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Background Information:

There are many geographical features on the Earth, each with its own traits. These landforms may have been formed by plate tectonics. If tectonic plates move toward each other, land is pushed upward resulting in hills and mountains. Erosion may change the shape of these. The formation of new crust and volcanoes are just two features caused by divergent plates. As plates move away from one another, water may accumulate resulting in lakes, streams, and rivers. As these water shapes expand they may change into features such as oceans and seas. Erosion also plays a part in shaping the land. Trenches are the result of plates sliding past one another.

Physical properties of matter are those that can be observed without changing the chemical composition of the matter. Size, shape, color, flexibility, texture, solubility, melting point, and odor are just a few physical properties. Using these observations is helpful in classifying matter and determining which materials would be ideal for various uses. For example, something that dissolves in water would not be useful in making beverage cups.

Heating or cooling an object will always change its temperature and may alter other properties as well. The temperature change is reversible, but changes to other properties might be irreversible. Heating, in particular, often causes chemical changes in which atoms alter their bonding to form new substances. Cooking an egg changes the egg in ways that cannot be undone. It cannot be "uncooked" into a raw egg.

Phase changes are generally reversible. Water can be frozen, melted back into liquid, boiled into vapor, and then condensed back into its original liquid form. When considering a manufactured object, however, phase changes often alter the shape of the object in irreversible ways that leave it unsuitable for its intended purpose. Many materials may be cooled without permanent impact. If they contain water, however, freezing will cause the water to expand, possibly rupturing solid structures in irreversible ways.

Pollinators are responsible for moving pollen from one flower to another flower of the same species or from one part of a flower to another part of the same flower. Moving the pollen from the **stamen**, male part of the flower, to the **stigma**, the female part of the flower, completes pollination, and results in the fertilization of a plant so that seeds may be produced to ensure reproduction. This involves animals such as butterflies, bees, wasps, insects, spiders, hummingbirds, and bats. These animals may deliberately visit a flower to gather pollen or accidently collect pollen while seeking nectar or nest

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building materials. Some animals have structures that assist in the collecting of pollen, which is sticky and barbed. For example, a lemur and bat have fur, bees have fuzzy covered legs, and some birds have a sticky tongue. Abiotic factors, such as wind and water, also help pollinate plants. Seeds that are produced by pollination may also be dispersed by animals, wind, and/or water.

Pollinators are vital members of ecosystems and contribute to clean air, healthy and stable soil, and generating oxygen. In addition, a large part of the agricultural economy is dependent upon pollinators.

Activity: Map It

2-ESS2- Earth's Systems
Develop a model to represent the shapes and kinds of land and bodies of water in an area.

Objectives:

- Students will recognize, map, model, and describe a variety of land and water geological features on the Earth.
- Students will discuss the relationships among geographical features.
- Students will discuss the features of a map.

Advanced Preparation:

- □ Determine what materials will be available for writing their explorer story.

Materials:

- *Map It* Cards
- Copy/Drawing Paper
- Clay/Play-Doh® (Suggested colors: Brown, Blue, Green)
- Paper for Writing Story
- Coloring Supplies (optional)

Suggested Approach:
Groups of 2-4. Distribute a set of landform cards to each group. Allow students time to view and discuss the cards. Pose questions such as the following to the class and discuss:

- ☆ *What do these cards tell you?*
- ☆ *Have you seen any of these?*
- ☆ *If you have seen any of these, where did you see them?*
- ☆ *Are these features on the land? Water? Both? Explain your idea(s).*

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Share with the class that their groups will be making a model of their shapes of land and water. You may wish to discuss their perceptions/ideas about what a model is, as well as the steps for making a model. If not part of the conversation, bring up the idea of planning before building.

Next groups will build their models and view other's work. Groups select the landforms they wish to represent. Then they consider how the landforms will connect to one another on the model. This is followed by teams making a drawing (plan) of how their model will look. Using up to half a stick of clay, groups will build their models.

Once models are completed, host a gallery walk. To prepare for the gallery wall, groups put their landform cards by their model. When a group goes to another model, they identify each landform by placing the card in front of the appropriate landform. Prior to moving to the next group, landform cards are placed to the side of the model.

When the gallery walk is complete, discuss ideas such as the following with the class:

- ☆ *What did you see when you visited each other's models?*
- ☆ *Were there any shapes of land (landforms)? Which did you see? Describe how their traits.*
- ☆ *Were there any shapes of places with water? Which did you see? Describe how they looked.*
- ☆ *How did you know if a (fill in the blank. i.e. mountain) was in the model?*

Display a map and a globe (if available). Allow students time to explore each. Continue the discussion with ideas such as:

- ☆ *What is the name of each of these?*
- ☆ *What did you notice on the map? The globe?*
- ☆ *Who would make these?*
- ☆ *How could you use these?*
- ☆ *Who would use these?*
- ☆ *How do think a map maker knows where to put a (fill in the blank: i.e. lake)?*
- ☆ *Who do you think were some of the first people to see these? (Coach the idea of an explorer.)*

Share with students that they will now become an early explorer who is the first to see these shapes of land and places with water. It is now time for them to write about their exciting discoveries. Prompt student thinking regarding

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how they would describe what they saw, where they were found, how they were connected to one another. Encourage inclusion of the drawing of a map. Distribute materials for writing their stories. When finished, allow students to share stories.

Debrief:

- ☆ *How can we share information about what the Earth looks like?*
- ☆ *Why is a map important?*
- ☆ *How can a map be used?*
- ☆ *Where are these features located?*
- ☆ *Where might you find a (fill in the blank: i.e. hill)?*
- ☆ *What would be next to that (fill in the blank: i.e. hill)?*

Resources:
https://en.wikipedia.org/wiki/List_of_landforms
https://pubs.usgs.gov/gip/dynamic/understanding.html

Activity: Make It

2-PS1-1 Matter and Its Interactions
Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

2-PS1-2 Matter and Its Interactions
Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

Objectives:

- ➢ Students will observe and record physical traits of objects.
- ➢ Students will design and conduct investigations to determine physical traits of objects.
- ➢ Students will analyze data and use evidence to determine potential uses of various objects.

Advanced Preparation:

- □ Warm water is recommended for use with the investigations.
- □ Determine what other materials could be used for testing.

Materials:

- Make It Power Point
- Make It Student Pages
- Cups

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- Water – Warm and Cold
- Copy/Drawing Paper
- Spoons
- Hand Lenses
- Droppers
- Rulers – If measurement is appropriate for your students
- Plastic Strips
- Paper Towels (for cleaning)
- Packing Peanuts – Soluble and Non-soluble
    - Variety of Items for Testing: *(suggestions)*
    - Kool-Aid
    - Packing Peanuts
    - Sand
    - Salt
    - Sugar
    - Pepper
    - Plain Paper Plates
    - Coated Paper Plates
    - Styrofoam Plates
    - Trash Bags

Suggested Approach:
Use the Make It power point to begin a class discussion. Alternately, you may wish to provide each group with a different picture and use questions such as: (Note: there is a slide in the Make It power point with questions only).

- ☆ *What is this?*
- ☆ *How is it used?*
- ☆ *What might be used to make this?*
- ☆ *Why would that be used?*

Prior to beginning the investigations, you may wish to pose question such as the following to the class and discuss:

- ☆ *How do you think people decide what materials to use when making something?*

Groups of 2-4 are suggested. You may also wish to setup stations. Share with the class that their groups will be working to observe traits/properties of various materials. Introduce the materials available to students. At this point it is suggested to have dark and light paper, hand lenses, and a variety of materials available for initial discovery. Allow ample time for students to

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observe and record their observations about the items. They also consider possible uses for the items.

Ask the class to consider if there is more information that could be obtained through additional observing. Share with the class what materials will be available for testing to gain more information about the items. Student groups then develop questions they would like to investigate using the materials available. Post student questions. Allow groups to select which question they would like to investigate. Now students will develop and record a method for testing the materials. Plenty of time should be provided for this phase. Again, students record their observations and suggest a product the item(s) could be used in a product. Evidence from the investigations should be incorporated into their ideas. Student groups would then share their ideas. You may wish to return to the original questions during this phase.

Debrief:

- ☑ *What types of observations did you make?*
- ☑ *Did any of the materials have the same traits/properties? What evidence do you have to support your ideas?*
- ☑ *Did any of the materials have different traits/properties? What evidence do you have to support your ideas?*
- ☑ *What else would be helpful to know about something before deciding to use it for a product?*

Activity: Heating, Cooling, and Reversibility

2-PS1-4 Physical Science

Construct an argument from evidence that some changes caused by heating and cooling can be reversed and some cannot.

Objectives:

- Students will consider how the characteristics of an object change as it is heated or cooled.
- Students will recognize that changes may be reversible or irreversible.
- Students will construct and defend an argument regarding reversibility.

Advanced Preparation:

- ⎦ Pre-cutting cards for students will save time.

Materials:

For the Teacher

- Reversibility slide show, computer, and projector

For each group (of 2 or 3 students)

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- 4 Hot Oven / Cold Freezer sheets
- 1 sheet of Reversibility cards
- 1 pair of scissors
- 1 glue stick

Suggested Approach:
Begin by discussing with students the difference between a **reversible** change and an **irreversible** change. One possible example:

> Remove the snap-top from a magic marker while students watch. Ask if the marker has changed. Ask if the change can be reversed and demonstrate it can by putting the cap back in place. Then ask if braking the marker in half is a reversible change. Since you are unlikely to get it back together in any useful way, this can be considered an irreversible change.

Help students form groups of two or three and give each group a sheet of Reversibility cards. Students use scissors to cut the cards.

Give each group four Hot Oven sheets and four Cold Freezer sheets.

Groups select an object card and decide whether to heat the object by placing it in the Hot Oven or cool the object by placing it in the Cold Freezer.

After gluing the object card in place, students take turns describing the object's properties before it is heated or cooled. Each description is recorded with a word or two in the box labelled "Before".

Then students take turns describing the object's properties after it is heated or cooled. Their ideas are recorded in the "After" box.

Students then discuss and record their ideas about what has changed and whether these changes are reversible. These ideas are recorded in the final box.

Students do this for each of the eight object cards.

Begin the Reversibility slide show. At each slide, ask students what changes they would expect to see. Ask whether those changes are reversible. You may have each group express their opinion quickly by raising aloft either their "Reversible" card or their "Irreversible" card. Challenge them to reference the notes they recorded earlier when expressing an opinion. Note that each group will only have examined eight of the 16 scenarios.

For many of these scenarios, there is ample room for divergent opinions. The

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point is to have students explain their reasoning and defend their argument with logic. Of course using experimental data is always desirable. If the teacher can bring in a cooler of ice, a hair dryer, or desk lamp with an incandescent bulb, it will be possible to test at least some of the students' ideas.

Activity – Look at That

2-LS2-2 Ecosystems: Interactions, Energy, and Dynamics
Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

Objective:

- Students will observe and describe seeds and simulated pollen.

Advanced Preparation:

- Buy flowers ahead of time. Try to purchase flowers with a lot of pollen.
- You may wish to have gloves available for students.
- Students will need to wash their hands after touching and working with pollen.
- Plan how materials will be distributed to students. Will they have one material to observe at a time or will they be given all at the same time? Will they pick up the materials from a central location?

Materials:

- Look at That Student Pages
- Hand wipes (optional)
- Flowers (Pollen - if appropriate for your class)
- Variety of Seeds
- Burrs or Similar
- Cup/Container for Seeds & Burrs
- Hand Lens
- Black Paper
- Drawing Paper
- Coloring Supplies

Suggested Inquiry Approach:
Students will observe pollen, seeds, and burrs. Introduce the lesson by asking students questions such as:

- ✓ *What is a seed?*
- ✓ *What is pollen?*
- ✓ *What is a burr?*

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- ✓ *Where do pollen, seeds, and burrs come from?*
- ✓ *Why do you think plants make pollen, seeds, and burs?*

Share with students that they will be making observations of pollen, seeds, and burrs. If needed, allow students time to practice using hand lenses. Explain to students that they will use the hand lenses to observe the items. They will be recording their observations by drawing each of the items they examined.

Distribute the materials as you have planned. (Students may need help in locating the pollen in the flowers.) Assist student groups as needed. Collect the materials.

Debrief*:*
Allow time for students to share their experiences.

- ☑ *What did you observe about the pollen? The seeds? The burrs?*
- ☑ *How were they alike?*
- ☑ *How were they different?*
- ☑ *Why do plants make pollen, seeds, and burrs?*
- ☑ *Do you think the pollen, seeds, and burrs stay in one place? Are they moved from place to place?*

Activity: "Critter"

2-LS2-2 Ecosystems: Interactions, Energy, and Dynamics
Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

Objectives:

- ➢ Develop, design, test, and evaluate models for dispersing seeds and pollinating plants.
- ➢ Collect and analyze data to evaluate function of model.

Advanced Preparation:

- Decide what materials will be available for student use to build their pollinators or seed dispersers.
- Decide how materials will be handled.
- If using sidewalk chalk, crush chalk prior to the activity.
- Decide how the testing will occur.
- You may wish to break this lesson into multiple phases:
    - Thinking, planning, designing
    - Building
    - Testing

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- Redesign, rebuild (if completing these stages)

Materials: (Suggestions)

- Critter Student Pages
- Cotton Balls
- Craft Sticks
- Chenille Stems
- Tape
- Wax Paper
- Construction Paper
- Flour or Other Powder to Simulate Pollen
- Scissors
- Glue/Glue Stick
- Student Pages
- Coloring Supplies

Suggested Inquiry Approach:

Students will build a pollinator and/or a seed disperser. Introduce the lesson by asking students questions such as:

- ☆ *How could pollen get from one flower to another?*
- ☆ *How could a seed get from one place in your yard to another?*
- ☆ *Why do plants need pollen and seeds to move from one place to another?*

Explain to students that their challenge is to design a "Critter" that will be able to move pollen and/or seeds from one place to another. They will then test their "Critter" to see how well it works.

Have student groups look at the materials available for their design. Encourage them to think about how the materials could be used. Distribute the student planning page to each student so students may draw their idea(s). Allow ample time for students to plan how they will make their "Critter." Depending upon your students, you may wish to have them share and explain their idea(s) with either a partner or you prior to obtaining materials for building.

When ready, assist students as they assemble their "Critter." Share how students will test their "Critter." One suggestion is to provide each student group with a small amount of simulated pollen and/or seeds. Have them test how well their "Critter" is able to pick up and transfer pollen and/or seeds. This can be done by counting the number of seeds that the "Critter" was able to transfer from one place to another. Pollen can be tracked by placing darker construction paper under the path of the "Critter" and tapping it when it

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reaches the other side of the paper. Students can observe if pollen fell off on the way to the final destination and how much pollen was dropped at the end.

If time allows, students could redesign and rebuild their "Critter" to see if they are able to improve the function of the "Critter."

Debrief:
Allow time for students to share their experiences.

- ☑ *How well did your "Critter" work?*
- ☑ *How did your "Critter" move? Did it "Critter" walk, fly, crawl, or move some other way?*
- ☑ *What special body parts did you put on your "Critter" to help it work?*

Activity: What are they doing?

2-LS2-2 Ecosystems: Interactions, Energy, and Dynamics
Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

Objective:
Students will identify features of animals that help in pollination and/or seed dispersal.

Materials:

- Power Point
- Computer
- Projector

Suggested Inquiry Approach:
Either in pairs or groups of four have students share details about their "Critter." Show the power point and allow time for observation, discussion, and questions about each slide.

Debrief:

- ☑ *What body parts (features, traits, structures) did the animals have that helped them pollinate and/or spread seeds?*
- ☑ *How did the body part (feature, trait, structure) help the animal?*

Resources:
http://www.fs.fed.us/wildflowers/pollinators/animals/index.shtml Retrieved 7 June, 2016.
https://www.nps.gov/subjects/pollinators/what-is-a-pollinator.htmv Retrieved

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8 June, 2016.
<ahref="http://science.jrank.org/kids/pages/71/REPRODUCTION.html">
REPRODUCTION - Stamen, Carpel, Petals, Sepals, What Is Pollination?,
Animal-Pollinated Plants, Wind-Pollinated Plants Retrieved 20 June, 2016