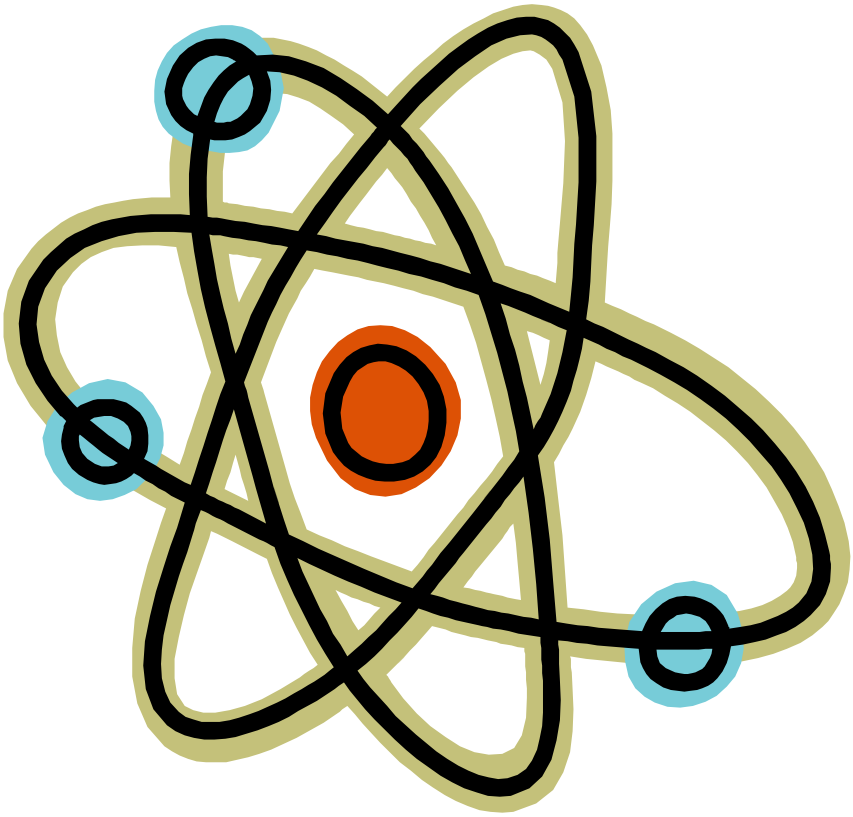
Structure and Properties of Matters

5th Grade Unit
Teacher Manual



TBA ISD LEADING LIFETIME LEARNING

NGSS Lesson Planning Template

Grade: 5th	Topic: Structure and Properties of Matter	Lesson 1 Modeling the Particles of Matter

Brief Lesson Description:
A variety of online simulations, strategies of think–pair-share, Edmodo survey polls, model drawings, student labs and writing pieces (summary/evidence based response/acrostic poetry) will help students understand the concept of scientific modeling of matter particles. A scientific model is an abstract, simplified representation of a system. A model should explain data, agree with what we know about the Laws of Nature and can be used to make a prediction. The Crosscutting Concept for this lesson is "Natural objects exist from the *very small* to the immensely large" so a focus will be placed on matter in the gaseous state and how it is detected.

Activities that require the internet can be viewed on individual student laptops, computer lab, and mobile lab or be done as a whole group lesson using a projection tool.

Performance Expectation(s):
5-PS-1 Develop a model to describe that matter is made of particles too small to be seen.

Students will develop their own models to describe phenomena.
They will build and revise simple models and use them to represent events and design solutions.
Students will focus on a model that shows that gases are made from matter particles that are too small to see.

Specific Learning Outcomes:
Students will be responsible for summarizing their understanding of what a scientific model is and how it can be used.
Students will build and revise a model to describe phenomena concerning matter in its particle form with a focus on matter in the gas state.
Students will be responsible for design and conducting an investigation dealing with gaseous particles.

Narrative / Background Information

Prior Student Knowledge:
Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.(2-PS1-1)
Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.(2-PS1-2)
Make observations to construct an evidence-based account of how an object made of small set of pieces can be disassembled and made into a new object. (2-PS1-3)
Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. (2-PS1-4)

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
☐ Asking questions (science) and defining problems (engineering) ☐ Developing and using models ☐ Planning and carrying out investigations ☐ Analyzing and interpreting data ☐ Using mathematics and computational thinking ☐ Constructing explanations (science) and designing solutions (engineering) ☐ Engaging in argument from evidence ☐ Obtaining, evaluating, and communicating information	**Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon; the effects of air on larger particles or objects. (5-PS1-1)**	☐ Patterns ☐ Cause and effect: Mechanism and explanation ☐ Scale, proportion, and quantity ☐ Systems and system models ☐ Energy and matter: Flows, cycles, and conservation ☐ Structure and function ☐ Stability and change

Possible Preconceptions/Misconceptions
There is no space between the particles of solids.
The size (dimension) of the particles of solids is bigger than the particles of liquids and the particles of liquids are bigger then of gases.
The particles of solids cannot move.
Solids are made up of the particles completely, but liquids and gases are made up the particles not completely (contain another things).
All solids have a definite shape
The shape of solids does not change.
Although solids have volume liquids and gases do not.
Solids have more particles then that of liquids which have more particle than gases.

Gases do not have weight.Gases are light, liquids are heavier than gases and solids are the heaviest.
Matters that can be poured from one container to the other are liquids.
Gases fly.
Since gases are not affected by gravity they do not fall down like solids and liquids.
Gasses do not have weight
Educatonal Research and Review 2011

LESSON PLAN – 5-E Model

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions
Share internet *website "Strange Matter"* and explain how to navigate site (use the "zoom inside" section only). Students are to work their way through the site then through a whole class discussion about information from the simulation. Record student responses on chart paper. Scientific Model and Matter need to be defined. (free site)
http://www.strangematterexhibit.com/

Share internet *website "Acrostic Poem"* and explain how to navigate site. Students are to create an acrostic poem about matter. Save and share poetry as time allows. Use ideas and definitions from prior lesson to build poem. (free site)
http://www.readwritethink.org/files/resources/interactives/acrostic/

EXPLORE: Lesson Description /Questions
Does matter still exist if you cannot see it? In what ways can matter change?

Use *the McGraw-Hill Interactive* to learn about the foundational concepts about particle matter. As a whole group, use the *Quiz* to review the main ideas. Students are to *draw and label a model* of the 3 states of matter. (free site)
http://www.mcgrawhill.ca/school/applets/bcscience7/particle/

Use this *BBC website* to look at matter in its different states, follow the simulation steps and take the *quiz* at the end. (free site)
http://www.bbc.co.uk/schools/scienceclips/ages/9_10/changing_state_fs.shtml

Use the *Brain Pop Website* to explore the states of matter. They will determine whether an example of matter is a solid, liquid, gas or plasma through collaborative/real world activities and computer simulation. This site has the embedded *States of Matter Video*, *Matter Sorter Game, Group Classroom Lesson and Review Quiz*. Also, students will use the *Cause and Effect Graphic Organizer* as a recording device for the States of Matter (gas state) Experiment. (purchase site)
http://www.brainpop.com/educators/community/lesson-plan/matter-sorter-game-lesson-plan/?bp-topic=states-of-matter

View the *Wonderville Clip* have students record all the representations the filmmakers used for depicting gases. (free site)
http://www.wonderville.ca/asset/whattodowithCO2

EXPLAIN: Concepts Explained and Vocabulary Defined
Matter is made of particles too small to be seen. Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists.

Pose the question to students- How could you lift this book above the desk? Supply baggies and books-ask students to make observations as to what is holding up the book… How could you develop this model (cushion of air) a d engineer it into a useable product?

Does a balloon gain weight as you fill it? Have students use two methods (blow-up using their lungs and blow-up using a pump) Weigh each method and record to see if there is a difference in the 2 gases. Have students form explanations based on evidence as to why there is a difference.

Vocabulary: Model-Observations-Matter-Particles-States of Matter-Phase Change-Solid-Liquid-Gas
Teacher demonstration *Screaming Balloons*, focus on the effect of gas on a balloon (filling it)
http://www.youtube.com/watch?v=aAMW_3kWUhE&safe=active

Teacher demonstrates adding air to expand a variety of inflatable objects such as: balloons, basketball, football, beach ball, air mattress, whoopee cushion… Use this site for ideas.
https://en.wikipedia.org/wiki/List_of_inflatable_manufactured_goods

Students will then design a model (drawing) that uses a gas to create an object to help people in their everyday life. (Help people learn, swim, live, travel, health, building)
Possible rubric:
http://www.isbe.net/ils/science/pdf/rubric.pdf

Use this BBC Website to look at matter in the gas phase, follow the simulation steps and take the quiz at the end. (free site) *http://www.bbc.co.uk/schools/scienceclips/ages/9_10/gases.shtml*
EVALUATE: **Formative Monitoring (Questioning / Discussion):** **Student Lab Sheets** **Student built model examples** **Teacher observations & data records** **Quick Quizzes** **Scientific dialogue with students** **Summative Assessment (Quiz / Project / Report): Work in progress…**
Elaborate Further / Reflect: Enrichment Activities

Materials Required for This Lesson/Activity

Quantity	Description	Potential Supplier (item #)	Estimated Price
6 sets	Plastic beakers (2 per kit)		
6 set	Funnels (2 per kit)		
12	Stopwatches (4 per kit)		
6 sets	Dry Measure (2 per kit)		
6 sets	Flexible Rulers(2 packs per kit)		
9 sets	Test Tubes with Racks (3 per kit)		
2	Dune Balances (1per kit) Do you have another one of these?		
3	Tape Measures (1 per kit)		
3	Floating Magnet Sets (1 per kit)		
6	Test Tube (2 per kit)		
3	Site Licenses to Brain Pop (Dreaming right… Instead of textbooks?)	ISD Technology Purchase	$205.00 per classroom
3 packs of 100	7 oz. solo wax cups (1 set per kit)	Gordon Foods	
6 packs of 50	2 oz. clear plastic cups (1 pack per kit)	Gordon Foods	
3 Quart Kits	Flexible Foam (1per kit)	IASCO	$29.99
30	9” clear latex balloons	Party Store	
30	11” clear latex balloons	Party Store	
60	¼” hex nuts	Hardware Store	

NGSS Lesson Planning Template

Grade: 5th	Topic: Structure and Properties of Matter	Lesson 2 Identifying Substances by their Properties

Brief Lesson Description:
Students will investigate properties of solid substances. Students will learn about properties of liquids and solids. Students will apply their knowledge of properties to the usability of the substance to create a new object.

Performance Expectation(s):
5-PS1-3 Make observations and measurements to identify materials based on their properties. Examples of materials to ID include: baking soda, other powders, metals, minerals, and liquids. Properties include: color, hardness, reflectivity, electric properties (electrical conductivity), heat properties (thermal conductivity), response to magnetic forces, and solubility. Assessment does not include density or distinguishing mass and weight.

Specific Learning Outcomes:

1. **Substances have characteristic properties.**
2. **Properties are used to identify substances.**

Narrative / Background Information

Prior Student Knowledge:
Matter is made of particles too small to be seen. The different arrangement and movement of these particles designates a specific state of matter. Substances require energy changes to change state. 5-PS-1-1

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
☐ Asking questions (science) and defining problems (engineering) ☐ Developing and using models ☐ **Planning and carrying out investigations** ☐ Analyzing and interpreting data ☐ **Using mathematics and computational thinking** ☐ Constructing explanations (science) and designing solutions (engineering) ☐ Engaging in argument from evidence ☐ Obtaining, evaluating, and communicating information	**Matter has properties.** **Properties can be measured.** **Properties can be used to identify substances.**	☐ Patterns ☐ **Cause and effect: Mechanism and explanation** ☐ **Scale, proportion, and quantity** ☐ Systems and system models ☐ Energy and matter: Flows, cycles, and conservation ☐ Structure and function ☐ Stability and change

Possible Preconceptions/Misconceptions

PLAN – 5-E Model

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions
Whole Group

- Review the definition of matter
- Review the states of matter
- BrainPOP video http://www.brainpop.com/science/matterandchemistry/statesofmatter/

MATERIALS – chart paper, whiteboards, stick pick

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions
Small Groups of 2

- Groups will receive small bags containing images of different shoes.
- Groups will be asked to sort or classify the shoes.
- **MATERIALS – small bags, laminated set of cards with shoe images, record sheet**

Whole Group – following small group activity

- Discuss the different ways that groups classified or sorted their shoes.
- Create a cumulative list.
- **MATERIALS – chart paper, whiteboards, stick pick**

Return to Small Groups

- Have student groups sort their shoes in a new way.
- **MATERIALS – (same as before) small bags, laminated set of cards with shoe images, record sheet**

Whole Group – following 2nd round of small groups

- Discuss if groups were able to sort by using the new categories.
- Discuss the idea that shoes could be sorted using more than one classification.
- Ask students to think of a scientific name that describes all the different categories/classifications that were used.
- Lead them to the vocabulary word of PROPERTY.

MATERIALS – chart paper, whiteboards, stick pick

EXPLAIN: Concepts Explained and Vocabulary Defined

CONCEPTS

- Matter is anything that takes up space.
- Matter can be described by its characteristics or properties.
- Properties of matter can be physical or chemical.
- Physical properties can be measured or observed without changing the matter into something else.
- Chemical properties describe the ability of matter to react or combine with other matter to form a new substance. These can be hard to observe.
- Properties can be used to identify matter and substances.
- Discovery Education website – Video segments #2 and #3 – http://app.discoveryeducation.com/search?Ntt=chemical+and+physical+properties+of+matter

VOCABULARY

Matter, property, characteristic, physical property, chemical property, substance, solid, liquid, gas, color, hardness, magnetic forces, heat properties, electrical properties, solubility, reflectivityMystery Matter Lab – testing properties to identify substances

- Students will use their observation skills to identify properties of a variety of materials.
- Students will investigate using a scavenger hunt-type activity and record sheet.

ELABORATE: Applications and Extensions

Mystery Powder Investigation –

Materials Needed:

3 pounds salt
5 pounds sugar
4 pounds baking soda
4 pounds cornstarch
5 pounds plaster of Paris
Small clear cups
Post-it notes
Wooden stir sticks
Dropper bottles
Recording sheets
Mystery Powders Mixtures sheets
Science notebooks and pencils
Toothpicks
Heat source: hot plate, candles, or Sterno
Wooden clothespin
Hand lenses
Spoons
Iodine
Water
Safety Goggles
Vinegar
Newspaper
Sponges
Paper towels

Procedure:

1. Introduce Mystery Powders by telling students that over the course of the next two weeks they will become detectives. Explain they will be developing experiments in order to crack the case of the five mystery powders. Show students the unknown powders and let them speculate what they think they might be. Warn students of the dangers of tasting unknown substances.
2. Testing with Magnet: Students put a small sample of the powder in a testing container. They use a magnet to test for attraction.

3. Testing with Heat: Now that students have become familiar with the powders, they can try a few more tests. To complete the heat tests I would set-up one teacher station, and students will record the results they observe on their recording sheet. I will use a hot plate, candles, or cans of Sterno. Put the powder in a little cup made from aluminum foil and hold it over the heat source with a wooden clothespin. Heat the powders for a few minutes, or until no more changes occur. If you like, you can demonstrate how caramel is made by melting sugar in a pan. When it turns brown pour it into cups to harden and the students can enjoy a candy treat! There will be no change for the baking soda and plaster of paris. The cornstarch will turn brown and smell like burnt toast. Sugar will melt, bubble, smoke, caramelize, turn black, and finally harden. The heat test is a good one to detect sugar.

4. Mixing with Water: Students will mix each of the mystery powders with water to discover what happens. They will record their observations on the recording sheet. Encourage students to try different amounts of water to see the difference in results. Share results of water tests. Results should include: baking soda turns a milky color and gets sticky, sugar dissolves, cornstarch turns to a soft solid, salt dissolves, and plaster absorbs water and hardens.

5. Testing with Vinegar: Just like with the iodine tests, distribute little cups with each of the powders. Have students add a few drops of vinegar to each cup and record their observations on the recording sheet. The results include: cornstarch thickens like glue, then hardens, baking soda fizzes, foams, bubbles, and makes noise, sugar partially dissolves, plaster bubbles, melts, hardens, and salt shows no change.

6. Testing with Iodine: For the iodine tests, have students cover their desks with newspaper for easier clean-up. Have students put a little of each powder, some diluted iodine in a dropper bottle, and toothpicks for mixing. Students (in pairs) will then drop iodine on each of the mystery powders. They will record their reactions on the recording sheet. The results for the iodine testing include plaster turning a mustard yellow color, baking soda turns brown, cornstarch starts out red, then ends black, sugar turns purple, and salt turns multi-colored. There may be some disagreement about which powders change since only a small amount of starch is necessary to give a black color, some contamination may occur from mixing up the mixing sticks.

Mystery Metal Investigation –
Mystery Liquid Investigation –

http://www.brainpop.com/science/matterandchemistry/propertychanges/

EVALUATE:

Formative Monitoring (Questioning / Discussion):

- Teacher observations throughout the investigations
- Student recording sheets
- Scientific dialogue with students

Summative Assessment (Quiz / Project / Report):

- Students will identify mystery solids.

Elaborate Further / Reflect:

- Students will decide on a substance that would be best suited to create a new object. Students will support their idea with observations and evidence from the lessons.

IDENTIFYING SUBSTANCES BY THEIR PROPERTIES

5-PS1-3 Make observations and measurements to identify materials based on their properties. Examples of materials to ID include: baking soda, other powders, metals, minerals, and liquids. Properties include: color, hardness, reflectivity, electric properties (electrical conductivity), heat properties (thermal conductivity), response to magnetic forces, and solubility. Assessment does not include density or distinguishing mass and weight.

BACKGROUND INFORMATION

- Matter is anything that takes up space.
- Matter can be described by its characteristics or properties.
- Properties of matter can be physical or chemical.
- Physical properties can be measured or observed without changing the matter into something else.
- Chemical properties describe the ability of matter to react or combine with other matter to form a new substance. These can be hard to observe.
- Properties can be used to identify matter and substances.
- Discovery Education website – Video segments #2 and #3 – http://app.discoveryeducation.com/search?Ntt=chemical+and+physical+properties+of+matter

VOCABULARY

Matter, property, characteristic, physical property, chemical property, substance, solid, liquid, gas, plasma, color, hardness, magnetic forces, heat properties, electrical properties, solubility, reflectivity

DAY ONE – Matter Review and Discovering Properties

Vocabulary: matter, solid, liquid, gas, plasma

Materials: chart paper, whiteboards, small bags containing laminated cards with shoe images, student record sheet, student journals

Procedure:

1. As a whole group, discuss the previous unit activities regarding matter and what matter is. Be sure to talk about the different states of matter – including plasma.
2. Show the BrainPOP video
    a. http://www.brainpop.com/science/matterandchemistry/statesofmatter/
3. Next, small student groups will receive bags containing images of different shoes and they will be sorting/classifying them.
4. Following the small group activity, lead the entire class in a discussion about the different ways that groups classified or sorted their shoes. Create a cumulative list.
5. Then, the small student groups will reconvene to sort their shoes in a new way. Groups can choose from the cumulative list.
6. Finally, as a whole group again, discuss if small groups were able to sort by using the new categories. Discuss the idea that the shoes can be sorted using more than one classification. Ask students to think of a scientific name that describes all the different categories/classifications that were used. Lead them to the vocabulary word of PROPERTY. Ask students how properties relate to matter.
7. Have students journal – Why do you think investigating properties of matter might be useful in the real world?

NAME _____

Matter and their _____
(Day One)

Whole Class:

JOURNAL - Why do you think investigating properties of matter might be useful in the real world?

_____

_____

_____

_____

_____

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_____

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_____

SHOE IMAGES


MBT

DAYS TWO, THREE, and FOUR – Mystery Matter (Solids) Investigation

Vocabulary: Matter, property, characteristic, physical property, chemical property, substance, solid, liquid, gas, plasma, color, hardness, magnetic forces, heat properties, electrical properties, solubility, reflectivity

Materials: Mystery Matter student record sheet, Safety Goggles, Small clear cups, Post-it notes, Wooden stir sticks, toothpicks, Dropper bottles, Wooden clothespin, Hand lenses, Spoons, Newspaper, Sponges, Paper towels, chemistry reaction plates, Iodine, Water, Vinegar
Heat source: hot plate, candles, or Sterno
Substances: salt, sugar, baking soda, cornstarch, plaster of paris, aluminum (tinfoil), iron (nails), copper (pennies), granite (rock), lead (fishing line weights), limestone (rock), stryrofoam (cup), wood

Procedure:

1. Review yesterday's information on properties of matter by showing the following video clips from Discovery Education.
    a. Discovery Education website – Video segments #2 and #3 – http://app.discoveryeducation.com/search?Ntt=chemical+and+physical+properties+of+matter
2. Introduce Mystery Powders by telling students that over the course of the next few days they will become detectives. Explain they will be developing experiments in order to crack the case of "Mystery Matter". Show students the unknown substances and let them speculate what they think they might be. Warn students of the dangers of tasting unknown substances.
3. Property of Color: Students record the color that the matter resembles.
4. Testing with Magnet: Students put a small sample of the powder in a testing container. They use a magnet to test for attraction.
5. Testing with Heat: Now that students have become familiar with the powders, they can try a few more tests. To complete the heat tests I would set-up one teacher station, and students will record the results they observe on their recording sheet. I will use a hot plate, candles, or cans of Sterno. Put the powder in a little cup made from aluminum foil and hold it over the heat source with a wooden clothespin. Heat the powders for a few minutes, or until no more changes occur. If you like, you can demonstrate how caramel is made by melting sugar in a pan. When it turns brown pour it into cups to harden and the students can enjoy a candy treat! There will be no change for the baking soda and plaster of paris. The cornstarch will turn brown and smell like burnt toast. Sugar will melt, bubble, smoke, caramelize, turn black, and finally harden. The heat test is a good one to detect sugar.
6. Mixing with Water: Students will mix each of the mystery powders with water to discover what happens. They will record their observations on the recording sheet. Encourage students to try different amounts of water to see the difference in results. Share results of water tests. Results should include: baking soda turns a milky color and gets sticky, sugar dissolves, cornstarch turns to a soft solid, salt dissolves, and plaster absorbs water and hardens.
7. Testing with Vinegar: Just like with the iodine tests, distribute little cups with each of the powders. Have students add a few drops of vinegar to each cup and record their observations on the recording sheet. The results include: cornstarch thickens like glue, then hardens, baking soda fizzes, foams, bubbles, and makes noise, sugar partially dissolves, plaster bubbles, melts, hardens, and salt shows no change.
8. Testing with Iodine: For the iodine tests, have students cover their desks with newspaper for easier clean-up. Have students put a little of each powder, some diluted iodine in a dropper bottle, and toothpicks for mixing. Students (in pairs) will then drop iodine on each of the mystery powders. They will record their reactions on the recording sheet. The results for the iodine testing include plaster turning a mustard yellow color, baking soda turns brown, cornstarch starts out red, then ends black, sugar turns purple, and salt turns multi-colored. There may be some disagreement about which powders change since only a small amount of starch is necessary to give a black color, some contamination may occur from mixing up the mixing sticks.

Name _____

Mystery Matter (Solids) Recording Sheets
(Days 2-4)

CHEMICAL AND PHYSICAL PROPERTIES TO INVESTIGATE…

Physical

Color- What color or colors make up the appearance of the substance?

Heat- How quickly does the substance heat? Does the powder liquefy? What color does it turn? Does it smoke or burn? What does it smell like?

Magnetic- Is the substance attracted to magnets?

Solubility- How much and well does a substance dissolve in water?

Chemical

Vinegar- Does the substance dissolve? Does it fizz or bubble? Is the resulting liquid clear or cloudy?

Iodine- Does the substance dissolve? What color is the liquid?

NAME _____

Mystery Matter (Solids) Recording Sheets - (Days 2-4)

SUBSTANCE NUMBER	PROPERTIES		
	Color	**Heat**	**Magnetic**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

OVER PLEASE…

SUSBSTANCE NUMBER	PROPERTIES		
	Solubility (Water)	Vinegar	Iodine
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

DAY FIVE– Properties of Gases

Vocabulary: Matter, property, characteristic, physical property, chemical property, substance, solid, liquid, gas, plasma, color, hardness, magnetic forces, heat properties, electrical properties, solubility, reflectivity

Materials: Demo observation and Pause Points record sheet, Access to internet and videos and video clips

Procedure:

1. Review and discuss observations and conclusions discovered while investigating physical and chemical properties of solids. Students can share informally as an entire class, or do short presentations to the group (could utilize technology for this). Concepts for review include: solids, property, chemical property, physical property.
2. Begin questioning students – and you will continue to come back to this – about how properties of matter can relate to the real world. Meaning – why would one want to know about a substances' properties? (Properties of matter can help determine which materials may or may not be useful for creating certain products.)
3. Tell students that they will be viewing a few demonstrations that demonstrate unique properties of gases – another state of matter. View, pause, and discuss the demos. Students should use the Demo Observation and Pause Points worksheet.
    a. Candles and Carbon Dioxide clip - http://www.youtube.com/watch?v=PsAMoGxZIOs
    b. Flame and Carbon Dioxide clip - http://www.youtube.com/watch?v=vDVKSyxKjic
    c. Discovery Education Carbon Dioxide - http://app.discoveryeducation.com/search?Ntt=carbon+dioxide+gas
4. Discuss videos – use the Pause Points and Demo Observation sheet to help guide discussion.

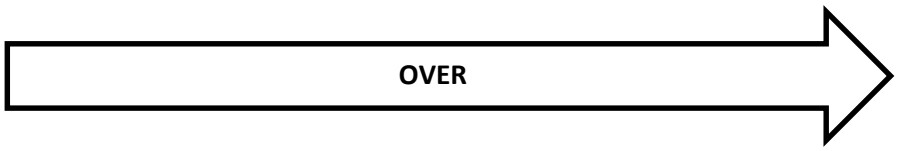
NAME _____

VIDEO - PAUSE POINTS

(Day 5)

Name of Video: _____

TIME (ON VIDEO)	CONCEPT	PAUSE PROMPT



NAME _____

PROPERTIES OF GASES DEMONSTRATION OBSERVATIONS

(Day 5)

What I saw:	**Why do I think it happened?**
I was right about:	**What I didn't know was:**
Key Vocabulary for this Demo:	

DAY SIX – Properties of Liquids

Vocabulary: Matter, property, characteristic, physical property, chemical property, substance, solid, liquid, gas, plasma, color, hardness, magnetic forces, heat properties, electrical properties, solubility, reflectivity

Materials: Demo observation sheet, Access to internet and videos and video clips

Procedure:

1. Review and discuss observations and conclusions discovered while viewing videos on physical and chemical properties of liquids
2. Continue questioning how properties of matter can relate to the real world. Meaning – why would one want to know about a substances' properties? (Properties of matter can help determine which materials may or may not be useful for creating certain products.)
3. Tell students that they will be viewing a few demonstrations that demonstrate unique properties of liquids – another state of matter. View, pause, and discuss the demos. Students should use the Demo Observation and Pause Points worksheet.
    a. Properties of Liquids - http://www.youtube.com/watch?v=AjfkzuRqWHw
    b. Surface Tension - http://www.youtube.com/watch?v=Hm52rkh68JA
    c. Properties of Matter - http://app.discoveryeducation.com/search?Ntt=properties+of+liquids
4. Discuss videos – use the Pause Points and Demo Observation sheet to help guide discussion.

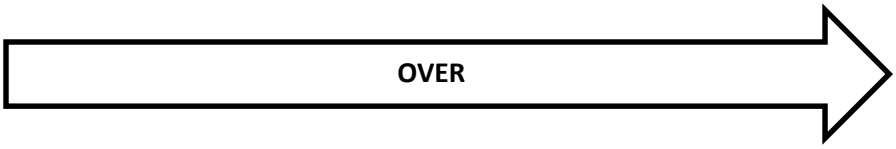
NAME _____

VIDEO - PAUSE POINTS

(Day 6)

Name of Video: _____

TIME (ON VIDEO)	CONCEPT	PAUSE PROMPT



NAME _____

PROPERTIES OF LIQUIDS DEMONSTRATION OBSERVATIONS

(Day 6)

What I saw:	**Why do I think it happened?**
I was right about:	**What I didn't know was:**
Key Vocabulary for this Demo:	

DAY SEVEN – Scientific Dialogue

Vocabulary: Matter, property, characteristic, physical property, chemical property, substance, solid, liquid, gas, plasma, color, hardness, magnetic forces, heat properties, electrical properties, solubility, reflectivity

Materials: Scientific Dialogue record sheet, Access to internet and videos and video clips, record sheets from previous days, writing frame template

Procedure:

1. Concluding discussions should lead to children understanding the importance of matter properties. Students should record the main points of the class discussion on their record sheets.
2. Show BrainPOP video – Property Changes
    a. http://www.brainpop.com/science/matterandchemistry/propertychanges/
3. Also discuss if shape should be considered a property of objects. (No, because shape depends on the object, not the substance. The same substance can be formed into many different shapes.)
4. Ask the students if they can think of and explain cases in which color does not help identify a substance. (Some substances have a distinctive color, like metals. Many other materials, such as plastics and glass can be dyed and produced in any color.)
5. Finally, ask students to write a brief paper that supports the use of a specific substance to create a specific object. For example, using granite to make a garden statue, or Styrofoam for forming a toy boat.

NAME _____

SCIENTIFIC DIALOGUE

(Day 7)

NAME _____

Writing Frame

Selecting a Substance for creating an Object

(Day 7)

There is a lot of discussion about which substances should be used to create a/an _____

_____ .

My decision is that _____ should be used to make

_____ .

I based my decision on the following evidence (look back at observations and data):

First, _____

_____

_____ .

Second, _____

_____

_____ .

People who disagree with my decision might say that (find an observation or data that does NOT support your idea) _____

_____

_____ .

However, I still think _____

_____ .

Materials Required for This Lesson/Activity

Quantity	Description	Potential Supplier (item #)	Estimated Price

NGSS Lesson Planning Template

Grade: 5th	Topic: Structure and Properties of Matter	Lesson 3 Conservation of Matter and Chemical Reactions

Brief Lesson Description:
The students will measure and graph to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of the matter is conserved. Examples of reactions or changes could include phase changes, dissolving, and mixing the forms new substance.

Performance Expectation(s):
5-PS1-2-Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.
5-PS1-2 The student will measure and graph quantities such as weight to address scientific and engineering question and problems.
5-PS1-2 Scale, Proportion, and Quantity-Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.
PS1.B Chemical Reactions-No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.) 5-PS1-2

Specific Learning Outcomes:
1. 5-PS1-2 Students use various tools to measure and graph substances to address scientific and engineering question and problems.
2. 5-PS1-2 Students use measurement descriptions to describe physical quantities such as weight, time, temperature, and volume.
3. 5-PS1-2 Students will understand that no matter what reaction or change in properties occurs, the total weight of the substances does not change.

Narrative / Background Information

Prior Student Knowledge:
2-PS1-1 Plan and conduct investigations to describe and classify different kinds of materials by their observable properties.
2-PS1-2 Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.
2-PS1-3 Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.
2-PS1-4 Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
☐ Asking questions (science) and defining problems (engineering) ☐ Developing and using models ☐ Planning and carrying out investigations ☐ Analyzing and interpreting data ☐ Using mathematics and computational thinking ☐ Constructing explanations (science) and designing solutions (engineering) ☐ Engaging in argument from evidence ☐ Obtaining, evaluating, and communicating information	No matter what reaction or change in properties occurs, the total weight of the substances does not change.	☐ Patterns ☐ Cause and effect: Mechanism and explanation ☐ Scale, proportion, and quantity ☐ Systems and system models ☐ Energy and matter: Flows, cycles, and conservation ☐ Structure and function ☐ Stability and change

Possible Preconceptions/Misconceptions

LESSON PLAN – 5-E Model

Day 1

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions
Review the concepts that matter is made of particles too small to be seen and matter can be identified based on properties and characteristics. Pose the questions, **"When matter changes, does its weight change?" "What effects do open and closed systems have on matter and the changes that occur?"** Record responses on chart paper, smartboard, or any other available means. Post so that this can be referenced throughout this section.

*Crystal Demonstation-Might prepare a crystal experiment ahead of time. This will take a week to do ahead of time. A class experiment can then be set up. Site for crystal growing ideas are referenced below.
http://chemistry.about.com/od/crystalsforkids/Crystal_Projects_for_Kids.htm
http://chemistry.about.com/od/crystalrecipes/a/saltvinegar.htm
http://chemistry.about.com/od/growingcrystals/Growing_Crystals.htm

Day 2-4

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions
Students will learn about the concepts of **open** and **closed systems** along with the **Law of Conservation of Mass**. This will be done in both large group discussion and small student group settings. Students will be involved with the **Conservation of Mass** experiment.

Lesson background, procedures, and student sheets are attached.

Day 5-6

EXPLAIN: Concepts Explained and Vocabulary Defined

Open and Closed Systems
Ludwig Bertalanffy describes two types of systems: **open systems** and **closed systems**. The open systems are systems that allow interactions between its internal elements and the environment. An open system is defined as a "system in exchange of matter with its environment, presenting import and export, building-up and breaking-down of its material components."[1] Closed systems, on the other hand, are held to be isolated from their environment. Equilibrium thermodynamics, for example, is a field of study that applies to closed systems. The idea of open systems was further developed in systems theory. In this case, open systems in systems theory encourage a non-representational and non-referential post-humanist approach that actualizes the complexity of reality in a non-deterministic framework.

http://science.yourdictionary.com/open-system http://science.yourdictionary.com/closed-system

- Review the video clip on conservation of mass. http://app.discoveryeducation.com/player/view/assetGuid/9A6C9BF8-DDA5-430D-9343-D2C9301A26A8 for a discussion on conservation of mass. Ask students what variables could impact the conservation of mass concept. Introduce the concept s of open and closed systems. Show students two plastic jars, one with a top on and one without. Ask the class, "Which system is a closed system, and which system is an open system?"

Day 7-10

ELABORATE: Applications and Extensions
This time should be spent having students run more experiments that demonstrate the Law of Conservation of Mass and its implications. Experiments could include:

- Growing a Borax snowflake- www.http://chemistry.about.com/cs/howtos/ht/boraxsnowflake.htm
- Making Gak- www.http://www.stevespanglerscience.com/lab/experiments/glue-borax-gak
- Making Ice Cream- www.https://www.stevespanglerscience.com/lab/experiments/homemade-ice-cream-sick-science
- Go to this link to find out what Elements are.- www.http://www.chem4kids.com/files/elem_intro.html
- Go to this link to read more about Reactions. - www.http://www.chem4kids.com/files/react_intro.html
- Go to this link to learn about Thermochemistry. -www.http://www.chem4kids.com/files/react_thermo.html

EVALUATE:
Formative Monitoring (Questioning / Discussion): Checklists would be an option using the highlighted standard for Science and Engineering Standards, Disciplinary Core Ideas, and the Crosscutting Concepts as guides. A rubric could be made to fit this purpose.

Summative Assessment (Quiz / Project / Report):

Elaborate Further / Reflect: It is suggested that students keep a Science Journal for this unit to record the day's question(s), procedures, and findings. These should be monitored by the instructor on a weekly basis.

Conservation of Mass

Getting Started

1. Introduce the concepts of open and closed systems.
Show students two jars, one with a top on and one without. Ask the class ***Which system is a closed system, and which is an open system?*** Students are likely to respond that the container with the top is the closed system. Explain that in this activity they will observe chemical reactions in an open system and conduct chemical reactions in a closed system. In an open system the contents of the jar can mix with the air surrounding the outside of the jar. In the closed system, however the chemical reaction is contained inside of the jar, and all reactants and products stay in the jar. Point out that it is not an absolutely closed system, in that heat and light will be able to escape.

Reinforce the concept of open-vs.-closed systems, using a can of soda. When it is sealed, it is closed system. When it is open and the gases are released it is an open system with the air around the can. Ask students, ***What type of system is a person- open or closed?*** A person is an open system because we take in food, oxygen, and water, from outside our bodies and excrete waste, carbon dioxide, and other substances. Challenge student to think of both open and closed systems. Once soda has been placed in a 2-liter bottle and sealed, it can be considered a closed system since there is no exchange of matter between it and its surroundings. In reality there are very few absolutely closed systems in our universe. Our planet, for example, is an open system in that it exchanges mass with the solar system and galaxy. Challenge students to think of additional systems and to describe which they are open or closed and why.

2. **Demonstrate two chemical reactions in open systems.** Students will be measuring, recording, and using scientific procedures to demonstrate that the law of conservation of mass is indeed correct.

- Review the signs of a chemical reaction, which include change in color of products, production of gas, emission of light or heat, and appearance of a new solid (precipitate) or liquid. Reinforce that these changes in physical appearances or characteristics of the reactants are a way to visually detect a chemical change, while change at the atomic level is not visible directly. Prompt them to look for these signs that indicate a chemical reaction is occurring.
- Review the use of balances to measure mass. Explain to students that they will record the mass of the reactants and products to the nearest 1/10.
- Demonstrate how to use the dropper to correctly measure the necessary materials.
- Stress to the students that they must not allow the two reactants to mix before they have done the initial measurement of mass. Reaction containers should be removed from the scale before beginning the experiment. Advise students not to hold the reaction containers while the reactions are occurring as aluminum/copper chloride reaction is exothermic.
- While students are observing the reactions in closed container, circulate around the room, and encourage students to record detailed observations. Expect that students' results will show a change in mass of 0.0-0.1g. Sample student results for Student Sheet 25.1 ***Mass of Reactants and Products***, is shown below. Students' results will likely show a change in mass of 0.0-0.3g. The Law of Conservation of Mass dictates that there should be no change in mass when measuring products against reactants in a closed system. If students determine a change in mass, discuss why. It could be due to human error in measurement, or the reaction chamber is not truly a closed system in that it allows heat and possibly some gaas to escape. Use this information to prompt students to recommend ways to conduct more tests and to reduce the amount of human or instrument error.

Sample results for Student Sheet, ***Mass of Reactants and Products Chemical Reactions in a Closed System***

Reactants	Initial Mass (g)	Final Mass (g)	Change in Mass (g)
Copper chloride + Aluminum	18.3	18.2	0.1
Copper Chloride +Sodium hydrogen phosphate	23.1	23.1	0.0

Reaction: copper chloride + aluminum

Observations before	Observations During	Observations After
Copper solution is blue. The aluminum washers are shiny silver metallic disks with hole in the middle.	There was fizzing, and condensation formed on the sides of the jar. The solid part started to turn brown. The cup is warm.	The liquid level went down. The cup is still warm. There are chunks of red in a liquid that is gray in color.

Reaction: copper chloride + sodium hydrogen phosphate

Observations Before	Observations During	Observations After
The copper solution is a blue liquid. The sodium solution is a clear liquid.	A thick, bright blue liquid forms that is very cloudy/milky.	Same as during the reaction.

3. **Follow-Up**

The class compares change-in-mass data for reactions in a closed system.

Have students transfer their data onto a class graph for both reaction. Use this data to start a class discussion. Ask, ***What trend do you see in the data? What is this telling us about what is happening to the mass of the reactants as compared to the mass of the products?*** Students will likely point out that there is minimal change from the mass of the products.

This is a good time to reinforce the negligible change in mass observed with a closed reaction containers, and to discuss how the ***Law of Conservation of Mass*** applies to this experiment. The students were exposed to the ***Law of Conservation of Mass*** in one of the opening video clips. This is the time to explain that scientists established that the mass of the products in a chemical reactions is equal to the mass of the reactants, assuming that no matter has escaped. Mass cannot be created or destroyed in a chemical reaction, but it can change form. Emphasize that mass is conserved whether a reaction takes place in a closed or open system, but when conducted in a closed system the mass of the system remains the same. When the same reaction is conducted in an open system, mass may escape (in the form of gases, or liquids through evaporation which causes a change in the mass. The real world connection and implication is that no matter that is created is truly ever destroyed. It simply takes another form. This is something to think about when considering environmental issues.

Materials and Advance Preparation

For the teacher

Chart paper (this will be needed for recording student generated ideas and also making a class graph to record changes in mass following the experiment.
1 10-ml. Graduated cylinder
2 aluminum washers
1 bottle of 100,000 ppm copper chloride solution
1 bottle of sodium hydrogen phosphate solution
1 overhead projector
1 ***Change in Mass for Two Chemical Reaction in a Closed System*** lab sheet
*1 can of soda

For each group of students (about 4-6 students in a group)

1 balance (due to cost a class may have to share one or two scales)
1 set-up tray to hold the test tubes
1 30 ml container of 100,000 ppm copper chloride solution
1 30 ml container of sodium hydrogen phosphate solution
1 10ml graduated cylinder or other comparable containers
1 aluminum washer
2 eye droppers

For each student

1 Student Sheet ***Mass Reactants and Products***
1 pair of safety goggles

*Optional

Student Names_____

Date_____

Homeroom_____

Mass of Reactants and Products Student Sheet

	Initial Mass (g)	Final Mass (g)	Change in Mass (g)
Copper Chloride + Aluminum			
Copper Chloride + Sodium Hydrogen Phosphate			

Reaction: Copper Chloride + Aluminum

Observations before	Observations during	Observations After

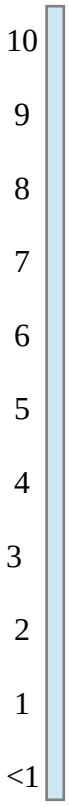
Reaction: Copper Chloride + Sodium Hydrogen Phosphate

Observations Before	Observations During	Observations After

Class Graph Model for the Teacher

Below is an example of how a class graph might look. The intention is to give students practice at graphing scientific data and interpreting the results.

Class Graph Model for Changes in Mass



Copper Chloride + Aluminum (g)
Copper Chloride + Sodium Hydrogen Phosphate (g)

Student Experiment Procedures

1. Students will need to collect the following items for their groups:
    - safety glasses for every group member
    - 4 10ml test tubes, two with covers and a set up tray (small solo cups with lids and small packing trays can be substituted here as the trays are used for guarding against spills)
    - 4 eye droppers with graduated measurements on the sides
    - 2 containers with smidgen amounts of 100,000 ppm copper chloride solution
    - 2 containers with smidgen amounts of sodium hydrogen phosphate solution
    - 2 aluminum washers

*Students will have to take turns sharing the classroom scales to weight their materials.

2. Students will measure and weigh 1ml of copper chloride solution into a container either the test tube or small cup and 1 aluminum washer. These materials should be weighed separately before the chemical reactions. Students record this information on ***Student Sheets***.

3. Following the weighing of materials, students will pour the 1ml copper chloride solution into the cup containing the aluminum washer. The cup does not get covered. The reaction will take approximately 5 minutes to complete. During this time students are to record observable property changes as the reaction progresses.

4. When the reaction has stopped students record their final observations and reweigh there materials. Compare the pre and post mass weights. Was there a change in mass weight? Why? If there was a difference in weights what happened?

5. Repeat the entire weighing process using 1ml. copper chloride and 3 ml. sodium hydrogen phosphate.

6. Following the weighing of these materials and observing their individual properties, combine the solutions into one cup and quickly cover the cup containing the new solution. The finished reaction time should be approximately 2 minutes. While the reaction is taking place students are to observe and record their observations on the ***Student Sheets.***

7. When the reaction has stopped students record their final observations and reweigh there materials. Compare the pre and post mass weights. Was there a change in mass weight? Why? If there was a difference in weights what happened?

8. Once all data have been recorded students are to clean up their areas, thoroughly wipe up their stations and return all materials to where they belong making sure everything is clean and dry.

NGSS Lesson Planning Template

Grade: 5th	Topic: Structure and Properties of Matter	Lesson 4 Producing a New Substance

Brief Lesson Description:
Conduct an investigation to determine whether the mixing of two or more substances results in a new substance.

Performance Expectation(s):
Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.

Specific Learning Outcomes:
Cause and effect relationships are routinely identified, tested, and used to explain change.
Conduct an investigation to determine whether the mixing of two or more substances results in a new substance.

Narrative / Background Information

Prior Student Knowledge:
Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.(2-PS1-1)
Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.(2-PS1-2)
Make observations to construct an evidence-based account of how an object made of small set of pieces can be disassembled and made into a new object. (2-PS1-3)
Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. (2-PS1-4)

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
☐ Asking questions (science) and defining problems (engineering) ☐ Developing and using models ☐ Planning and carrying out investigations ☐ Analyzing and interpreting data ☐ Using mathematics and computational thinking ☐ Constructing explanations (science) and designing solutions (engineering) ☐ Engaging in argument from evidence ☐ Obtaining, evaluating, and communicating information	When two or more different substances are mixed, a new substance with different properties may be formed.	☐ Patterns ☐ Cause and effect: Mechanism and explanation ☐ Scale, proportion, and quantity ☐ Systems and system models ☐ Energy and matter: Flows, cycles, and conservation ☐ Structure and function ☐ Stability and change

Possible Preconceptions/Misconceptions

- The term "reaction" simply means a change in appearance with no change in substance
- In order for a chemical reaction to occur, two substances (especially two liquids or a liquid and a solid) must be poured or stirred together
- A chemical reaction occurs during a change of state
- Substances are inert objects (and, therefore, cannot change into other substances
- Substances cannot change into other substances
- Matter disappears when a chemical reaction occurs
- Invisible gases cannot act as reactants or products in chemical reactions
- A chemical reaction cannot occur over a long time span. They may think that it has to be immediate and dramatic
- A chemical reaction must take place in a laboratory, and therefore, they do not think that phenomena occurring in other places could also be chemical reactions

LESSON PLAN – 5-E Model

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions
Preparing Flexible Urethane Foam Website For Teacher Background
http://www.youtube.com/watch?v=PUB1GU_tvpI&safe=active

Student Lab:
Materials:
Flexible Urethane Foam Parts A and B (IASCO supplier)
Small paper cups (2)
Craft sticks
Balance scale

Procedures:
Set balance to read zero when paper cut o paced on it
Measure out 5 grams of part A into cup and set this aside
Pace a second paper cup on the balance an set balance to read zero
Place 15 grams of Part B into cup
Mix Part A into Part B- total mixing time should be about 30 seconds
Let the mixture sit and allow foam to form

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions
Record observations after 3 minutes.
What does it look like?
Feel like?
Smell like?
How has the mixture changed?
Describe the characteristics of the material that was made, before and after the reaction.
(Data collection sheet needs to be developed)

EXPLAIN: Concepts Explained and Vocabulary Defined
Cause and effect relationships are routinely identified, tested, and used to explain change.
Determine whether the mixing of two or more substances results in a new substance.

Vocabulary:
Cause and effect
Chemical reactions
Evidence
Matter
Mixture
Substance
Reactions
Urethane

ELABORATE: Applications and Extensions
What applications do you see this product being used for? For example, do you think it's an insulator or a conductor? How could this be engineered into a useful product?

EVALUATE:
Formative Monitoring (Questioning / Discussion): Needs to be developed

Summative Assessment (Quiz / Project / Report): Needs to be developed

Elaborate Further / Reflect: Enrichment
Needs to be developed

Materials Required for This Lesson/Activity

Quantity	Description	Potential Supplier (item #)	Estimated Price
3 Quart Kits	Flexible Foam (1 quart per kit)	IASCO	$29.99
3 packs of 100	7 oz. solo wax cups (1 pack per kit)	Gordon Foods	
6 packs of 50	2 oz. clear plastic cups (1 pack per kit)	Gordon Foods	
3 feet	Nitinol Memory Wire (1 foot per kit)	Carolina	$14.95