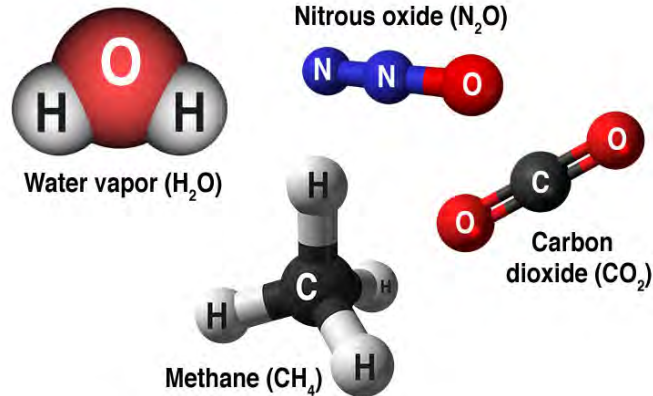




NASA Spotlite Interactive Lesson

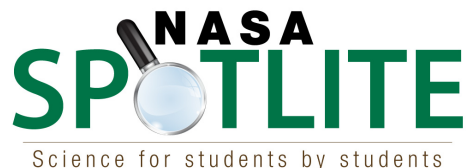
Gases and Mass Grades 5-8



Teacher Packet



NASA Spotlight Interactive Lesson Guide



This NASA eClips™ Spotlight Interactive Lesson supports existing curriculum and should be used as one of many strategies to build students' understandings of science content. The goal of this 5E lesson is to correct the science misconception. Through watching a student-produced video (Engage), completing activities (Explore), learning new vocabulary collectively using a Frayer Model (Explain), and applying new information (Extend/Elaborate), students will develop an understanding of science content and how to correct the science misconception.

This PDF document should be downloaded to use the interactive features. 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.

Try using Adobe Acrobat Reader and Flash Player for optimal performance of all interactive features included in this guide.

An accompanying student packet is located on the NASA eClips™ Website.

What are NASA Spotlights?

NASA Spotlights are 90-120 second student-produced video segments that address common science misconceptions as determined by reputable assessment sources such as the National Assessment of Educational Progress (NAEP),

National Science Foundation (NSF) Factual Knowledge Questions, and the Misconceptions-Oriented Standards-based Assessment Resources for Teachers (MOSART). NASA Spotlights are designed to increase scientific literacy in a standards-based classroom. By producing Spotlight videos, students gain production experience, as well as deepen their understanding of science content. Approved NASA Spotlights can be found at the NASA eClips™ website.
<https://nasaclips.arc.nasa.gov/>

Animated 5E Instructional Model



NASA eClips™ Guides use the 5E constructivist model developed by Biological Sciences Curriculum Study. 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 stages for teaching and learning: Engage, Explore, Explain, Extend (or Elaborate), and Evaluate.

Lesson Information

Science Misconception

Gases have no mass.

Standards

Next Generation Science Standards

- 5-PS1-3: Make observations and measurements to identify materials based on their properties.
- PS1.A: Structure and Properties of Matter
Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.

Objective

As a result of watching the Spotlight video, learning the vocabulary collaboratively using the Frayer Model, and discussing the characteristics of gases, students will be able to use scientific vocabulary to explain that gases have mass.

Time Frame

Between two and three 45-minute class periods:

Day 1 - Engage and Explore

Day 2 - Explain and Elaborate/Extend

Day 3 – Evaluate

Materials

Assessments

Per student: copy of pretest and posttest

Frayer Model Activity

- Per small group: copy of a digital Frayer Model (alternatively, this can be printed)
- Per classroom: chart paper for posting final vocabulary definitions

Background Information

- Gases are matter and have mass and take up space. The mass of a gas can be measured.
- Mass is the measure of the amount of matter in an object, material or substance.
- Matter is made of very small particles called atoms. Atoms are composed of even smaller components. Mass is one of the measurable properties of these components.

Target Vocabulary: gas, phase, compound, matter, volume, mass, weight

Safety

Explain proper use of materials used in the elaborate activity. Review digital citizenship before students use online resources.



This icon identifies the suggested directions and information to read to students.

Save



Remind students to save responses. Suggested steps: Under "file" choose "save as." Type your name in front of the document name. Choose "save."

Engage

Pre-Assessment

Probe for students' prior knowledge using the pre-assessments.

1. Pretest items are located on page 11. Student packets contain a pretest.
2. Essential question
3. Discussion questions (this page)

Essential Question

What are the characteristics of gases?



Today's Lesson

In today's lesson you will learn about the characteristics of gases. Using interactive Frayer Models, you will learn key vocabulary that will help you form a clearer understanding of the properties of gases.

What do you already know about the characteristics of gases? How do you know this?

True or False: Gases have no mass.

Spotlite Video



Next, you will watch a short video on the characteristics of gases. As you watch the video, pay close attention to any new vocabulary. (Example vocabulary: gas, phase, compound, element, matter, volume, atom, mass, weight)



Video Link - NASA Spotlight: Gassy Games

NASA eClips™ Website - https://nasaclips.arc.nasa.gov/spotlite/gas-and-mass/gas-and-mass_nasa-spotlite-gassy-games-aps NASA eClips™
YouTube - <https://youtu.be/WaDrmYjTBIw>

Use the questions to lead the class in a discussion.

1. What did you learn about the properties of gases from watching the video?
2. What is mass?
3. Do gases have mass?

Explore

Explore Activity



Use the interactive to observe the differences between solids, liquids, and gases. How are they alike? How are they different?

On the interactive, press play and then choose a tab to learn more.

States of Matter Home | Credits

Matter Solids Liquids Gases Phase Changes Phase Activity

Getting Started

This learning object will introduce students to the three states of matter.

To use the learning object:

1. Follow the order of the top menu items from left to right.
2. Use the arrows along the screen bottom to navigate within sections.
3. Place your mouse over a term that is blue to generate a definition of that term.
4. Take the Summary Quiz when you have completed all sections to test your understanding of the states of matter and phase changes.

Click on "Matter" to start.

Summary Quiz



Think-Pair-Share

With a partner, discuss how solids, liquids, and gases are alike and different.



Let's compare your answers!

Unlike solids and liquids, the molecules in gases are spread out and constantly moving because they are full of energy. The molecules in gases spread out to fill the container they are in, regardless of the container's shape or size.

Explore

Explore Activity



Draw and label what you think is inside each ball.



Now watch this video. Revisit your drawing and labels.



Video source -American Chemistry Society - Middle School Chemistry http://www.middleschoolchemistry.com/multimedia/chapter1/lesson5 - particles_of_a_gas



Do you still agree with your earlier prediction? Why or why not?

Explain

Vocabulary Development

It's almost impossible to learn science concepts without also learning vocabulary words. Those vocabulary words help people discuss science concepts, so they're important. However, knowing vocabulary words is not the same as understanding science concepts. This section is designed to help your students do more than memorize definitions as they connect the vocabulary to the science concepts that they have explored.

As a class, use the Frayer Model to help students develop a conceptual understanding of key vocabulary.

1. Place the word "mass" in the center of the graphic organizer. (See page 10 for a fillable Frayer Model.) Facilitate a discussion with students exploring why this word is key vocabulary to this study.
2. Ask students to brainstorm characteristics of "mass" 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. Next, ask students to add examples and non-examples in the Frayer Model. Emphasize the higher-level thinking skill of comparing and contrasting.



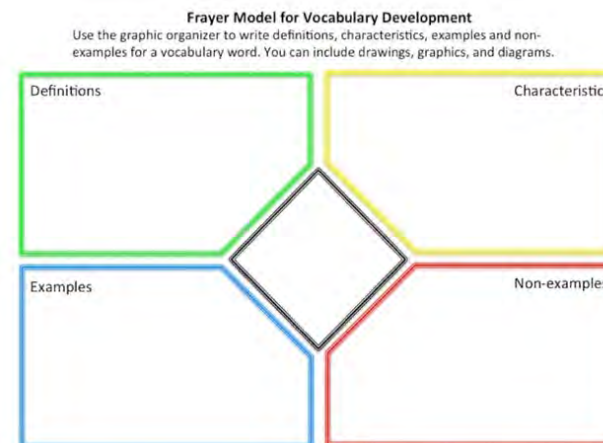
How are the examples alike/different than the non-examples?

5. Using the information provided, ask students to develop their own definition of the word "mass" that is clear and concise. An example is in the Answer Key section of this document (page 14).

6. After completing the example together, assign a new vocabulary word to each group of students to work on collaboratively.



Now complete a new Frayer Model with a partner. Select one word from the key vocabulary list and fill in the graphic organizer. We will share some as a class.



7. Groups will share their Frayer Models and lead discussions to check for understanding of each vocabulary word. Refer to definitions in the Answer Key (page 12).
8. Compile and post final definitions so all students have access for later reference.



You will review key vocabulary. Pay attention to how your definitions compare to standard definitions.

Elaborate/Extend

It is important for the students to explain what's going on by applying what they have learned. It is not unusual for students to have a bit of difficulty with elaborate activities. Students are not used to doing "novel" activities and being asked to apply what they know.

Elaborate/Extend Activity

For additional activities to reinforce content and further assess students' understanding of gases and mass lead students in one of these activities.

1. Does Air Have Weight?

This experimental activity is designed to develop an understanding that air has mass. Students conduct an investigation and observe the change in the position of a bar balancing a balloon inflated with air on one end and an uninflated balloon on the other end.

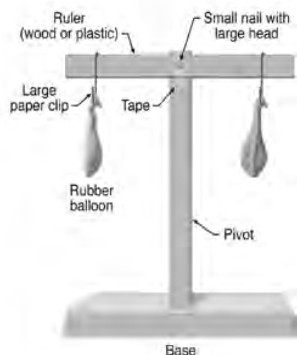
Make sure students understand that both balloons must be the same temperature as the environment.

Activity and Image Source:

https://www.nasa.gov/centers/langley/pdf/245898main_MeteorologyTeacherRes-Ch7.r3.pdf



Does Air Have Weight? How can you use this set up to design an investigation to show that air has mass?

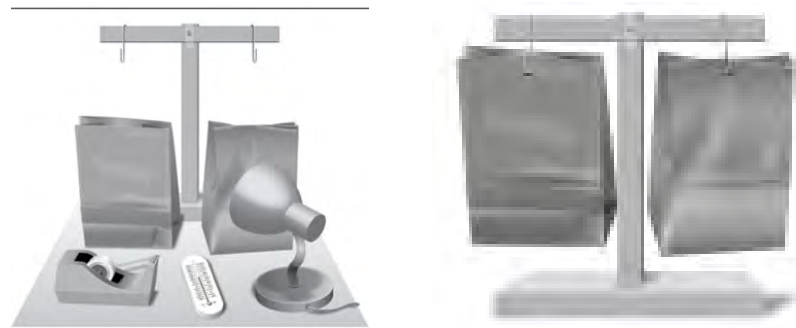


2. Can you Show that the Temperature of Air has an Effect on its Weight and its Direction of Vertical Movement?

This activity demonstrates that warm air and cold air differ in weight.

Activity and Image Source:

https://www.nasa.gov/centers/langley/pdf/245899main_MeteorologyTeacherRes-Ch8.r3.pdf



Each bag is filled with air.

What will happen when one of the bags is carefully heated with the heat lamp?



With a partner, discuss how solids, liquids, and gases are alike and different.

Evaluate

Post-assessment

Check students' understanding with these activities.

Identify Misconception



What is a common misconception about the mass of gases and how can you correct this misconception?

Discussion Questions

1. Do gases have mass?
2. What are the properties of gases?
3. Describe the characteristics of matter.
4. What is mass?

Carefully rewatch the NASA Spotlite video about gases to assess your understanding of their characteristics.



Video Link - NASA Spotlite: Gassy Games

NASA eClips™ Website - https://nasaclips.arc.nasa.gov/spotlite/gas-and-mass/gas-and-mass_nasa-spotlite-gassy-games-aps

NASA eClips™ YouTube - <https://youtu.be/WaDrmYjTBIw>

Vocabulary Review



You are helping a friend fill balloons with helium for the school carnival. Someone took the new tank of helium out of the box and put it next to an identical looking empty tank.

Use your new vocabulary about gases to explain how you can figure out which tank is the new tank that is filled with helium.

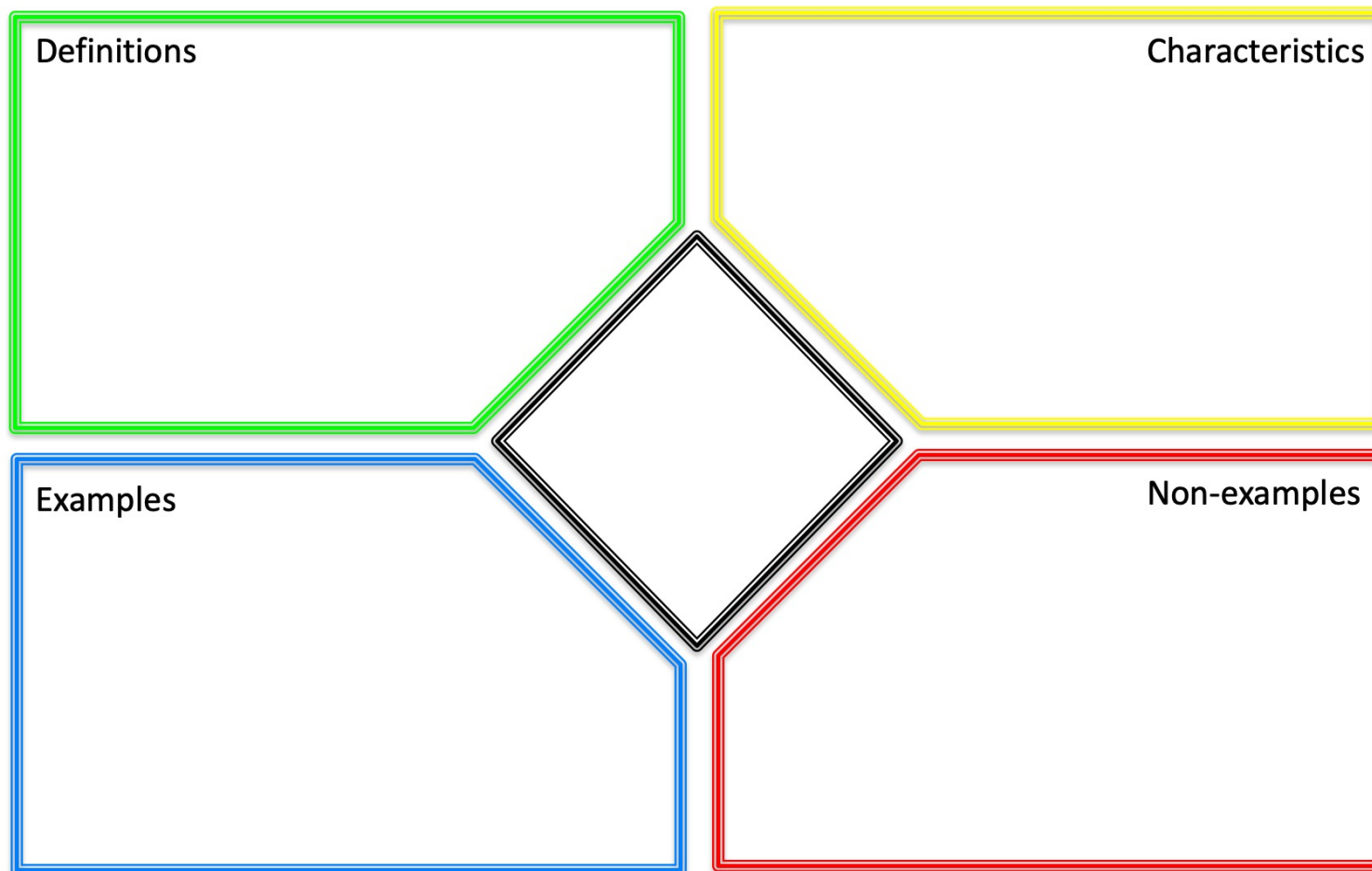


Image credit: Shutterstock.com

Resources

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.



The diagram is a Frayer Model graphic organizer. It consists of a central diamond shape with a black border. Surrounding the diamond are four rectangular boxes, each with a colored border: green for 'Definitions' (top-left), yellow for 'Characteristics' (top-right), blue for 'Examples' (bottom-left), and red for 'Non-examples' (bottom-right). The labels are placed in the top-left corner of each box.

Definitions

Characteristics

Examples

Non-examples

Resources

Gases and Mass Grades 5-8 Posttest NASA Spotlite Interactive Lesson

Read each question and select the best choice.

1. Gases are one of the four phases of

4. This is a measure of the amount of matter in a substance.

6. Jaden blew up a balloon and measured its mass. He then measured the mass of an identical but deflated balloon. Here is what he found.

Inflated Balloon	Deflated Balloon
3.0 grams	0.75 grams

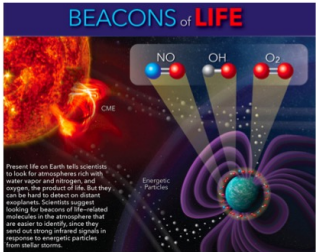
2. All gases

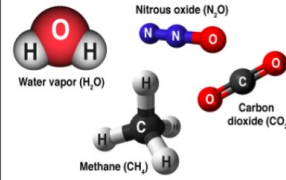
5. The _____ of a gas can be measured.

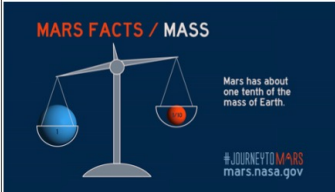
Jaden's experiment illustrated that gases:

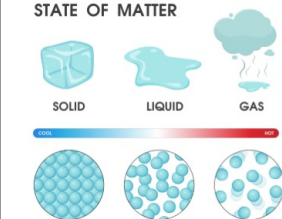
3. A gas, like all matter, is made up of tiny particles called:


Answer Key

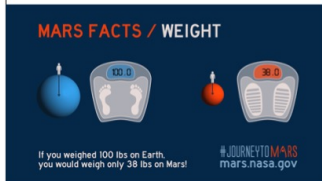
Word	Definition
COMPOUND 	A compound is a substance that is formed by the chemical combination of two or more elements. Carbon dioxide and water vapor are examples of gases that are compounds.

Word	Definition
GAS 	A gas is a state of matter that has no definite shape and no definite volume. The molecules in a gas move rapidly in all directions and spread out to fill the space they are in. Examples of gases include oxygen, nitrogen, carbon dioxide, and neon.

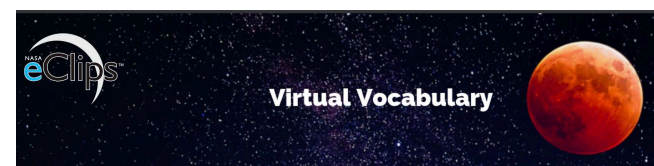
Word	Definition
MASS 	Mass is the amount of matter in an object or substance.

Word	Definition
MATTER 	Matter is defined as anything that has mass and takes up space (has volume), and it is the generic term for the substance of which all physical objects are composed. Matter can be in several different states, including solids, liquids, gases, or plasma.

Word	Definition
VOLUME 	Volume is the amount of space an object or substance takes up.

Word	Definition
Weight 	Weight is the force of gravity on an object. It is affected by an object's mass and the force of gravity. A person's weight on the moon is less than their weight on Earth because of the difference in gravity.

Visit the NASA eClips™ Virtual Vocabulary for more definitions.



Answer Key

Gases and Mass Grades 5-8 Pretest / Posttest NASA Spotlite Interactive Lesson

Read each question and select the best choice.

1. Gases are one of the four phases of

4. This is a measure of the amount of matter in a substance.

6. Jaden blew up a balloon and measured its mass. He then measured the mass of an identical but deflated balloon. Here is what he found.

Inflated Balloon	Deflated Balloon
3.0 grams	0.75 grams

2. All gases

5. The _____ of a gas can be measured.

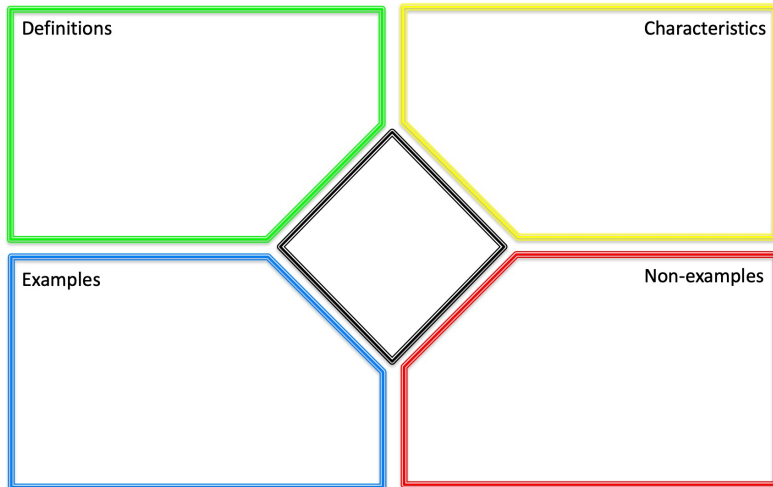
Jaden's experiment illustrated that gases:

3. A gas, like all matter, is made up of tiny particles called

Answer Key

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.



The diagram is a Frayer Model graphic organizer. It consists of a central diamond shape with four quadrants. The top-left quadrant is labeled 'Definitions' and has a green border. The top-right quadrant is labeled 'Characteristics' and has a yellow border. The bottom-left quadrant is labeled 'Examples' and has a blue border. The bottom-right quadrant is labeled 'Non-examples' and has a red border. The central diamond is outlined in black.

Vocabulary Word

- Mass

Characteristics

- number of atoms that are packed into an object
- does not change due to location

Examples

- grams
- kilograms

Non-examples

- light
- sound

Definition

- Mass is the amount of matter in an object or substance.

Product Information

This product has been developed by the National Institute of Aerospace's Center for Integrative STEM Education.

This document is based upon work supported by NASA under award No. NNX16AB91A. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration (NASA).

Published January 2019