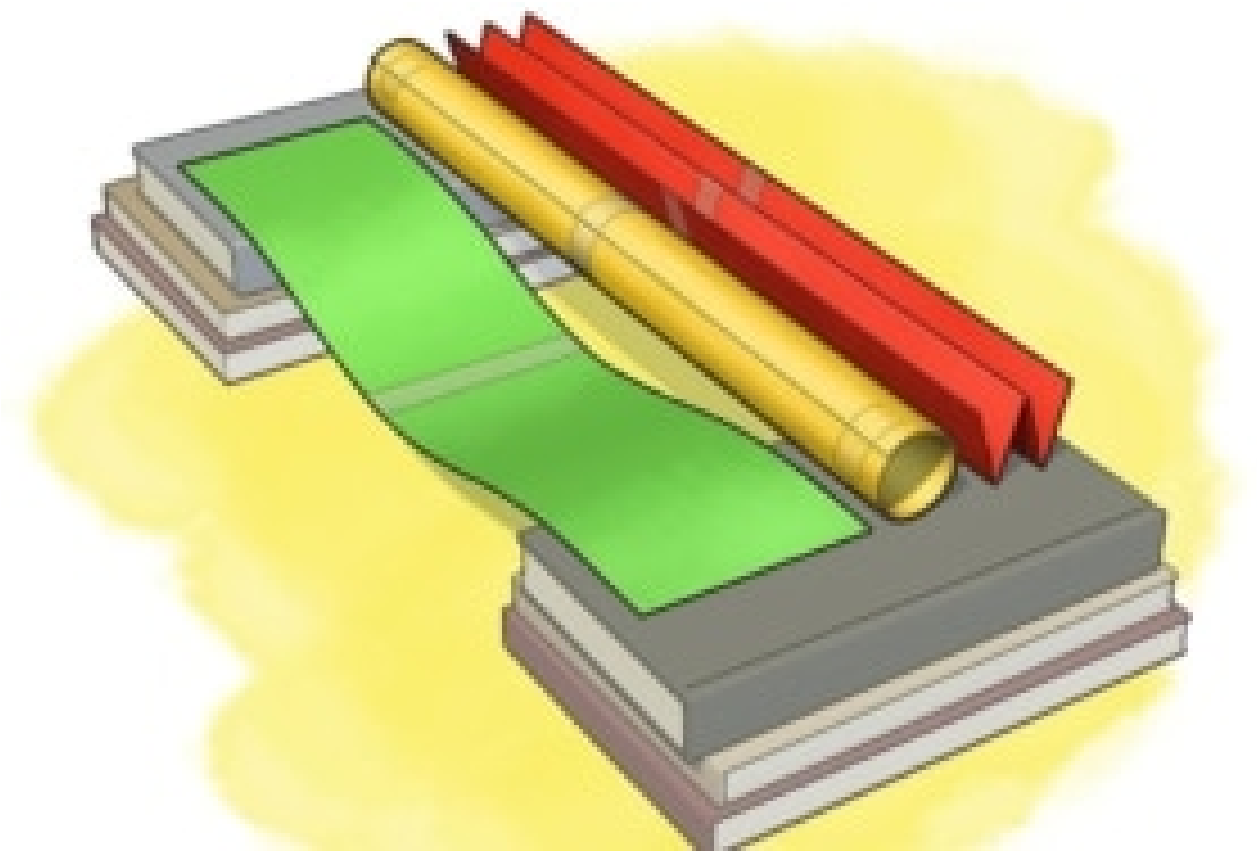
Teacher Says/Does	Student Says/Does	Language requirements
1. Ask the students whether they think they could make a paper structure that would hold an object heavier than a book. Let them suggest ways to do that. They might connect rolled newspaper tubes together to make a chair or table shape, and place the heavy object upon it. 2. Write in a class shared Enginnering Log (if applicable) some of the things the students tell you about structures and their shape. 3. Lastly as a refresher, have student pairs discuss and share one thing they know about a cylinder and an accordion-pleated structure. See handout (**1.5.4**). 4. Give students handouts (**1.5.5**) to deepen their knowledge of the words "W" shaped structure and Cylinder by writing the word, making a drawing of it, describing it and giving an example.	Students experiment with paper structures that can hold heavy objects Students discuss what they learned about the relationship between shape and strength of objects Students fill out a graphic organizer about the words "W" shaped structure of cylinder.	Vocabulary: Cylinder "W" Shaped structure

Name: _____ Date: _____

I think that the paper cylinder will hold_____ books.

After our test, we found out that our paper cylinder held up_____books.

Reference: Paper Bridges



Green: Flat Rectangle Bridge

Yellow: Cylinder Bridge

Red: “W” Shaped Bridge (Accordion-Pleated Bridge)

Name: _____ Date: _____

It is better if the weight is placed_____.

The_____ will hold the weight up highest.

It is better to place the book_____.

The _____structure has more area.

In order to make it stronger, we need to _____.

Name: _____ Date: _____

Something I learned about the “W” shaped structure (or accordion-pleated structures) is _____.

Something I learned about cylinders is_____.

Name: _____ Date: _____

Write the word:
"W" shaped structure

make a drawing of a "W" shaped structure

Describe a "W" shaped structure

Give an example where a "W" shaped structure is used

Name: _____ Date: _____

Write the word:

cylinder

make a drawing of a cylinder

Describe a cylinder

Give an example where a cylinder is used

Unit 6 (Mechanisms):
We Use Balancing

Concept
Objects can balance on a balance scale; the point of the scale where objects balance is a pivot point; levers are beams that have a pivot point or fulcrum; levers make work easier.

Content objective
Student teams explore the balance and pivot point of levers.

Language objectives
Students will orally describe levers using adjectives and adverbs
Students will get familiar with the meaning of the words: levers, fulcrum, triangle, frame and blue print

Standards

- **NGSS**
  - **K-2-ETS1-1** Ask questions, make observations, and gather information about a situation people want to change to define problem that can be solved with a new or improved object or tool.
- **ELPS**
  - **1A** Use prior knowledge and experiences to understand meanings in English. [Prior knowledge]
  - **3C** Speak using a variety of grammatical structures, sentence lengths, sentence types, and connecting words with increasing accuracy and ease as more English is acquired [Spoken Syntax]
  - **3D** Speak using grade-level content area vocabulary in context to internalize new English words and build academic language proficiency [Application for Acquisition]
  - **3E** Share information in cooperative learning interactions [Communicative Competence]
- **TEKS**
  - **2B** Develops ability to ask questions, seek answers in investigations (Investigates movement)
  - **3A** Knows that information and critical thinking are used in scientific problem solving. (Explain problem & solution)
  - **4A** Uses age-appropriate tools and models to investigate the natural world (Uses tools)
  - **6C** Knows that energy, force, and motion are related and are a part of everyday life; changes in location of an object
  - **6D** Knows that energy, force, and motion are related and are a part of everyday life; how objects move.

Suggested Literature Connections:
“How do You Lift a Lion?” by Robert E. Wells

Materials:
Rulers, gold stars stickers or other stickers, popsicle sticks, poster board, markers or marker lids, pom poms**,** washers, glue gun

Day 1: Engage, Explore *Mechanisms- We Use Balancing*

Teacher Says/Does	Student Says/Does	Language requirements
1. Show one example of a lever in everyday life: a see-saw. Have students share experiences with a seesaw. Introduce the vocabulary: *lever, fulcrum, beam* using the see-saw as an example. See handout (**1.6.1**) for reference). **Example of a Lever**  2. Show them parts of this video, but make sure to make frequent stops through out to further elaborate on the examples/explanaitions: https://www.youtube.com/watch?v=OdM2jWg2uEE 3. Show more examples of levers in the handout (**1.6.2**) where "E" stands for Effort and "R" stands for Resistance Force or Load, and then have student pairs discuss and respond to the questions: • *What do the figures have in common?* • *Why do we need levers?* • *Can you think of a lever that you've seen before that's been used in everyday life?* 4. Demonstrate to the classroom a ruler balancing on a marker lid to represent a lever, but do one demonstration with the fulcrum in the middle of the ruler and the other with the	Students identify and compare levers in everyday life	***Brick words:*** *Lever, fulcrum, beam* The two examples showed the _____ in the middle of the ruler and towards the end of the ruler. The lever with the fulcrum that is _____ made the pom pom fly the farthest. I think the position of the fulcrum is important because_____.

Teacher Says/Does	Student Says/Does	Language requirements
fulcrum towards one end of the ruler. Ask them: • *Which lever will make the pom pom fly the farthest?* • *Why do you think it matters where the fulcrum is on a lever?* • *What would have happened if our fultrum had been on the opposite side of the ruler?* 5. Give student pairs sentence starters (handout **1.6.3**) to respond to the questions 6. For the students' activity, give each pair of students a ruler with a sticker or gold star to mark the center point and a triangular blocks act as a fulcrum. The purpose is for student to balance the ruler. 7. Students balance the "center-point" on a fulcrum and investigate the relationship between placement of weights such as washers at various points. What happens when the students move the fulcrum? 8. After group comes back together, teacher will demonstrate with class scale the different pivot points.		

Day 2: Explore/ Explain *Mechanisms- We Use Balancing*

Teacher Says/Does	Student Says/Does	Language requirements
1. Show the students a class balancing scale and point out the arms and pivot point of the lever. 2. Push down one arm of the lever and have them see what happens to the other arm. Ask the students to describe what happens to one arm of the lever when you push down on the other. 3. Write down the rule that tells what happens on the posterboard with the lever model. 4. Ask the students to find the pivot points on their levers made earlier. 5. Show the students a lever model made with posterboard and a fastener. See handout (**1.6.4**) for a teacher reference. 6. Move the pivot point by placing the fastener through another hole in the lever and ask the students to tell you now where the arms of the lever are and where the pivot point is. 7. Have them describe how the movement of the lever is different. 8. Have a student place the point of a pencil through a hole in the end of a lever arm and trace the path of the lever as it moves. The path the pencil traces will be an arc, part of a circle, instead of a straight line. If the lever is moved completely around its pivot point and back again, the path of the pencil will be a circle. 9. Ask your students to discuss this pattern and use the sentence starters as guides. For this, you can use handout (**1.6.5**). 10. Tell your students again that levers are simple mechanisms that we us to make movement and work easier. Reiterate to your students the friendly explanation for a fulcrum, e.g., a balancing point.	Students discuss the mechanisms involved in levers Students learn about the impact of moving the pivot point on a lever Students answer questions about the meaning of: *lever* and *fulcrum*	Vocabulary: Lever Pivot point Fulcrum When the lever arm is traced, it makes the shape of a _____. The closer the pencil is to the fulcrum, the _____ the size of the circle is. The farther away the pencil is to the fulcrum, the _____ the size of the circle is.

Day 3: Elaborate/Evaluate *Mechanisms- We Use Balancing*

Teacher Says/Does	Student Says/Does	Language requirements
1. Show examples of levers in everyday applications during a walk around the room, the school, or in the neighborhood. Here are some things you might look for: • *A step-can in the kitchen: you step down and the lid goes up.* • *The toilet seat: lifts up like a lever. Find the pivot point!* • *A door has a pivot point and acts like a lever.* • *A see-saw* • *The lid to a floppy disk case* • *An elbow, a knee, a shoulder, all are pivot points* • *We use a screwdriver like a lever when opening a paint can.* • *We use a juice can opener like a lever.* 2. Ask students to discuss with their partners of any other examples they can remember, and ask for volunteers to share with the classroom. 3. Have students use the graphic organizer in handout (**1.6.6**) to demonstrate their understanding of levers	Students discuss and present examples of levers they've seen before.	Vocabulary: Lever Pivot point Fulcrum

(Teacher Reference)

Levers

The purpose of introducing levers at this level is to give experience with levers in many applications, and to see the change in direction of motion afforded by this simple mechanism.

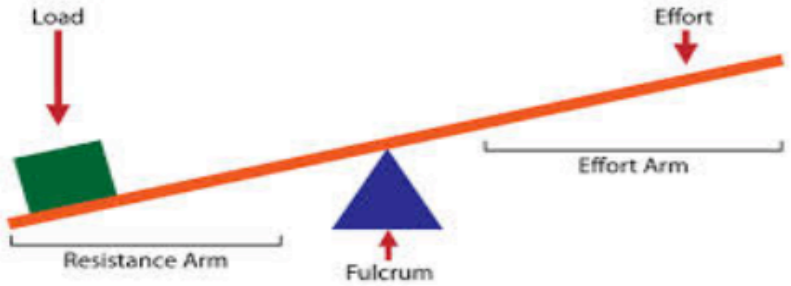
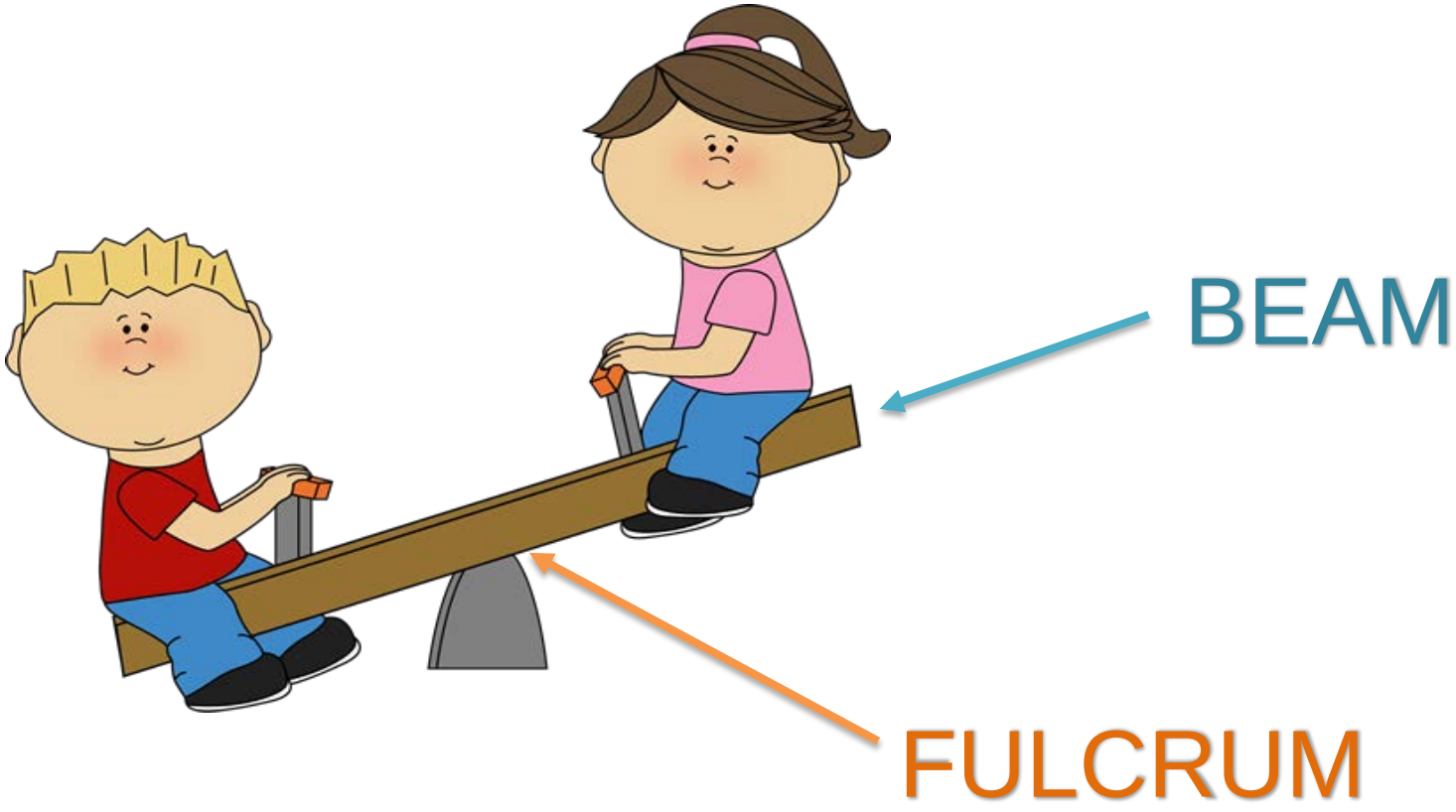


FIGURE 5. BASIC LEVER

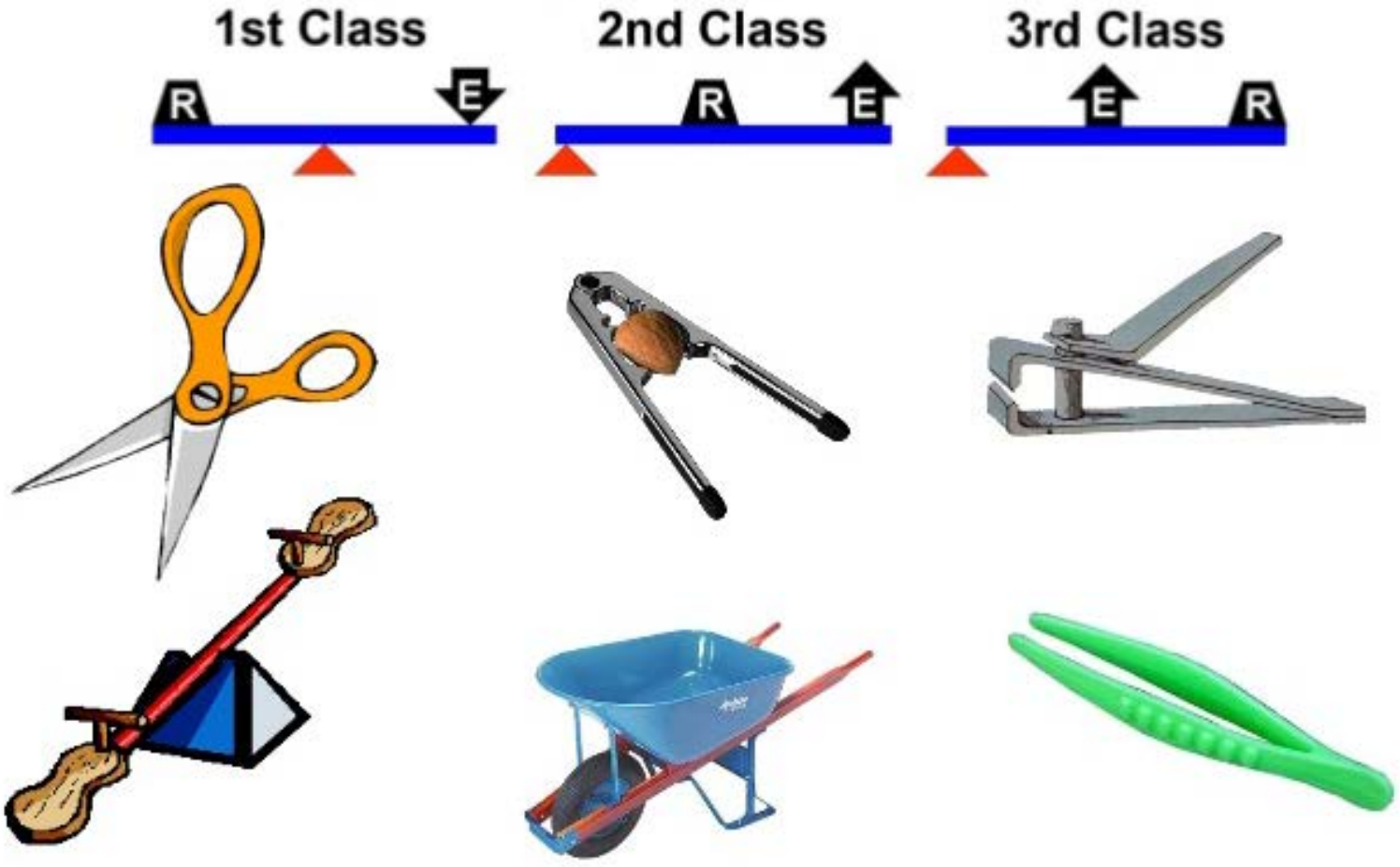
Levers are beams with a fixed point, called a pivot or fulcrum. They are mechanisms that change direction of motion and, most importantly, can give an advantage when lifting heavy objects. When a LOAD (the weight) is at one end of a lever, EFFORT (pushing down on the opposite arm of the lever) must equal the force of the LOAD in order to lift it. If, however, the fulcrum is moved so that the EFFORT is exerted on the longer arm of the lever (is further from the fulcrum) and the LOAD is on the shorter arm (closer to the pivot), less effort is required to lift the load.

When a mechanism gives an advantage such as this, we say it has provided "mechanical advantage." A box that is full of books might be too heavy to lift, but you can use a hand truck (below) as a lever, and, with the aid of wheels, can not only lift the box from the ground but also take it to the bookroom.

Example of a Lever



Examples of Levers



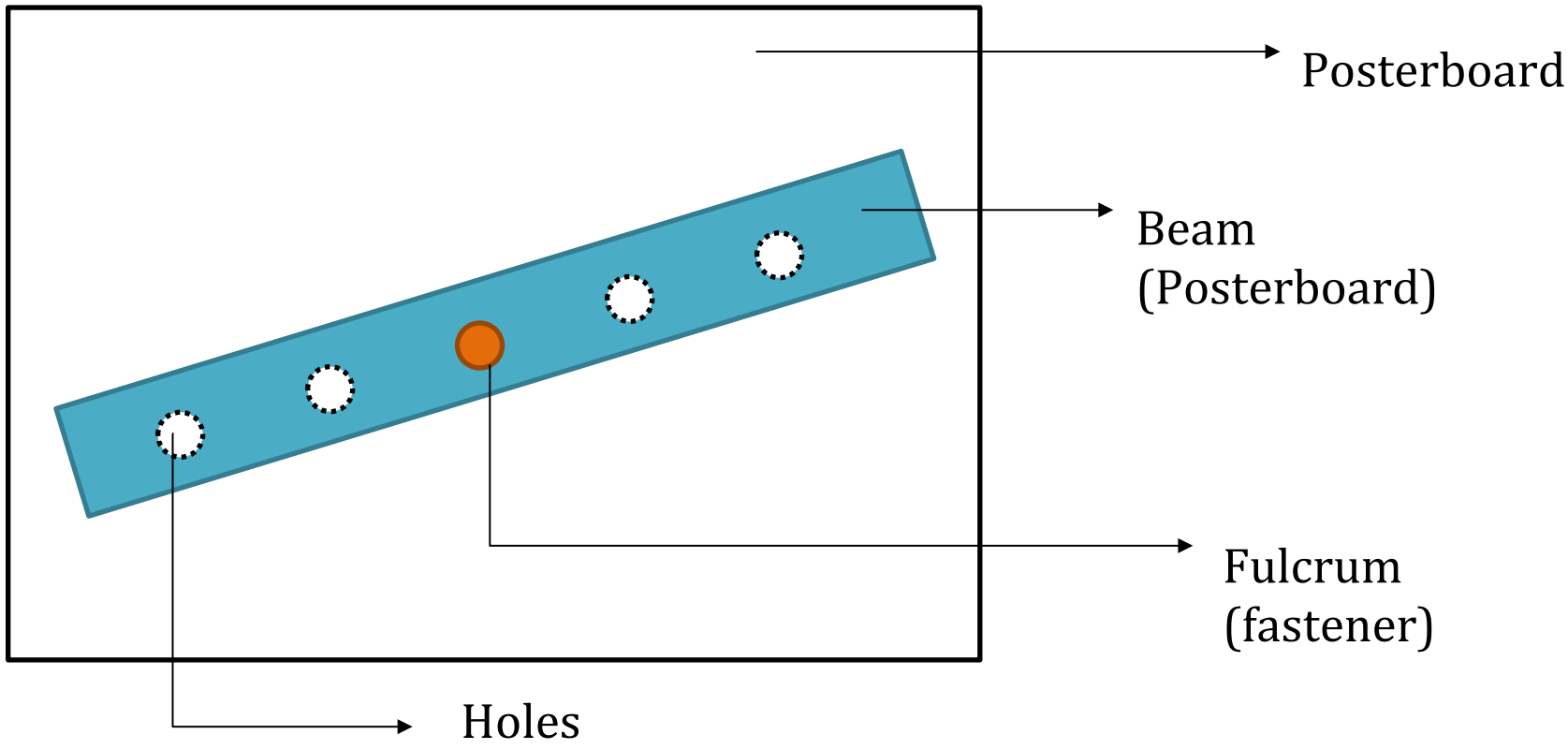
Name: _____ Date: _____

The two examples showed the _____ in the middle and towards the end of the ruler.

The lever with the fulcrum that is _____ made the pom-pom fly the farthest.

I think the position of the fulcrum is important because _____.

Teacher reference



You are encouraged to decorate and laminate the model for appeal and durability.

Name: _____ Date: _____

When the lever arm is traced, it makes the shape of a _____.

The closer the pencil is to the fulcrum, the _____ the size of the circle is.

The farther away the pencil is to the fulcrum, the _____ the size of the circle is.

Name: _____ Date: _____

Write the word:

lever

make a drawing of a lever

Describe what a lever is

Give an example where a lever is used

Unit 7 (Mechanisms):
A Card that Moves with Levers

Concept
Levers work in sets called linkages that make movement change direction.

Content objective
A movable greeting card model is demonstrated for students, and teams draw the mechanisms which they feel make the card move as it does. Teams then make cards of their own.

Language objectives
Students will get familiar with the meanings of the words: lever, pivot point and fixed point (fulcrum), as part of oral discussions
Students will expand sentences using the conditional and the future tense

Standards

- **NGSS**
  - **K-2-ETS1-1** Ask questions, make observations, and gather information about a situation people want to change to define problem that can be solved with a new or improved object or tool.
  - **K-2-ETS1-2** Make a drawing or physical model to illustrate how the shape of an object helps it to solve a problem.
  - **K-2-ETS1-3** Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses.
- **ELPS**
  - **1C** Use strategic learning techniques such as concept mapping, drawing, memorizing, comparing, contrasting, and reviewing to acquire basic and grade-level vocabulary. [Metacognitive Strategies]
  - **2D** Monitor understanding of spoken language during classroom instruction and interactions and seek clarification as needed [Comprehensible Input]
  - **3G** Express opinions, ideas, and feelings ranging from communicating single words and short phrases to participating in extended discussions on a variety of social and grade-appropriate academic topics; [Speech Production @ Grade Level]
- **TEKS**
  - **2B** plan and conduct simple descriptive investigations such as ways objects move (Investigates movement).
  - **3A** identify and explain a problem such as finding a home for a classroom pet and propose a solution in his/her own words (Explain problem & solution)
  - **4A** Uses age-appropriate tools and models to investigate the natural world (Uses tools)
  - **6C** Knows that energy, force, and motion is related and is a part of everyday life; changes in location of object.
  - **6D** Knows that energy, force, and motion are related and are a part of everyday life; how objects move.

Suggested Literature Connections:
"Snappy Heads Andy Alligator" by Sarah Albee

Materials:
Model of a card that moves using levers (see reference in handout **1.7.1**), posterboard, glue, construction paper, paper fasteners, tongue depressors (drilled w/5 holes if possible), markers, crayons, scissors, hand drill or hole puncher

Day 1: Engage, Explore *Mechanisms-A Card that Moves with Levers*

Teacher Says/Does	Student Says/Does	Language requirements
1. Tell the students that you wanted to send a greeting card to cheer up a friend (or some other reason). Construct a card using the figure like in the handout (**1.7.1**), and show the class the movable card. Do not show them the levers inside or behind that make the card move as it does. Show how when you push or pull in one direction, the movement goes in another. Ask students to tell how that might be happening. 2. Point to the levers in the model and review what a lever is; point to the fixed point and to the pivot point and review what they are. 3. Ask the following questions to check understanding of these three words: • *Which of the three words is a stick that helps you move something? (Lever)* • *Which of the three words is a place where there is a fastener that allows the card to move? (Pivot point)* • *Which of the three words is a place where there is a fastener that does not allow the card to move? (Fixed point)* 4. Organize students in pairs, and give each pair one-word card: lever, pivot point and fixed point (See handout **1.7.2**). Give a definition of each, and after giving students a few minutes to decide, ask those who have the card that matches the definition to stand up.	Students construct a greeting card and attempt to describe the movements involved Students answer questions to deepen their understanding of levers	Vocabulary: Lever Pivot point Fixed point (Fulcrum)

Day 2: Explore/ Explain *Mechanisms-A Card that Moves with Levers*

Teacher Says/Does	Student Says/Does	Language requirements
1. Ask teams of two to work independently, first talking about and then drawing what they think the greeting card used in the previous lesson looks like behind. 2. Bring the teams together again and ask them to share their ideas (have them use handout **1.7.3** as reference). Look at the drawings they have made together. After they have had a chance to share, show them how it works. 3. Have them count the levers and pivot points, and show where the direction of movement changes. Show them any fixed points (fulcrums), places where fasteners are not supposed to let the card move. 4. Let the teams analyze their drawings to see if they match the card you have shown them. 5. Ask the teams to talk about what kind of movable card they might like to make (have them use handout **1.7.4** as reference) Once a team has decided, and has drawn their plans, let them choose materials and begin work. Some ideas might be moving animals, greeting cards, or illustrations from current stories or events.	Students make and test their predictions about mechanisms and levers using greeting cards Students learn about levers and mechanisms by making movable cards	We think that behind the card_____ There are _____ levers There are_____ pivot points We would like to make a movable card that _____ Our card will be different than the model because _____ The kind of movable card we would like to make is _____

Day 3: Elaborate/Evaluate *Mechanisms-A Card that Moves with Levers*

Teacher Says/Does	Student Says/Does	Language requirements
1. The next time you have the class together, talk to the children about making a collection of their drawings and sketches. Each team can collect their plans and ideas in a "working portfolio." You may like to make portfolios for each team or have individuals make their own. The sketches they have made of the inside of your movable card should be the first items in the teams' portfolios. 2. You may like to make a bulletin board showing portfolios and the kinds of things that go into them: plans, sketches, and ideas. In the Design Gallery display the movable cards the teams have made. Have the students label the levers on their movable cards.	Students incorporate their movable cards into their portfolios Students label the levers on their movable cards	

Teacher Reference:

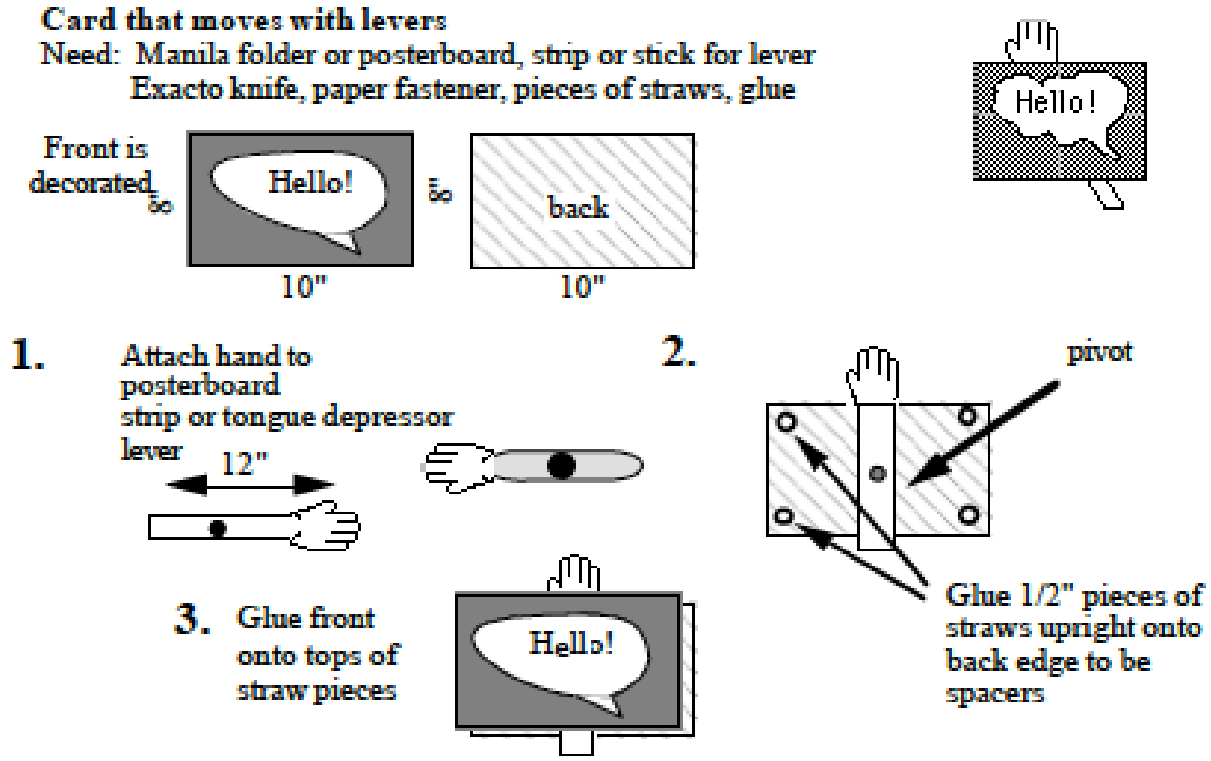
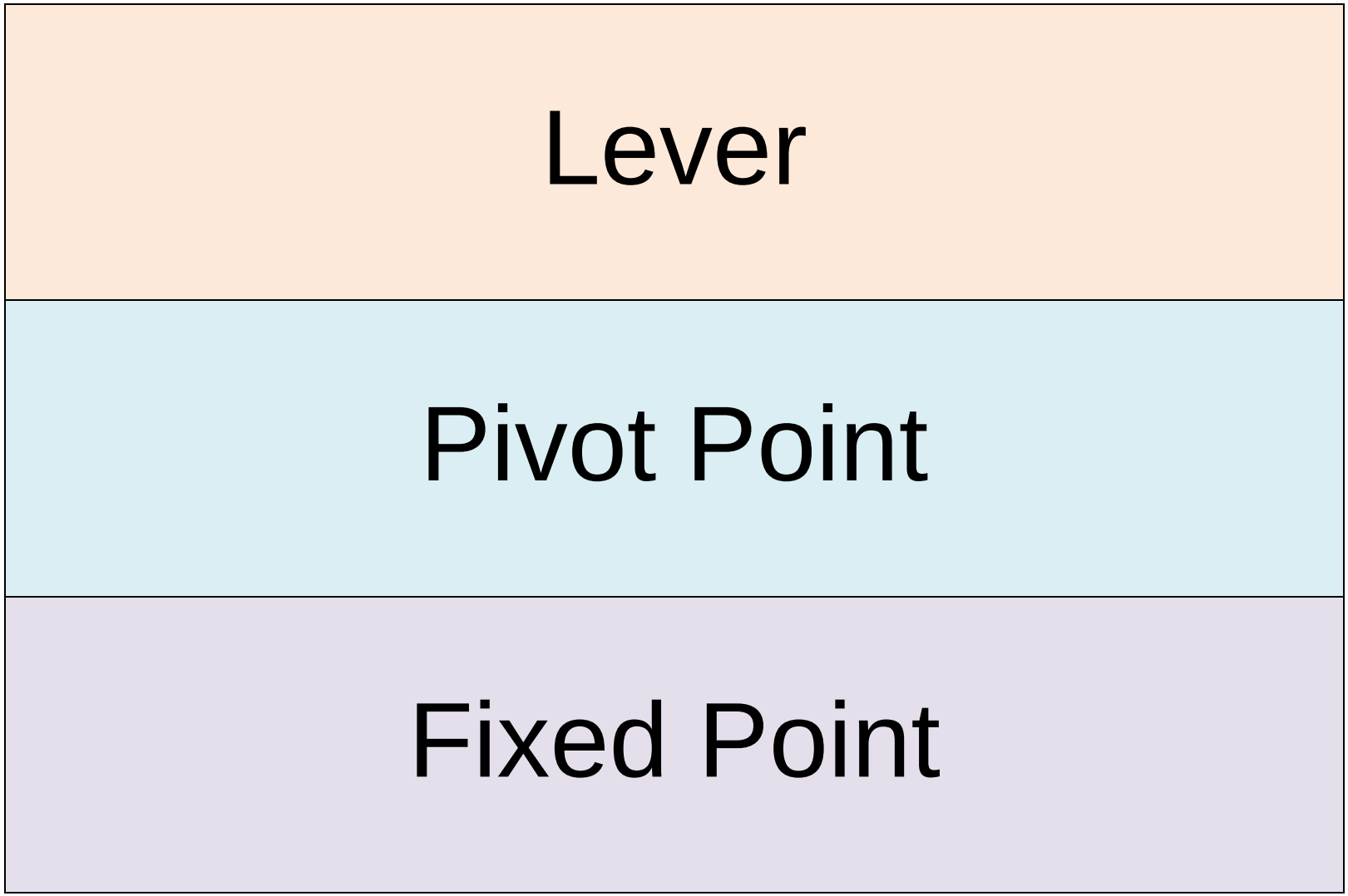


FIGURE 15. CARD THAT MOVES WITH LEVERS FOR LESSON 8


Lever
Pivot Point
Fixed Point

Name: _____ Date: _____

Our drawing:

We think that behind the card_____

_____.

There are _____ levers.

There are_____ pivot points.

There are ____ fixed points.

Name: _____ Date: _____

We would like to make a movable card that

_____

_____.

Our card will be different than the model

because_____

_____.

The kind of movable card we would like to

make is_____

_____.

Unit 8 (Mechanisms):
Mechanimals Design Project: Toys that move w/ levers

Concept
Levers can be used to make toys that have movement.

Content objective
Student teams make "mechanimals", models of animals or characters that move using levers.

Language objectives
Explain designs using target vocabulary: levers, movement, work, energy
Summarize the design process using past tense verbs.

Standards

- **NGSS**
  - **K-2-ETS1-1** Ask questions, make observations, and gather information about a situation people want to change to define problem that can be solved with a new or improved object or tool.
  - **K-2-ETS1-2** Make a drawing or physical model to illustrate how the shape of an object helps it to solve a problem.
  - **K-2-ETS1-3** Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses.
- **ELPS**
  - **1C** use strategic learning techniques such as concept mapping, drawing, memorizing, comparing, contrasting, and reviewing to acquire basic and grade-level vocabulary. (Metacognitive Strategies)
  - **2I** Demonstrate listening comprehension of increasingly complex spoken English by following directions, retelling or summarizing spoken messages, responding to questions and requests, collaborating with peers, and taking notes commensurate with content and grade-level needs [Demonstrate LC in Context]
  - **4A** learn relationships between sounds and letters of the English language and decode (sound out) words using a combination of skills such as recognizing sound-letter relationships and identifying cognates, affixes, roots, and base words
- **TEKS**
  - **2B** plan and conduct simple descriptive investigations such as ways objects move (Investigates movement)
  - **2E** communicate observations and provide reasons for explanations using student-generated data from simple descriptive investigations (Communicate results from own data)
  - **3A** identify and explain a problem such as finding a home for a classroom pet and propose a solution in his/her own words (Explain problem & solution)
  - **4A** Uses age-appropriate tools and models to investigate the natural world (Uses tools)
  - **6D** Knows that energy, force, and motion are related and are a part of everyday life; how objects move.

Suggested Literature Connections:
"If I Built a Car" by Chris Van Dusen

Materials:
Posterboard, paper fasteners, K'nex connector kit (if possible); Model of a toy that moves using levers (see reference in handout **1.8.1**); Copy of Design Brief on a chart; Cereal boxes, other recycled materials; Scissors, crayons, markers, wood stripts, screw driver, hole puncher

Day 1: Engage, Explore *Mechanisms-Mechanimals Design Project: Toys that move w/ levers*

Teacher Says/Does	Student Says/Does	Language requirements
1. Get the class together and show them a model of a toy that uses levers or show them a model created by you (see handout **1.8.1**). Do not show them how it works. Ask the students to close their eyes and think about what might be making the toy move when you operate the slider, crank, or strings. 2. Using one of the toys, demonstrate one way of doing a sketch of a simple toy as a class. Develop a list of steps so they are visible to all students who may need them. 3. Organize students in teams of 3-4, and ask the teams to draw a sketch of what they think is inside another toy; specifically focused on what mechanism is making the toy move as it does. 4. Have the teams individually show you their sketches. Then let them look behind or inside of the toy. Let them evaluate their sketches and find where the sketch is different from the actual model. Place the sketches in the working portfolios. 5. Bring the class back together to discuss their sketches. What clues did they use to make their initial sketches? How were their sketches the same and/or different from what was in side the actual toy?	Students orally describe the model shown, and chorally read the steps of how to make a sketch and use it during group work. Students make drawings of a sketch that might reflect the movement of the toy.	

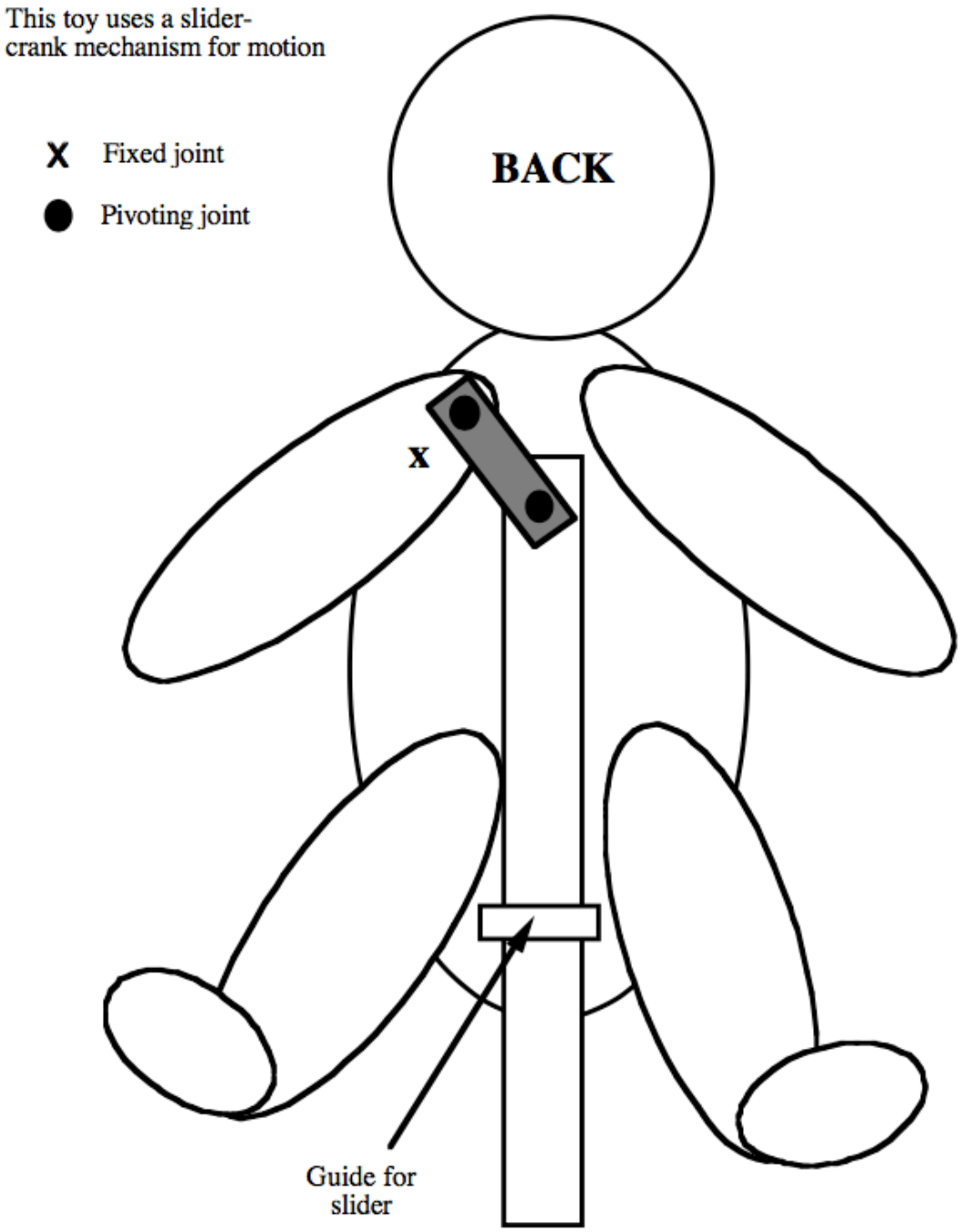
Day 2: Explore/ Explain *Mechanisms-Mechanimals Design Project: Toys that move w/ levers*

Teacher Says/Does	Student Says/Does	Language requirements
1. Show the students the following Design Brief: **DESIGN BRIEF:** Make a mechanimal from our [story or study] that has at least one part that moves 2. Explain to them that a Design Brief is a problem for their team of two to solve, and that to begin solving a Design Brief problem they need to think about it. 3. Remind them of how to begin work on a Design Brief: • Look at the Design Brief. • Ask questions about what the words mean. • When you understand what the words in the Design Brief mean, talk with your partner and plan what you might like to make. • Using cut pieces of paper or drawing, make a plan for what you will make. Talk about who will do what jobs and how you will make sure both people have interesting jobs to do. 4. Before they begin, emphasize that their mechanimal should be based on a character from a story you have enjoyed together (or a science or social studies unit you have been working on). Have the children name some things they have worked on of interest to them. 5. When the students have finished discussing the Design Brief, let the teams begin planning and sketching their products. Students may use handout (**1.8.2**) as a reference.	Students use sentence frames to complete task.	As part of our design brief, we would like to make_____ My job will be to _____ My job is interesting because_____ My partner's job will be to _____ My partner's job is interesting because_____

Day 3: Elaborate/Evaluate *Mechanisms-Mechanimals Design Project: Toys that move w/ levers*

Teacher Says/Does	Student Says/Does	Language requirements
1. Collect all children's drawings and sketches, as part of a "working portfolio." You may like to make portfolios for each team or have individuals make their own. 2. After students have planned, selected their materials, and made their products, bring the class together to evaluate the following questions: • *Has this team made a character that moves using levers?* • *How well did your team work together?* • *Did you have ideas that you did not use? Why/why not?* • *What happens to ideas that we don't use?* • *What might the saying mean, "Back to the drawing board"?* • *Where is there "work" or energy in the models you have made?* • *What might you do to make the product better?* • *What would you have to do in order to make the "mechanimal/object" move in a different way?* 3. Ask students to finish their projects by filling out a reflection handout (**1.8.3**).	Students incorporate their movable cards into their portfolios Students label the levers on their movable cards	

TEACHER REFERENCE



Name: _____ Date: _____

DESIGN BRIEF: Make a “Mechanimal” from our story that has at least 1 part that moves.

As part of our design brief, we would like to make_____.

My job will be to _____.

My job is interesting because_____.

My partner's job will be to _____.

My partner's job is interesting because_____.

Name: _____ Date: _____

We (did/did not) make a character that moves because_____.

We (worked/did not work) well together because_____.

We (had/did not have) useful ideas because_____.

In order to make the product better we would have to_____.