



## County Implementation Award Program (CIAP) Math and Science Lesson

<b>Unit Title:</b> Water's Denial
<b>Lesson Title:</b> Volume and Matter Conservation
<b>Author:</b> Sandra Soto
<b>Grade Level:</b> 5 <sup>th</sup> Grade
<b>Time Frame:</b> Three 45-minute periods
<b>Standard(s):</b> 5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen. [Clarification Statement: Examples of evidence could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.] <b>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.</b> [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that forms new substances.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.] <b>Math</b> 5-MD-2. Represent and interpret data. 2. Make a line plot to display a data set of measurements in fractions of a unit ( $1/2$ , $1/4$ , $1/8$ ). Use operations on fractions for this grade to solve problems involving information presented in line plots. For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally. <b>5-MD-2</b> 2. Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane and interpret coordinate values of points in the context of the situation.
<b>Short Description of Targeted Phenomenon:</b> Show students a video of the Mississippi where it meets the ocean. Have students record what they notice and what they wonder, generating a list of questions. <a href="https://www.youtube.com/watch?v=czd20tdEDUE">https://www.youtube.com/watch?v=czd20tdEDUE</a>  Students will investigate whether water is made of tiny particles that cannot be seen by the human eye and integrate key mathematical standards or record their observations.

### Three Dimensions of NGSS

#### **Science & Engineering Practice/s (SEP): Developing and Using Models**

Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

- Develop a model to describe phenomena. (5-PS1-1)

#### **Using Mathematics and Computational Thinking**

Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.

- Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5-PS1-2)

#### **Crosscutting Concept/s (CCC): Scale, Proportion, and Quantity**

*Natural objects exist from the very small to the immensely large. (5-PS1-1)*

*Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (5-PS1-2), (5-PS1-3)*

#### **Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems**

Science assumes consistent patterns in natural systems. (5-PS1-2)

#### **Disciplinary Core Idea/s (DCI): PS1.A: Structure and Properties of Matter**

- *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 shows 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 and the effects of air on larger particles or objects. (5-PS1-1)*
- *The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2)*
- *The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2)*

#### **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)*

#### **Language Supports:**

Key Vocabulary: matter, compounds, particles, graph, meters, x and y axis, coordinate plane

#### **Materials Needed:**

Activity packet, droppers, microscopes or magnifying glasses, food coloring, measuring cups, thermometer, water (hot, cold, and room temperature), thick sheet of plastic (or if used as

recommended on this lesson, one see through flat glass square, either from a picture frame or glass chopping board).

**Objective(s): Students will be able to:**

1. Describe how matter is made up of particles too small to be seen.
2. Use ordered pairs to describe the expansion or lack of expansion of food coloring.
3. Convert meters to kilometers.
4. Make concrete observation of phenomena as it happens.
5. Come to a conclusion based on evidence they found through their observations.

**How Math and Science concepts/skills/practices were integrated in this lesson:**

Students released drops of water onto a penny, dime, and quarter. They observe how many drops it takes to fill each to the brim. They integrate a line plot with an x per drop of water in order to observe and interpret quantities.

Students observe how food coloring will spread in three different temperatures of water: hot, room temperature, and cold. They select four ordered pairs at four points of the food coloring, after a minute, then after three.

Students converted meters to kilometers, in addition scaled inches and meters. They made this connection to see how far water traveled; whether it stayed together or dispersed in the map.

**Possible Challenges /Misconceptions:** It is important to model how to select the ordered pairs, where to write them down, and how to use them to compare/analyze data. Students can easily get confused while doing this.

**Formative Assessment:** Finished packet with written conclusions. Students must support their conclusions with examples and research.

**Lesson Opening**

**Teacher Actions**

- a. Teacher opens discussion on what is matter made of and writes it on a KWL Chart as students share.
- b. Teacher shows the [video](#) and pauses it on the water-balloon popping section:
- c. Teacher asks students to describe what is happening.
- d. Teacher asks students to describe what they are seeing in their interactive science journal.
- e. Teacher leads discussion on observation, students' own personal interpretation, then asks students to write down what that makes them wonder.

**Student Actions**

- Students share their ideas.
- Students watch the video.
- Students discuss their what they think is happening with their shoulder partner.
- Students write possible answers:
1. Water stays together for a short time after the balloon gets popped.
  2. Water maintains the shape et.
  3. Students fill out the form for the interactive notebook.

<p><b>Teacher Actions</b></p> <p>Teacher Sets Up the Materials for student use. Teacher explains the experiments, goes over safety procedures. Note: Teacher handles the hot water, has thermometers to double check that temperature is above 100 degrees. (Teacher could set a section where the hot water is handled by teacher and calls each student group.)</p> <p>Prior Knowledge: Teacher needs to make sure that students know how to find, and use ordered pairs, line plots, and convert meter to kilometers.</p>	<p><b>Student Actions</b></p> <p>Student 1: Gathers the materials Student 2: Reads the instructions Student 3: Clarifies instructions with the rest of the team. Student 4: Helps guide the experiment</p>
<p><b>Body of Lesson</b></p>	
<p><b>Teacher Actions</b></p> <p>Task 2: Students are going to investigate particles in water by completing the “Crime Scene” tasks. See ditto below. Then students are going to write down their observations in order to explain if water is made of tiny particles that are too small to be seen.</p> <p><b>First Experiment:</b> Teacher goes over microscope safety and procedure, if you don’t have microscope a magnifying glass can be used. Explain the importance of careful observation, note-taking, and writing what you see versus what you think is there.</p> <p><b>Teacher Actions</b> <b>Second Experiment (Crime Scene Number 2):</b></p> <p>Read the tasks and explanations. Step 1: Teacher makes sure that each group has a dropper, penny, nickel, quarter, and notes packet. Step 2: Teacher demonstrates that each drop that goes on top of the penny et., represents an x in the line plot. Step 3: Remind students to take careful notes of what is happening to the water, they are the investigators.</p>	<p><b>Student Actions</b></p> <p>Task 2: Students conduct the experiments, write down their observations, questions, and reflections on the lab. The lab will be cut and pasted in their Science Interactive Notebooks.</p> <p><b>First Experiment (Crime Scene Number 1)</b> Student drop 3 drops of water on disk under a microscope, observe what they see, draw it, then take notes. Next step, they add one drop of food coloring into the water, observe what they see, draw it, then take notes. At this point, they write down what they think or wonder.</p> <p><b>Student Action</b> <b>Second Experiment (Crime Scene Number 2)</b></p> <p>Students work as a group to complete the task, groups of 4 works well. One student drops the water drops onto a penny, the other onto a nickel, third student onto a quarter, and the fourth student records the drops in a line plot (makes sure they have the correct count and notes). Students observe what happens to the water, how many drops it takes before it overflows, and the shape it takes on the coin before that happens. (Note: They need to write what they see and take notes in the observation section). They should note the difference in drops for</p>

<p><b>Third Experiment (Crime Scene Number 3):</b></p> <ol style="list-style-type: none"> <li>Teacher explains task as written on the packet and demonstrates that the students need to move the water with the toothpick on a side angle, not the pointed angle.</li> <li>Students will need a ruler to measure approximate inches of the road, scale from inches to meters, then convert from meters to kilometers.</li> </ol> <hr/> <p><b>Fifth Experiment (Crime Scene Number 4):</b></p> <ol style="list-style-type: none"> <li>Teacher needs to demonstrate how and where to write down the four ordered pairs.</li> <li>For example, if the food color spreads 2 spaces from the center drop point (5, 5), then they would write (5, 7), (7, 5), (5, 3), (3, 5) et.</li> <li>Teacher gives students iced water for the first part, water at room temperature for the second part, and hot water for the third part of the experiment. These are given separately.</li> </ol>	<p>each coin.</p> <hr/> <p><b>Third Experiment (Crime Scene Number 3):</b></p> <ol style="list-style-type: none"> <li>Students will use a toothpick to move the water from one location on the map to another designated spot.</li> <li>Students will note what happens to water as it is moved across the mat.</li> <li>Students will measure the distance in inches, scale from inches to meters, then convert from meters to kilometers.</li> <li>Students need to analyze if water traveled far and if this is relevant.</li> </ol> <hr/> <p><b>Fifth Experiment (Crime Scene Number 4):</b></p> <ol style="list-style-type: none"> <li>Students record the movement of the water color after one minute, then after three with the different temperatures, one after the other. As they observe they write down what they see on the allotted boxes and note down what all these makes them wonder.</li> </ol>
<p><b>Lesson Closure</b></p>	
<p><b>Teacher Actions</b></p> <ol style="list-style-type: none"> <li>Teacher will post the question, “Is matter (in this case represented by water) made up of tiny particles that cannot be seen?”</li> </ol> <p>Assignment: Based on the behavior exhibited by water, what can you conclude?</p> <p>Optional research: Find two credible sources, along with your experiment that justifies your response. Note: It is important that students cite the source for any research they have done.</p>	<p><b>Student Actions</b></p> <ol style="list-style-type: none"> <li>Students will answer the question based on the experiments that they concluded. They must use examples from their experiments and logic for their explanations. See rubric.</li> <li>(Option) Students will then do an online search to help them back up their conclusions. They need to cite the source and include a small bibliography (Note, this is only an option, you can have the students base it completely on their own experiments).</li> </ol>

**Summative Assessment:**

Scientific Lab Rubric

**Other Teaching Resources:**

**Lab Safety:**

Teacher handles hot water.

**Extensions (if any):**

- Students can pretend to write an official crime report with explanations from their experiments, observations, and research.
- Students can write a fictional newspaper article where they pretend to have been on this very important forensic team, his/trials and tribulations, how they solved the case of the century, to its conclusion.

## Water Video Observation

What do you see?

Draw an illustration.

I think this is happening because....

It makes me wonder...

Name: \_\_\_\_\_

Date: \_\_\_\_\_

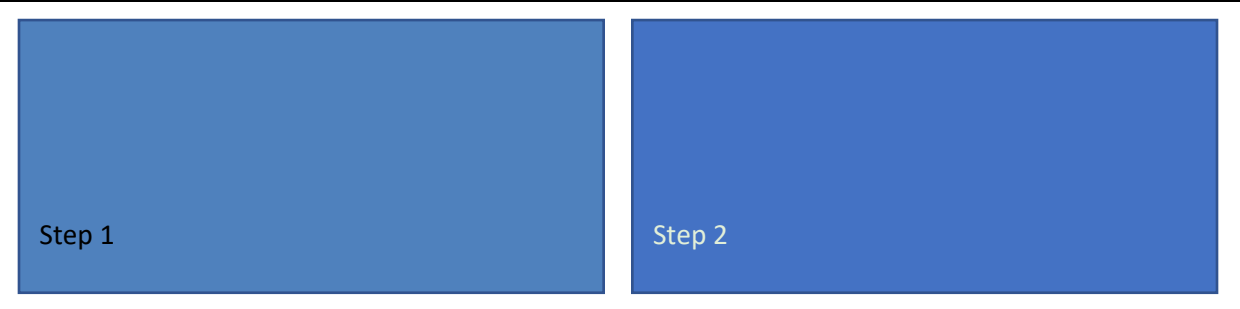
### Water Investigators

You and your team of forensic scientists are investigating a crime. Water has lied to the judge. Under oath, it officially stated that it is not made of tiny particles that cannot be seen by the human eye. You must use your scientific knowledge and investigative training to get to the bottom of this. Then you need to turn in your report to the chief so that he can either press charges or not. Good luck with your investigation!

Crime Scene Number One:

There was an abandoned water beaker in a warehouse. Step 1: You must retrieve it and put three drops in a glass disk to observe water under a microscope/or magnifying glass. Step 2: Add one drop of food coloring and repeat.

#### Illustration



What I observed	What it made me wonder...



Crime Scene Number Two:

Water claims that it easily separates and that nothing holds it together. It must prove this by easily separating from itself. Using a dropper, pour one drop at a time over each coin (penny, dime, quarter) until it is to full capacity. Count each drop until it overflows. Don't count the drop that caused the water to overflow. Fill the line plot below. Observe how water behaves over the coin. Fill out the line plot, remember that each drop is an x.

	Line Plot		
Num ber of Dro ps			
	Penny	Nickel	Quarter

What I observed	What it made me wonder...

Crime Scene Number Three:

Water was trying to disperse and hide from the investigation. You and your team must return it to its original location. Using a toothpick, guide water to its proper location. Again, you are observing its behavior and taking careful notes.

Illustration-How is water behaving, writes captions about what is going on.

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What I observed	What it made me wonder...

Each inch represents 50 meters. How many kilometers did you travel? Show you calculations. Did water travel far? How do you know?

Crime Scene Number Four:

Alert! Water is trying to throw off the case by presenting itself in three different temperatures: hot, room temperature, and cold. Your job is to add 5 drops of food coloring to each temperature and record what happens. Water (10 drops) is located in coordinates (5, 5) on the graph. Drop the food coloring in the center of the water, wait a minute then record the measurements at four different coordinates (one in each corner of the food coloring; you must record the movement of the food coloring). Write your observations. Repeat after 3 minutes.

Trials by Temperature	1 Minute	Notes	3 Minutes
First: Cold			
Second: Room Temperature			
Third: Hot			
Thoughts			

Observations	Makes Me Wonder

Research on Temperature effects on matter	
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Name: \_\_\_\_\_

### Water: An Investigation!!!

Points For Each Activity				
5	4	3	2	1
Included descriptive details, observations and analysis, illustration has captions	Has details, examples, questions, and clear illustration with some captions	Included details and analysis, illustration is clear	Some information and illustration	Limited or no Information and Illustration
Introduction (10 points)				
Crime Scene 1 (10 points)		Microscope		
Crime Scene 2		Coins		
		Line Plot		
Crime Scene 3		Road		
		Meter/Kilometer Conversion		
Crime Scene 4		Three Different Temp. Comparison		
		(x, y) Coordinates		
Conclusions				
20	15	10	5	
Clear and concise	Clear explanation and	Explanation and	Almost no	



Recommendations

Further Questions and Analysis:

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