**Oakland Schools Science Scope**

**Grade 1**

**Unit 1 – Properties of Objects**

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**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 develops 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 Cycle | 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 cycle and revisited at the cycle’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 cycle, the Explore 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. |

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**Unit 1 – Properties of Objects**

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**Unit 1 – Properties of Objects**

**Unit Introduction**

This unit attends to the Michigan Grade Level Content Expectations as they are gathered in Grade 1: Unit 1 of the Michigan Department of Education Science Companion Document. Topically, the unit addresses concepts and skills related to identifying and using the observable properties of materials to organize objects and solve engineering problems. This unit will provide the knowledge and skills students will need in to perform science investigations and engineering challenges in upcoming units.

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 (composition style)
* Some recording sheets can be glued into it
* The left-hand page is for teacher content or modeling, the right is for student work
* Use the first page for students to draw themselves as scientists
* Make grade-level decisions for format of writing in the notebooks
* Leave the notebooks in the room.

**Advance Preparation**

 Send home the letter requesting materials for Activity 9 and Activity 10 at least on week prior to beginning these lessons.

**Using Senses to Identify and Use Properties of Objects**

**Introduction**

The first unit in Grade 1 focuses on Physical Science and is designed to develop the young learners’ skills in using the appropriate senses to make purposeful observations of the properties of a variety of objects and materials. They investigate the observable physical attributes of color, shape, size, sinking, floating, texture and magnetic attraction. They explore the properties of water in its solid and liquid state. They plan and conduct investigations collaboratively to produce data to serve as the basis for evidence to answer a question or solve a problem. They use materials to design a device that solves a specific problem.

Note: Students are referred to as scientists when they are performing investigations and as students when teacher is taking action to organize the activity.

**Learning Objectives**

Students will be able to:

* Demonstrate the ability to sort objects according to observable properties such as color, shape, and size, sinking and floating.
* Make purposeful observations of the properties of a variety of objects using the appropriate senses.
* Identify materials that are attracted by magnets.
* Demonstrate that magnets can repel or attract other magnets.
* Demonstrate that magnets can attract and repel at a distance.
* Make purposeful observations of materials that are attracted to magnet using the appropriate senses.
* Identify characteristics of water as a solid and a liquid.
* Demonstrate that water as a solid keeps its shape (ice).
* Demonstrate that water as a liquid takes on the shape of various containers.
* Identify that water as a liquid feels wet.
* Make purposeful observations of water as a solid and a liquid.

**Key Question: How are scientific properties used to choose materials for solving engineering challenges?**

**Engage and Elicit**

**Activity 1 – What is in the Bag?**

**Purpose**

To elicit student understanding of how to make purposeful observations using a variety of senses.

**Activity Description**

Students use a variety of senses to infer what items are in a paper bag. Students record observations and inferences in science notebooks. This initial science notebook recording activity can be used to begin to establish the parameters and expectations for science writing.

**Focus Question**

How do we use our senses to identify objects?

**Duration**

One class session

**Materials**

* Three or four brown paper lunch bags
* One object for each bag. Suggestions: crayon, marker, pencil, cotton ball, tissue, scrap of paper, marble, pattern block, bell, sliced lemon, sliced orange
* Picture book about five senses (see suggestions below)
* Science notebook for each student

**Teacher Preparation**

1. Select one object for each paper bag.
2. Choose objects that require the use of different senses to identify.

Example: crayon, cotton ball, bell, sliced lemon.

1. Put one object in each bag. Label each bag with a letter or number. Close each bag.
2. Select picture book about five senses for read-aloud. Borrowing from Kindergarten makes a nice learning connection.

Suggestions: *My Five Senses* by Aliki

*Our Five Senses* by Ellen Catala

*The Five Senses* by Faulkner.

(You can find a digital copy of this book by going to <http://kids.mel.org/HomeworkHelpers> and clicking on the eBook K-8 Collection and then typing 5 senses in the search bar)

1. Plan and adapt questions for whole-group conversation.
2. Prepare group reflection and learning chart.
3. Plan parameters and expectations for recording in notebooks.

**Classroom Procedure**

1. Show the first paper bag with a “unique” object inside to the whole class (lemon is a good one to start with). Ask students: *What do you think might be in this bag? How can we find out without looking inside?*
2. Encourage students to ask for more information. Example: Shake the bag. Pass the bag around.
3. Model for students how they should record their inferences (what they think is in the bag based on their observations) in their personal notebooks.
4. As students ask for more information and change their predictions, have them record changes in thinking in their notebooks.
5. Ask students which part of their body they are using to get more information. Probe to find out if students can also label the appropriate sense or senses used to get the information they used for identifying the object in the bag.

Example: Shake the bag = ears/hearing

1. Record student responses on a large class reflection chart.
2. Repeat process with remaining bags.
3. Use student responses to assess how much students learned/remember from Kindergarten study of senses.
4. Use an appropriate five senses picture book to review as needed. Ask students to add appropriate terminology to chart as needed.

Sample Class Chart:

**What’s in the Bag?**

|  |  |  |
| --- | --- | --- |
| Bag Number | What we learned… | How we learned…. |
|  | *Record observations and inferences made by students in this section.* | *Record parts of body and/or senses used in this section.* |

Note: Use student terminology at this point. Save chart for future revisions.

**Explore**

**Activity 2 – Exploring Our Senses**

**Purpose**

To identify which senses are most useful when making purposeful observations.

**Activity Description**

In centers or stations, students use a variety of senses to investigate assorted objects. Students record which senses they found most valuable in making observations on individual charts and then share their ideas as a whole class.

**Focus Question**

How do we use our senses to help us investigate objects?

**Duration**

One or two class sessions

**Material Sets**

* Investigation 1

Pattern blocks

Dominoes

Buttons

Bottle caps

* Investigation 2

Cotton balls

Craft sticks

Dominoes

Large paper clips

Sandpaper

* Investigation 3

Sandpaper

Bottle caps

Rocks

Corks

Craft sticks

Cotton balls

Playdough

Clay

* Investigation 4

M & M candies

Skittles candies

Raisins

Dried cranberries

* Investigation 5

Scented soap pieces

Garlic clove

Coffee grounds

Tea bag

Bottle caps

Playdough

Clay

* Containers/tubs/boxes for each of the Investigations
* Copies of “Using Our Senses to Investigate” worksheet (see next page)

**Teacher Preparation**

1. Gather the materials and containers.
2. Put a set of the materials for each Investigation in separate containers.
3. Label each container with the Investigation number.
4. Organize students into groups of 3-5.
5. Devise a rotation plan for groups to visit/experience all the Investigation materials.
6. Prepare a copy of “Using Our Senses to Investigate”recording sheet for each student (next page).
7. Keep the Investigation Labs organized for subsequent lessons.

**Classroom Procedure**

1. Introduce the activity by explaining that as scientists students will use their senses to discover information about objects.
2. Revisit the Reflection Chart from the previous lesson. Draw connections to the observations they made during previous lesson to learn what was in each bag. Explain to students how they will again be using their senses to gather information about different objects. Quickly review the senses they will be using and the body part associated with each of the senses.
3. Model for students how they will use their recording sheet to indicate which senses helped them the most in each Investigation. When completed, recording sheets can be glued into science notebooks.
4. Assign small groups of students to a starting “Investigation” box. Explain rotation process.
5. After exploring the set of materials in each Investigation box, Student Scientists record which sense(s) helped them the most by placing a check or an X in the appropriate box(es) on the recording sheets.
6. Circulate and ask: “*Which sense is helping you with your discoveries? Which sense is not the most helpful?”* Assist Student Scientists as needed in completing the recording sheets.
7. After all groups have had time at each set of Investigation materials, facilitate a closing whole-class discussion:
	1. *Which sense was most helpful at Lab1, 2, 3, 4, 5?*
	2. *Why was it helpful? Which sense was not helpful? Why?*
	3. *Why might it be important for scientists to use the appropriate sense during investigations*?

**Scientist’s Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |
| --- |
| **Using Our Senses to Investigate** |
| **Materials** | **See** | **Hear** | **Touch** | **Taste** | **Smell** |
| **Set 1** |  |  |  |  |  |
| **Set 2** |  |  |  |  |  |
| **Set 3** |  |  |  |  |  |
| **Set 4** |  |  |  |  |  |
| **Set 5** |  |  |  |  |  |

**Explore**

**Activity 3 – Investigating Properties**

**Purpose**

To use different senses to make observations and comparisons.

**Activity Description**

Students revisit materials used during Activity 2 Investigations to make and record detailed observations of objects in each set or container. Students record their observations on individual charts and then share their results as a whole class. During the whole class wrap-up, students will discuss how they use their senses to learn about and compare different objects.

**Focus Question**

How can we use each of our senses to describe and compare objects?

**Duration**

One or two class sessions

**Materials**

Trade book:*Dinosaurs Before Dark* (Magic Tree House Series #1) by Mary Pope Osborne (Free audiobook available at the following link: <https://www.youtube.com/watch?v=NkSuQrSNTIw> )

Labs from previous lesson

* Investigation 1 (see)

Pattern blocks

Dominoes

Buttons

Bottle caps

* Investigation 2 (hear)

Cotton balls

Craft sticks

Dominoes

Large paper clips

Sandpaper

* Investigation 3 (touch)

Sandpaper

Bottle caps

Rocks

Corks

Craft sticks

Cotton balls

Play dough

Clay

* Investigation 4 (taste)

M & M candies

Skittles candies

Raisins

Dried cranberries

* Investigation 5 (smell)

Scented soap pieces

Garlic clove

Coffee grounds

Tea bag

Bottle caps

Play dough

Clay

* “My Observations” Individual recording sheets
* Group recording chart (see sample)

**Teacher Preparation**

1. Gather the materials and containers from previous activity.
2. Make sure that materials are in the correct containers.
3. If not already done, label the containers with the Investigation numbers.
4. Organize students into groups of 3-5.
5. Devise a rotation plan for groups to visit all the Investigations.
6. Make copies of “My Observations” recording sheets (one per student).
7. Keep the Investigation Labs organized for subsequent lessons.
8. Plan to begin reading aloud one chapter each day from *Dinosaurs Before Dark* (Magic Tree House Series #1) by Mary Pope Osborne in preparation for final summative lesson.

**Classroom Procedure**

1. Briefly revisit science notebooks from previous lesson. Ask students: *“Why is it important for scientists to use the appropriate sense during investigations?”*
2. Ask Student Scientists which sense would be most appropriate for each set of Investigation materials.

Lab 1 (see) Lab 2 (hear) Lab 3 (touch) Lab 4 (taste) Lab 5 (smell)

1. Model for Student Scientists how they will be recording their observations from each Investigation Lab onto their individual record sheet. Note: The recording sheets can be glued into science notebooks when complete.
2. Describe the Investigation rotation process that the class will be using for this activity.
3. Organize students into small groups. Assign each group their starting Investigation Lab.
4. As students engage in the Investigation Labs, circulate and ask: *“What are you observing about the objects? Which of your senses are you using the most? How can you record that idea?”* Assist Student Scientists as needed in completing their recording sheets.
5. After students have had the opportunity to observe all of the Investigation material sets, bring the students back together as a class for a closing discussion.
6. Compile the individual Student Scientists’ observations onto a group data chart that is like their individual charts (see below). Save chart for subsequent lesson.

**Scientist’s Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |
| --- | --- |
|  | **My Observations** |
| **Lab 1****See** |  |
| **Lab 2****Hear** |  |
| **Lab 3****Touch** |  |
| **Lab 4****Taste** |  |
| **Lab 4****Smell** |  |

**Explain**

**Activity 4 – Describing Properties**

**Purpose**

To use observed properties to identify objects and materials.

**Activity Description**

Working with a partner, students will use observed descriptions to identify familiar objects. Students will record a diagram of each mystery object and the clue that helped them identify the object. Students will then develop a class definition for the term Property. *Examples: Property: Something you can learn about an object using your senses; Properties are ways of describing objects, including color, shape, size, texture, sound made, height and weight*. *Properties are how we identify and organize objects.*

**Focus Question**

How do we describe and name properties of objects?

**Duration**

One class session

**Materials**

* Small containers or baggies, one for each pair of students
* Materials from previous lesson’s Investigation Sets: pattern blocks, dominoes, buttons, cotton ball, craft sticks, paper clips, rocks, corks, sandpaper, clay, and Play
* dough for each container or baggie
* Students’ science notebooks
* *“What is a Property”* recording chart - optional

**Teacher Preparation**

* Put four or five items from the list into each container or baggie.
* Label containers or baggies with different numbers or letters.
* Plan to organize students into pairs of Student Scientists.
* Prepare large t-chart for whole-group reflection (see example below).
* Prepare individual “What is a Property” recording charts (optional)
* Plan to keep baggies and objects together for subsequent lesson.

**Classroom Procedure**

1. Explain to class that each pair of Student Scientists will receive a bag of small objects they have used before in a lesson. Model for students the procedure they will be following and how to record their results on their chart. Explain that each property they record should be observable using one or more of their senses (not what it is or what it is made of)
2. During this activity, the student partners will take turns doing the following:
* Student A: Closes eyes while Student B picks an object from the bag and describes it to the partner, using appropriate senses.
* Student A guesses the name of the object Student B described and explains which observations provided the clues that helped the most (and why).
* Both students record a picture of the object and what part of the description helped identify the object on their individual charts or notebooks.
* Student partners switch roles and repeat with another object from the bag.
1. Circulate and assist students with taking turns and recording data. Ask students which of their senses they used for properties that they are recording. Encourage students to only record what they can **see, touch, smell or hear** – no tasting.)
2. When students have finished taking turns and recording their data on their individual charts, bring them together to compile their results on a class chart similar to the one they have been using (see example on next page.)
3. After ideas are recorded, tell the students that the clues they used to help identify each object are examples of properties. Ask Student Scientists to develop a class definition of the term property: *Example:*

 *What is a property?*

* *A property is something you can see/touch/hear.*
* *A property is the color, shape, size, texture (feel).*
* *A property is something that helps you identify an object.*

**Note:** Students may include the material the object is made from instead of observable properties. Accept these answers for now. Their ideas will be refined in the subsequent lesson.

1. Record students’ definitions of property on the class chart.

**What is a Property?**

|  |  |
| --- | --- |
| **Object***Draw and label a picture.* | **Clue***Record one or two things that help identify the object.* |
| *Diagram of Pattern block* | *Red, sharp edges, hard, smooth* |
|  |  |
|  |  |
|  |  |
|  |  |

**Explain**

**Activity 5 – Properties of Materials**

**Purpose**

To use observable properties to sort objects according to the materials they are made from.

**Activity Description**

Using observations from previous investigations, students will scientifically (operationally) define the term “material”. They will use their definition to sort objects according to the material from which the objects are made.

*Note: An****operational definition****defines something (e.g. a*[*variable*](http://www.wikipedia.org/wiki/Variable_%28mathematics%29)*,*[*term*](http://www.wikipedia.org/wiki/Terminology)*, or*[*object*](http://www.wikipedia.org/wiki/Object_%28philosophy%29)*) in terms of the specific process or set of tests used to determine its presence and quantity. That is, one defines something in terms of the operations that count as measuring it. Example: the operational definition of a material is based on its observable and/or measurable properties. The operational definition of aluminum might be “a light, shiny, bendable”.*

**Focus Question**

How can properties be used to sort materials?

**Duration**

One class session

**Materials**

* Baggies containing a variety of objects (each baggie should contain objects made of two or three different types of materials—items from previous lesson can be regrouped as appropriate)
* Group reflection t-chart from previous lesson
* Students’ definition of the term property

**Teacher Preparation**

1. Plan and organize students into pairs.
2. Look ahead to the Evaluate Lessons and begin planning/collecting materials.

**Classroom Procedure**

1. Review students’ definition of the term property.
2. Review class chart from Activity 4.
3. Explain the relationship between observable properties and the materials from which an object is made: *“Scientists observe properties of objects in order to decide what they are made from. A material is what something is made from. Scientists describe, identify and organize materials by their properties. That is what you will be doing today.”*
4. Model for class how to sort objects by material. For example, demonstrate that even if blocks are different sizes or colors, they are still made of the same material—wood. Use “Think Aloud” to describe which observable properties you decided were important for selecting objects made of wood from a set of objects made of different materials.
5. Give one baggie of assorted objects to each pair of students.
6. Direct Student Scientists to sort objects by the materials they are made from. *For example: Wood: blocks and dominoes; Metal: bottle caps and paper clips.*
7. Circulate as students observe and sort objects into sets. Ask students to explain which observable properties they used to identify common materials. How did they decide which groups to make?
8. Facilitate whole-group reflection. Ask each student pair to describe one of the groups they made from their set of materials and the properties that the group of materials shared. Ask the student pair to name the material they think the group of materials had in common (*for example: A pencil has wood and lead—but if put into a group with blocks then the common material is wood*).
9. Model for the class how to play a modified version of “I Spy.” Go through at least one round, focusing on how to use evidence and reasoning to support a claim.

**Directions:**

1. Have a volunteer student scan the room silently to select an object in the room.
2. Have the student say: “I spy with my little eye an object made of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (material such as plastic).
3. Allow other students to ask a few yes/no questions about other observable properties of the object. (*Is it red? Is it bigger than a book? Note: objects of the same material can have other observable properties.*)
4. Ask students if anyone thinks they know what the object might be based on the material listed and the answers to the questions (expect students to support their ideas using evidence from the clues given: *“I think the object is the telephone in the room because it is made of plastic and is black”).*
5. If the correct object is identified, the student with the right answer picks the next object and repeats the process. If the object is not correctly identified, the volunteer shows the correct object to the class and chooses the next student from volunteers.
6. Ask students to summarize what they learned today about Properties and Materials. Review if necessary the difference between an observable property and the material that an object is made from.

**Explain/Elaborate**

**Activity 6 – Magnetic or Not Magnetic?**



**Purpose**

To demonstrate the ability to sort objects according to a new observable property: magnetic attraction.

**Activity Description**

Students will explore how magnets interact with one another. They will then investigate a set of objects to determine which will attract to a magnet. They will discuss the observable properties each of the objects and whether these properties are related to the objects’ behavior with the magnet.

**Focus Question**

How can magnets be used to sort objects?

**Duration**

One class session

**Materials**

* Baggie per group of mixed magnetic and non-magnetic material (use items from Investigation Labs):

Button

Bottle cap

Penny

Rubber band

Cotton balls

Craft stick

Large paper clips

Nickel or dime

Rock

Cork

Aluminum foil

Nail

Pencil

* Two polar magnets per pair of students
* “Magnetic and Non-Magnetic” record sheet - 1 per pair
* Student science notebooks

**Teacher Preparation**

1. Gather magnets and a variety of magnetic and non-magnetic materials and put a collection of each into Ziploc baggies.
2. Group students into pairs.
3. Revise “Magnetic and Non-Magnetic” record sheet master to match objects available in student baggies to be tested before making copies.
4. Make copies of record sheets and large version for a class recording chart (see below).

**Classroom Procedure**

1. Review with students the difference between observable properties of an object and the material that the object is made from. Use examples of two objects that are the same color or shape but are made of different materials (for example, a red rubber ball and a red wooden block).
2. Explain that today they will be investigating another observable property that can be used to identify some type of materials.
3. Give each student pair two magnets and direct them to investigate how the two magnets interact with each other and the desks/table.
4. Ask students to describe their observations. When students list examples of the magnets sticking to each other or to parts of the table, introduce the term “attract.”
5. Ask if the two magnets always stick together or “attract?” If no one mentions that the magnets sometimes push each other apart, direct the students to try flipping one of the magnets over and observing what happens when the magnets are brought together.
6. Model for students how magnets “attract” and “repel” one another using larger bar magnets if available. Have students include these words in their science journals or on a class word wall.
7. Model for the class how to select one item from a bag of assorted materials for testing. Tell students not to dump the bag out on their work area. Demonstrate how to first make a prediction about what will happen when an object is tested with a magnet and then how to use a magnet to test the object selected. Use a large class chart to demonstrate how to record the students’ predictions and then their observations on their individual recording charts.
8. Give one baggie of assorted magnetic and non-magnetic objects to each pair of students.
9. Direct Student Scientists to take turns selecting an object from the bag, making a prediction, testing the object and placing it into the correct category (Magnetic and Not Magnetic).
10. Bring students together as a whole class to discuss their results. Come to a collective decision about which objects are and are not magnetic. Encourage students to use the term “attract” when describing their observations.
11. Ask students where they find magnets in their home and how they are used. Discuss:

*How is the property of being magnetic useful in students’ lives?*

*How can magnets be used to make toys more fun?*

1. Ask students if they think they could use a magnet to move an object without touching it. Encourage students to think of ways this might work. Demonstrate examples of magnets acting at a distance and through material (through a piece of cardboard or through a glass of water).

**Magnetic or Non-Magnetic?**

**Scientist’s Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |
| --- | --- | --- | --- |
| **Object** | **Prediction**M or N | Magnetic | Not Magnetic  |
| Button |  |  |  |
| Bottle cap |  |  |  |
| Penny |  |  |  |
| Rubber band |  |  |  |
| Cotton ball |  |  |  |
| Craft stick |  |  |  |
| Large paper clip |  |  |  |
| Nickel or dime |  |  |  |
| Rock |  |  |  |
| Cork |  |  |  |
| Aluminum foil |  |  |  |
| Nail |  |  |  |
| Pencil |  |  |  |

**Explain/Elaborate**

**Activity 7 – Solids and Liquids**



**Purpose**

To demonstrate the ability to sort materials according to new observable property: solid or liquid.

**Activity Description**

Students will investigate the physical properties of solids and liquids. They will compare samples of frozen and un-frozen colored water. They will describe how the solid form of water is similar and different from the liquid form. They will then apply this understanding to a variety of materials by using the properties of the sample presented to organize solids and liquids into groups based on their observable properties. Students will examine additional examples of materials at home and use observable properties to decide if each represents a solid or a liquid.

**Focus Question**

Which observable properties determine if something is a solid or a liquid?

**Duration**

One class session

**Materials**

* Two clear, medium-size plastic cups (6 or 8-ounce)
* Two small paper cups (3 or 4-ounce) for each pair of students
* Food coloring
* Trays for carrying materials (plastic trays, aluminum pans or styrofoam meat trays)
* Scissors for teacher
* One pair of scissors for each pair of students
* Paper towels (for spills)
* A variety of solid and liquid materials (examples: bar of soap, liquid soap, cooking oil, milk, materials from previous Investigations)
* Copy of homework - “Liquids and Solids in My Home” - for each student

**Teacher Preparation**

1. Prepare cups of frozen colored water in advance:
* For teacher demonstration: Make a mixture of water and food coloring in a medium-size, clear plastic cup and freeze the cup overnight.
* For each pair of students (one cup per pair): Put water and food coloring mixture into small paper cups and freeze overnight.
1. Collect other materials needed for activity.
2. Prior to activity: Prepare a matching set of cups (medium plastic for teacher, and small paper for each student pair) with the same water and food coloring mixture. Do not freeze. Plan and organize student partnerships.
3. Prepare clean-up procedure and materials for possible spills.
4. Prepare copies of homework assignment and letter home for each student.

**Classroom Procedure**

1. Display the two clear plastic “teacher” cups for the class to see—one with colored liquid water and one with frozen water. Ask students to describe the properties they can observe from a distance. Ask students if they have any questions about the material inside the two cups.
2. Explain that today they will be investigating the observable properties of these two special types of materials: solids and liquids. Tell students that the colored water is an example of a “liquid” and that the ice is an example of a “solid.”
3. Model for the class how to carefully use scissors to cut away the paper cups (containing both liquid and ice) over their tray or pan.
4. To each pair of students, distribute a pair of scissors, one small paper cup containing liquid colored water, and one small paper cup containing frozen colored water in a tray or pan.
5. Direct students to carefully cut away the paper from one cup at a time, observing what happens for each cup.
6. As a whole class discuss:
* *What happened when you cut the cup away from the solid?*
* *What happened when you cut the cup away from the liquid?*
* *How were the properties of the liquid similar to the properties of the solid (color)?*
* *How were the properties of the liquid different than the properties of the solid (took shape of tray or not)?*
1. Demonstrate for the class that liquid takes the shape of its container: Pour an amount of liquid water into a variety of different shaped clear containers.
2. Demonstrate for class that solids keep their own shape: Take one of the frozen chunks of water and put it into a variety of different shape and size containers. Have students note that the shape stayed the same regardless of the container.
3. Hold up a container of glue and a rubber ball. Have students complete the following stems (in their science journal or to a partner):
* *I think the glue is a liquid because*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* *I think the ball is a solid because*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
1. Hold up samples of a variety of solid and liquid materials and ask students to vote on whether each is an example of a solid or a liquid. Ask individual students what evidence they used to decide or what test they need to perform to find out.
2. Assign homework: “Liquids and Solids in My Home.” Send directions for parents and data collection sheet as homework. See example below.

**Liquids and Solids in My Home**

**Dear parents: We are studying the properties of liquids and solids in science. Please help your child locate examples of each. Encourage your child to explain to you whether the material is an example of a liquid or solid and what evidence they have that led them to this decision. Help your child record the materials observed in the appropriate column. If the material examined is puzzling to them and they are not sure, record it the “Not Sure” column.**

**Scientist’s Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |
| --- | --- | --- |
| Liquids | Solids | Not Sure? |
|  |  |  |

 **Elaborate**

**Activity 8 – Sinking and Floating**



**Purpose**

To demonstrate the ability to sort objects according to new observable property: sinking or floating (buoyancy.)

**Activity Description**

Students will investigate a set of objects to determine which will sink or float. They will discuss the observable properties of each of the objects and whether these properties are related to the objects’ behavior in the tub of water. They will also compare the shapes of the objects and materials the objects are made from to their behavior in tubs of water. Students will apply their understanding of which properties and materials float/sink to design problems.

**Focus Question**

Which materials will sink or float?

**Duration**

One class session

**Materials**

* Labs from previous lesson with some adjustments
* Investigation Lab 1

Pattern blocks

Dominoes

Buttons

Bottle caps

* Investigation Lab 2

Cotton balls

Craft sticks

Large paper clips

Sandpaper

* Investigation Lab 3

Rocks

Corks

Playdough

Clay

* A collection of different fruits (banana, orange, grape, grapefruit)
* One large, clear plastic tub that will hold water
* Two small tubs of water for each Investigation Lab (e.g., plastic sweater boxes or dishpans)
* Student science notebooks
* “Sink or Float” recording chart (one per pair of students)

**Teacher Preparation**

1. Plan partnerships and organize students into pairs.
2. Plan and organize how students will circulate through different Investigations.
3. Plan process for taking care of wet items and dry items and for potential spills.
4. Make large class version of recording chart (see next page).

**Classroom Procedure**

1. Explain to the class that today they will be working as scientists to use a new and different property of materials to organize objects.
2. Model for students that some objects will sink and some objects will float. Floating fruits is one possible demonstration, but any other set of objects not included in their investigation will work.
3. Hold up a banana and ask the class to vote on whether they think it will sink or float. Count and record the votes on a class chart similar to the one they will be using with their investigations.
4. Test the banana and model how to record what happens on the class chart.
5. Repeat with each of the fruit samples.
6. Ask students what surprised them about the results (*The grape is smaller than the orange but it will sink; the orange and grapefruit should float.*)

Note: This demonstration should lead to the idea that size is not the property that determines if an object will sink or float. It is based on what the object is made of and also on the object’s shape. For example, a sheet of tin foil will float. A ball of the same amount of tin foil will sink. A peeled orange will sink.

1. Explain that students will be doing the same thing in partners for their Investigation. Demonstrate how they will put an S or F in the **Prediction** column of their record sheet before testing each item and an X in the appropriate column (**Sink** or **Float** column) after testing the item. See example below

3. Provide directions for moving with a partner to each lab station to test objects for the property of sinking or floating.

4. Circulate and monitor students as they test out each set of investigation materials. Make sure that students are making predictions before testing each object.

5. As a whole class, discuss the results collected. Ask students:

1. *If you were going to build a raft, which objects would you choose to use? Why?*
2. *If you were going to build a toy to use in the tub/lake, which object would you choose? Why?*
3. *How can you change an object that sinks into one that floats? (Model this by showing how the tinfoil will sink if made into a ball.)*
4. *How can you change an object that sinks into one that can float? (Model this by showing that the orange will sink when it has been peeled.)*

**Sink or Float?**

**Scientist’s Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

|  |  |  |  |
| --- | --- | --- | --- |
| **Object** | **Prediction** | **Sinks** | **Floats** |
| Pattern block | *S* |  | *X* |
| Domino |  |  |  |
| Button |  |  |  |
| Bottle cap |  |  |  |
| Cotton ball |  |  |  |
| Stick |  |  |  |
|  Paper clip |  |  |  |
| Paper |  |  |  |
| Rock |  |  |  |
| Cork |  |  |  |
| Playdough |  |  |  |
| Clay |  |  |  |

**Elaborate**

**Activity 9 – Build a Boat**

**Purpose**

To demonstrate an understanding that properties of materials influence their use for building a boat or raft.

**Activity Description**

Students will use an engineering process to design, construct and test a raft or boat. They will select the materials to use from a variety available and justify their choices based on the materials’ properties. They test how well their design works by adding passengers to their boat until it sinks. They will investigate ways to modify and improve the properties of their selected materials and their design in order make a boat that floats better and carries more passengers.

Note: This is the first engineering project students design and build. The teacher should use this activity to model and coach during the process of testing and choosing materials based on their relevant properties for the design. The teacher should model and teach the recording process on the “Boat Building Report.”

**Focus Question**

Which materials are better for building a boat or raft?

**Duration**

Two or three class sessions

**Materials**

* Copy of *Who Sank the Boat* by Pamela Allen
* Optional: YouTube narration of *Who Sank the Boat*: <http://www.youtube.com/watch?v=OsYb1YSYR34>
* Several objects that float and several that sink (e.g., blocks of wood, pieces of plastic, coins, washers)
* Styrofoam containers or trays
* Beakers (or other containers) of water
* Clay
* Aluminum foil
* Craft (popsicle) sticks
* Toothpicks
* Straws
* Tape
* Glue
* Small masses (marbles or plastic animals)
* Small cups to hold marbles
* Containers for water (from Activity 8)
* Copy of “Boat Building Report” template, one per student team

**Teacher Preparation**

1. Several days prior to this activity, send home the letter requesting materials for Activity 9 and Activity 10.
2. Plan storage area for incoming materials and completed projects.
3. Plan and organize partnerships.
4. Set up a few boat-testing areas: tubs of water that can be used by teams when ready to test their designs.
5. Make one copy of the “Boat Building Report” for each team
6. Preview YouTube narration of *Who Sank the Boat* to make sure it is not blocked: <http://www.youtube.com/watch?v=OsYb1YSYR34>

**Classroom Procedure**

1. Read aloud *Who Sank the Boat* by Pamela Allen (or use optional YouTube Video version)
2. Ask students if there was any way to design a better boat that would not sink so easily? Tell them that today they will be Student Engineers and they will be using what they learned about the properties of materials to design and test a raft or boat.
3. Show students the materials available for building their raft or boat and review the previous activity on “Sinking and Floating.” Remind students that some materials can be changed from floaters to sinkers (remind them about the tin foil and the orange).
4. Explain to students that their challenge will be to design and build a raft or boat that can carry a number of passengers (marbles or plastic animals). Explain that they will have the opportunity to test their design and improve it to try to carry more passengers before sinking.
5. In teams of two, have students draw and label a plan in their notebooks for how they will build their boat or raft. Have students label the parts of their design and the materials they propose to use. Check and discuss plans with students before they begin to collect materials. Ask students to explain why they have chosen certain materials.
6. When student teams have received approval for their plans, invite them to collect the materials they listed and build their boat according to their design.
7. Student teams should take turns using the water containers at the “testing stations” to see if their design will float and carry passengers.
8. Encourage students to improve and retest their boats as much as time permits.
9. When Student Engineers are finished testing and improving their boats, have them complete the Boat Building Report. Students will draw a picture of one material they used. Then they should complete the sentence to name it and describe its property. They will repeat this on the report for three of the materials they used.
10. When finished, discuss as a whole class:
* *Which materials did you choose for building your boat? What properties did these materials have that made them useful?*
* *Did you change any of the materials to make them into better floaters? Describe what you did.*
* *How well did your design work? What was the best part of your design?*
* *How did you change your design to make it better after testing it with passengers?*
* ***New challenge:*** *What could you change about your design to make your boat move without touching it?*

**Evaluate**

**Activity 10 – Build a Bridge**

**Purpose**

To demonstrate an understanding that properties of materials influence their use for building a strong bridge.

**Activity Description**

Students will use an engineering process to design, construct and test a bridge. They will select the materials to use from a variety available and justify their choices based on the materials’ properties. They will test how well their design works by applying weight until the bridge collapses. They will analyze the materials they used and their various designs to make recommendations for improvement.

**Focus Question**

Which materials are better for building a bridge and why?

**Duration**

Two to three class sessions

**Materials**

* A copy of *The Three Billy Goats Gruff* to read aloud (You can find a digital copy of this book by going to <http://kids.mel.org/HomeworkHelpers> and clicking on the eBook K-8 Collection and then typing Three Billy Goats in the search bar. You can also use the video at the following link: <https://www.youtube.com/watch?v=9JXPPi2Piaw> )
* Assorted recycled materials brought in by students
* Large gallon baggies for students to collect materials from home
* Glue or glue sticks
* Tape
* Staplers and staples
* 8½ x 11-inch construction paper for each partnership to build bridge on
* Three objects to symbolize the three Billy Goats Gruff (these will be used to test the bridge)
* Student science notebooks
* Craft (popsicle) sticks
* Toothpicks
* Straws
* Glue
* Copy of “Bridge Design Report” template - one per student

**Teacher Preparation**

1. Plan and arrange partnerships
2. Make one copy of “Bridge Design Report” per student

**Classroom Procedure**

1. Read aloud *The Three Billy Goats Gruff.*
2. Tell students that today they will be once again be Student Engineers and they will be using what they learned about the properties of materials and the engineering design process to create a bridge that will hold the three billy goats and protect them from the troll.
3. Show students the materials available for building their bridge and explain to students that their challenge will be to design and build a bridge that can hold three weights (show class what will be used as testing weights).
4. In teams of two, have students draw and label a plan in their notebooks for how they will build their bridge. Have students label the parts of their design and the materials they propose to use. Check and discuss plans with students before they begin collecting materials. Ask students to explain why they have chosen certain materials.
5. When student teams have received approval for their plans, invite them to collect the materials they listed and build their bridge according to their design and to test their bridge with the three provided weights.
6. Encourage students to improve and retest their bridge as much as time permits.
7. When Student Engineers are finished testing and improving their bridges, have them **individually** complete the *Bridge Design Report*. Students will draw a picture of one of the materials they used. Then they complete the sentence to name it and describe its property. They repeat this on the report for three of the materials they used.
8. As students are working independently, circulate to check for their understanding of the unit learning goals. Some additional questions might include:
* *Are the materials you selected for your bridge solids or liquids? How do you know?*
* *Are any of the materials on your bridge magnetic? How could you find out?*
* *If you were blindfolded, how would you know which materials to choose to build your bridge? Which of your senses would you be using?*
1. When all the students have completed their summary reports select teams to demonstrate for the class how they tested their bridge. Discuss as a class which designs were most successful and why:
* *Did well did your design work?*
* *How would you change your design to make the bridge even stronger?*

*10.* Bring the unit to closure by discussing examples of how engineers that design a specific products use their scientific knowledge about the properties of materials. I.e. “*How do auto engineers decide what type of materials to use for the different parts of a car? Why are tires made of rubber? Windows made of glass?*

**Science Scope on Atlas Rubicon Curriculum Manager:** http://oaklandk12.rubiconatlas.org/public/

**Oakland Schools:** http://www.oakland.k12.mi.us/