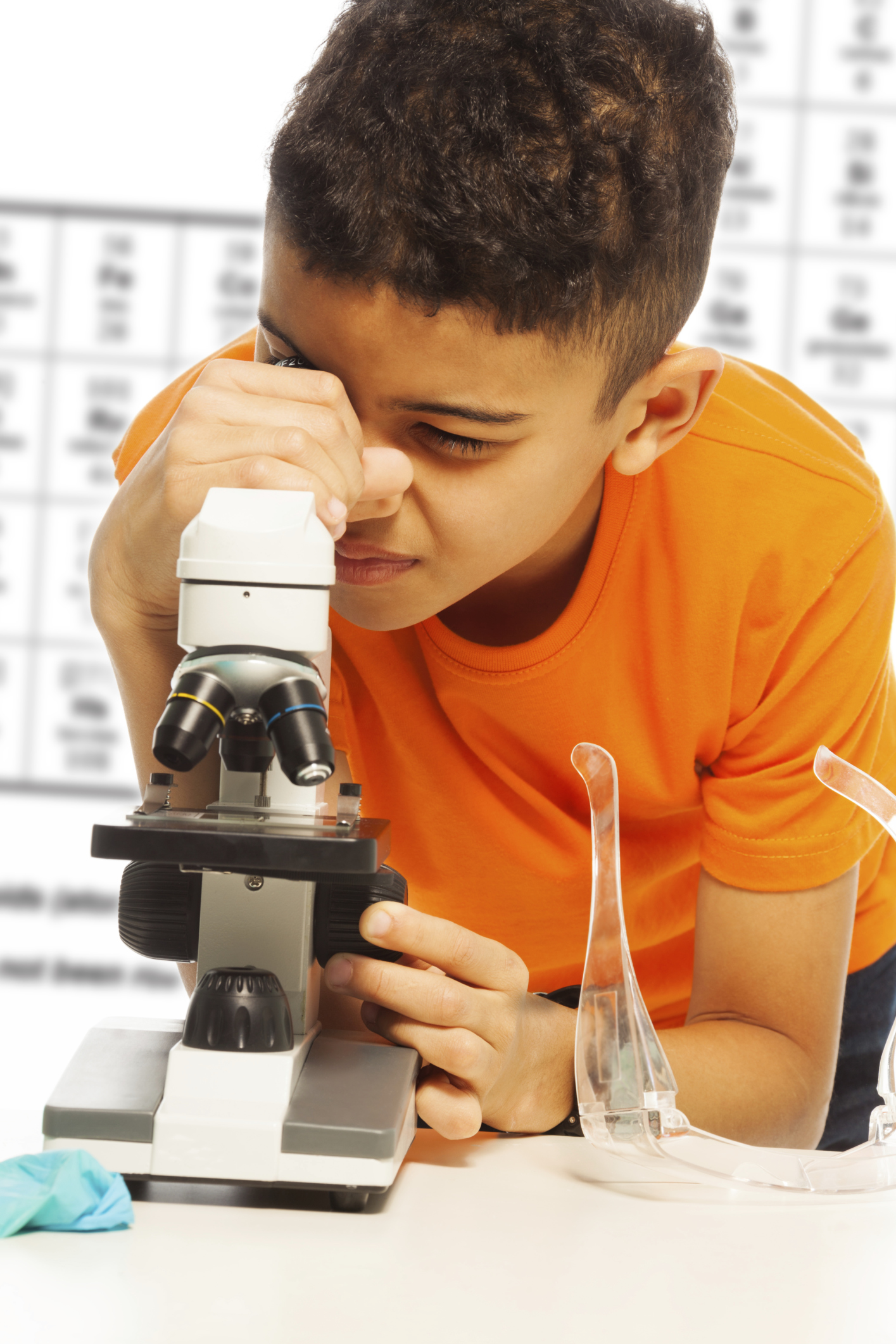
**Science: Grade 2**

**Unit 1 – Properties of Materials & Mixtures**

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**Unit 1 – Properties of Materials & Mixtures**

**Science: Grade 2**

**Unit 1 – Properties of Materials & Mixtures**

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**Science: Grade 2**

**Unit 1 – Properties of Materials & Mixtures**

**About Our Scope Unit/Lesson Template**

This template is designed to serve several teaching and learning principles considered as staples of state of the art science instruction. Here are the key principles in summary:

* It’s critical to **elicit prior knowledge** as a unit or lesson begins.
* **Key questions** should drive student explorations and investigations.
* **Activity Before Concept** – Student inquiry-based explorations which give personal experience with phenomena and ideas should precede a presentation of science ideas.
* **Evidence is the heart of the scientific enterprise.** Students generate evidence and analyze patterns in data that help to construct scientific explanations around key questions.
* **Concept Before Vocabulary** – Attaching science vocabulary to concepts developed by student investigations yields more success than beginning a unit or lesson with a list of science vocabulary.
* **Talk, argument** **and writing** are central to scientific practice and are among the most important activities that develop understanding.
* **Application** of the ideas provides review, extends understanding, and reveals relevance of important ideas.
* **Assessment** of knowledge, skill, and reasoning should involve students throughout the learning process and be well aligned to the main objectives and activities of the unit.

The Scope Science template is designed to put these principles into practice through the design of the ***SCOPE LEARNING CYCLE FOR SCIENCE***. Each unit has at least one cycle. The components are listed below:

|  |  |
| --- | --- |
| The Key Question for the Unit | Each cycle has one, open-ended driving question that relates to all the content and skills of the unit. The Key Question is presented at the opening of the unit and revisited at the unit’s conclusion. |
| Engage and Elicit | Each unit begins with an activity designed to elicit and reveal student understanding and skill prior to instruction. Teachers are to probe students for detailed and specific information while maintaining a non-evaluative stance. They also can record and manage student understanding which may change as instruction proceeds. |
| Explore | A sequence of activities provides opportunities to explore phenomena and relationships related to the Key Question of the unit. Students will develop their ideas about the topic of the unit and the Key Question as they proceed through the Explore stage of the learning cycle.  Each of the activities may have its own Focus Question or central task that will be more focused than the unit question. The heart of these activities will be scientific investigations of various sorts. The results, data and patterns will be the topic of classroom discourse and/or student writing. A key goal of the teacher is to reference the Key Question of the unit, the Engage and Elicit of the students and to build a consensus especially on the results of the investigations. |
| Explain | Each unit has at least one activity in the Explain portion of the unit when students reconcile ideas with the consensus ideas of science. Teachers ensure that students have had ample opportunity to fully express their ideas and then to make sure accurate and comprehensible representations of the scientific explanations are presented. A teacher lecture, reading of science text, or video would be appropriate ways to convey the consensus ideas of science. Relevant vocabulary, formal definitions, and explanations are provided. It’s critical that the activity and supporting assessments develop a consensus around the Key Questions and concepts central to the unit. |
| Elaborate | Each unit cycle has at least one activity or project where students discover the power of scientific ideas. Knowledge and skill in science are put to use in a variety of types of applications. They can be used to understand other scientific concepts or in societal applications of technology, engineering or problem solving. Some units may have a modest Elaborate stage where students explore the application of ideas by studying a research project over the course of a day or two. Other units may have more robust projects that take a few weeks. |
| Evaluation | While assessment of student learning occurs throughout the unit as formative assessment, each unit will have a summative assessment. Summative assessments are posted in a separate document. |

**Science: Grade 2**

**Unit 1 – Properties of Materials & Mixtures**

**Unit Introduction**

This unit attends to the Michigan Grade Level Content Expectations as they are gathered in the 2nd Grade Unit 1 of the Michigan Department of Education Science Companion Document. Topically, the unit addresses concepts related to classifying objects and mixtures based on their properties, procedures and tools used for measuring properties, and strategies for using knowledge of those properties to solve problems.

As teachers look for ways to have students use real-world data, apply interactive technology to real-world questions and foster meaningful tasks for reading, writing, argumentation and mathematics and framed by the Common Core Curriculum Standards, the issues here provide abundant opportunity. The main limitation is the class time available given other content demands.

*On the Common Core State Standards for English Language Arts and Literacy in Science*

All science teachers will find the Common Core State Standards of ELA a tremendous asset for reaching learning objectives in science education. Reading, writing, argumentation and discourse are central proficiencies necessary for success in science. All teachers should become fluent with the document and will likely find it validating.

[**http://www.corestandards.org/assets/CCSSI\_ELA%20Standards.pdf**](http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf)

These standards are best reached with science instruction that connects content to real-world problems and experiments, complimented with scientific writing, challenging questions, processes for classroom discussion and debate, and use of scientific text.

It is recommended that teachers require students to use an interactive science notebook to support learning in this unit. Here are some features and policies to consider:

* Use a bound notebook – cut and paste some other materials into it (quad-ruled notebooks are nice for graphing activities).
* The right facing page is for teacher content; the left is for student reflection.
* Leave four pages for a table of contents.
* Leave the notebooks in the room.

**Science: Grade 2**

**Unit 1 – Properties of Materials & Mixtures**

**Learning Cycle: Properties of Materials & Mixtures**

**Introduction**

In this unit, students develop competence identifying, classifying, and measuring properties of objects. They use their knowledge of properties to separate mixtures into their parts. They use this knowledge to choose objects that have properties that can help solve various engineering design problems.

**Learning Objectives**

Students will be able to:

* Describe objects and substances according to their properties (color, size, shape, texture, hardness, liquid or solid, sinking or floating).
* Measure the length of objects using rulers (centimeters) and meter sticks (meters).
* Recognize that some objects are composed of single substances (water, sugar, salt) and others are composed of more than one substance (soil)
* Make purposeful observations of various objects according to their properties.
* Plan and conduct simple investigations of objects or substances to determine whether they sink or float and to compare objects using a balance.
* Manipulate simple tools (metric rulers and meter sticks) to determine the length of objects and the volume of liquids (measuring cups and measuring spoons)
* Make accurate measurements of length of objects in appropriate units (meter, centimeter)
* Share ideas about the properties of objects and the classification of single substances and mixtures.
* Communicate and present findings about the properties of objects or substances and the classification of single substances and mixtures.
* Develop strategies and skills for gathering information about the properties of objects or substances.
* Demonstrate a means of classifying objects as single substances or mixtures through various illustrations, performances, exhibits, or activities.
* Recognize that when a science investigation on sinking and floating of objects or substances is done the way it was done before, similar results are expected.
* Use evidence when communicating ideas about the classification of single substances and mixtures.

**Key Question: How does understanding properties help us use materials to solve problems?**

**Advance Preparation for the Learning Cycle**

Allow time to obtain items not necessarily on hand or easily purchased at a local store:

* Science notebooks for each student. (Lesson 3)
* Different types of counter top materials. Scraps can be obtained from companies that make counter tops. They give them away as samples. Parents may also have left over samples at home. Interior designers may also keep a sample set. (Lesson 5)
* *Stone Soup* Trade Book with folktale—any version or author. (Lesson 8)
* Sweet smelling, colorful flowers (such as roses). Flower shops and funeral homes often have leftovers that they will donate. See parent letter requesting donations: Potpourri Parent Letter. (Lesson 10)
* Teacher should plan to dry flowers and herbs at least two-three weeks prior to teaching Lesson 10. Flowers should be hung upside down or put on screens to dry. For more detailed descriptions visit online potpourri sites, such as [www.projects-for-kids.com/gift-projects/potpourri.php](http://www.projects-for-kids.com/gift-projects/potpourri.php) or Martha Stewart videos on making potpourri.
* Polymer crystals (polyacrylamide) available at Science Kit & Boreal Laboratories: call (716) 874-6020; also available at gardening stores and online sources (Amazon sells them as “Ghost Crystals”). (Lesson 12)
* **Before Lesson 3:** Send the “*Properties Speaker Letter”* home requesting parent volunteers to be a “Guest Speaker” about how they use properties of materials in their work (see Lesson 11).

**Duration of unit**

12 lessons (14 class sessions)

**Engage and Elicit**

**Activity 1 – Moving Day Help**

**Purpose**

To use prior knowledge of properties and sorting systems to organize a set of objects.

**Activity Description**

Students are told that a teacher had to move to a new classroom and someone else put everything in boxes for her. But now everything is disorganized. It is the students’ job to organize the items.

**Focus Question**

What are different ways items can be organized?

**Duration**

One class session

**Materials**

* 8-10 semi-random classroom items. Select objects with different textures, buoyancy, and size, including one item less than two inches and one more than 10 inches; liquids in containers (water or perfume bottles) placed in a boxes. Prepare one box per group of 3-4 students – see teacher prep #1 below.
* “Moving Day Help” pages (one set per group).
* One pencil/marker per group.

**Teacher Preparation**

1. Prepare boxes of items to be sorted from materials listed above. Groups A and B should have the same items in their boxes. Groups C and D should have the same items **and so on**. Plan to place the identical boxes in locations away from each other so their items aren’t noticed by students. The goal is to see how different teams of students choose to categorize the same items.
2. Copy and print “Moving Day Help” pages (one set per group).
3. Plan questions to ask the students about why they organized the items the way they did.

Suggestions:

* + *Why did your group sort this way?*
  + *What other ways could you have sorted?*
  + *Why didn’t you choose one of those other ways?*
  + *How did where these items might be kept in the room affect the way you sorted them?*
  + *How would knowing what the items are going to be used for (the purpose of them) affect how you sorted them?*

Note: “Talk Science Primer” by Sarah Michaels and Cathy O’Conner is an excellent resource for classroom discussions.

**Consideration:** Be careful not to give students words or ideas. It is tempting to say, “So, are you sorting it by texture or size?” Make note of their language. For now, it’s okay for them to say they are sorting by “big or small” or “soft or hard.” This activity is a pre-assessment of their current understanding of how to sort by properties and of the associated scientific vocabulary.

**Classroom Procedure**

1. Tell the students that you know about a teacher with a problem. She was excited to change classrooms, but it is a big job. Friends of hers helped her put her things into boxes. Now, the boxes are all disorganized and she is frustrated. It is a big job to reorganize. (Wait to see if the students offer to reorganize the boxes. If not, ask them for help.)
2. Tell students that you want their best thinking so the classroom will be more organized. Since you know they are kind and would like to help, you made them a record sheet to use. Show and explain “Moving Day Help.”
3. Discuss how to work as a team to fill out the paper, take turns talking, and what to do if the group does not agree with the best method to record.
4. Tell students they should physically sort their items the way they think is best and fill out their paper.
5. Give each group of 3-4 students a box, and assign them a place to work. Be careful to assign identical boxes to different areas of the room.
6. As students work, circulate and ask the questions you planned in the Teacher Preparation Section, step 3.
7. As the groups are beginning to finish, let them know that in two minutes they will be asked to stop working and to circulate around to see how other groups sorted their items.
8. Allow two or so minutes per number of boxes. Then, call the students to a sitting area with their groups and their paper to have a class discussion.
9. Ask students what they thought as they looked at other groups’ sorting methods.
10. Record the methods used on a class chart in kid-friendly language, either in a web format, or a list. SAVE this chart to reference often during this unit!
11. Be sure to compare the identical boxes during your discussion: “*Were they sorted the same way? Why/why not? Is there a right or wrong way? Would it matter if the items were put in different parts of the room, such as on shelves, in cupboards...? Would it matter how they were going to be used?”*
12. **Collect and save** the Moving Day Help papers for later use and discussion.
13. **SAVE** the boxes for the next lesson.

**Explore and Explain** 

**Activity 2 – Which Container?**

**Purpose**

To use measuring tools to help collect data on the size of selected objects.

**Activity Description**

This activity has two segments:

1. Explore: Students will sort their items into small, medium, and large piles.
2. Explain: Students will use rulers to measure items from their boxes to see which container their items best fit in.

**Focus Question**

How can we use tools to measure the size of objects?

**Duration**

Two class sessions

**Note:** Because this lesson may take more than one class session, plan an appropriate stopping point for continuing the lesson the following day.

**Materials**

* One “Which Container” worksheet per group
* One metric ruler per group
* Boxes from previous lesson
* Three different sized storage containers from your classroom

**Teacher Preparation**

1. Gather three different sized storage containers from your classroom.
2. Produce one copy of worksheet per group.
3. Decide how to show a larger version of a ruler; for example, image one on a Smartboard or display one with a document camera (see Step 4 below).
4. Select one item that is slightly too large for one of the containers and set it aside.

**Classroom Procedure**

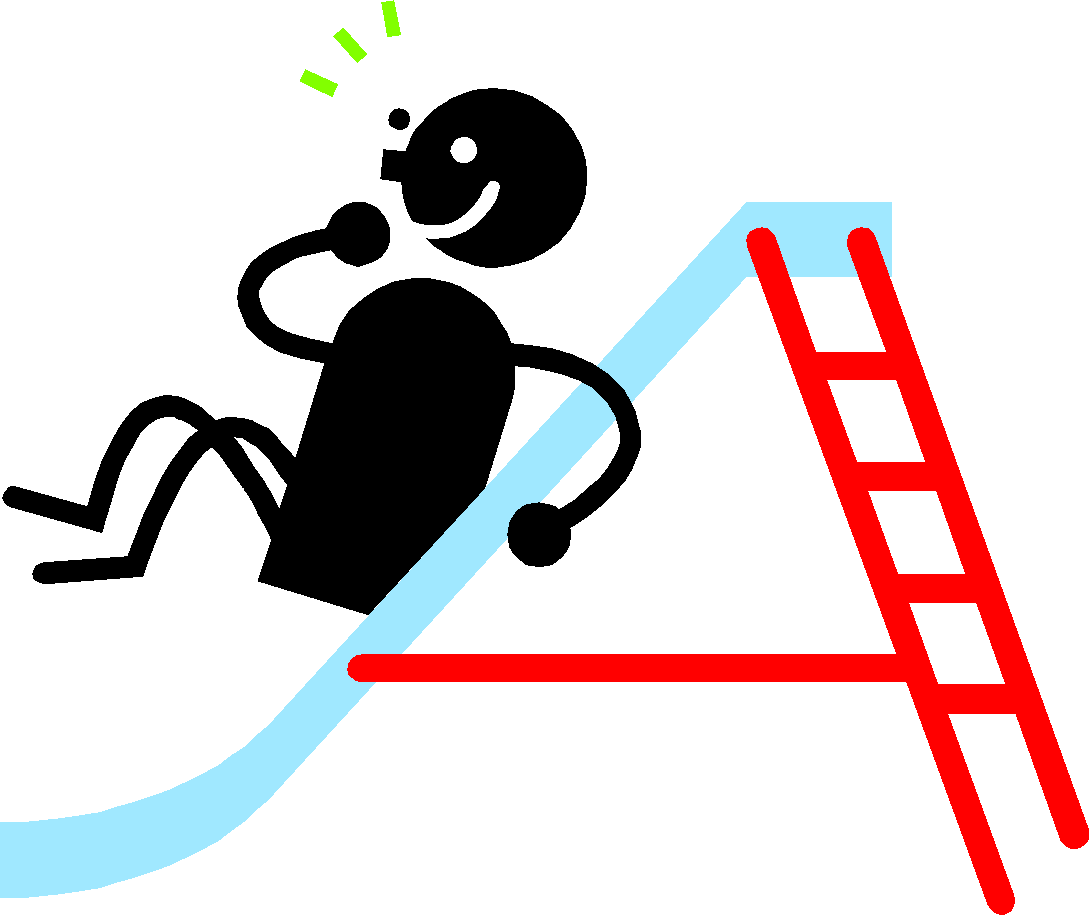
**Explore Stage:**

1. The teacher whom the students are helping thanks the students for their hard work giving suggestions on how to group the materials. She is now thinking about where exactly to store them. She has containers she wants to use and may need to buy some.
2. Ask the students to sort their items into groups that go in the small, medium, and big storage containers and immediately direct them to work with the same partners in the same places as yesterday. If they have any questions, they should raise their hands when their group is at their spot.
3. IF students ask, allow use of rulers or other nonstandard forms of measurement. Do not let students try out the items in the various boxes. Do not stop the class to suggest ruler use. Rather, let the students decide how to solve this problem—either on their own or by following examples observed around them.

**Explain Stage:**

1. After groups seem to be ready, ask the students, “*How can we know for sure if this container will be good for storing this item?* For example*, “Class, do you think this item would fit best in the small, medium, or large container?*” Ask students to raise hands for each size. Put an object in and remind students sometimes we need to be more precise, so we know for sure. Ask, *“How can we know for sure without trying it out, since we don’t have time to wait for each person to try out their items?”*
2. When measurement is brought up, show students a metric ruler and meter stick. *“Which tool should be used to measure which items?”*
3. Model how to use a ruler to measure to the nearest centimeter. It is best if this done with a larger version of a ruler, so all students can see the lines, either by drawing a model on the board, or zooming in on a camera document or Smartboard. Be sure to start from the zero line.
4. Measure each box in front of the students and write down the measurements where they can easily see them.
5. Model how to record on “Which Container?” sheet by first showing students how to copy in the measurements of the boxes. Teach students the definition of “length.”
6. Discuss the importance of measuring accurately to determine whether the items fit in the container. Remind students of the phrase “Measure once, cut twice,” which means you should double-check your work. At least one of the partners should double-check each measurement as they work.
7. Direct students to work in the same place, with the same group as yesterday.
8. As students work, circulate to make sure they are measuring accurately and record examples from student conversations to use during whole class discussion.
9. When groups are beginning to finish, give them an advance 1-2 minute warning. It is okay if they have not measured every item, as long as they were focused.
10. At the end, call students to a discussion area with their papers and groups. *“What did we sort by today?” “Was size on our chart*?” Refer back to the chart from Day 1, re-post if not there, and add the definition stated below.
11. “*So, size means how big* (use hand motion of spreading apart hands*) or small* (use hand motion of bringing hands to close together) *something is*. *We can discuss size by comparing: small, medium, large, or more specifically by using a ruler or other tool to use numbers to tell the size.*
12. Explain that: *“Size is a property. Property means how something feels, looks, smells, tastes, or sounds. We use our five senses to determine an object’s properties. We also use tools like rulers to help us be more accurate when we use our senses.*”
13. Add or change a title to your chart: “Sorting Properties.” Ask students: *Which sense did we use to sort the sizes today?*
14. Discuss why knowing size is important*. When is knowing size important in our lives? When do we use size in our lives?* (clothes size, bicycle size, purchasing beverages—small, medium, or large pop—bed size).

**BEFORE LESSON 3:** SEND HOME REQUEST LETTER FOR PROPERTIES SPEAKER FOR LESSON 11 SO THE SPEAKER HAS TIME TO PREPARE AND TIME TO SCHEDULE IT IN (SEE LESSON 11.)

**Explore and Explain** 

**Activity 3 – Feeling the Playground**

**Purpose**

To investigate various surfaces’ textures found on their playground.

**Activity Description**

Students feel the textures of various items on their playground, especially those on which they walk or sit.

**Focus Question**

Why did the designer choose different textures for different surfaces?

**Duration**

One class session

**Materials**

* One Science Notebook per student (these could be spiral bound, composition, or homemade notebooks that are inside of a folder or folded piece of construction paper with lined paper inside). See notebook directions on page 4 of this unit
* One pencil/pen per student

**Teacher Preparation**

1. Gather notebooks (see materials above).
2. Let the building secretary know your class will be outside on the playground during the time scheduled for this class session.

**Classroom Procedure**

**Explore Stage:**

1. Thank the students for helping to figure out which storage containers would be best to use, trade with other teachers, or buy to store her supplies in an organized way. Remind them that they used a property: size, how big or small an object is (have students use hand motions) to figure this out. Today they will have fun exploring a different property on the playground. Ask students*: How do different things on the playground feel when you touch them?*
2. Explain that they will be using Science Notebooks for the first time. They must write and spell neatly enough that when they go back to reread them, they will be able to understand what they wrote.
3. Pass out the notebooks. Have students write their names and a title for their notebooks. Show how to make a two-column chart labeled Object and Feeling.
4. Remind students when they go outside it is not to play, it is as a researcher. They will work in pairs to test surfaces on playground and record the surfaces they feel. *For example, you could investigate how the different parts of the slide feel*.
5. Model how to test surface texture using a think aloud and observations (students could copy this if they plan on touching the slide). Think aloud: “*I am wondering,* w*hat are words that might describe how a slide feels? What about the steps to the slide? Now I going to touch the step on the slide and record how it feels.”*
6. Recommend students start by observing the playground equipment. Make suggestions for a variety of possible surfaces to observe: *“You could touch the seat of the swing, the chains of the swing, the sidewalk, the pebble/gravel/grass…..”*
7. Before students go outside, establish a signal for when to come back in, and where to line up. Remind them they will silently walk back to class afterwards and sit with their partners in the group area to share their observations.

**Explain Stage:**

1. Have students share observations made outside. Records their observations on the chart you started prior to going outside. Other students who observed the same object can add additional adjectives describing the texture.
2. If you would like students to add their words to their charts, have them do so.
3. If inaccurate terminology surfaces, clarify the meaning and make sure an appropriate adjective is used. Any terminology errors should be corrected before being entered into student notebooks.
4. If students did not include key adjectives, add the following words to the playground chart and explain them: bumpy, rough, smooth, slippery.
5. Tell students that scientists use the word texture to state how something feels when you touch it. Add texture to the ongoing Properties chart.
6. Ask students to turn and talk to create a gesture or body motion that will describe and help them remember the property of texture. As a class, decide on one.
7. Discuss the following as a whole class:

* “*Why did the designers of the slide make it feel* (whatever is on the chart) *slippery? Why are the steps bumpy?* (So you don’t slip.) Ask questions about each of the properties the object on the list and why the designers of the object decided to use the materials with that property.
* *“Are there other properties we left off that maybe we didn’t feel on the playground but could find in other places?”* (How does a dog/cat feel?) Add additional terms that surface to the Properties Chart.
* *“Look at the bottoms of your shoes. Compare your texture with the pair I (or someone not wearing tennis shoes) am wearing. Why do shoe manufacturers make some shoes bumpy and some shoes smooth?”*

1. Direct students to individually complete the following sentence in their journals*:*

*A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ manufacturer wants their \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ to have a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ texture because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.*

**Extension:** With extra time each day, play “Guess My Object.” The student who chooses the object gives a clue, as in the “Guess My Object” homework, or with students asking questions about the properties. Whoever guesses the object correctly first wins and chooses the next object.

**Explore and Explain**

**Activity 4 – Clean Up That Spill**

**Purpose**

To compare absorbency of a variety of different types of paper products

**Activity Description**

Student will develop an operational definition for paper absorbency – which paper sample can absorb the most water in a given amount of time. After discussing the components of a good investigation for testing different types of paper, they will work in groups of four to compare the absorbency of 4-5 types of paper.

**Focus Question**

How does the absorbency of the different types of paper compare?

**Duration**

One class session

**Materials**

* “*Testing Paper Absorbency*” recording sheet (optional)
* Science Journals
* 3-6 types of paper: Such as:

Paper towels – industrial from school

Paper towels – high quality for store

Toilet paper

Lined notebook paper

Construction paper

* Rulers – 2 per group (one to hold paper strips and one to measure)
* Masking tape
* Shallow trays or pans (can hold 1 – 2 inches of water)
* Large bull dog paper clip – 1 per group
* Pitchers of Water
* PowerPoint on Absorbency

**Teacher Preparation**

1. Preview PowerPoint on Absorbency and decide on when to stop for class discussion and when to stop for journal entries.
2. Decide whether to use investigation reporting sheet or science journals for data collection and summary.
3. Revise investigation-recording sheet to match types of paper selected for testing.
4. Gather different types of paper and cut each into equal size strips – approximately 1” x 5”.
5. Pour water in two big pitchers.
6. Set up a model for the investigation procedure (see photograph example in PowerPoint)

**Classroom Procedure**

**Explore Stage:**

1. Make connection with prior lessons: Tell students: “*Yesterday we learned that manufacturers really think about the properties of materials so they choose ones that do the job they want the best. Tennis shoe manufacturers want bumps on the shoe soles to help grab the floor when people run; dress shoes don’t need bumpy bottoms because people don’t run in them. So, if they think about bumpy or smooth, which property are they thinking about?* (texture; use gestures and/ or hand motions). *If they think about how big or small, what are they thinking about?”* (size; use gestures/hand motions)
2. Ask student what they think the word absorbency means (PowerPoint Slide #1.) Accept all answers and add the word to the class science word wall. Explain that today they will be learning more about the property absorbency.
3. Continue through the PowerPoint slides to #11, discussing each as appropriate.
4. Introduce investigation: *“Today you will test different kinds of paper to determine which is best at soaking up wet spills. How will we know which is the best at soaking up spills?”* (how much of the spill gets soaked up, how fast it soaks it up, how well the paper holds together).
5. Have students make predictions: *“Your group will be given a piece of paper towel, a piece of toilet paper, a piece of construction paper, and a piece of lined paper. Which do you think will soak up the spill the best? Predict by pointing to the person holding the type of paper you think will do the best job.”*
6. Have students record a rank order for the samples according to which they think will be most absorbent (1 = most absorbent) in their notebooks or on the investigation-recording sheet.
7. Explain that there are many ways to measure how absorbent a paper sample is, but that today they will be testing how far the water will rise on each sample in a given amount of time.
8. Give each team one ruler, one sample strip of each paper to be tested, masking tape and a bulldog clip. Demonstrate for students how to set up the paper testing system (strips of equal sized paper taped to the long side of one ruler.)
9. After all students have set up their ruler/paper sample systems give each team a pan for water and put approximately 1 inch of water in each.
10. Tell students that when you say “go” one person on the team will touch the edges of the paper to the top surface of the water – caution them not to dip the paper all the way into the pan. When you say “stop” have the students raise the paper holder and lay it flat on their desks.
11. Have students examine how far the water went up the papers and come to agreement on the rank order for the tested paper absorbency (1 = most.)

**Explain Stage:**

1. As a class compare and discuss the results of their investigation: Ask:

* *Which paper soaked water the best? How do you know?”*
* *How did your results compare with your predictions?*
* *Why do you think everyone should have the same amount of water for our test? Why do you think that everyone must start at the same time?* (Fair test)
* *Why do some of us have different results? Is there any way to make the investigation better?*

1. Guide students in writing a CER statement (claim, evidence, reason) to explain their paper investigation results. For example: "I think that paper towel **(claim)** is the best for absorbing water because I observed the water go higher up the paper towel sample than any of the other samples when dipped. (**evidence**) The faster the water goes up the paper the better the paper’s absorbency (**reasoning**.) (Provide a template as a scaffold.)
2. Add to Properties Chart: *Absorbency means able to soak up liquid.*
3. Ask students to turn and talk to create a gesture/body motion for the property of absorbency. As a class, decide on one.
4. Ask students:

* *So, which paper would you choose to absorb a spill? Why?*
* *Would a raincoat manufacturer think about absorbency? A boat manufacturer?*
* *What other types of manufacturers think about absorbency?* (cat litter producers, umbrella, cup makers, bowl makers, spoon makers, bath towel makers, snow glove makers).

1. Direct students to individually complete the following sentence in their notebooks*:*
2. *A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ manufacturer wants their \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_to be/not to be absorbent.*
3. Optional: Have the custodian demonstrate the material s/he uses to absorb vomit or other liquid spill and explain why they use this material.

**Explore and Explain** 

**Activity 5 – Which is Harder?**

**Purpose**

To investigate the property of hardness

**Activity Description**

Students compare the hardness of different countertop samples by using a scratch test.

**Focus Question**

How do scientists decide which materials are hard?

**Duration**

One class session

**Materials**

* Four different samples of countertop materials per group of four students (such as granite, marble, quartz, onyx; hardwoods such as walnut or oak). Note: Companies that sell or make countertops and/or interior decorators often have scraps. Home Depot will have samples as well. Small square samples are also available as **multiples on “no-mess” mounts**.
* “Material Hardness” Record Page (See teacher preparation below. Revise as needed)

**Teacher Preparation**

1. Read about hardness and the hardness scale at: <http://geology.com/minerals/mohs-hardness-scale.shtml>. This test is used to classify minerals. It is a measure of the resistance of a material to being scratched. In this activity, you will use a similar test to classify a variety of countertop materials according to their hardness.
2. Find pictures of different kitchen counters made of different types of materials. <http://www.houzz.com/ideabooks/7779702/list/Your-Guide-to-15-Popular-Kitchen-Countertop-Materials>
3. Produce one copy per group of the “Material Hardness” Record Page. (Note: revise as needed to ensure the materials you collected are listed.)
4. Number the materials collected according to your Material Hardness Record Page.

**Clarification:** The hardness test measures the how easily a material can be **scratched**, NOT how easily it can be broken or bent.

**Classroom Procedure**

**Explore Stage:**

1. Review properties studied so far with students*. “We’ve learned how to sort by a lot of properties. What are some of them?”* (For each property, students should say the property name and do the hand motions.) Identify something nearby and ask students to name as many properties as they can about the object (for example, an eraser, a student’s shirt, the corkboard or dry erase board).
2. Introduce the lesson by telling students they will learn about another property today.
3. Explain to students that you have a friend that wants to remodel her kitchen with new counter-tops and she wants to make sure the new ones will not get scratched up easily like the old ones did.
4. Show students pictures of countertops made of different natural materials (rocks, minerals and woods). Discuss how they are all very pretty and very expensive so your friend wants to make sure that her new one will last a long time and still look pretty.
5. The students will compare the hardness of different countertop materials by trying to scratch each with another sample of countertop material. They will use their results to make a recommendation for the best material that doesn’t scratch.
6. Model for students how to compare material hardness. Explain how to use the “Material Hardness” Record Page.
7. Assign students to groups of four to begin their investigation.
8. When groups are done testing, have them clean up their materials and bring their record sheet to the group area. Save one tray of natural materials for reference during the next portion of this lesson.

**Explain Stage:**

1. Ask students to describe what they observed when they tested their material samples. Tell students that the property they were testing is called “hardness.”
2. Add to Properties Chart: *“Hardness is the resistance of a material to scratching.”*
3. Ask students to turn and talk to a partner to create a body motion for the property of hardness. As a class, decide on one that best represents hardness as a property.
4. Discuss as a class: *What are some other examples of why manufacturers want items they make to be “hard”? (Dish manufacturers want dishes to be hard so they won’t scratch.) Think of examples of when it’s beneficial for materials to be less hard? (Artists want softer materials for carving).*
5. Ask students to come up with other terms that describe hardness and add to the chart (soft, squishy, etc.).

**Explore and Explain**

**Activity 6 – Best Benders**

**Purpose**

To compare the flexibility of objects and discuss the importance of measuring flexibility.

**Activity Description**

Students will be given a set of objects to determine if they don’t bend, bend a little, or bend a lot. Then they will discuss the importance of flexibility in those objects.

**Focus Question**

Why is it important that objects have different bending ability?

**Duration**

One class session

**Materials**

* Trays of objects for groups of 3-4 students that include objects with different degrees of bendability: for example, screwdriver, plastic spoon, icing spatula, paper clip, playdough, and rubber band
* Best Benders Record Sheet (revise sheet to match materials on tray as needed)
* Science Notebooks (see page 4 of unit for directions)

**Teacher Preparation**

1. Assemble trays with materials (see #1 above)
2. Run copies of the “Best Benders” Record Sheet for each group of 3-4 students.

**Classroom Procedure**

**Explore Stage:**

1. Review properties introduced so far with students. *We’ve learned how to sort by a lot of properties.* *Let’s go over them together.* (For each property, students should say the property name and do the hand motions.)
2. As a class, play a game of “I Spy.” Have a volunteer come to the front of the class and face away from the class. Another student chooses an object so the volunteer can’t see, but everyone else can. The student says “I Spy something that has\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (observable properties of object). The volunteer faces the class and tries to guess what the student was describing. Students take turns giving property clues so the volunteer can guess the object. Play for 3-5 minutes.
3. Introduce lesson by telling students they will learn about another property today.
4. Ask students if they stretch in gym class. Ask a couple of students to demonstrate reaching down to their toes. Ask the class to describe what they notice, accepting accurate observations but without specific vocabulary. Ask a gymnast in class to do a backbend, bridge, or back walkover (if none available, show a photo or video of a gymnast.)
5. Tell students they will perform tests to determine which materials bend or stretch the best. They will take turns choosing one item from the tray and seeing how much it will bend. They will record an X in the column that fits its “bendability.”
6. Divide students into groups of 3-4 and assign each team a work area.
7. Tell students to record their data on the worksheet in the top chart. When finished with their testing they should discuss with their team why they think it is important for certain objects to be more or less flexible. After their discussion they should complete the sentences on the worksheet.
8. Assign groups of 3-4 of students to a set of supplies and a place to work with (a metal spoon, a plastic spoon, an icing spatula, plays dough, paperclip, and rubber band).
9. Circulate the room to monitor student progress and to ask probing questions about observations. When students are finishing up ask them to put materials away and come to the group area with their group, papers, pencils, and science notebooks. Keep one set of objects for reference during the discussion.

**Explain Stage:**

1. Ask students to explain what bendable means in their own words. Explain that the scientific word for bendable is flexible. Flexible means to be able to bend without breaking. They were testing objects for their flexibility: how much something could bend without breaking.
2. Ask students to turn and talk and to create a body motion for the property of flexibility. As a class, decide on one.
3. Add to *Flexibility* to the Properties Chart and record the definition of flexible in their notebooks: *Flexible means to be able to be bent without breaking*. Also introduce and add the term “Stiff.” *If something is not very flexible, it is called stiff.*
4. Ask for other words that describe flexibility and add them to the chart. (Examples to include: rigid, stretchy, bendable, inflexible, unbendable.)

**Note: This would be an opportunity to quickly discuss the use of prefixes and suffixes (in; un; able.)**

1. Discuss with students the importance of flexibility in each object. *What is the purpose of this object? Does it need the property of being flexible to accomplish its purpose?*
2. Have the students make a CER (claim, evidence, reason) for one of the objects. For example: "I think that \_\_\_\_\_\_\_\_\_\_ is/isn’t flexible because \_\_\_\_\_\_\_\_ When/Since/So \_\_\_\_\_\_\_\_.
3. Ask students to make a two-column chart in their notebooks and draw and label a picture of something very flexible, and something not very flexible.
4. Share pictures in front of the class, asking the scientific artist to state why the property of flexibility was important and not important.

**Explain**

**Activity 7 – Describing Properties**

**Purpose**

To define and use terminology related to properties of matter.

**Activity Description**

Students will listen to, echo sing, choral sing, and sing in groups “The Properties Song.” They will summarize their understanding of different properties that can be used for sorting materials by illustrating the song and sorting terminology used to describe properties of materials and mixtures into appropriate categories.

**Focus Question**

What are some properties we can use to sort materials?

**Duration**

Two class sessions

**Materials**

* Overhead or Smartboard copy of “The Properties Song”
* Individual copies of “The Properties Song”
* Drawing supplies
* Optional completed homework papers “Sorting in my Life”
* “Property Word Sort” worksheet

**Teacher Preparation**:

1. Make an overhead or put a copy on the Smartboard of the “The Properties Song.”
2. Prepare one copy of the song per student.
3. Optional: Pre-cut sorting words and place in baggies for students to save instructional time.

**Classroom Procedure**

1. The teacher and the class will use the Property Chart as a review of the Properties.
2. If “Sorting in my Life” was assigned as homework and collected, some of these could be shared.
3. Explain “*We learn in different ways: by viewing, reading, and speaking. Another mode of learning is by singing and drawing. Today we will sing a song about properties and you will become illustrators for that song.”*
4. Display a copy of the song for the students to follow along with. First, sing the song solo to the students. Then sing it phrase by phrase with the students echoing each phrase. Then choral (all together) sing. Then have any brave individuals or groups sing.
5. Discuss how non-fiction illustrators use words in the text to decide what to draw. Discuss what might be appropriate to draw for each phrase. (Perhaps something bumpy, smooth, big, or small.) Sometimes nonfiction illustrators use labels or draw arrows to help their readers understand their meaning, too.
6. Explain to the students that next they will be using the words that they have learned about materials to complete a sorting activity. Say: “*You and* a *partner will sort property words we have been using into the category you think the word best describes. You and your partner must discuss and agree on the category before the word is glued down. After all of the words are glued down, you and your partner can add additional words for each category.”*
7. As students are working, circulate to evaluate their understanding of the descriptive terms and respective properties*.*
8. Select students to share and explain an example of a picture they drew to illustrate the Property Song. Ask student volunteers to label the property described with an appropriate category. (Example: student shows a picture of playground slide and says that this is an example of something smooth. Classmate identifies category as texture.)

**Elaborate**

**Activity 8 – Re-sorting the Moving Day Boxes**

**Purpose**

To apply understanding of properties when sorting objects into categories

**Activity Description**

Students individually write down as many ways as possible to sort the moving boxes. Afterwards, the students will share their ideas, without adding on to their papers. If the idea of sorting by solids and liquids doesn’t come up, the teacher will then sort the objects that way, and ask students to guess how she sorted them.

**Focus Question**

What are different ways we can sort things?

**Duration**

One class session

**Materials**

* Boxes saved from Moving Day Lesson 1
* “Moving Day Sorting” sheet (note that this a different record sheet than in Lesson 1)

**Teacher Preparation**

1. Gather saved Moving Day Boxes.
2. Run one copy *per student* of the “Moving Day Sorting” sheet.
3. Cover up/Put away the Properties Chart so the students cannot see it.
4. Run copies of optional homework, “Sorting in My Life,” if desired.

**Classroom Procedure**

1. Tell the students they have been working very hard on using properties to sort and using the scientific word for these properties. Today they will show what they have learned by finding as many ways as they can individually to sort the Moving Day boxes they used earlier.
2. Explain how to fill out the revised Moving Day Sorting sheet.
3. Tell students this is individual work in order to check to see what they each have learned. Explain that they cannot talk to anyone. Give each group a box to look at, but not to touch. They should individually fill out the sheet with AS MANY WAYS as they possibly can think of to sort the objects.
4. When the students are done, check for their names, and collect their papers, and have them put the boxes back. Keep one box for use later.
5. Have students come to their large group area and ask them to share the ways they sorted. Write down their ideas as they share.
6. When they are done sharing, show the Properties Chart. Praise for them remembering the properties they remembered, being sure to use scientific vocabulary. Discuss the properties they missed.
7. If no one mentioned solids and liquids, silently sort the items into these categories. Ask for ideas on how they were sorted. Call on individuals to share what they said.
8. Tell them that things that are wet and take the shape of their containers are liquids. Things that are not wet and have their own shape are solids.
9. Add Solids and Liquids to the Properties Chart. Ask for students to share ideas for hand/ body motions for solids and liquids. As a class, agree on which motion you will use.
10. **Optional Homework**: Sorting in My Life.

**Explain**

**Activity 9 – Mixtures!**

**Purpose**

To describe a mixture as something that is composed of more than one type of material

**Activity Description**

Students will help the teacher make a mixture using dried or fresh fruits. After fruit salad or trail mix. Then, they will each be given a little cup of the mixture. Students will be asked questions as they take out ingredients and put them back in.

**Focus Question**

How do you know if something is a mixture?

**Duration**

One class session

**Materials**

* 3-5 ingredients for either a Trail Mix or fruit salad (check first for allergies!)
* Small cup/bowl/napkin per student
* Large bowl for class mix or salad
* Mixing spoon
* Knife and cutting board, if using whole fruits
* Science Notebooks
* Trade Book: *Stone Soup*

**Teacher Preparation**

1. Decide if your class will make a trail mix or fruit salad and buy enough of 3-5 ingredients for each student to get a small cup of the mixed product. If using fruit, cut it into bite-size pieces.
2. Gather the other materials listed above.

**Classroom Procedure**

1. Introduce the lesson by telling the class, “*We have been discussing the properties of many different things. We’ve learned that we can describe objects by their properties.”* (Point to the chart and cover up the property category name, read the examples, and use choral response to have the class volunteer the missing property word along with the agreed upon representative motion.)
2. Tell students: *“Today you will help make something that is made of more than one material. Because what we are making has different things that are mixed together it is called a mixture. The substances we are mixing together each have different properties.”*
3. Show the class the 3-5 substances that will be used in this activity. As a class, make a chart listing the properties (using terminology from class Properties Chart/word list) for each separate material.
4. Ask one student to select a small amount of one ingredient and add it to a bowl. Ask the class *“Is this a mixture in the bowl?”* (No.*) “What’s your evidence?*” (There is only one ingredient in it.)
5. Ask the student to add a little more of that same ingredient and ask again, *“Is this a mixture now?”* (No, it still has only one type of ingredient.)
6. Ask another student to add a second, different ingredient. “*Is it a mixture now?”* (Yes.) “*What is your evidence?”* (There is more than one type of ingredient.)Continue adding ingredients and asking students to describe what they observe until all the ingredients are included.
7. Give each student a little bit of the mixture to observe. Ask them to describe how the properties of the mixture are similar and different from the properties of the separate items (different colors, textures, etc.)
8. *Ask students: “Can we separate the different materials in this mixture?”* Have students separate the ingredients in their sample into different piles on a piece of wax paper or paper towel.
9. Ask students to describe the properties of each pile. As a class, compare the properties of the separated ingredients with the properties of the mixture and original ingredients (separate piles should have properties similar to the original materials.)
10. Explain that: “*For something to be a mixture, it must ALSO be able to be ‘unmixed” or separated back to its original parts. Sometimes this is easy to do with the tools we have in the classroom but sometimes scientists need special tools to be able to do this.* (example – mixing two different types of juice together.)*”*
11. Ask students why bother making mixtures? *Why not just eat the ingredients separately? It is a lot more work to add more ingredients and put them together. (It changes the taste to have salty and sweet together in your mouth; makes it prettier for a party, etc.)*
12. As a class, discuss other reasons why mixtures are made (for example, gold is too soft for jewelry, but mixing it with other metals preserves the pretty gold color and gives it the hardness of the other metal).
13. Allow the students to eat their samples—separated or as a mixture (ask them which way they decided and why.)
14. While they are eating, read and discuss *Stone Soup*. As ingredients are added in the story, ask students to explain why it was better to add the food to the soup than to eat it separately: “W*hy add the potatoes? Why not eat them separately?”* (Makes the water in the soup taste better because the taste from the added ingredient flavors the soup.)
15. Share additional real-life examples of using materials separately or as a mixture:
    1. Add one pencil to a pencil box. Ask “*Is this a mixture?”* Add another pencil. “*Now?* *Why/not?”* Add a crayon or pen to the pencils in the box. “*Is this a mixture now? Defend your answer.”*
    2. Follow the same procedure as in Step a (above), including the questions, for other objects. (For example, items in a makeup bag, a school supply box, or a box of crayons.) “*Why would someone keep makeup as a mixture?”* (It is better to have all your makeup in one place to use.) “*Why would someone keep a mixture in their school supply box?”* (It is faster to get what you need.)
    3. Extend discussion to include the importance of human diversity*: “What about our class? Are we a mixture? How are we better because we are a mixture? Use evidence to defend your answer.”* (Example: more ideas to discuss, more interesting friends, different talents.)
    4. Make a connection between *Stone Soup* and eating at home, and the benefits of ingredients being combined: *“What about cereal? With milk?* (The cereal isn’t so dry.) “A *sandwich? Back up your answer with reasoning. How are these mixtures better than if they were all consumed separately?” (*Some students may say that they like to eat their foods separately. Have them explain why and how they separate the parts.)
    5. *Ask students to brainstorm a list of more mixtures in their world. Ask: “How do we know if it is a mixture?* (It has more than one ingredient.) “*What is the benefit in making these into mixtures?”*
16. Ask students to record a list of mixtures in words or pictures in their Science Notebooks.
17. Assign Homework: “Mixtures in My Life.”

**Elaborate**

**Activity 10 – Making Potpourri**

**Purpose**

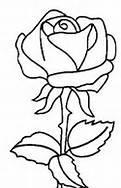
To design, prepare describe a mixture based on the properties of the separate parts

**Activity Description**

Students will create a mixture of potpourri to give as a gift to help families in need and write a recipe card for it.

**Focus Question**

How can the properties of individual materials be combined to make a mixture better?



**Duration**

Two class sessions

**Materials**:

* Dried flowers
* Dried herbs
* Other ingredients collected from home (see Potpourri Letter)
* Index cards or pieces of cardstock to make label cards (see Teacher Prep #4 below)
* Small glass jars or plastic bags that could be tied to hold the potpourri (large baby food jars; small Mason); one per student (needs to be able to hold approximately ½ Cup of Potpourri Mixture)
* Essential oils (your choice) available at Dollar Stores
* Completed “Mixtures in my Life” homework
* *Potpourri Plan* (one per student)
* *My Potpourri Recipe* card (two per student)
* Small cups and spoons for measuring ingredients
* Tray or paper plate, one per student

**Teacher Preparation**

1. Review how to make potpourri on the Internet or on the sites listed in the Advance Preparation Section.
2. Collect dried flowers (prepared as recommended in Advance Preparation Section).
3. Cut the dried lemon or orange peel into ¼ to ¾-inch pieces and hang or lay out to dry.
4. Collect the rest of the listed materials.
5. Make a label card for each ingredient by taping one of the items on it and writing the name. Put each type of ingredient on a separate paper plate with the label card.
6. Copy one page of the *Potpourri Plan* for each student.
7. Copy two pages of the *My Potpourri Recipe* card per student (one draft copy and one final copy).

**Classroom Procedure**

**Day 1: Making Potpourri**

1. Review with class what they have learned about mixtures *“Class, last science class we made mixtures and wrote up a list of other mixtures. Give me “a thumbs up” if what I say is a mixture and a thumbs down if it is not. When I call on you, you must give me your reason for your thumb vote. Is Potting Soil a mixture?* (Hopefully kids will say they don’tknow what it is. So you can ask them what must be true if potting soil is a mixture? Answer: It must be made of different ingredients mixed together that can be unmixed.)
2. Read a few of the mixtures from the Mixtures Homework. Discuss whether examples listed are mixtures based on evidence. Discuss the added value in making a mixture and not using separate ingredients. (Note that you will have more time during Lesson 12 to use homework examples.)
3. Introduce project by telling students that they will be making a mixture that they will be giving as a gift. Tell students: “*The mixture you will be making today is called potpourri. It is a collection of dried petals, leaves, herbs, and spices that can add a nice smell to a room and look nice sitting on a table. I do not have a recipe for potpourri. There are many different recipes. People like different smells. Sometimes they like many different smells or colors, and they use different potpourris with different scents or colors at different times. For example, some people have a different potpourri scent or color for each season.”*
4. Have the students first observe and discuss the properties of all of the available ingredients. (Be sure to discuss all of the following: a smell or scent; colors; size of pieces; texture of pieces.) Model questions you would ask yourself when making or buying a potpourri. Discuss and try out using different sizes, textures, colors, scents to make a sample potpourri. *“How will the ingredients your choose add to the way your mixture will smell, look and feel?”*
5. Tell students that before they can make their mixture, they must fill out a planning sheet.Tell them: *“You can choose ingredients based on the properties you want your mixture to have.”* Explain that the total mixture must fit into a **half-cup jar or container** and that they can only include **6 different types of ingredients** in their mixture. Give students the jars or bags that they will use as final containers to make sure they are making an appropriate amount.
6. Model for the students how to keep track of the amount of each ingredient they are adding to their mixture*.* (Demonstrate how to measure ingredients and keep track by using tally marks for each ingredient for their personal potpourri mixture recipe.)
7. Tell students that after they have added their ingredients, they need to choose and add a small amount of a binding agent to their mixture—either the lemon or orange peel.
8. If a student thinks that his/her mixture does not have a strong enough scent (and most won’t), add 1-2 drops of an essential oil (of student’s choice) to the mixture.
9. Once all of the ingredients have been added, have students pour the materials carefully out onto their tray (or plate) and gently mix the potpourri. When well combined, they should return the mixture to their jar/container and seal it tightly.
10. Students should then label their potpourri container using a permanent marker. They can then decorate the container with markers and/or ribbons.

**Day 2: Recipe Cards**

1. Explain to the students that today they will be writing a recipe card for their personal potpourri mixture. They will first write a draft and then a revised final copy.
2. Model for students how to create a title, and write a recipe that includes both the names of the ingredients and the amounts of each used on the front of the recipe card
3. Discuss how to write the directions for making their potpourri. Example:

Step 1: Add \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(a list of ingredients).

Step 2: Mix the first dry ingredients.

Step 3: Choose and add \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_as the binding agent.

Step 4: Choose and add the essential oil (if used).

Step 5 Mix everything together.

Step 6: Put it into the container.

Step 7: Label and decorate the container.

4. Have students peer review their draft recipe cards and then use the feedback received to make a final version.

**Explain and Elaborate**

**Activity 11 – Guest Speaker** (an engineer, gardener, or worker from recycling center)

**Purpose**

To apply their understanding of properties and mixtures to real-world situations.

**Activity Description**

Students will prepare questions on how people might use properties of materials and mixtures in their work. A guest speaker will respond to a list of student questions and provide examples of how he/she uses an understanding of properties of materials and mixtures to do his/her job.

**Focus Question**

How do adults use knowledge of properties and mixtures in their work?

**Duration**

One class session

**Materials**

* List of student questions
* Materials needed will depend on the speaker’s needs (see teacher preparation.)

**Teacher Preparation**

1. Collaborate with speaker well in advance of this lesson to plan the details of the visit.
2. Preparations and materials for the lesson will be based on the type of job the speaker holds (for example, gardener) and what he/she has decided to use in demonstration for the classroom visit and presentation.

**Classroom Procedure**

1. **At least one day prior to visit** tell the class that someone is coming in to visit soon to help them better understand how adults use knowledge of properties and mixtures to solve problems in their job. Describe the guest’s job for the students and ask them what questions they want to ask the speaker.
2. Record the questions and the name of the student who suggested the question on chart paper so the guest speaker can see the questions written down as well as hear them from the volunteering student.
3. When the speaker arrives introduce him/her and have a volunteer student explain what they have been learning about properties of materials and mixtures for the speaker.
4. Invite the speaker to explain how what they do depends on also understanding the properties of materials and/or mixtures.
5. Invite the speaker to respond to as many of the posted questions as possible. Ask the speaker to add additional information related to the topic as well as respond to new questions posed by the students and teacher.
6. The students will summarize what they have learned about how properties of materials and mixtures are important by completing this sentence in their science notebooks: Mr.(s) \_\_\_\_\_\_\_\_ is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and uses properties to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
7. When the lesson is over and the speaker has departed, have the students prepare and send a thank you card to the speaker.

**Evaluate**

**Activity 12** **–** **Mystery Crystals**

**Purpose**

To apply an understanding of properties of materials and mixtures when investigating a mystery material.

**Activity Description**

Students will apply their understanding of properties of materials and mixtures to investigating a mystery material by describing its properties and providing evidence for whether or not the material is an example of a mixture.

**Focus Question**

How do scientists investigate and describe mystery materials?

**Duration**

One class session

**Materials**

* “Mixtures in My Life” homework – completed earlier by students
* ¼ tsp Polymer crystals (polyacrylamide) per student (available at Science Kit & Boreal Laboratories: (716) 874-6020 or from gardening stores and on-line sources (at Amazon as Ghost Crystals)
* One small medicine cup per student
* One 10 oz. clear plastic cup of water per student
* One hand lens per student
* Water
* “Mystery Crystal” record sheet; one copy per student (to be completed independently)

**Teacher Preparation**

1. Prepare one copy of the “Mystery Crystal” record sheet per student.
2. Put ¼ tsp of the polymer crystals into small medicine cups (one per student).

**Classroom Procedure**

1. Introduce the lesson to the class by complimenting students on their good work these past days learning about properties and mixtures and discussing the examples of mixtures that they included on their “Mixtures at Home” worksheets.
2. Select an example from one of the homework sheets and ask students to turn and tell their partner if the example is or is not a mixture. Remind students they need to support their decision with evidence. If they think the example is a mixture, they should discuss if being a mixture makes the material more useful in some way than if it were not a mixture. Remind students that they should be prepared to share their ideas with the whole class if called upon.
3. Select a student to share what was discussed and decided about the example. Ask the class for thumbs up if they agree or thumbs down if they disagree with what was said. Repeat this process with as many examples as needed to determine if students have mastered the concept.
4. Explain to the students that now they will be asked to use what they have learned about properties of materials and mixtures to solve a science problem. Tell them that they will be given Magic Crystals to investigate and a record sheet that they will complete individually.
5. Review the procedure with the class, explaining that each student will first receive dry crystals and when they signal that they are ready, water will be added to their cup.
6. Give each student a copy of the Magic Crystal record sheet, a medicine cup with ¼ tsp of crystal and a hand lens. Tell students to carefully examine and record the properties of one crystal from the cup on the “Before Column” on the answer sheet. Remind students that as scientists they should use their property words with the appropriate category.
7. When students are have completed recording their “before” have them raise their hands and go to the supply area to get to get water a cup of water. Direct them to add the crystals into the cup of water and to watch for changes.
8. After 5-10 minutes direct students complete “After” column on their record sheet as well as the rest of the front and back of the record sheet.
9. As students are working, circulate to assist those who are having difficulty reading the questions or recording their ideas. Use student responses to evaluate their mastery of the unit learning goals.
10. Explain to students that the crystals are safe for plants and so they can be reused instead of being thrown away. Have students discuss ways that they can reuse the crystals instead of throwing them away. (Put the left over crystals into a garden, save them to use later in planters or use them to make neck coolers; see link below.)

**Suggestions for Extensions/Follow-up:**

1. Spreads the wet crystals from student cups out on a piece of wax paper and have students predict what they will find the next morning. (The water should evaporate and the crystals should be their original size and texture.)
2. Show students an example of a baby diaper and a pitcher of water. Have them predict how much water the diaper will hold. Then add the water. (The diaper contains polymer crystals in powder form. One pound of crystals can hold 50 gallons of water.)
3. Research shows that the polymer crystals retain cold temperatures 2.5 times longer than ordinary ice. Have students test this by comparing polymer crystals in place of crushed ice in an ice bag. Measure the temperature of both over time.

# Additional background information on polymer crystals:

# <http://www.stevespanglerscience.com/lab/experiments/water-jelly-crystals-superabsorbent-polymers#sthash.Us33BZhI.dpuf>

# How to make neck cooling scarfs containing polymer crystals:

# <http://www.watercrystals.com/nscarf0704.htm>