



National Aeronautics and Space Administration



Guide Lites

Interactive Lesson: Physical Change

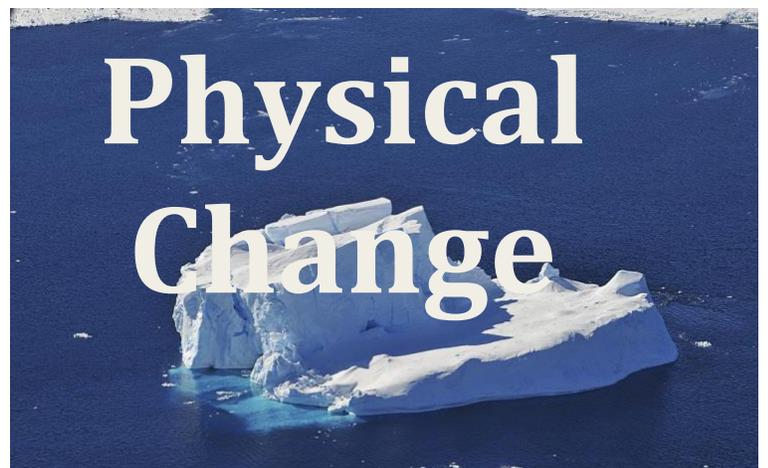
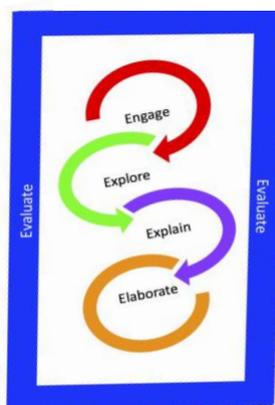


Image Credit: www.nasa.gov/multimedia/imagegallery/

NASA eClips™ Guide Lites are individual supplemental activities that are developed for formal and informal educational settings. Currently there are two types of Guide Lites:

- 1) excerpts from approved NASA eClips™ Educator Guides; and
- 2) targeted vocabulary lessons that help students confront science misconceptions addressed within NASA Spotlights, student-produced videos.

NASA eClips Guides use the "Five E" constructivist model developed by Roger Bybee. Constructivism is an educational philosophy that promotes student-centered learning where students build their own understanding of new ideas. The 5E instructional model consists of five sequential stages for teaching and learning: Engage, Explore, Explain, Extend (or Elaborate), and Evaluate.



- The ENGAGE stage piques student interest and gets them personally involved in the lesson, while pre-assessing prior understanding.
- The EXPLORE stage gets students involved in the topic, providing them with the opportunity to build their own understanding.
- The EXPLAIN stage provides students with an opportunity to communicate what they have learned so far and understand what it means. This lesson introduces vocabulary in context and confronts misconceptions.
- The EXTEND stage allows students to use their new knowledge and continue to explore its implications.
- The EVALUATION stage is for both students and teachers to determine how much learning and understanding has taken place.

This NASA eClips™ Guide Lites Interactive Lesson Plan is designed to support existing curriculum. The goal of this lesson is to correct a science misconception through watching a video (**Engage**), learning new vocabulary collectively, and participating in discussions (**Explore** and **Explain**). The suggested **Extend** activities are included to deepen conceptual understanding and can be used at the discretion of the teacher. The **Extend** activities will require additional instructional time.

The hyperlinks included in this document open PDFs or webpages and may perform differently based on the device being used. Links may have to be cut and pasted into a web browser to open. PDFs and other documents may need to be downloaded to view.

Standards

Next Generation Science Standards

PS1.A: Structure and Properties of Matter
Matter and Its Interactions

5-PS1-3 Make Observations and measurements to identify materials based on their properties.

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Student Misconception

Students incorrectly think a change of state or physical change is a chemical change.

Objective

As a result of watching the Spotlight video, learning the vocabulary collaboratively, and discussing the differences between physical and chemical change, students will be able to explain the difference between a physical change and a chemical change.

Time Frame

Approximately 45 minutes (pretest, video review and discussion [20 minutes], collaborative vocabulary with Frayer Model [25 minutes], posttest). Additional time needed for completion of extension activities.

Materials:

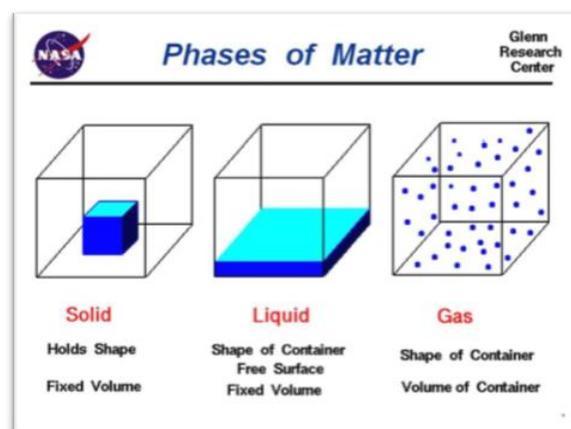
Per student: copy of pretest and posttest (alternatively, these can be completed online)

Per small group: copy of Frayer Model (alternatively, these can be completed online)

Per classroom: chart paper for posting final vocabulary definitions

Background Information

- A phase change is a change in a state of matter and is also called a physical change.
- An example of a physical change is liquid water freezing to solid ice or evaporating to water vapor, the gaseous form of water. Boiling and evaporation are also phase changes.
- During a physical change there is no chemical change. Water remains water no matter if it is a solid, liquid, or gas because the molecules have not changed.
- There are four phases of matter: solids, liquids, gases, and plasma.
- A chemical change occurs when the atoms of one or more substances are rearranged creating one or more new substances. Iron rusting is an example of a chemical change.



Pre-Assessment

Probe for students' prior knowledge using one or both of these pre-assessments.

1. Physical Change Pre- / Posttest is included in this packet.
2. Discussion questions:
 - What is the difference between a physical and a chemical change?
 - What is a physical change?
 - What are the characteristics of a phase change?
 - What are some examples of physical changes? chemical changes?

Engage

1. Ask students to watch the Spotlight video on physical change that can be found at the following link, <https://youtu.be/y0NYLvKamrM>. After viewing the video, lead a discussion with students to identify the misconception addressed in the video.

(Misconception: A physical change is a chemical change.)

2. Identify key vocabulary words and phrases in the video.

(Examples: temperature, phase change, chemical change, physical change, molecules, state of matter. Additional words should be added as needed.)

**These words, and other key vocabulary terms, can be found in the NASA eClips™ Virtual Vocabulary, <https://nasaclips.arc.nasa.gov/teachertoolbox/vocab>.

Explore and Explain

Use the Frayer Model to help students develop a conceptual understanding of key vocabulary.

Using a digital interactive Frayer Model enables students to work collaboratively and simultaneously on the same digital document.

Example: Place the word **matter** in the center of the graphic organizer.

1. Facilitate a discussion with students exploring why this word is key vocabulary to this study.
2. **(EXPLORE):** Ask students to brainstorm *characteristics of matter* and add responses to the area with the corresponding heading on the graphic organizer.
3. Ask students to continue their exploration as they research the topic using a variety of resources including their textbook and notes.
4. **(EXPLAIN):** Next, ask students to add *examples and non-examples* in the Frayer model. (*Emphasize the higher-level thinking skill of comparing and contrasting. How are the examples alike/different than the non-examples?*)
5. Using the information provided, ask students to develop their own definition of the word **matter** that is clear and concise. An example to guide work is started below.
6. After completing the example together, assign a new vocabulary word to each group of students to work on collaboratively.
7. Groups will share their Frayer Models and lead discussions to check for understanding of each vocabulary word.
8. Compile final definitions and post so all students have access for later work.

Implementation Note

Within the Frayer Model, students EXPLORE concepts through brainstorming and researching and EXPLAIN and synthesize their understanding.

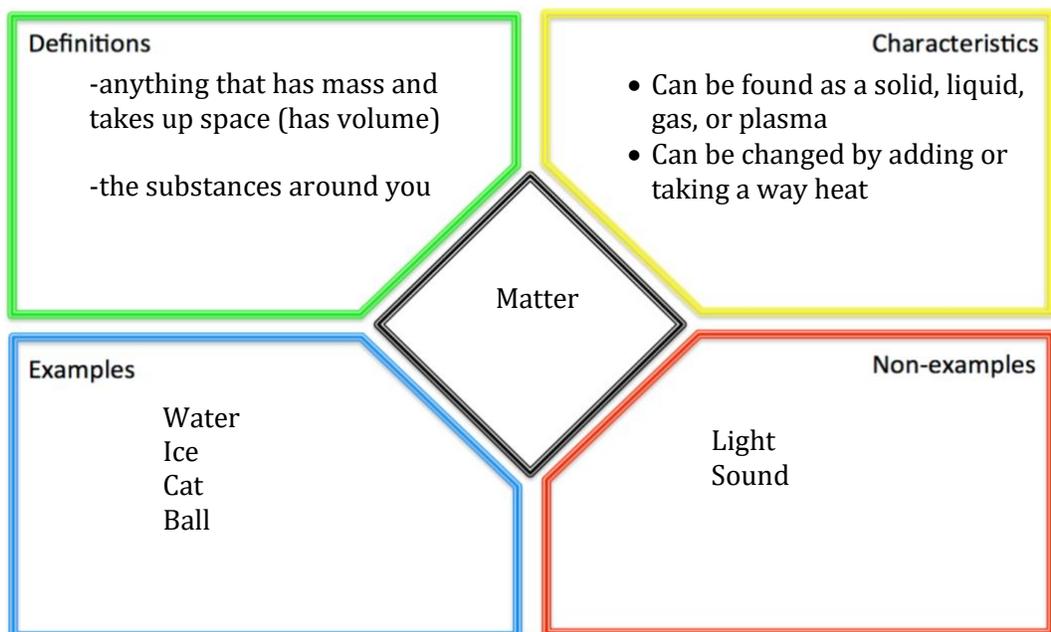
Implementation Note

Doing this activity in pairs or teams builds students' collaboration skills.

Frayer Model for Vocabulary Development

Use the graphic organizer to write definitions, characteristics, examples and non-examples for a vocabulary word. You can include drawings, graphics, and diagrams.

Implementation Note
Developing their own definitions helps students build conceptual understanding.



Evaluate

Return to these discussion questions:

- What is the difference between a physical and a chemical change?
- What is a physical change?
- What are the characteristics of a phase change?
- What are some examples of physical changes? chemical changes?

Compare student responses to the Pre-assessment with student responses to the Evaluate questions to determine if students have a clear understanding of the vocabulary.

Physical Change Pre- / Posttest is included in this packet.

Extend (optional)

For additional videos and activities to reinforce the physical changes of water, visit the related web site linked to the NASA eClips™ video **Our World: ICESat-2 – What is Ice**.

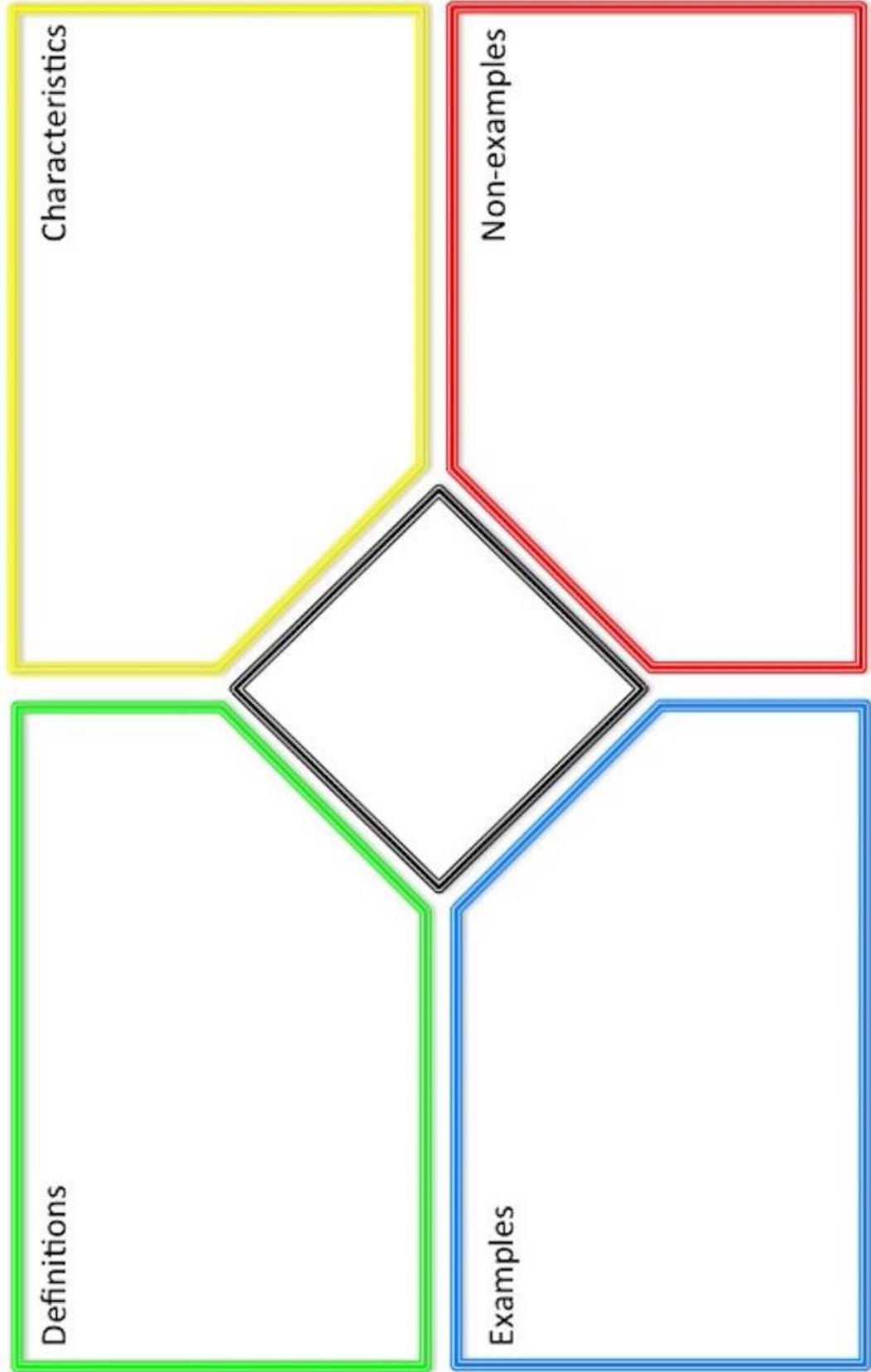
<https://nasaclips.arc.nasa.gov/video/ourworld/our-world-icesat-2-what-is-ice>

Have students research how the physical change of ice in Earth's cryosphere from a solid into a liquid is monitored by the ICESat-2 satellite. <https://icesat-2.gsfc.nasa.gov/mission>

Use this activity, **The Phoenix Mission: Uncovering Martian Water** (lesson 12), to introduce students to the Phoenix Mars Lander's mission to uncover water on the red planet using robotic arms. http://phoenix.lpl.arizona.edu/edu_robotics_lessons.php

Frayer Model for Vocabulary Development

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Physical Change Grades 3-5 Pre / Posttest NASA Spotlight Interactive Lesson

This assessment was designed for the interactive lesson plan featuring the student produced NASA Spotlight video Physical Change. <https://youtu.be/y0NYLvKamrM>

1. Which of the following is NOT a phase of matter?

- A. gas
- B. plasma
- C. sound
- D. liquid
- E. solid

2. Which is an example of a physical change?

- A. wood burning
- B. water vapor turning into liquid water
- C. cooking an egg
- D. combining two elements to create a compound.
- E. a rusting nail

3. When a substance changes from a liquid to a gas or a solid to a liquid it is considered a _____.

- A. mass change
- B. physical change
- C. chemical change

D. molecular change

4. A phase change is a _____

- A. change in mass
- B. change in volume
- C. change in the state of matter
- D. change in odor

5. You are boiling water to cook some noodles. As you watch the pot on the stove you notice bubbles forming on the bottom of the pot. Your brother thinks it is a chemical change. Is he correct?

- A. Yes, it is a chemical change because the bubbles contain oxygen and hydrogen that separated from the water.
- B. Yes, it is a chemical change because the bubbles are now filled with air.
- C. No, it is not a chemical change because the water changes into carbon dioxide.
- D. No, because it is a physical change when liquid water changes to water vapor.

**Physical Change Grades 3-5 Pre / Posttest
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