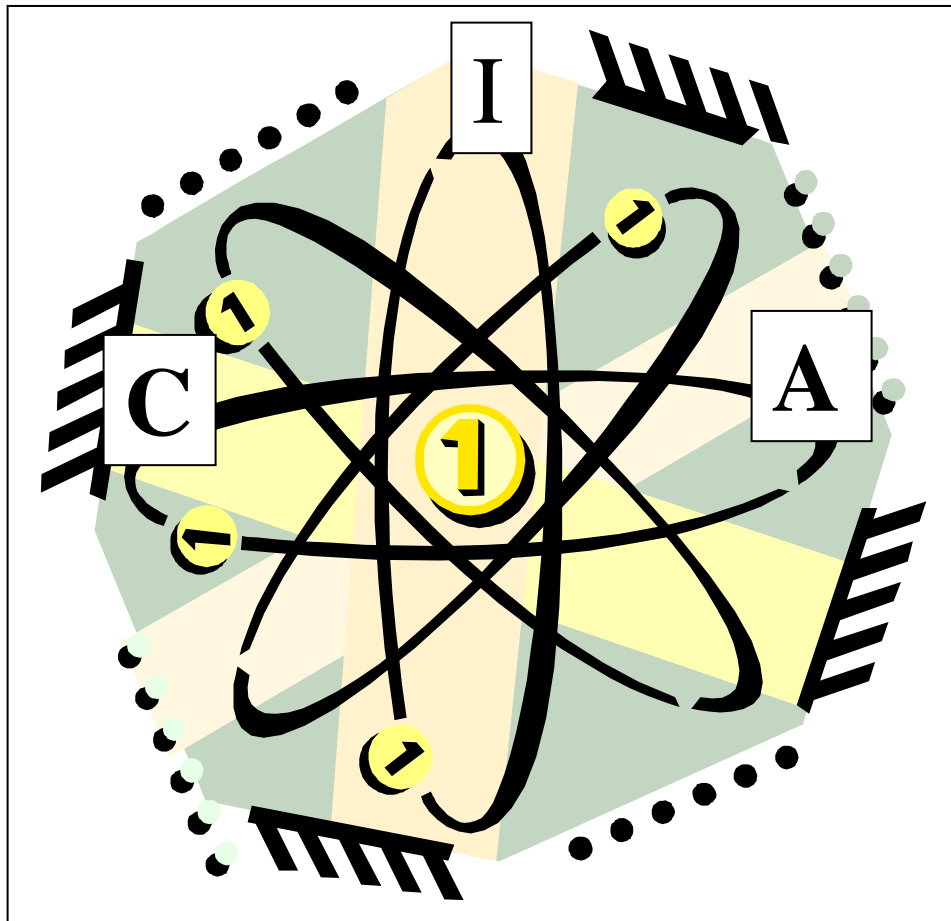


Curriculum, Instruction, Assessment (CIA) Alignment

Science, Grade 2 Unit 4: Matter

Task Analysis and Hands-on Investigations



Ronald Blocker, Superintendent
Orange County Public Schools
Orlando, Florida

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Subject Area: Science
Strand A: The Nature of Matter
Grade: 2

Benchmarks

SC.A.1.1.1: The student knows that objects can be described, classified, and compared by their composition (e.g., wood or metal) and their physical properties (e.g., color, size, and shape).

SC.A.1.1.2: The student recognizes that the same material can exist in different states.

SC.A.1.1.3: The student verifies that things can be done to materials to change some of their physical properties (e.g., cutting, heating, and freezing), but not all materials respond the same way (e.g., heating causes water to boil and sugar to melt).

SC.B.1.1.4: The student knows that heat can be produced in many ways (e.g., by burning and rubbing).

SC.B.2.1.1: The student recognizes systems of matter and energy.

TASK ANALYSIS

The student...

CHANGES IN MATTER

- classifies matter as a solid, liquid, or gas, based on its properties and/or behaviors.
- demonstrates that some common materials, such as water and sugar, can be changed from one state to another by heating or cooling.
- recognizes that matter is made of the same original material even after a physical change such as melting, freezing, dissolving, or evaporating.

COOL IT!



BENCHMARKS and TASKS

SC.A.1.1.2 The student recognizes that the same material can exist in different states.

SC.A.1.1.3 The student verifies that things can be done to materials to change some of their physical properties (e.g., cutting, heating, and freezing), but not all materials respond the same way (e.g., heating causes water to boil and sugar to melt).

- The student classifies matter as a solid, liquid, or gas, based on its properties and/or behaviors.
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- The student recognizes that matter is made of the same original material even after a physical change such as cutting, melting, freezing, dissolving, or evaporating.

KEY QUESTION

How does the removal of heat cause a change in matter?

BACKGROUND INFORMATION

Butyl stearate is a colorless, odorless ingredient used in lip ointments. It is normally bottled in its liquid state, but when cooled, will change to a solid state. When re-warmed, such as by holding it in the palm of your hand, it will change back to a liquid. Water and other water-based ingredients will not mix with butyl stearate.

MATERIALS

Teacher

1 cup with 2 Tbsp. water

1 cup with 2 Tbsp. butyl stearate

timer

Matter Really Matters (Let's Wonder About Science Series)

What Is Matter? (Benchmark Education Co.)

What Is Matter? (Newbridge)

Per group

small, clear cup containing 2 Tbsp. water (room temperature) – labeled #1

small, clear cup containing 2 Tbsp. butyl stearate – labeled #2

ice cubes

magnifiers

paper towels

2 stirrers

Liquid Comparison worksheet

TEACHING TIPS

1. Butyl stearate may be ordered from Delta Education, Inc.
P.O. Box M
Nashua, NH 03061 (Phone 800-442-5444)
***Order early in the year. May take several weeks to receive. Inexpensive.*
2. Caution students never to put substances in their mouth unless instructed to do so by the teacher.
3. Butyl stearate can be poured back into the bottle and reused.

ENGAGE

1. Give students the two labeled cups of liquids: one cup contains pure water and one cup contains butyl stearate. (Do not reveal the names of the liquids at this time.)
2. Have students use magnifiers to observe and discuss the properties of cup #1 (clear, wet, cool, odorless, etc.).
3. Have students use magnifiers to observe and describe the properties of cup #2 (clear, oily, has an odor, etc.).
4. Record student responses on a Venn diagram or Double Bubble Map.
5. Discuss how the two liquids are alike and how they are different.
6. Have students guess what is in each cup. Explain that one cup contains water and the other contains a substance called butyl stearate, which students will continue to explore.

EXPLORE

1. Give each group the *Liquid Comparison* worksheet, ice cube, and stirrer.
2. Tell students to combine the container of water with the cup of butyl stearate and then record their observations.
3. Ask students to add one ice cube to the butyl stearate and water mixture. Have them record their observations of how ice cubes react with the butyl stearate/water mixture.

EXPLAIN

Ask:

What are the properties of liquids? (Liquids take the shape of the container; solids can easily pass through liquids.)

What are the properties of solids? (Solids have a definite shape.)

What state of matter is water?

What state of matter is butyl stearate?

How did butyl stearate react when water was added to the cup?

What state of matter is the combination of water and butyl stearate?

After adding the ice cube, how did this change the butyl stearate? (The liquid changed into a solid.)

How could you change the butyl stearate back into a liquid state?

(It can be changed back by heating it. Students can try this by holding pieces of butyl stearate cupped in their hands. The warmth from their hands will be sufficient to change the solid back into a liquid.)

This activity verifies that things can be done to materials to change some of their physical properties (e.g., cutting, heating, freezing), but not all materials respond the same way.

EXTEND/APPLY

1. Explain that butyl stearate is an ingredient in lip ointments.

Ask:

Why is it important that this ingredient respond to warmth by changing into a liquid? Most lip ointments are a solid when applied to the lips. However as they adjust to the body's warmth, they liquefy, which makes it easier for them to be absorbed into the skin.

2. Read and discuss any of the recommended books.

ASSESSMENT

Completion of *Liquid Comparison* worksheet.

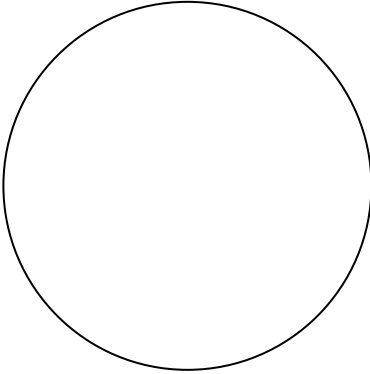
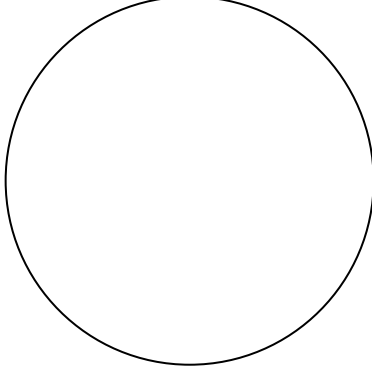
Teacher observation through class discussion.

Can identify matter as solid, liquid, or gas.

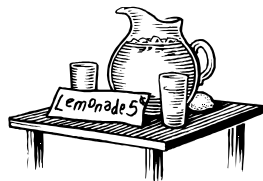
Student Scientists: _____

LIQUID COMPARISONS

Draw and describe what happens when certain substances are added to butyl stearate.

<p>Draw in the circle what you observed when each substance was added to the cup of butyl stearate.</p>	<p style="text-align: center;">Water</p> 	<p style="text-align: center;">Ice Cubes</p> 
<p>Describe what you observed.</p>		

WHAT'S THE MATTER?



BENCHMARKS AND TASKS

SC.A.1.1.1 The student knows that objects can be described, classified, and compared by their composition (e.g., wood or metal) and their physical properties (e.g. color, size, shape).

SC.A.1.1.3 The student verifies that things can be done to materials to change some of their physical properties (e.g., cutting, heating, freezing), but not all materials respond the same way (e.g., heating causes water to boil and sugar to melt).

- The student classifies matter as a solid, liquid, or gas, based on its properties and/or behaviors.
- The student demonstrates that some common materials, such as water and sugar, can be changed from one state to another by heating or cooling.
- The student recognizes that matter is made of the same original material even after a physical change such as cutting, melting, freezing, dissolving, or evaporating.

KEY QUESTION

What happens to matter when there is a physical change?

BACKGROUND INFORMATION

Matter can often be manipulated to change its shape and size without changing its physical properties (e.g., crumpling a piece of paper).

MATERIALS

Teacher

pencil
pencil sharpener
scissors

Per student

cookie
paper towel
clay
1 pkg. of presweetened Kool-Aid
pitcher of water to dissolve Kool-Aid
2 small paper cups
ice cube tray

TEACHING TIPS

1. Before you begin this activity, make arrangements with the cafeteria manager to use a freezer.
2. The teacher or another adult may choose to pour the Kool-Aid into the cups and into the ice cube tray rather than having the students do it.

ENGAGE

1. Show the students an unsharpened pencil.
Ask: *What can I do to change this pencil?* (sharpen it, use the eraser)
Will it still be a pencil?
Sharpen the pencil and tear off a bit of the eraser.
How have I changed the pencil?
Have I changed its size or shape?
Is it still a pencil?
2. If possible, bring in a doll with hair and show the doll to the students.
Cut off some of the doll's hair.
Ask:
How have I changed the hair?
Have I changed the size or shape of the hair?
Is it still hair?
3. Tell students they will be experimenting with objects to see what happens when some changes are made to those objects.

EXPLORE Part 1

1. Give each student a chocolate chip cookie on a paper towel. Ask the students to describe the cookie. Tell them to take a small bite from their cookie.
2. Tell the students to break their cookie into small pieces and to think about how the cookie has changed and how it has stayed the same. Tell them to eat a small piece of their broken cookie.

EXPLAIN

Discuss the changes to the cookie.

Ask:

How did the taste of the bite of the whole cookie and the taste of the small piece of the broken cookie compare?

Did breaking up the cookie change its taste?

Are the small pieces of broken cookie still the same material as the whole cookie?

What state of matter is the cookie? solid

Why is it a solid?

Allow students to eat the rest of their cookie.

EXPLORE Part 2

1. Give each student a ball of clay.
2. Have the students create something from their ball of clay.

EXPLAIN

Allow the students time to share their clay creations.

Discuss the changes to the clay.

Ask:

How did you change the clay?

Is your creation still clay?

Will the clay change into a different material when it is molded into another figure?

What state of matter is the clay? solid

Why is it a solid?

Students should recognize that matter is made of the original material even after a **physical** change has taken place.

EXPLORE Part 3

1. Give each group the Kool-Aid and pitcher of water. Discuss the two states of matter.
2. Have students mix the Kool-Aid and water and pour a small cup for each student.
Tell the students to drink their Kool-Aid and to think about the taste as they're drinking.
3. Have the students or an adult pour the remaining Kool-Aid into the ice cube trays and place the trays in the cafeteria freezer.
4. When frozen, give each student a Kool-Aid ice cube in a paper cup. Tell the students to taste (a small bite) the ice cube.
5. Tell the students to place and to leave the ice cube in the paper cup and allow the cube to melt.
6. After the cube has melted, tell the students to drink the Kool-Aid.

EXPLAIN

1. Discuss:
What state of matter was the Kool-Aid in the package?
What state of matter was the Kool-Aid after mixing it with the water?
Why is it a liquid?
What state of matter was the Kool-Aid ice cube?
Why is it a solid?
Other than temperature, how did the taste of Kool-Aid and the Kool-Aid ice cube compare?
Did freezing the Kool-Aid and then melting the Kool-Aid ice cube have any effect on the taste?
2. Help students realize that matter is made of the original material even after a **physical** change has taken place.

EXTEND/APPLY

Discuss physical changes we make to vegetables (e.g., shredding carrots, tearing lettuce, cutting tomatoes) when we make a tossed salad.

If you have a Play-doh machine, allow students the opportunity to put a ball of the dough into the machine and observe what size/shape comes out.

Help students realize that matter is made of the original material even after a **physical** change has taken place.

Changes in size and shape can also be explored and discussed by bending, tearing, and breaking other materials to determine differences and similarities between them and the original material.

ASSESSMENT

Provide students with a new material and give instructions on what to do with the material to make a physical change. Ask questions that are similar to the ones in the **Explain** sections. Use the following rubric to assess understanding as demonstrated in the student responses:

Exceeds: Correctly identifies the physical change, and states that the changed object is made of the same material as the original object.

Meets: Correctly identifies the physical change, but **does not** state that the changed object is made of the same material as the original object.

Basic: **Incorrectly** identifies the physical change, and **does not** state that the changed object is made of the same material as the original object.

THE HEAT IS ON

BENCHMARKS AND TASKS

SC.A.1.1.2 The student recognizes that the same material can exist in different states.

SC.A.1.1.3 The student verifies that things can be done to materials to change some of their physical properties (e.g., cutting, heating, and freezing), but not all materials respond the same way (e.g., heating causes water to boil and sugar to melt).

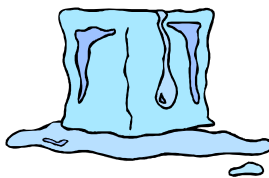
SC.B.1.1.4 The student knows that heat can be produced in many ways (e.g., by burning and rubbing).

SC.B. 2.1.1 The student recognizes systems of matter and energy.

- The student classifies matter as a solid, liquid, or gas, based on its properties and/or behaviors.
- The student demonstrates that some common materials, such as water and sugar, can be changed from one state to another by heating or cooling.

KEY QUESTION

How does heat cause a change in matter?



BACKGROUND INFORMATION

Matter is anything that takes up space and has mass. Matter on earth may exist in three states: solid, liquid, and gas. Adding or reducing heat causes matter to change from one state to another. A solid is something that maintains its shape. Its atoms vibrate in a fixed place. When heated to the melting point, the atoms vibrate out of their fixed space and become liquid.

A liquid maintains its volume but takes the shape of its container. When heat is applied, some atoms on the surface of the liquid vibrate enough to break away (evaporate).

A gas has no fixed volume. The atoms of a gas are spaced apart. When heat is lost, the matter changes from gas to liquid to solid states.

MATERIALS

Teacher

electric skillet with lid
cooler for storing ice
chalk

Student

plastic zipper-type bag with ice
1 ice cube in a cup
Solid, Liquid, Gas worksheet

TEACHING TIP

A good analogy to help students understand molecular motion is to compare the movement of particles in a solid to the movement of soldiers in a tight military formation; the particles of liquid to the movement of dancers on a crowded floor; and the particles of gas to the movement of popping popcorn.

ENGAGE

Give each student a cup with one ice cube. Tell the students to put the pieces of ice on their tongues but not to chew them.

Ask:

What is happening?

What is causing the ice to melt?

What are some other ways we could melt the ice?

EXPLORE Part 1

1. Give each student an ice cube in a plastic zipper-type bag.
2. Tell students to see if they can melt the ice cube without taking it out of the bag.

EXPLAIN

Ask the students to describe how they melted their ice cubes.

Record the responses on the board.

Help students to realize that they were applying a heat source by holding the ice bag in their hands, sitting on the bag, wrapping it up in their jacket, etc.

EXPLORE Part 2

1. Explain that they are now going to observe ice being melted at a higher temperature than they could produce themselves.
2. Place an ice cube in an electric skillet. **Caution students not to touch the electric skillet.** Ask students to observe the melting ice. Continue heating until most of the water has changed to a gas.
Ask:
What is the difference between melting the ice cube in a bag and melting it in a skillet?
Do you observe anything forming above the skillet?
What would you call this smoke-like substance forming above the skillet?
What do you think is going to happen to the liquid?
3. Explain to students that the increased heat not only caused the ice to melt quickly but that it also changed the liquid to a gas.
4. Ask students if they think we could reverse the process (change the gas back to liquid).
Ask:
If we added heat to change the ice to water and the water to steam, what do we now need to take away to reverse the change?
5. Have the students feel the lid of the skillet.
Ask:
How does the lid feel? (Since the lid has not been used on the skillet, it should feel cool to the touch.)
6. Put the lid on the skillet to collect the condensation. After a few moments, remove the lid to show the students the water droplets.
Ask:
How did these water droplets form? (When the steam came in contact with the cool skillet lid, the gas particles condensed into liquid particles.)

EXPLAIN

1. On an outside paved area, have the students stand as close to each other as they can while you draw a chalk circle around them. Tell them to move without getting out of the circle. Tell them that they are behaving as the parts of a solid. They stay in one spot and cannot move freely.
2. Now have the students step away from each other so there is at least an arm's length between them and they can no longer touch one another. Draw another chalk circle around the outside of the group. Tell them to move around within the circle again. Point out that they are now behaving as the parts of a liquid. They can move a little more freely but still tend to stay together.
3. Finally, have the students spread out in the entire area of a large given space (an area still has to be designated for the students). Tell them to move around the space.
Ask:
Do you feel more space?
Do you feel restricted or confined?
Tell them that they are behaving as the parts of a gas. They can move very freely and do not have to stay in one place.
4. Guide students to draw how the parts are arranged in a solid, a liquid, and a gas on the *Solid, Liquid, Gas* worksheet. Have students list some solids, liquids, and gases on the worksheet. (An excellent reference is Pg. 253 of *ScienceSaurus*, from Great Source Education Group.)

EXTEND/APPLY

Ask students to estimate how long it would take the ice cube to melt at room temperature, in the sunlight, in a cooler, or in a refrigerator. Invite other suggestions and explore as time allows.

Student Scientist _____

SOLID, LIQUID OR GAS

SOLID	LIQUID	GAS

