



LESSON PLAN - MATTER_SOLIDS, LIQUIDS, & GASES_VASOL SCIENCE K.5, 1.3, 2.3

TARGET AGE GROUP: Kindergarten, 1st Grade, 2nd Grade

ESTIMATED TIME: 30-45 Minutes

PURPOSE

The purpose of this activity is to teach elementary students about matter, with a specific focus on the properties of solids, liquids, and gases.

VA SOLs

This activity can be used to complement classroom instruction related to the following VA SOLs:

Kindergarten: Science

Matter K.5: The student will investigate and understand that water flows and has properties that can be observed and tested.

Key concepts include:

- a.) water occurs in different states (solid, liquid, gas);
- b.) the natural flow of water downhill; and
- c.) some materials float in water, while others sink.

Grade One: Science

Matter 1.3: The student will investigate and understand how different common materials interact with water. Key concepts include:

- a.) some liquids will separate when mixed with water, but others will not;
- b.) some common solids will dissolve in water, but others will not; and
- c.) some substances will dissolve more readily in hot water than cold water.

Grade Two: Science

Matter 2.3: The student will investigate and understand basic properties of solids, liquids, and gases. Key concepts include:

- a.) mass and volume; and
- b.) processes involved with changes in matter form one state to another (condensation, evaporation, melting, and freezing).

OBJECTIVES

- 1) Define "Matter" and list examples.
- 2) Identify the three states of matter.
- 3) Identify the properties of solids, liquids, and gases.
- 4) Classify materials as solids, liquids, or gases.
- 5) Define "Dissolve".
- 6) Observe which solids dissolve in water and those that do not dissolve in water.
- 7) Observe which liquids separate when mixed with water and those that do not.

BACKGROUND INFORMATION

Matter: what all things are made of; anything that has weight and takes up space; can be a solid, liquid, or gas

Atom: the smallest part of a chemical element; all matter is made up of atoms; atoms combine to form molecules.

Molecule: the smallest particle into which a substance can be divided without being changed chemically.

SOLID PROPERTIES

1. Maintains Shape: b/c molecules are very close together and cannot move out of their places.
2. Maintains Size (not easily compressible): b/c little free space between particles.
3. Does not flow easily: b/c the particles cannot move/slide past one another
4. Maintains Visibility.

LIQUID PROPERTIES

1. Does not maintain shape b/c the molecules of a liquid are not as close together as those of a solid. Instead a liquid assumes the shape of the container which it occupies, while not changing in volume. Example: Water poured into a square container will appear square and the same water poured into a round container will appear round.
2. Is not easily compressible b/c there is little free space between particles
3. Flows easily (the particles can move/slide past one another).
4. Most liquids are visible.

GAS PROPERTIES

1. Does not maintain shape b/c the molecules of a gas are far apart. Gas will diffuse (spread out to fill any container).
2. Gas is much less dense than solids and liquids.
3. Gas will expand and contract with changes in pressure and temperature (compressible).

MATERIALS

- Solid - Block of Wood or similar material
- Liquid - Water w/ Food Coloring
- Various Containers (sizes and shapes) in which to place solid and pour liquid
- Gas - 2-liter empty soda bottle, balloon, vinegar, baking soda
- Chart Paper w/ Markers or Board w/ Markers/Chalk
- Experiment Supplies: Data Collection Sheets, Student Pencil/Pen, Water Supply, 1 Large Cup per Group, 5 Small Cups per Group, 1 Plastic Spoon per Group, Baking Soda, Oil, Rocks, Salt, Sand, Soil, Sugar, Vinegar *Optional Supplies: Milk, Powdered Drink Mix, etc.*
- Large Bucket or Tub for experiment liquid waste
- Review Worksheet - "All About Matter"

BRIEF INTRODUCTION

If this is the first activity of the day, introduce yourself and the agency/organization you represent. Briefly discuss what you do and how it correlates with this particular lesson.

Instructor Dialogue Example: Good Morning! My name is Jane. I work for XYZ Soil and Water Conservation District. We protect and preserve the natural resources (air, water, soil, plants, and animals) of XYZ County.

PART I: INTRODUCTION TO MATTER

Today's lesson is going to focus on MATTER. All living and nonliving things are made up of matter. All matter is made up of parts too small to see. These parts are called atoms. When atoms join together they form molecules.

Student Question: What is the definition of matter? *Answer: Matter is anything that has mass, which essentially means anything that has weight and takes up space.*

Ask student volunteers to point out at least 3 items in the classroom that would be classified as matter. (desk, chair, chalk, etc.)

Continue to lead the discussion on matter with the following True/False questions on matter. Ask for student volunteers to answer.

- True or False: Matter can be in different shapes. *Answer: True*
- True or False: Air occupies space and can be weighed; therefore, air is matter. *Answer: True; Air does take up space and can be weighed, thus it is matter.*
- True or False: Heat can be weighed; therefore, heat is matter. *Answer: False; Heat can not be weighed, thus it is not matter.*
- True or False: Light is matter. *Answer: False; Light does not take up space.*

Matter exists in three states or phases. **Student Question: What are 3 basic states of matter?** *Answer: Solid, Liquid, Gas*

Starting with SOLIDS...**Student Question: What are some examples of solids inside or outside the classroom?**
Answer: Rocks, Pencils, Trees, Books, etc.

Now to LIQUIDS...**Student Question: What are some examples of liquids inside or outside the classroom?**
Answer: Rain, Water in water fountain, Milk, etc.

Finally, GASES... **Student Question: What are some examples of gases inside or outside the classroom?**
Answer: Air - Oxygen and Carbon Dioxide

Today, you are going to be able to find out why something is labeled as a solid, liquid, or gas.

PART II: PROPERTIES OF "SOLIDS" and "LIQUIDS" DEMONSTRATION

"SOLIDS" Demonstration

- Show students a block (solid). Ask students: "Can you see the block?"
- Place the block in various containers (short, tall, round, square). Ask students: "Does the block change shape when put in different containers?" *Answer: NO*
- Record student responses on a chart labeled SOLIDS.
 1. Solids are visible (able to be seen).
 2. Solids do not easily change shape.

"LIQUIDS" Demonstration

- Using colored water (liquid), repeat the above process. Ask students: "Can you see the liquid?"
- Pour the liquid in various containers (short, tall, round, square). Ask students: "Does the liquid change shape when put in different containers?" *Answer: NO*
- Record student responses on a chart labeled LIQUIDS.
 1. Liquids are visible (able to be seen).
 2. Liquids easily change shape.

"GASES" Demonstration

- Explain that although you can't always see gas, you can always tell when it is there
- Introduce vinegar and baking soda together in the soda bottle, quickly stretch balloon over the top, so that the gas fills it up. Make sure to use enough vinegar and baking soda to fill the balloon up substantially, so that all can see.
- Record student responses on a chart labeled GASES.
 1. Gas is much less dense than solids and liquids
 2. Gas will expand and contract with changes in pressure and temperature (compressible)
 3. Gas will diffuse (spread out to fill any container)

If time permits, this is a perfect time to discuss melting and freezing.

Student Question: What happens when we heat up some solids? For example what happens to chocolate when you leave it in your pocket or sit it out in the sun? *Answer: It melts.*

Student Question: How can we return the chocolate to a solid state? *Answer: Cool it back down; Freezing.*

PART III: GROUP LAB - SOLIDS AND LIQUIDS

Begin this segment of the class by letting students know that some solids will mix with water, while others will not. Some substances will actually dissolve when mixed with other substances. The same is true when mixing various liquids with water; some will separate, while some will not separate.

Student Question: What does the term "dissolve" mean? *Answer: to completely mix with another substance; to cause to pass into solution; little pieces of one substance hook onto little pieces of another to make a new substance.*

Student Question: Does the temperature of the water effect how easily a substance dissolves in water? If so, what type of effect? *Answer: Yes, most substances will dissolve more easily in hot water than cold water. Examples include: tea, hot chocolate, etc.*

Note: Given the age of students in Kindergarten and 1st Grade the lab will be conducted as a class demo led by the instructor, rather than dividing students into groups to complete. However, second graders should be able to complete the lab in student groups after a brief instructor demo. Directions for various age groups are provided.

Kindergarten and 1st Grade

- Set-up a demonstration table in a location that will allow students room to gather around the table to observe and participate in lesson experiments led by the instructor.
- Use one student volunteer per experiment. Perform the following experiments:
 - **Baking Soda Experiment**
 1. Fill a clear bowl/glass with water. (Does not have to be completely full.)
 2. Introduce baking soda. Ask students if baking soda is a liquid or a solid. *Answer: SOLID*
 3. Ask students to hypothesize (predict) whether or not baking soda will mix with water. Discuss.
 4. Perform experiment w/ volunteer assistance - add approx. 1 tablespoon of baking soda to the water and stir.
 5. Discuss results and conclusions. Did the baking soda mix with the water? *Answer: YES* Discuss how little pieces of the baking soda hook onto little pieces of the water to make "soda water".
 6. Dump the mixture into a bucket or tub and proceed with the next experiment.
 - **Soil Experiment**
 1. Fill a clear bowl/glass with water. (Does not have to be completely full.)
 2. Introduce soil. Ask students if soil is a liquid or a solid. *Answer: SOLID*
 3. Ask students to hypothesize (predict) whether or not the soil will mix with water. Discuss.
 4. Perform experiment - add approx. 1 tablespoon of soil to the water and stir.
 5. Discuss results and conclusions. Did the soil mix with the water?
 6. Dump the mixture into a bucket or tub and proceed with the next experiment.Continue using the same procedure as previous experiments.
 - **Vinegar Experiment:** Vinegar and water will mix.
 - **Oil Experiment:** Oil and water will not mix.
 - **Rock Experiment:** Rocks and water will not mix.
 - **Salt Experiment:** Salt and water will mix. (Discuss salt water and the ocean.)
 - **Sand Experiment:** Sand and water will not mix.
 - **Sugar Experiment:** Sugar and water will mix. (Discuss sugar water and Kool-aid, etc.)

2nd Grade Instructor Demo to Prepare for 2nd Grade Lab: Perform the following experiments with second grade students gathered around to watch. Suggest using one student volunteer per experiment. The instructor-led experiments should help second grade students understand what to do when the lab is assigned.

▪ **Baking Soda Experiment**

1. Fill a clear bowl/glass with water. (Does not have to be completely full.)
2. Introduce baking soda. Ask students if baking soda is a liquid or a solid.
3. Ask students to hypothesize (predict) whether or not baking soda will mix with water. Discuss.
4. Perform experiment - add approx. 1 tablespoon of baking soda to the water and stir.
5. Discuss results and conclusions. Did the baking soda mix with the water? Discuss how little pieces of the baking soda hook onto little pieces of the water to make "soda water".
6. Dump the mixture into a bucket or tub and proceed with the next experiment.

▪ **Soil Experiment**

1. Fill a clear bowl/glass with water. (Does not have to be completely full.)
2. Introduce soil. Ask students if soil is a liquid or a solid.
3. Ask students to hypothesize (predict) whether or not the soil will mix with water. Discuss.
4. Perform experiment - add approx. 1 tablespoon of soil to the water and stir.
5. Discuss results and conclusions. Did the soil mix with the water?
6. Dump the mixture into a bucket or tub and proceed with the next experiment.

▪ **Vinegar Experiment**

1. Fill a clear bowl/glass with water. (Does not have to be completely full.)
2. Introduce vinegar. Ask students if vinegar is a liquid or a solid.
3. Ask students to hypothesize (predict) whether or not the vinegar will mix with water. Discuss.
4. Perform experiment - add approx. 1 tablespoon of vinegar to the water and stir.
5. Discuss results and conclusions. Did the vinegar mix with the water?
6. Dump the mixture into a bucket or tub and proceed with the next experiment.

AT THIS TIME, ALLOW STUDENTS TO WORK IN GROUPS TO COMPLETE REMAINING EXPERIMENTS!

2nd Grade - Group Lab

1. Divide students into groups of 2 or 3.
2. Distribute a Data Collection Sheet to each group.
3. Explain to students that they are going to work in groups to complete some experiments, similar to those just demonstrated.
4. Refer to the Data Collection Sheet for specific directions. Read directions aloud with students.
5. Depending on the students, the instructor may walk through each step of the experiment with them or the instructor may elect to let students groups complete the lab without too much instructor involvement.
6. At the end of the lab, discuss each part with the class.

Note: Sugar and Sand can be poured, but both are solids b/c the tiny pieces of sugar and sand hold their shape.

PART IV: REVIEW WORKSHEET

Depending on time, the worksheet can be completed immediately following the experiments, assigned the next day, or assigned as homework. The worksheet can be completed individually or in groups.

CONCLUSION

Close w/ the following review questions:

1. What are the three states or phases in which matter is found? *Answer: Solid, Liquid, Gas*
2. True or False - A solid takes the shape of the container it is placed in? *Answer: False*

All About Matter Worksheet

Directions: Circle the correct answers for each question.

1. Matter is anything that has mass.
 - a. True
 - b. False

2. Matter takes up space.
 - a. True
 - b. False

3. Matter can be in different shapes.
 - a. True
 - b. False

4. A spaceship ceases to be matter when it is in space because it has no weight.
 - a. True
 - b. False

5. Matter can exist in three states: solid, liquid, gas.
 - a. True
 - b. False

6. I can be picked up. I do not change shape when you move me. What am I?
 - a. Solid
 - b. Liquid
 - c. Neither

7. I can not be picked up. I take the shape of any container. What am I?
 - a. Solid
 - b. Liquid
 - c. Neither

8. Which of the following are examples of liquids?
 - a. Wood and Paper
 - b. Shampoo and Oil
 - c. Shoes and Socks

9. Sugar and sand can be poured; therefore, they are liquids.
 - a. True
 - b. False

10. Heat has weight.
 - a. True
 - b. False

11. Heat is matter.
 - a. True
 - b. False

12. Light takes up space; light is matter.
- True
 - False
13. Water has no definite shape; therefore, it is not matter.
- True
 - False
14. A solid has a definite shape.
- True
 - False
15. You cannot easily change the shape of a solid.
- True
 - False
16. You can compress water to force it to occupy less space.
- True
 - False
17. You can change the shape of plasticine; therefore, it is not a solid? Note: Plasticine is modeling clay or putty.
- True
 - False
18. What term describes the process of a solid being heated and turning into a liquid?
- Dissolving
 - Freezing
 - Melting
19. What term describes the process of a liquid cooling and turning into a solid?
- Dissolving
 - Freezing
 - Melting
20. Once a solid has turned into a liquid it can be changed back to a solid by cooling it.
- True
 - False

EXPERIMENTING WITH SOLIDS AND LIQUIDS: DATA COLLECTION SHEET

Lab Directions:

1. Designate one group member to be the recorder. This individual should record all lab results.
2. Identify whether each item (Items 1-5) is a solid or liquid and record results.
3. Form a Hypothesis for each item (Items 1-5). Make a prediction as to whether or not your group thinks the substance will dissolve when mixed with water. Simply write "yes" if you think it will dissolve or "no" if you think it will not dissolve.
4. To perform the experiments, designate one group member to obtain the lab materials from the instructor.
5. Take turns performing the experiments.
6. Using the red plastic cup, pour water to the black fill line on each of the 5 smaller cups.
7. After each of the 5 cups has been filled with water, using a spoon and a pre-determined amount of each item, mix Item 1 below with one cup of water.
8. Stir the substance to mix. Did it dissolve in the water? Record results/conclusions.
9. Continue the steps above with Item 2 through Item 5.

<u>Substance Identification</u>	<u>Is this substance a Solid or Liquid?</u>	<u>Hypothesis/Prediction: Will the substance dissolve in water – Yes or No?.</u>	<u>Results/Conclusion: Did the substance dissolve in water – Yes or No?</u>
Baking Soda			
Soil			
Vinegar			
1. Oil			
2. Rocks			
3. Salt			
4. Sand			
5. Sugar			