**5E Learning Cycle Lesson Plan**

1.**Title**

Properties of Matter

2. **Overview and Statement of Purpose**.

A, **Include a several sentence statement of purpose for the lesson**.

The purpose of this lesson is for third grade students to understand the properties of matter, states of matter, and how matter can change. This includes understanding that matter can exist in three different states: solid, liquid, and gas. Students will be able to demonstrate this knowledge by understanding the different types of matter that exist in each state, and that matter can change from one state to another without altering its composition. Students will use many science process skills to inquire and investigate different types of matter, and how they can change from one state to another.

B. **How does it connect to the real world?**

This lesson connects to the real world because matter is all around us everyday. Students need to understand that everything is matter, and there are certain ways we can classify matter. Matter is important to scientists because they study materials based on their properties to make certain things for housing, foods, and clothing. Students will learn how to recognize different types of matter based on their properties to determine whether it is a solid, liquid, or gas.

3. **Grade Level and Objectives.**

Grade Level: 3

3.P.2.1: Recognize that air is a substance that surrounds us, takes up space and has mass.

3.P.2.2: Compare solids, liquids, and gases based on their basic properties.

3.P.2.3: Summarize changes that occur to the observable properties of materials when different degrees of heat are applied to them, such as melting ice or ice cream, boiling water or an egg, or freezing water.

B. For objective 3.P.2.1: Recognize that air is a substance that surrounds us, takes up space and has mass. I will have students think about all of the things around us in the classroom that is matter. I will ask students if they think that the air we breathe is matter? Does air have mass and take up space? I will demonstrate this idea to students by have a deflated balloon on one side of a scale and then a blown up balloon on the other to show that the balloon that is full of air weighs more than the one that doesn’t. I will also demonstrate this idea by blowing air into a plastic bag and resting a small book on top of the bag to show that a book can be held up by air.

For objective 3.P.2.2: Compare solids, liquids, and gases based on their basic properties. Students will explore different types of objects based on their properties. Students will collect data that describes the physical properties of solids, liquids, and gases while comparing and contrasting what they do and don’t have in common. Students will also be given the opportunity to physically represent the behavior of molecules in a solid, liquid, and gas to show why they have different properties based on their molecules.

For objective 3.P.2.3: Summarize changes that occur to the observable properties of materials when different degrees of heat are applied to them, such as melting ice or ice cream, boiling water or an egg, or freezing water. I will use several demonstrations to represent a physical change. I will show a liquid to a solid by having the students observe water in a small container on one day, and then telling them I will put it in the freezer over night and observing what happens the next day. This will show students that a liquid can be changed to a solid when different temperatures are applied. I will also use a demonstration with dry ice to show that when you put the ice in water it changes from a solid to a gas immediately.

4. **21st Century Skills.**

A. Please list [21st Century Skills](http://www.p21.org/overview) targeted by this lesson.

**Learning and Innovation Skills**

**Creativity and Innovation**

**Think Creatively**

* Use a wide range of idea creation techniques (such as brainstorming)
* Create new and worthwhile ideas (both incremental and radical concepts)
* Elaborate, refine, analyze and evaluate their own ideas in order to improve and maximize creative efforts.

 **Communication and Collaboration**

**Communicate clearly**

* Articulate thoughts and ideas effectively using oral, written, and non-verbal communication skills in a variety of forms and contexts.

 **Collaborate with Others**

* Demonstrate the ability to work effectively and respectfully with diverse teams.
* Assume shared responsibility for collaborative work, and value the individual contributions made by each team member.

B. The Creativity and Innovation objective will be met during the exploration when students are working on the properties of different materials. Students should think creatively when they are observing the physical properties of the materials, and understand that there is more than one way to sort and classify the materials. This activity will help the students to use descriptive language when describing all of the different materials, and will push them to understand that matter can have different physical properties.

The Communication and Collaboration objective will also be met during the exploration. Students are asked to work together to come up with different ways to describe the physical properties of matter. Students will have to collaborate with others to come up with shared ideas about the behavior of molecules, and will work together to demonstrate this idea. Students will also have to communicate their ideas clearly in their science journals to demonstrate their understanding of matter, solids, liquids, gases, and physical change.

5. **Curricular Integration.** (Note: You do not actually have to teach these activities during your 5E lesson. This just shows that you are aware of some ways that you could integrate).

A. First Activity:

i. What is an additional curricular integration activity (from language arts, social studies, health etc.) you could use with your lesson plan?

Language Arts: Students will write a short narrative explaining why matter is important, and why we need solids, liquids, and gases in the world. Students should include and use their own understandings for each of the definitions for matter in their narrative. This should include a description of matter, with examples of solids, liquids, and gases. Students may include a picture or diagram showing each example of the three states.

ii. How would you integrate this activity?

I would integrate this activity after the explanation. Students would be able to use what they learned from the explore and explain section to describe the different types of matter and the three states in which they are found.

iii. Which competency goal from your same grade does this activity address?

Language Arts/Writing Standards: Grade 3

**Text Types and Purposes**

3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

* a. Introduce a topic and group related information together; include illustrations when useful to aiding comprehension.
* b. Develop the topic with facts, definitions, and details.

B. Second activity:

i. What is a second additional curricular integration activity (from language arts, social studies, health etc.) you could use with your lesson plan?

Language Arts/Reading: Students will use the informational text “Inside the World of Matter” by Jane Weir to read and learn about the different features of informational text while learning more about matter. Students will list and describe the different features of an informational text, and why they are important while reading different sections.

ii. How would you integrate this activity?

This activity will be used during the explain section when students are learning the different definitions and meanings for matter, solids, liquids, and gases. This activity will be used to see if students understand what an information text is and how it is useful when learning about science.

iii. Which competency goal from your same grade does this activity address?

Language Arts/Reading Informational Text: Grade 3

**Craft and Structure**

4. Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3 topic subject area.

5. Use text features and search tools (e.g., key words, side bars, hyperlinks) to locate information relevant to a given topic efficiently.

6. **Essential Knowledge (for teacher**).

Physical science is the exploration of nonliving materials.

**I.** What is Matter?

Matter is anything that has mass and takes up space. Mass is the amount of matter in an object. You can’t tell how much mass an object has if you just look at it. A golf ball and a ping-pong ball are about the same size, but a golf ball has much more mass than a ping-pong ball. You have to measure to find out how much mass an object has.

Matter is generally classified or grouped by physical properties. Physical properties can be observed using the senses: how it feels, how it looks, how it smells, and how it sounds. Color, size, shape, odor, and hardness are all words to describe the physical properties of matter. You can observe some physical properties of matter using sight. You might observe what the color of the object is, how big it is, and some that are dull and some that are shiny. Properties of matter can also be observed by touch (what it feels like). Different types of matter can feel rough or smooth, hot or cold, soft or sharp, scratchy or furry. Different parts of the same object may feel different: for example, a cat’s fur is soft, but its claws are sharp. Matter can also be observed by the sound it makes. You might observe something that makes a loud or soft noise, makes a ping, or something that doesn’t make a sound at all. Matter can also have a certain smell. There are different kinds of matter that smells good, some that doesn’t smell so pleasant, and those that do not have a smell. For example, flowers usually smell sweet, but the odor of a skunk doesn’t smell very good.

**II.** States of Matter

Matter has three different common forms, called states. The three states of matter that can be observed are a solid, liquid, or gas.

Solid: A solid takes up a specific amount of space (volume) and has a definite shape. A solid does not lose its shape, and the volume stays the same. A solid object takes up the same amount of space all the time, and can be easily measured and weighed on a scale. The particles that make up a solid wiggle in place, but don’t move relative to one another, that is why it cannot change its shape.

Liquid: A liquid has a volume that stays the same, but it can change its shape. A liquid takes the shape of any container, but it will always stay the same volume. Liquids have a definite size but no definite shape. The most common liquid on Earth is water. The particles that make up a liquid are loosely attached to each other and can move relative to one another, but are still close together.

Gas: A gas does not have a definite shape or a definite volume. Gases take the size and shape of their container. It takes up all the space in its container. Air is an example of a gas that takes up the space in a classroom. The size of the classroom does not matter because air will spread out to take up all of the space in the room. Each particle in a gas moves in a straight line until something stops it. It bounces off that object and moves off in another straight line. The particles in gas move around to fill up the space or container that it is in, and molecules are far apart and can move relative to one another.

 Air is a mixture of gases. Oxygen and nitrogen are the main gases that make up air. Oxygen is the most important for humans to breathe, but only about 21 percent of the air is oxygen while 78 percent is nitrogen.

**III.** Energy

 When matter is changed from one state to another it takes a certain amount of energy to create this change. Elements combine to make up the different types of matter. An element is the simplest form of matter and is made up of only one type of material. There are ninety-two naturally occurring elements in the universe. The smallest part of an element is an atom. Atoms form to create molecules, which are the smallest part of a compound while still retaining the properties of that compound. When a combination of two or more elements is created in a definite proportion we call this a compound. For example, water is a compound with two parts hydrogen and one part oxygen and these elements stay constant for all water therefore they fall under the category of a compound. There is also another combination of elements called a mixture. This can be any combination of elements, compounds or other mixtures.

 Atoms are the basic building blocks of matter. Some pieces of matter are so small that you can see them only by using special tools such as a magnifying glass. Some pieces are so small that you cannot see them at all. But scientists can observe the effects of what these pieces of matter do. The pieces of matter are called atoms.

Sometimes substances can be two states of matter at one time. Like the green goo from Koch chapter that was both a liquid and a solid and therefore fit in the category of suspension; which means that solid particles are suspended between the water particles.

Types of energy:

* Kinetic energy: the energy that an object has because it is in motion. Example, wind, falling ball, etc.
* Gravitational Potential energy: stored-up energy that all objects or people have and it comes from the position of the object in space. A ball rolling off of a five foot hill has more potential energy than a ball rolling off of a two foot hill because the five foot hill ball has farther to roll and from a higher position so it can move farther and gain more speed therefore it has more potential energy.

Scientists study the world closely and record what they sense. This is called observing. Observing is one way scientists answer questions about matter. (Process skill: observation)

**IV.** Changes of State

* Adding heat or taking heat away causes matter to change states. This is because adding heat makes the particles in matter move faster. Taking away heat, or cooling, makes the particles slow down.

Example: Adding heat to ice makes it change from a solid to a liquid. The heat caused the particles in the ice to move faster. As the particles moved faster, the connections between them became looser. When the particles are moving loose enough to slide past one another, the ice starts to change into a liquid.

* Water, like many substances, can exist in all three states, solid, liquid, and gas.
* Liquid water has molecules wiggling at many different speeds. The fastest of these may leave the surface of the liquid in the process of evaporation and turn into water vapor, which is the process in which a liquid becomes a gas. (The larger the surface area, the more likely a fast moving water molecule will get to the surface and leave.)
* If water is heated to a temperature of 100 degrees Celsius, bubbles of water vapor form within the water. This is boiling.
* Water vapor has relatively fast moving molecules, but if they are slowed down—for example- by contact with a cold surface- they can stick together and form liquid water in a process called condensation.
* Liquid water molecules that are cooled down to 0 degrees Celsius begin to form a crystal called ice in the process of freezing. This crystal has the unusual property that the molecules actually spread out a bit as they get fixed into position in the crystal. This is why ice floats (because it is less dense, or less tightly packed than water).
* When molecules of water in ice begin to wiggle too fast to stay in the crystal form, the ice melts.

Dry ice is solid carbon dioxide. It has the unusual property that it goes right from being a solid to being a gas without going through the liquid

Sources: Koch, J. (2010). Science Stories: Science Methods for Elementary and Middle School Teachers, 4th Edition. Chapter 6: Matter Matters (Print Source)

Harcourt, Inc. (2000). Harcourt Science: Physical Science. Investigating Matter-Properties of Matter (Print Source)

7.**Developmental Level/Student Background Knowledge.**

A. How does this lesson fit the students coming to you in terms of what they might have experienced in real life?

This lesson fits with my students in terms of what they might have experienced in real life because matter has always surrounded them. Whether students understand the term matter or not doesn’t depend on their experience with all of the matter in the world. Solids, liquids, and gases constantly surround students throughout their day, and they will be able to relate to all of these objects because they can recognize and understand what they are.

B. Explain how it is matched to their physical skills (what they can do with their bodies)?

This lesson allows students to physically represent what a molecule looks like using three students to model the three atoms in a water molecule. Students are also able to represent the behavior of the molecules in a solid, liquid, and gas when they are learning about the properties of each state of matter. The properties of matter activity during the explore, allows students to work with different kinds of matter to help them understand what kinds of properties they hold and will allow them to recognize these properties when they are surrounded by different kinds of matter in their life.

C. How is it matched to their conceptual skills (what is going on developmentally in their minds)?

Third grade students are beginning to think more logically about the different things around them. The properties of matter activities allows students to have hands on materials that they are able to physically see and touch to formulate their own understandings about the materials. During this time students are entering Piaget’s concrete operational stage where the thought process becomes more rational, mature, and adult-like. In the concrete operational stage, students have the ability to develop logical thought about an object, if they are able to manipulate it. Throughout this lesson, students are given many opportunities to touch and observe different types of matter to help them develop ideas and push them towards entering the formal operations stage.

D. How does it relate to what they would have learned in previous grade levels (look at the curriculum!)?

**North Carolina Standard Course of Study**

Science: Grade 2

**Competency Goal 3: The learner will observe and conduct investigations to build an understanding of changes in properties.**

3.01 Identify three states of matter:

 • Solid.

 • Liquid.

 • Gas.

 3.02 Observe changes in state due to heating and cooling of common materials.

3.03 Explain how heat is produced and can move from one material or object to another.

3.04 Show that solids, liquids and gases can be characterized by their properties.

3.05 Investigate and observe how mixtures can be made by combining solids, liquids or gases and how they can be separated again.

3.06 Observe that a new material is made by combining two or more materials with properties different from the original material.

E. How does it relate to what they will learn in the future (look at the curriculum!)?

Understanding the structure and properties of matter in third grade will prepare students for their study of understanding the composition and properties of matter before and after they undergo a change or interaction in fourth grade. Students will be able to build on their understanding of the different types of matter, and how they are related to each other in order to understand its composition. Students will use this knowledge of matter in order to learn how to classify the different types of rocks based on their physical properties.

Science Essential Standards-Grade 4

Matter: Properties and Change

**4.P.2 Understand the composition and properties of matter before and after they undergo a change or interaction.**

4.P.2.1 Compare the physical properties of samples of matter (strength, hardness, flexibility, ability to conduct heat, ability to conduct electricity, ability to be attracted to magnets, reactions to water and fire).

4.P.2.2 Explain how minerals are identified using tests for the physical properties of hardness, color, luster, cleavage, and streak.

4.P.2.3 Classify rocks as metamorphic, sedimentary, or igneous based on their composition, how they are formed and the processes that create them.

8. **Detailed Lesson Plan**. The Learning Cycle (5E’s) should be developed in enough detail for a knowledgeable substitute to use. (Be sure to see your [rubric](http://www1.appstate.edu/~goodmanj/elemscience/lessonplanning/5E_learning_cycle_rubric.htm%22%20%5Ct%20%22_blank) for specific details of what to include in each of the phases of the 5E Learning Cycle.)

**A. Engagement with transition question, challenge, or problem**

**i.** I am going to introduce and engage students into the topic of matter and the different properties by showing them a video clip from the movie, Despicable Me. This clip shows many different types of matter, and will be able to get the students interest and attention where they are able to think about different types of matter. **(Observation, Prediction)**

 **1.Video (46 sec)** <http://ficscience.blogspot.com/2011/01/despicable-me-shrink-ray.html>

**-Ask students why they think I showed them the video clip from Despicable Me? I will have them think about all of the different things that were shown in the video. (Ray, the airplane, air, gas, what happened to ray) Introduce that all of this “stuff” is matter. (**Sample Answer: At first, students may not understand why I showed them the video clip. To show us that Ray shrinks or that he is flying in a plane. To show us that there are different types of matter in the video such as Ray, the airplane, air, and clouds.)

**-Ask the students to look around the classroom and identify some of the matter that they see? (**Sample Answer: (books, desks, pencils, chairs, students, teacher, paper, etc.)

**Discuss with students as a class what matter is. (“Stuff” that takes up space and has mass). Hold up a ping-pong ball and a golf ball to the class, ask:**

* Do these have the same mass?

Pass the ball around for students to hold, ask:

* Do the balls feel the same?
* What is different about them?

**ii.** How will you connect to students’ everyday lives?

Matter is a part of our everyday lives. Anything that has mass and takes up space is matter. Air is also matter, and it is very important because we must have it to live. Air is matter because it takes up space and has mass. (Further investigation of air during explanation.)

 To connect this lesson to students’ everyday lives they will read together a page from the informational text, *Inside the World of Matter*. The text talks about how everything in their home, town, country, world and even universe are made up of matter. It is all around us and everywhere in our lives. Another purpose for the text is for students to get familiar with informational text features. To check for comprehension and understanding, following the reading, the questions below should be asked.

 Talk about different things around their classroom with the students. Discuss how people combine matter to make things they need, like desks, notebooks, etc. Instruct students to write an entry in their science journals about all the features they noticed about the informational text.

iii. What questions will you ask? (Provide sample answers.)

**-Ask the students what does the word matter mean in the question “What’s the matter with you?” (**Sample Answer: It means what is wrong with you? It could be asking what is bothering you, or if something is not right.)

**-Do you think that matter in the sentence provided means the same thing as what we just learned about matter? (**Sample Answer: No, because matter in the question is not representing something that has mass and takes up space.)

-**Why is learning about matter important? (**Sample Answer: It is important to learn the different types of matter, and how we use it in our everyday life. It is also important to learn what state or form the matter is in so we know how it is used.)

**-Who is this information important to? (**Sample Answer: Scientists, because they need to know the different types of matter. Architectures, people who build different buildings because they need to know the strongest types of matter.)

**-What would the world be like if we didn’t have matter? (**Sample Answer: There wouldn’t be anything because everything in the world is made of matter)

**B. Exploration**

**i.** How will you transition from the engagement to the exploration?

I will transition from the engage to the exploration by reviewing with the students all of the information and examples of matter that we previously discussed. I will introduce the exploration by showing the explaining to the students that we are going to be working with different types of objects that they are going to observe. I will make sure to let the students know that all of the objects are different types of *matter*. Matter meaning that they all have mass and take up space. They all have different types of properties and characteristics that we can see using four of our senses. The students’ job is to take on the job of a scientist and look at all of the objects provided and record what they see, feel, smell, and hear when they analyze them. **(Communicate, Observe, Organize)**

**ii.** How will you set up this exploration? Include a table or example.

Different objects have different properties. Students will be observing different properties of matter during this exploration. Students will look at the objects provided and sort them based on their physical properties. Students will record their observations in a table like the one below. (Science journal)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Object | How it Looks | How it Feels | How it Smells | How it Sounds |
| Cotton Ball | White/Fluffy | Soft |  | There is no sound. |

**iii.** What data will students gather?

Students will gather data by recording their observations about the physical properties of the objects given.

* Students will be seated at their desks, while the objects are rotated around the room. Students should use descriptive language to record the different properties of each object. The objects students will be observing are a full coke bottle, penny, nickel, cotton ball, empty bottle of air, crackers, bag of water, and a small bag of rocks.
* The students will record whether the object looks shiny or dull, and what color it is. They will also record whether it is soft, hard, rough or smooth, sweet, sharp, has no smell, loud, soft, makes a ping, or no sound. The students will also be asked to write down all of the things they can say to describe the objects in their notebooks.
* After observing the different properties of matter, I will ask the students to sort the objects as a class based on their similar properties. For example, students could sort the objects based on color, size, and whether it is a solid, liquid, or gas.

**iv**. How will you help students generate their own questions?

I will help students generate their own questions by directing them to use their personal experience with the items to classify them as to how they feel, look, smell and sound. If students need help collecting data, I will help them by asking what the objects look like? Is it hard, rough or soft? Does the object have a smell? Can you make the object change its shape or size? Does the object make a sound when you tap it? For the empty bottle, coke bottle, and bag of water I will ask the students to focus on what is inside the containers.

**v**. What questions will you ask? (Provide sample answers.)

 While the students are observing and recording their data, I will ask different groups to explain the main properties that were used to record observations about the objects.

**-What are some of the characteristics/properties of one of the objects you have observed? (**Sample Answer: The cotton ball is white, soft, doesn’t have a smell or sound when you tap it. The penny and nickel are both coins, hard, shiny, and makes a sound when you tap it.)

**-What do the objects in each group have in common?** (Sample Answer: The penny and nickel are both shiny, hard, and makes a sound when you tap it with your fingernail. The coke and water bottle are both liquids, and you can drink them. You cannot see the physical characteristics of air; therefore it doesn’t have color, smell, or sound. The crackers and rocks are grouped separately because the rocks are hard and dull, and the crackers have a distinguished smell, taste, and color.)

**-You can learn about physical properties of matter using the five senses. What sense didn’t you use when analyzing the objects in this activity? Why is it not a good idea to taste different types of matter? What can you learn from using taste to observe matter? —Make sure you only taste matter that is food and is edible. (**Sample Answer: We didn’t taste any of the objects. People have to be careful about tasting things because some can make you sick and are not good for your health. You can learn if a food tastes sweet, sour, salty or bitter.)

**C. Explanation**

**i.** How will you get students to share their data?

Once students have discussed how to sort the objects, the teacher will create a chart on the White/Smart Board sorting the given objects. If students have not already come up with the category of solids, liquids, and gases, introduce the three separate categories. I will make sure that the students understand that the categories they have chosen to sort the objects are good, but in some cases they would not work for certain objects. The solid, liquid, gas structure will let the students categorize just about all things. **(Communicate, Inference, Observation, Comparing)**

* Students will explain their knowledge of properties of matter those being solids, liquids, and gases and how their molecules behave relative to one another.
* Students will observe three different objects that represent a solid, liquid, and gas. Students will develop their own definition and understanding of the properties of all three states of matter.
* Students will draw a picture in their science journals that illustrate how the molecules are moving in each state of matter. Students will be able to share with another student their ideas about what they know and understand about the molecules in each state. **(Inference, Observation, Comparing)**

After the students have completed recording the properties on their charts, I will have an empty chart displayed on the smart board with all of the objects they have observed. I will ask students to identify the characteristics of one or two objects and ask them why they identified it with those properties. The class will sort the objects into three different categories, and share their ideas with how the objects should be sorted into solids, liquids, and gases. I will collect and display the students’ observations of the objects in the chart on the smart board while the students are explaining the properties.

Students will finger point read along with the teacher a short reading from the informational text “Inside the World of Matter”, that informs the students about the three states of matter. This will allow an introduction to a class discussion about solids, liquids, and gases.

**ii**. What guiding questions will you ask? (Provide sample answers.)

***What are some physical properties of matter that you can see?* (**Sample Answer: size, shape, texture, color, mass, and height)

***What are some physical properties of matter that you can feel?* (**Sample Answer: rough, smooth, hard, and sharp)

***Do some of the objects fit into more than one category?* (**Sample Answer: Some of the objects might be both a solid and a liquid.)

***Is there only one way for us to sort these objects into categories, or can we use multiple ways?* (**Sample Answer: We can sort them by their color, shape, size, and whether it is a solid, liquid, or gas.)

***Was it hard to sort any of the materials?*** (Sample Answer: May be hard to categorize things like cotton ball, empty bottle, etc.)

There will be at least one example of each state of matter (solid, liquid, gas). Solid: Rocks, Liquid: bag of water, Gas: Balloon, or bag of air

***What can you tell about the molecules of the water in the bag by observation? How do you think they are moving, or do you think they are moving?*** *(*Sample Answer: The molecules are moving relative to one another, but they still have a definite volume because they take the shape of their container.)

***Rocks are examples of a solid, what can you tell about the molecules of the rock?*** *(*Sample Answer: Rocks are hard, and it does not change shape when you put it in a different container. It has a definite volume and definite shape. The molecules are very close together when it is ice, and that is why they cannot move relative to one another.)

 ***How do you think the molecules are behaving in the bag of air?*** *(*Sample Answer:Molecules are far apart and move relative to one another. Fills the container’s shape, and doesn’t have a definite volume.)

**iii**. What ideas will you be trying to develop?

* After collecting and analyzing data, students should understand that all of the objects are different types of matter that could be classified according to common physical properties. All matter has mass and takes up space. Objects can be classified by color, temperature (if you see steam rising then it is hot, if no steam or condensation then it is cooler), size, whether it is shiny or dull, and soft or hard. If students did not sort the objects by solids, liquids, and gases, introduce to the students that matter has three different forms, called states. **(Classifying)**
* Matter can be sorted into three different states or forms. The three states of matter are solids, liquids, and gases. Solids, liquids, and gases are all different because of how the molecules behave relative to one another. Solid’s molecules are very close together and cannot move relative to one another. Liquid’s molecules are close, but they can move relative to one another. Gas’ molecules are far apart and can move relative to one another to take the shape of their container. Students should know and understand vocabulary that relates to matter.

**iv**. How might you act out or demonstrate the ideas you’re developing?

I will use several demonstrations and examples to help the students develop their ideas and understandings of solids, liquids, and gases. The concept that air is a gas and takes up space could be very difficult for some students to comprehend. I will go back to the demonstration of the air in a bag that holds up a book. This represents that air has mass and takes up space because it allows the book to rest on top of the bag. To demonstrate a solid, show the class a rock. Try to push on the rock to make it smaller; nothing happens so this shows the students that a solid cannot be made smaller and doesn’t take the shape of its container. To illustrate the properties of a liquid, have three different containers and the same amount of water in each. Ask the students which container has more water? Have a measuring cup to demonstrate to the students that the amount of water doesn’t change, but it does take the shape of its container. This allows liquids to look like there is more, when really it is the same amount.

 Students will use their understanding of solids, liquids, and gases to demonstrate their understanding of how the molecules behave relative to one another. Students will be applying these concepts in three different ways: physical body demonstrations, illustrations with written descriptions, and class discussion.

-To model a solid: Have five or six students stand very close to each other and stand still to model that molecules in a solid cannot move around.

-To model a liquid: Have five or six students stand in a circle to represent a container, and have students in the middle of the circle moving around each other. This shows students that liquid molecules can move around in a container, but their volume doesn’t change. You can also have the circle become bigger or smaller to show that the same amount of liquid is inside, but it takes the shape of its container.

-To model a gas: Have five or six students move around a set area to show that they can move relative to one another no matter where they are.

Ask the students who are watching to describe to the rest of the class what they see happening and how the students are moving around. Students will write and illustrate how the molecules behave relative to one another in each state of matter after they observe each demonstration

**v.** What terminology will you introduce, and how will you relate this to the data?

* Matter is anything that takes up space. (All of the objects observed in the explore are examples of matter around us)
* Property: Anything you can observe about an object by using your senses. (Students will be recording all of the different properties of the objects during explore)
* A gas does not have a definite shape or definite volume. It takes up all of the space in its container. The air in the classroom is a gas. It takes the shape of the classroom. If you put the same amount of air into a larger classroom, the air would spread out to take up all of the space in the room. Gas’ molecules are far apart and can move relative to one another to take the shape of their container.
* (Air in balloon)
* A solid object takes up a specific amount of space and has a definite shape, which means that you cannot change the shape or volume. Solid’s molecules are very close together and cannot move relative to one another. (You cannot change what it looks like or how big it is, Example: Cotton ball, penny, nickel, rocks)
* A liquid has a specific volume that doesn’t change, but takes the shape of its container. Liquid’s molecules are close, but they can move relative to one another.
* Ex. One cup of water always takes up one cup of space, in any container. (Model this by pouring one cup of water into a tall, narrow container, and then into a short, wide container.) *Ask the students how the liquid changed each time it was poured?* – The shape of the water changed each time it was poured into a different container.
* Atoms: All matter is made up of atoms. The smallest part of a compound that still has the properties of that compound is a molecule. Molecules are made up of atoms.

 Ask the students who are watching to describe to the rest of the class what they see happening and how the students are moving around. Also have students demonstrate what happens when energy is applied in condensation and evaporation and how it changes the state of matter.

 Air is matter because it takes up space and has mass. (Demonstrate this idea to students by blowing air into a plastic bag and tying it shut, rest a small book on top of the bag of air and ask the children to observe how the air takes up space and supports the weight of the book.) Explain that blowing the air into the bag and tying the bag pushes the tiny air particles together.

**-How can we prove that this air weighs something?**

(You can prove that air weighs something by using the two bottles with pump experiment that shows that when you pump air into a bottle it weighs more than the bottle with none.)

**-Before letting go of the balloons, ask the students what they think is going to happen? Ask the children to blow on their hands.**This idea that the children can feel the air they are blowing helps to show them that air is matter**: it not only has mass and takes up space, but you can feel it and it can be warm or cold. (**Sample Answer: The balloons will weigh the same thing. The inflated balloon will weigh more because it is bigger.)

D. Expansion

i. What will students do in the expansion phase?

* Students will expand their understanding of the properties of matter, and how the molecules behave relative to one another in a solid, liquid, and gas.
* Students will investigate the effects of temperature change on phase changes by applying previous concepts built on solids and liquids in making homemade ice cream. Students will work in partners to mix together ingredients to observe changing a liquid to a solid by adding ice to change the temperature. (**Observation**, **Prediction, Inference**)

Physical Phase Change

* Students will be assigned a partner at their table where they will work together to make their vanilla ice cream. The ingredients need to be prepared ahead of time to make sure that each pair of students will have enough to make their ice cream
* Students will need to cover their desks with a paper towel in order to make sure that the experiment doesn’t get too messy.
* Each pair of students will need:

 - 1/2 cup of cream

 - 1 tablespoon of sugar

 - 1 teaspoon of vanilla extract

 - 1 (large) gallon freezer quality Ziploc bag

 - 1 (small) quart freezer quality Ziploc bag

 - 2 cups of ice

 - ¼ cup of salt

 - two spoons

 -thermometer

* Before beginning this activity, review with the term matter. Have students give several examples of each type of matter using the terms solid, liquid, and gas.
* Explain to the students that we will be taking different states of matter that we learned about, and combine them together to make something new—a different kind of matter (ice cream).
* Writing: Students will describe each ingredient as a solid, liquid, or gas with support as to why each is in that state of matter in their science journal.
* Modeling: Demonstrate along with the students how to combine the ingredients, and tell them which ingredient to add step by step. Once all of the students have combined the materials, help them to close and seal the bag very tightly to avoid spills.

***Procedure for Activity***

1. First have the students mix ½ cup cream, 1 tablespoon sugar, and 1 teaspoon of vanilla into the small Ziploc bag.
2. Squeeze out extra air and zip the bag closed. Set this bag to the side.
3. Fill the large Ziploc bag with approximately 2 cups of ice, and add ¼ cup of salt to the ice. Have students take the temperature of the ice.
4. Have the students place the small bag of mixed ingredients into the large bag of ice, and take turns flipping and shaking the bag over and over. (*Students should hold the bag at the corners*)
5. Pairs will continue taking turns and flipping the bag over and over for ten to fifteen minutes.
6. Have students take the temperature of the ice/water now that they have made their ice cream.
* Once the students have made their phase change, ask the students to observe the outside of the large bag and then let them enjoy their creation by eating the vanilla ice cream.
* While the students are eating, ask them guided questions about what they observed through the activity.

 After the students have completed and discussed the ice cream phase change activity, the class will work through the interactive smart board activity that deals with solids, liquids, gases, and changing states of water.

 <http://www.sciencekids.co.nz/chemistry.html>

 ii. What concepts will you be having them apply?

 Students will be applying previous concepts they have learned about the three states of matter- solid, liquid, and gas. Students should understand that most of the matter in the world could be sorted into one of the three categories. Students will use their knowledge of the three states of matter to recognize and indicate what state of matter all of the ingredients are in that are used in the activity. Students will be able to relate their understanding of how the molecules behave in each state of matter to what will happen to each state when they begin to mix the ingredients together. Students will observe what happens to the cream (liquid) whenever cold energy is applied, and see that the liquid changes from a liquid to a solid (ice cream). Students will discuss what has to happen in order for matter to change states, and understand that heat or cold energy has to be applied. They will also apply the concept of condensation when they observe what accumulates on the outside of the large bag from the ice. After the class has discussed the concept of condensation, and why the water accumulates on the outside of the bag I will introduce the term evaporation. Students will model both of these concepts by using physical demonstrations to show what happens to the molecules in order for condensation and evaporation to occur.

iii. How is this different but related to what came before?

This activity allows students to use the information that was previously introduced about how you can observe properties of matter, the different states of matter, and how the molecules in each state behave relative to each other. Students are applying the information previously introduced to understand the relationship of the molecules in the three states: solid, liquid, and gas. They are applying their knowledge in a new situation that uses the same basis for how the molecules relate to each other by observing a liquid change into a solid when cold energy is applied. Students are applying their knowledge in a new situation where they are observing matter in a new form that will help them to relate their understanding to how matter can change states.

 iv. What guiding questions will you ask? (Provide sample answers.)

 -***What do you think will happen when you mix all of the ingredients together in the small Ziploc Bag? What state of matter do you think will be inside of the bag?*** (Sample Answer: All of the ingredients will mix together, and will be a liquid.)

 ***-What do you think will happen to the ingredients when you shake it inside of the bag of ice?*** (Sample Answer: The ingredients will freeze and change from a liquid to a solid.)

 -***What state of matter was the cream when you began?*** (Sample Answer: The cream was in the liquid state of matter.)

-***What has to happen for matter to change state?***(Sample Answer: Some form of energy must be applied, heat, cooling, etc.)

***-In order to change the phase of the cream and ingredients, what had to be removed?*** (Sample Answer: The heat from the cream and sugar had to be removed in order for the phase change to occur.)

-***Why do you think that we added salt to the ice?*** (Salt was needed in order to lower the freezing point of the ingredients inside of the smaller bag, and to help the ingredients freeze faster)

***-Why do you think energy is required to change the state of matter?*** (Sample Answer: Because energy changes the way the molecules behave.)

**-*When matter changes from a liquid to a gas and then back to a liquid through condensation, how do the molecules behave during this?*** (Sample Answer: The molecules cool and slow down and get stuck to the side of a glass and move so slowly that they turn back into a liquid.)

E. Evaluation

i. What formative assessments will you use, and when in the lesson will you use them?

**(Organize, Observe, Compare)**

I will be using informal/formative assessment throughout this lesson by observing student behavior, participation, and responses to the activities given during class.

* Students will be using their science journals to record observations in the beginning activity on the properties of matter. They will be recording all of the different properties of the objects they can observe physically in an organizer. (Look, feel, sound, smell) --**Exploration**
* Students will physically model the representation of a water molecule in groups of three. Two students will represent one hydrogen atom and one student will be the oxygen atom. Students will also physically model the behavior of the molecules in a solid, liquid, and a gas. This will assess whether the students understand the behavior differences in the three states of matter. --**Explanation**

ii. What specifically will you be looking for in these?

Students should demonstrate active participation and engagement during the activities in the lesson. If students’ are struggling with an activity or assignment I will support them and give them assistance. Students should put forth effort in all aspects of the assignments.

* Science Journals: Students should record and classify the objects given by writing descriptive words about the properties that each display. I will be assessing the journals on whether the student contributed and demonstrated knowledge and understanding of properties of matter (*exploration).* Students should include descriptive information on what they identified about each object.
* Science Journals: I will also be looking that the students later identified matter as a solid, liquid or gas. The students put thought and effort in creating an organizer that describes the properties of a solid, liquid, and gas in their own words that they can understand *(expansion).*
* Modeling of Molecules: Students should be actively engaged in the activity whether they are modeling or observing the other students. Students should show understanding of the relationship of the molecules in their organizer.

iii. What summative assessment will you use?

-Vocabulary Test: Students will be given the same vocabulary test they had for a pre-assessment on the key terms that was presented in the third grade unit on matter. Their understandings of the vocabulary terms will be presented by whether the students are able to choose the correct word from the word bank to fit each definition.

-Creative Writing: Students will be given a prompt to choose and think of themselves as a particular state of matter. They should be able to describe in detail what they look like, and how their molecules behave in order for me to guess which state of matter they are.

-Science Journals: Journals will be taken up on the last day of class, and will be assessed on the quality of work presented by the student. The journals will also be graded on the content of student work and if they completed the assignments, charts, and pictures for the lesson on each day.

iv. What specifically will you be looking for in this?

Students should demonstrate knowledge of the content in properties of matter. They should be able to explain and identify key terms and their definitions. Students should also understand the properties that each state of matter obtain, understanding that air is matter because it takes up space and has mass, and that matter can be found in three different states. Students should demonstrate an understanding of how solids, liquids, gases are similar and different by writing a short entry in their science journal. Students should also demonstrate an understanding of phase change. Students will write a summary explaining what they observed when making ice cream, and why they were able to change a liquid to a solid. The summary should include an explanation of how the molecules in each state of matter are behaving relative to one another.

v. Provide a sample response to the summative assessment and a rubric for grading this.

**Summative Assessment**

 Properties of Matter Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Fill in the blank for each question below.

1. What is the basic building block of matter that is connected by bonds to create molecules? (Think of when we made the water molecule with our bodies and connected our arms together)
	1. \_\_atoms­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. I am a group of two or more atoms stuck together and I create matter. What am I? (Look at the picture to the right)
	1. \_\_molecule\_\_\_\_\_\_\_\_\_\_\_\_

O

1. What is everything in the world made up of?

H

H

* 1. \_\_matter\_\_\_\_\_\_\_\_\_\_\_\_\_\_
1. What is the amount of stuff in matter called?
	1. \_\_mass\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. I take the shape of my container and I have definite size/volume and my molecules wiggle and move close together. What state of matter am I?
	1. \_\_liquid\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. I have definite size/volume and definite shape and my molecules wiggle but they don’t move around. What state of matter am I?
	1. \_\_solid\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. I have no definite shape and no definite size and my molecules wiggle but they don’t like to be close to each other so they spread out all over. What state of matter am I?
	1. \_\_gas\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Tell what state of matter each object in the pictures below is in.

  

 \_\_\_\_\_\_\_\_gas\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_solid\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_liquid\_\_\_\_\_\_\_\_\_\_

When matter changes from a liquid to a gas, heat must be applied. This is called evaporation. Tell how the wiggling of the molecules change when the liquid becomes a gas.

\_\_\_the molecules wiggle faster and spread out \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

When matter changes from a gas to a liquid, cold must be applied. This is called condensation. Tell how the wiggling of the molecules change when a gas becomes a liquid.

\_\_\_the molecules wiggle slower and closer together \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If you were going to describe to a friend the properties of a solid and they had to guess what you were, how would you describe it? You need to make sure they would know you were talking about matter in the solid state.

\_\_\_You can’t change my shape and I have definite volume. My molecules wiggle but they are stuck together and don’t move. What am I? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What state of matter is air? Tell how you know that air is matter and has mass and takes up space.

\_\_Air is a gas and I know it takes up space and has mass because when you blow air into a balloon and press on the balloon with your hands the air takes up the space between your hands.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Draw a picture of how the molecules look in a liquid.

 Draw picture of molecules that are moving

 around but are still close to each other.

**Rubric: Grading and Assessment for Science Journals**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Evidence | **Emerging****(Incomplete)** | **Developing****✓-** | **Using****✓** | **Applying** **✓+** |
| Proposes explanations about the properties of matter.  | Students are unable to demonstrate understanding of the concept of properties of matter. | Students are able to demonstrate little understanding of matter, and provide very little evidence of learning. | Students are able to demonstrate a basic understanding of properties of matter, and provide examples of matter. | Students are able to demonstrates an excellent understanding of properties of matter, and provide multiple examples of matter. |
| Proposes explanations and representations for solids, liquids, and gases. | Students are unable to demonstrate understanding of the properties of a solid, liquid, and gas.  | Students are able to demonstrate little understanding of the properties of a solid, liquid, and gas with no picture representations. | Students are able to demonstrate a basic understanding of the properties of a solid, liquid, and gas with few picture representations. | Students are able to demonstrate an excellent understanding of the properties of a solid, liquid, and gas with multiple pictures representations. |
| Communicates understanding for content area vocabulary terms. | Students are able to represent and explain their understanding 0-3 vocabulary terms. | Students are able to represent and explain their understanding of 4-8 vocabulary terms. | Students are able to represent and explain their understanding of all 13-vocabulary terms. | Students are able to represent and explain their understanding of all vocabulary words, and apply the definition to content. |
| Communicates and Presents Learning. | Students are unable to represent their understanding of a molecule, and the behaviors in a solid, liquid, and gas. | Students are able to represent little understanding of a molecule, and the behaviors in a solid, liquid, and gas. | Students are able to represent a clear understanding of a molecule, and the behaviors in a solid, liquid, and gas. | Students are able to represent clear and consistent understanding of a molecule, and the behaviors in a solid, liquid, and gas.  |

9. **Modifications.**

A. How will you modify this lesson to meet the needs of students with ADD/ADHD?

This lesson will be modified to meet the needs of students with ADD/ADHD by grouping and pairing students with others that can work well and keep them on task. There is only one student in my class with ADHD, and he works really well with others. Throughout this lesson, students will be able to use hands on activities, and demonstrations that will help them to concentrate on what they are doing. This will help to limit other distractions for these students during the lesson and activity.

B. How will you modify this lesson to meet the needs of learning disabled students? Note: connect these to the [Extended Essential Standards](http://www.ncpublicschools.org/ec/instructional/extended/%22%20%5Ct%20%22_blank).

Students with learning disabilities will be able to have modified vocabulary lists, work with other students in pairs, and have prompts and questions read aloud. All of these modifications will be made based on the student’s disability.

**3rd Grade Physical Science Extended Essential Standard**

**EX. 3.P.2 Understand the properties of matter before and after they undergo change.**

EX.3.P.2.1 Identify liquids and how they take the shape of their container.

EX.3.P.2.2 Compare properties of water to other objects (e.g., objects that can sink, float or stay suspended in water).

EX.3.P.2.3 Identify processes (e.g., heating, cooling, cutting, smashing) that result in a physical change.

EX.3.P.2.4 Compare the effect of temperature change on matter (e.g., melting ice or ice cream, boiling water, or freezing water).

**3rd Grade English Language Arts Extended Writing Standards**

**Text Types and Purposes**

**2. Write to convey information clearly.**

a. Select a topic and illustrations or visual/tactile supports related to it.

b. List words related to the topic.

C. How will you modify this lesson to meet the needs of AG students?

AG students will be able to complete the assigned activities and writing prompts, and when they are finished can work on an extra writing prompt using descriptive language and details. These students will be asked to come up with further sorting and classifying ideas after they finish recording the physical properties of the materials. If these students finish the work or activity before all of the other students, they will be given the higher order thinking questions to respond to and explain their understanding of each concept that is introduced before the class discussion. This will challenge the students to think about the concepts they are working with, and will be able to relate to previous knowledge on matter.

D. How will you modify this lesson to meet the needs of ESL students?

This lesson can be modified to meet the needs of ESL students by cooperatively working with the ESL teacher. The vocabulary and readings can be presented to these students in both Spanish and English so they can understand the material. The activities in this lesson can be presented to the students where the teacher models the activities and demonstrating what they will be doing.

10. **List of Materials.**

* Penny
* Nickel
* Rocks
* Empty bottle (air)
* Cotton Ball
* Crackers
* Full Coke Bottle
* Bag of Water
* Smart Board
* Science Journal
* Balloons (one inflated, one deflated)
* Measuring balance
* Three different size containers
* 1/2 cup of cream
* 1 tablespoon of sugar
* 1 teaspoon of vanilla extract
* 1 (large) gallon freezer quality Ziploc bag
* 1 (small) quart freezer quality Ziploc bag
* 2 cups of ice
* ¼ cup of salt
* spoons
* thermometer

11. **Safety Considerations.**

This lesson is overall safe for all students to participate. I will make sure to explain to the students that all of the materials should be carefully observed, and there should be no throwing or playing with the objects. The rocks are somewhat sharp, so I will make sure that students know not to poke themselves or others with them. I will explain to the class that the bag of water and coke should be handed carefully, but mistakes can happen and they might spill. We will have extra paper towels in case this happens. Students should always keep in mind classroom behavior when switching from the activity to class discussion, and this should be done in a timely manner with limited talking and staying on task.

12. **Sources.**

A. Note a minimum of three different science sources used for developing the lesson plan and background information. The SCOS is not considered one of your sources. Each source should include a title, bibliographic information, and a short annotation.

Koch, J. (2010). Science Stories: Science Methods for Elementary and Middle School Teachers, 4th Edition. Chapter 6: Matter Matters (Print Source)

This book provides very good content that teachers should know about teaching properties of matter. It provides different ideas for activities that can demonstrate to students matter in the three states, and how to show that air has mass and takes up space.

Harcourt, Inc. (2000). Harcourt Science: Physical Science. Investigating Matter-Properties of Matter (Print Source)

This book is very useful for coming up with different activities for students to investigate matter. There are many resources for showing volume, solids, liquids, and gases in a hands on way that students can manipulate and work with.

Weir, J. (2007). Teacher Created Materials Publishing. Inside the World of Matter (Print Source)

This book is a very good resource to have for students. Students can read the sections in this book to learn how matter relates to their life. It gives several examples of solid, liquids, and gases, and explains what makes up matter in a way that students can understand.

B. List at least one video you could use showing this concept in real life. This should not be an animation or video lesson, but a real life example related to your topic. (This should be used somewhere in the 5E directly.)

**Sky Diver Jumps From Edge of Space**

http://www.youtube.com/watch?v=dkdDdTfHOtU&feature=relmfu