

SPACEGATE STATION VIDEO SERIES

Physical and Chemical Change



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Concept Summary

Physical & Chemical Changes – Core Idea Students explore how matter behaves when it undergoes changes. They compare **physical changes** (changes in form, state, or appearance) with **chemical changes** (new substances formed). This unit emphasizes observation, evidence-based reasoning, and the role of temperature in driving or influencing changes.

Real-World Anchors

- Melting, dissolving, tearing, and mixing
- Rusting, burning, digesting, and reacting
- Temperature effects on rate and type of change

Core Themes for Instruction

- Identifying evidence of chemical change
- Distinguishing physical vs. chemical processes
- Understanding temperature's role in matter changes
- Scientific reasoning and justification
- Modeling changes using diagrams and particle representations

Florida Standards Alignment

Nature of Science (NOS)

- **SC.5.N.1.1** – Define a problem, plan investigations, collect data, interpret results.
- **SC.6.N.3.4** – Identify the role of models.
- **SC.7.N.3.2** – Benefits and limitations of scientific models.
- **SC.8.N.3.1** – Select models useful for investigations.

Physical Science

- **SC.5.P.9.1** – Temperature affects physical and chemical changes.

Lesson Plan: Physical & Chemical Changes – Science Integration

Objective

Students will analyze examples of physical and chemical changes, identify evidence for each, and connect them to Florida science standards.

Materials

- Guided Notes
- Physical & Chemical Change Worksheet
- Common materials for demonstrations (ice, sugar, vinegar, baking soda, paper)
- Student glossary
- Hands-On Chemistry Challenge

Engage (10 min) SC.5.N.1.1; SC.5.P.9.1

- Show a short demonstration (ice melting, paper tearing).
- Ask students: *“What changed? Did the substance stay the same?”*

Explore (15 min) SC.5.P.9.1; SC.6.N.3.4

Students rotate through stations:

- Dissolving sugar
- Tearing paper
- Mixing vinegar and baking soda
- Heating chocolate

Groups record:

- What changed?
- Was a new substance formed?
- Did temperature matter?

Explain (15 min) SC.5.N.1.1

Teacher connects observations to standards:

- Evidence of chemical change
- Why dissolving is physical
- Why burning is chemical
- How temperature influences both

Elaborate (20 min) SC.6.N.3.4; SC.7.N.3.2

Students choose one process and create a **particle-level diagram** showing:

- Before the change
- After the change
- Whether particles rearranged or stayed the same

Evaluate (10 min)

Students answer discussion questions. Teacher checks for understanding.

SPACEGATE STATION – GUIDED NOTES

WORD BANK

physical change • chemical change • temperature • state of matter • solid • liquid • gas • phase change • sublimation • identity • molecules • sucrose • carbon dioxide • reaction • pH • acidity • gas production • precipitate • evidence • criteria • mass • observation • appearance • properties • state • physical • chemical • color • gas

GUIDED NOTES

Fill in the blanks using the word bank.

1. Key Vocabulary

A **physical change** is when a substance changes its _____ or _____ but keeps the same chemical _____.

A **chemical change** is when a _____ occurs and a new _____ is formed with different _____.

A **phase change** is when matter changes from one _____ of matter to another (solid, liquid, gas).

2. Physical Change Demonstrations

A. Ice vs. Liquid Water

Water at 0°C and water at 20°C are chemically identical. The only difference is their _____ of matter caused by _____.

B. Crushing Sugar

Sugar (also called _____) was crushed into a powder. Its appearance changed, but its _____ and _____ stayed the same.

The _____ did NOT change.

C. Dry Ice

Dry ice is solid _____.
It changes directly from a solid to a gas in a process called _____.

This is a _____ change because the chemical identity stays the same.

3. Criteria for Physical Change

A physical change occurs when:

The chemical _____ stays the same. Only the _____ or _____ changes. No new substance is formed; _____ stays the same

4. Chemical Change Demonstrations

A. Baking Soda + Hydrochloric Acid

When mixed, they produced _____ gas, the _____ increased, and the pH changed from 1 to _____.

This shows a new substance formed → a _____ change.

B. Hydrochloric Acid + Silver Nitrate

A white solid called a _____ formed.
This is evidence of a chemical _____.

5. Criteria for Chemical Change

A chemical change occurs when a material:

- No longer keeps its original _____
- Forms a new substance with new _____

Evidence includes:

- Change in _____
- Change in _____
- Production of a _____
- Formation of a _____ (solid)

6. Temperature and Changes

Increasing temperature _____ the rate of physical and chemical changes.

Decreasing temperature _____ the rate of physical and chemical changes.

7. Practice: Physical or Chemical?

1. Ripping paper → _____
2. Dissolving sugar in water → _____
3. Digesting food → _____

TEACHER ANSWER KEY – Spacegate Station Guided Notes

SECTION 1 – KEY DEFINITIONS

Physical change: appearance, state, identity

Chemical change: reaction, product (or substance), properties

Phase change: state

SECTION 2 – PHYSICAL CHANGE EXAMPLES

A. Ice vs. Liquid Water: state, temperature

B. Crushing Sugar: sucrose, identity, molecules, mass does not

C. Dry Ice: carbon dioxide, sublimation, physical

Criteria for Physical Change: identity, appearance, state, mass does not

SECTION 3 – CHEMICAL CHANGE EXAMPLES

A. Baking Soda + Hydrochloric Acid: carbon dioxide, temperature, 6, chemical

B. Hydrochloric Acid + Silver Nitrate: precipitate, reaction

Criteria for Chemical Change: identity, properties, color, temperature, gas, precipitate

SECTION 4 – TEMPERATURE AND CHANGES

Increasing temperature → speeds up

Decreasing temperature → slows down

SECTION 5 – PRACTICE CLASSIFICATION

1. Ripping paper → **Physical**
2. Dissolving sugar in water → **Physical**
3. Digesting food → **Chemical**

Discussion Questions

Nature of Science (SC.5.N.1.1; SC.6.N.3.4)

1. How do scientists use evidence to determine whether a change is physical or chemical?
- 2.
3. Why are models useful when explaining changes in matter?

Physical Science (SC.5.P.9.1)

3. How does temperature affect physical changes like melting or dissolving?
4. How does temperature affect chemical changes like rusting or burning?

Scientific Reasoning

5. What clues tell you a chemical change has occurred?
6. Why is dissolving sugar a physical change even though the sugar “disappears”?

Sample Response Key

1. Scientists observe properties before and after a change and look for new substances.
2. Models help visualize particles and processes we cannot see.
3. Higher temperature speeds up melting and dissolving.
4. Higher temperature speeds up chemical reactions.
5. Clues: color change, gas production, heat/light, new substance.
6. Sugar molecules stay the same; they are just spread out in water.

Discussion Questions Rubric

Criteria	4 - Exceeds	3 - Meets	2 - Developing	1 - Beginning
Understanding	Clear and accurate	Correct	Partial	Incorrect
Evidence	Strong examples	Some examples	Limited	None
Depth	Insightful reasoning	Logical	Basic	Minimal
Clarity	Clear and organized	Mostly clear	Some confusion	Unclear

Name: _____ period: _____ date: _____

Student Worksheet

1. Engage – Observing Changes

A. List two physical changes you saw in class.

B. List one chemical change you saw.

C. What clues helped you decide?

2. Explore – Identifying Change Types

A. At Station 1, what change occurred?

B. At Station 2, what evidence did you observe?

C. Which station showed a chemical change? Why?

3. Explain – Using Science Practices

A. What evidence shows a chemical change?

B. How does temperature affect the changes you observed?

C. How do models help explain what happened?

4. Elaborate – Particle Diagram

Choose one: melting, dissolving, burning, rusting.

A. Draw a before/after particle diagram.

B. Explain what happened to the particles.

5. Evaluate – Reflection

A. Why is it important to distinguish physical and chemical changes?

B. How can this knowledge help in real life?

Teacher Answer Key — Student Worksheet

1A. Melting ice, tearing paper, dissolving sugar.

1B. Vinegar + baking soda reaction.

1C. Evidence: gas, temperature change, new substance.

2A. Physical change (melting/dissolving).

2B. No new substance formed.

2C. Chemical change at reaction station due to gas formation.

3A. Gas, color change, heat.

3B. Higher temperature speeds up both types of changes.

3C. Models show particle movement and rearrangement.

4A–B. Answers vary; look for correct particle reasoning.

5A. Helps classify processes and predict outcomes.

5B. Cooking, cleaning, safety, engineering.

Glossary of Terms

Physical Change – A change in form or appearance where the substance stays the same.

Chemical Change – A change where a new substance is formed.

Temperature – A measure of heat energy that affects how fast changes occur.

Dissolve – When particles spread out evenly in a liquid.

React – When substances combine to form something new.

Evidence – Observations that support a conclusion.

Model – A representation used to explain something difficult to observe.

Gas Production – Bubbles or fizzing that indicate a chemical reaction.

Color Change – A sign that a new substance may have formed.

Precipitate – A solid that forms from a liquid reaction.

Hands-On Chemistry Challenge: “Fix the Broken Change!”

Objective

Students will identify whether a change is physical or chemical using evidence and reasoning.

Teacher Setup: Create “Mystery Change Bags”

Each bag contains materials that undergo a change. Students must diagnose the type of change.

Possible Bags:

- Ice melting
- Sugar dissolving
- Steel wool rusting
- Baking soda + vinegar
- Chocolate softening
- Paper tearing
- Glow stick activation

Students must:

1. Observe
2. Record evidence
3. Classify the change
4. Justify their reasoning

Name: _____ Date: _____ period: _____

Exit Ticket

1. What evidence shows a chemical change?
 - Change in shape
 - New substance formed
 - Change in size
 - Change in state
2. Which is a physical change?
 - Burning wood
 - Rusting metal
 - Melting ice
 - Baking a cake
3. Explain why dissolving sugar is a physical change.
4. How does temperature affect changes in matter?
5. Why is evidence important when identifying change types?

Exit Ticket – Teacher Key

1. **New substance formed**
2. **Melting ice**
3. Sugar stays sugar; particles spread out but do not change.
4. Higher temperatures speed up both physical and chemical changes.
5. Evidence helps confirm whether a new substance is formed.

Exit Ticket Rubric

Criteria	4 - Exceeds	3 - Meets	2 - Developing	1 - Beginning
Understanding	Clear and accurate	Correct	Partial	Incorrect
Evidence	Strong examples	Some examples	Limited	None
Depth	Insightful reasoning	Logical	Basic	Minimal
Clarity	Clear and organized	Mostly clear	Some confusion	Unclear

NGSS Compliance Summary

Middle School NGSS

- **MS-PS1-2** – Analyze properties before/after a change.
- **MS-PS1-4** – Particle-level models.
- **MS-PS1-6** – Evidence of chemical reactions.

Science & Engineering Practices

- Asking Questions
- Developing Models
- Constructing Explanations
- Analyzing Data
- Using Evidence

Application Across Packet

- **Lesson Plan:** Observation, modeling, explanation
- **Discussion Questions:** Evidence-based reasoning
- **Worksheet:** Data identification and classification
- **Hands-On Challenge:** Real-world application
- **Exit Ticket:** Concept mastery