

Lesson 20

Introduction

National Standards

Focus: B1

Related: A1, A2, B2

Category

Physical Science

Focus

Chemical/Physical change

Objective

To explore how matter can change from one state to another

Overview

Read the overview aloud to your students. The goal is to create an atmosphere of curiosity and inquiry.

Say: *“Matter comes in different forms called ‘states.’ But sometimes matter changes from one state to another. The most common changes in state are caused by chemical or physical actions.”*

BiCarb Balloon Lesson 20



FOCUS Chemical & Physical change

OBJECTIVE To explore how matter can change from one state to another

OVERVIEW Matter comes in different forms called “states”. But sometimes matter changes from one state to another. Common changes in state are caused by chemical or physical actions.

WHAT TO DO

With your team, carefully follow each step below.



Observe

Look at the baking soda. Look at the salt. Look at the vinegar. Think about what common state of matter (solid, liquid, gas) best describes each item.



Describe

Describe the baking soda, salt, and vinegar. What does each one look like? What does each one feel like? What does each one smell like?



Discuss

What state of matter best describes salt? *solid*
What state of matter best describes vinegar? *liquid*
What state of matter best describes air? *gas*

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Additional Notes

Introduce this lesson by asking students if they have ever traveled from one state to another. You’ll probably discover that many students have traveled from their home state to another state to visit someone or some place.

Now ask students how long it took for them to reach the other state, and how far they had to travel.

Once you have allowed sufficient time for answers, tell students that in this activity they will see something change from one state to another . . . and it won’t even have to leave the classroom!

You can use this introduction to highlight the fact that many words in the English language have more than one meaning.

What To Do

Once students are seated in “research teams” with materials in front of them, read the first section (OBSERVE) aloud.

Say, “*To start this lesson, we’re going to **observe** some things. Good scientists always carefully examine the things they will be working with before beginning. First, I will read the instructions to you. Then you can follow the instructions as you **observe** the items in front of you.*”

Monitor teams closely as they follow instructions. When teams are finished with this section, repeat the process with the DESCRIBE section. Conclude with the DISCUSS section.

Options

Expand the DISCUSS section by having students trace dotted “key words” using crayons or markers. Trace the word **solid** in brown, the word **liquid** in blue, and the word **gas** in green.

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What state of matter best describes salt? **solid**
 What state of matter best describes vinegar? **liquid**
 What state of matter best describes air? **gas**

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Teacher to Teacher

For students in this age group, it’s best to focus only on the most common states of matter on Earth — solid, liquid, and gas.

But as students enter high school, they’ll find there are other states of matter beyond our planet. In fact, *plasma* is the most common state of matter in the universe. (That’s what stars are made from.)

And back here on Earth, advanced physics research has been discovering other states of matter.

Through super-conductivity experiments, Bose-Einstein Condensate was discovered in 1996. A related form called Fermionic Condensate was discovered in 2004. That makes SIX states of matter that scientists have discovered to date.



READ THE STORY

Matter comes in different states (solid, liquid, gas). But sometimes matter can change from one state to another. Read the story below to find out more.

Changes in Matter

Matter may change from one state to another.

A solid may turn into a liquid. A liquid may turn into a gas. Such changes happen all the time. Common changes in state are caused by chemical or physical actions.

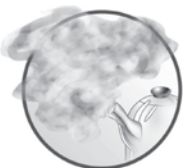


This is a chemical change.

A chemical action may change matter.

There are many kinds of chemical actions like rotting, rusting, and burning. These actions make different substances.

For instance, mixing baking soda (sodium bicarbonate) with vinegar (acetic acid) creates carbon dioxide (CO₂). The *solid* and the *liquid* combine to make a *gas*.



This is a physical change.

A physical action may change matter.

There are many kinds of physical actions like cutting, melting, freezing, or boiling. These can make matter change states.

Boiling can create physical change.

Heating water makes it boil. When water boils, it turns into a type of gas (steam). The matter changes from liquid to gas.



Changes happen all the time.

Changes in matter can be natural.

Unprotected iron rusts over time (chemical change). Cold weather can turn liquid water to solid ice (physical change).

Changes can also be caused by people.

Scientists combine chemicals and other ingredients to create many useful items — from plastic spoons to airplane parts!

Read The Story

Read the story aloud with your students. (See READING LEVELS on page 12.) After reading, monitor teams as they discuss what was read. Once you feel students have mastered the basic concepts, have them answer the comprehension questions (**What I Learned** - part 1) on the next page.

To introduce the story, say:

“The title of this story is ‘Changes in Matter.’ Look at your story and follow along as we read it together.”

If you wish, encourage Emergent readers to point to words and pictures as you read.

What I Learned (part 1)

These are basic fact-based comprehension questions. Student answers will vary, but suggested responses include:

- ① chemical; physical
- ② a) both physical changes b) freezing changes a liquid to a solid; boiling changes a liquid to a gas
- ③ Answers will vary, but should include freezing or boiling. Some students may also refer to “chemical” changes, such as mixing in another substance

Field Trip

Visit a manufacturer that makes synthetic products such as plastics. Talk about the chemical changes taking place.

Guest Speaker

Invite a chemistry teacher from a local college to visit your class. Ask him/her to demonstrate some simple chemical changes.

Extended Teaching

1. To expand vocabulary, explain that “bicarb” is an abbreviation for “bicarbonate of soda.” Most people know it as “baking soda.” Baking soda is primarily used to make baked goods, and sometimes to help relieve excess stomach acid.
2. Explain that “change” is an action verb. We can expect something to happen when there is a change. Physical changes include grinding, chopping, breaking, melting, freezing, cutting, and so on. Chemical changes include rotting, rusting, food digesting, etc.
3. Physics: Discuss the concept of “forces.” A force always pushes or pulls, usually resulting in change. Both chemical and physical forces “force” changes to occur.
4. Make “States of Matter” Jell-O®! Point out that the powder is a solid; the steam from the boiling water is a gas; mixing the powder with water creates a liquid; and finally, cooling the gel creates a solid again.

Expand - Day 3

Materials Needed*

plastic tube - clear salt
balloons -2 funnel
baking soda (sodium bicarbonate)
vinegar (acetic acid)

Safety Concerns

3. Poison Hazard

Keep materials out of mouths and away from eyes. Balloons can pose a choking hazard.

4. Slipping

There is a potential for spilled liquids. Remind students to exercise caution.

Do the Activity

Read the activity in advance so you understand it thoroughly. (If time allows, try it yourself.) Before students begin, carefully go over the **Safety Concerns** together.

Pass out materials, then have your students follow along as you read the instructions for **Step 1**. Monitor teams closely as they complete this step.

Once teams have completed **Step 1**, read instructions for **Step 2**. Monitor teams as before. Repeat for **Step 3** and **Step 4**.

After the activity, allow time for each team to share their observations. To encourage higher-level thinking, encourage teams to not only share their observations with each other, but also with other teams.

Special Instructions

Step 1 - Have one team member hold the funnel while another adds the salt. Note: "a little" means half a spoonful or less!



Step 2 - Differences in motor skills development may make it difficult for some teams to attach the balloon to the tube. Balloon must be tight! If you see problems, join the group and demonstrate. This will shift the focus from the skill to the observation process.


Step 3 - Keep paper towels on hand for immediate cleanup of spills.


* *Bold-faced items supplied in kit.*


DO THE ACTIVITY


Working with your research team, carefully follow each step below. Before you start, be sure you know the safety rules for this activity.



STEP 1

Examine the salt, baking soda, and vinegar. Discuss which state of matter (solid, liquid, or gas) best describes each item. Pour a little salt into one balloon.

STEP 2

Pour an inch of vinegar into the tube. Attach the balloon to the top of the tube. Now quickly tip the balloon so the salt falls in the tube. Observe what happens.

STEP 3

Empty the tube and rinse with clean water. Now pour a little baking soda in the other balloon. Repeat step 2. Carefully observe what happens.

STEP 4

Compare steps 2 and 3. Discuss what states of matter were shown in each step. Compare your observations with those of other research teams.

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What Happened?

Immediately following the activity, help your students understand what they observed.

In Step 2, you saw a solid (salt) change into a liquid — a physical change.

Say: "In this activity you explored the changes in matter caused by various chemical actions.

In Step 3, you observed a solid (baking soda) change into a gas — a chemical change.

In Step 1, you classified each material according to its state of matter.

Remember, never try an activity like this at home unless an adult is present to help you."

NAME _____

SHOW WHAT YOU KNOW - 1

Circle any physical change in red. Circle any chemical change in blue. Write the word that best describes the change on the lines below.

These changes are _____
physical

These changes are _____
chemical

To the Parent . . . **Scripture Connection: 1 Corinthians 15:52**

Lesson Focus:
Chemical and Physical Change

Lesson Objective:
To explore how matter can change from one state to another

National Science Education Standards:
Standard B1 — "All students should understand that materials have observable (and measurable) properties . . . Materials exist in different states . . . some materials can be changed from one state to another . . ."

Follow-up Questions:
Ask your child to name the three most common states of matter on Earth (solid, liquid, gas).
Ask your child to describe a physical change in matter, then give an example (water turns to ice, water turns to steam, etc.).
Ask your child to describe a chemical change in matter, then give an example (baking soda and vinegar make a gas, etc.).

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Expand - Day 4

Begin **Day 4** with a review of **Day 3**, then have students answer "part 2" questions.

What I Learned (part 2)

These are higher-level cognitive questions (explain, compare, predict). Student answers will vary but suggested responses may include:

- ① a) solid, liquid, gas b) salt and baking soda began as solids; salt mixed with vinegar became liquid; baking soda mixed with vinegar became a gas
- ② a) did the same things b) answers should reflect the fact that different ingredients produced different results
- ③ adds gas; makes it expand or "rise"

Assess - Day 5

Suggestions for modifying assessments to reflect reading levels can be found under **ASSESSMENT METHODS** on page 12.

Show What You Know 1

(general assessment in Student Worktext)

Top scenes are physical (circle in red);
Bottom scenes are chemical (circle in blue).

Show What You Know 2

(optional test master in Teacher Guide)

- 1) chemical 2) physical 3) chemical
4) physical 5) physical

To The Parent

Included at the bottom of all assessment tests, "To The Parent" provides a great way to solicit parent involvement. It not only gives parents an overview of the lesson, but also provides follow-up questions for home use.

Food For Thought

A related "Scripture Object Lesson" you can share with your students.

1 Corinthians 15:52

We often use the word "change" in our daily lives. We change our clothes, change our surroundings, and even change our minds. When we travel, we may have to change buses, or planes, or trains. If we buy something, our money may make a sudden change from big bills to small coins. And sometimes we may even need a change of attitude.

In this text, God promises us the ultimate change. One day everyone who believes in God will be changed from an earthly body to a heavenly one!

In our new bodies, we will never again worry about sickness, pain, or death. And best of all, we will live forever with God, sharing in the wonders of this amazing universe He has created.

**Show What You Know 2**

Read each sentence below. If it describes a chemical change, fill in the word **chemical**. If it describes a physical change, fill in the word **physical**.

1. Mixing baking soda and vinegar creates a _____ change.
2. Boiling water creates a _____ change.
3. Unprotected iron rusts. This is a _____ change.
4. Turning liquid water into solid ice is a _____ change.
5. Turning solid ice into liquid water is a _____ change.

To the Parent . . .**Scripture Connection:** 1 Corinthians 15:52**Lesson Focus:**

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Follow-up Questions:

Ask your child to name the three most common states of matter on Earth (solid, liquid, gas).

Ask your child to describe a physical change in matter, then give an example (water turns to ice, water turns to steam, etc.).

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