

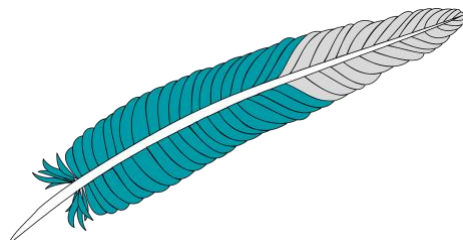
National Aeronautics and Space Administration



Guide Lites

Interactive Lesson: Mass & Weight
Grades 3-5

Mass and Weight



National Standards:**5-PS1 Matter and Its Interactions****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. (5-PS1-1)

The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (5-PS1-2)

Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3)

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Student Misconception

Students incorrectly think that heavier objects fall faster than lighter objects and that mass and weight are the same thing.

Objective

In this activity, students will explain the difference between mass and weight as a result of watching the NASA Spotlite video, learning the vocabulary collaboratively, and discussing how gravity affects falling objects.

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:

- Gravity is an invisible force that occurs between two objects.
- Weight is the force of gravity acting on an object. (Weight is a measure of force.)
- Objects with mass are attracted to each other due to the force of gravity.
- The matter of Earth pulls on an object causing them to fall to the surface of Earth.
- Things near Earth fall to the ground unless something holds them up.
- Objects of different weights but the same size and shape will fall to Earth's surface at the same rate.

Pre-Assessment

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

1. **Mass & Weight** Pre / Post Test is included in this packet. For an electronic version, use this link to view the NASA Spotlite Interactive Lesson Plan – **Mass & Weight** Pre / Post Test at ClassFlow:

<https://prod.classflow.com/classflow/#!/product/itemId=818b56c1e399412f9242c658908c5c3d>

2. Discussion questions:

- ☐ How does gravity affect falling objects?
- ☐ What is mass?
- ☐ What is weight?
- ☐ How does the force of gravity between Earth and an object change as the mass of the object increases?

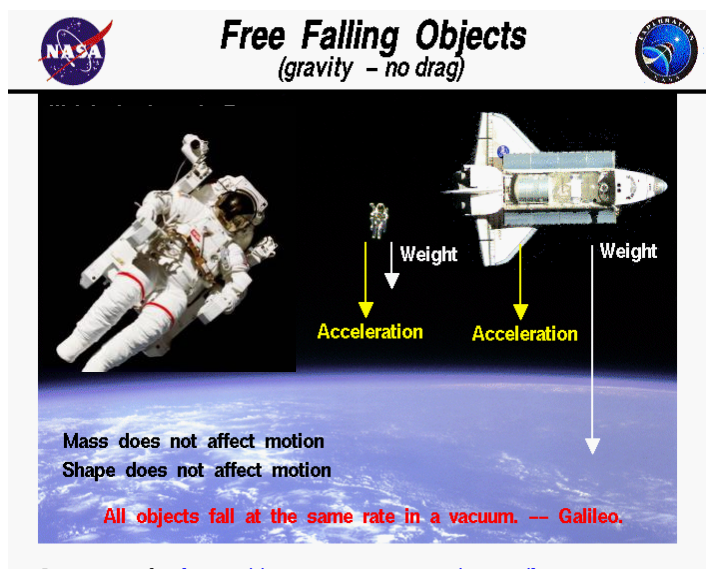


Image credit: <https://www.grc.nasa.gov/www/k-12/rocket/ffall.html>

Engage

1. Ask students to watch the Spotlight video on **Mass and Weight** that can be found at the following link, <https://youtu.be/lyKhxOKekw8>. After viewing the video, lead a discussion with students to identify the misconception addressed in the video.

(Misconception: Heavier objects fall faster than lighter objects.)

2. Identify key vocabulary words and phrases in the video and/or related to this topic.

(Examples: gravity, mass, weight, force, speed, 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 explore ideas collaboratively and simultaneously on the same digital document.

Several digital Frayer models can be found at:

- ClassFlow:
<http://tinyurl.com/FrayeronClassFlow>
- PDF Filler:
<http://tinyurl.com/FrayeronPDFfiller>
- Google Slides
<https://docs.google.com/presentation/d/1a8RaLcmOmSwlYxZBFPWHgbkoEZrJnnp5gicNeElXzjc/edit?usp=sharing>

Implementation Note

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

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

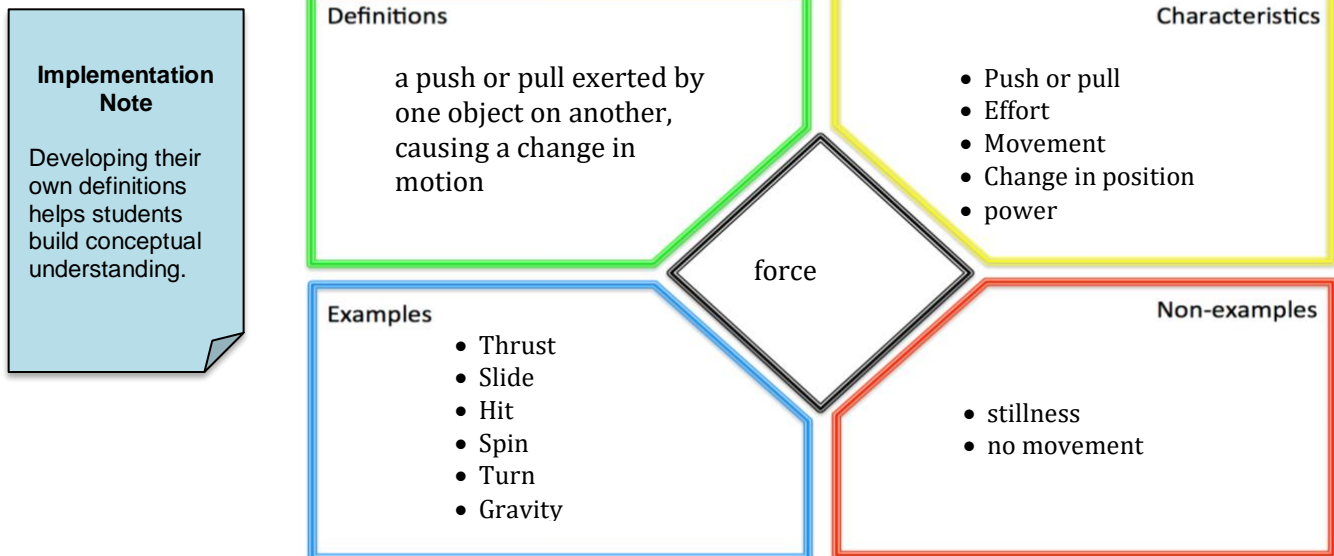
1. Facilitate a discussion with students exploring why this word is key vocabulary to this study.
2. **(EXPLORE):** Ask students to brainstorm *characteristics of force* and add responses to the area with the corresponding heading on the graphic organizer.
3. Ask students to continue their exploration as they research the topic using a variety of resources including their text book 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 **force** 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

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.



Evaluate

Return to these discussion questions:

- ☐ How does gravity affect falling objects?
- ☐ What is mass?
- ☐ What is weight?
- ☐ How does the force of gravity between Earth and an object change as the mass of the object increases?

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

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Extend

To reinforce and extend content knowledge, ask students to view the **NASA eClips™ video Our World: Gravity in Space**

<https://nasaclips.arc.nasa.gov/search/?terms=orbit&playlists=ourworld&v=archive-our-world-gravity-in-space>

To further extend students understanding of the effect of gravity on objects, have students complete the NASA eClips™ activity **Our World: Keeping the Beat**. Students participate in a cardiac relay to deepen understanding of the circulatory system and

make observations of gravity's effects on a water balloon to learn about its effects on water in the body.

<https://nasaclips.arc.nasa.gov/search/?terms=gravity&r=our-world-keeping-the-beat>

Additional NASA resources can be found tagged to this video at the NASA eClips website.

Fray 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 graphic organizer is a central diamond shape with four rectangular boxes attached to its sides. The top box is yellow and labeled 'Characteristics'. The bottom box is red and labeled 'Non-examples'. The left box is green and labeled 'Definitions'. The right box is blue and labeled 'Examples'. The central diamond is white with a black border.

Characteristics

Non-examples

Definitions

Examples



Mass and Weight Pre / Post Test NASA Spotlight Interactive Lesson

This assessment was designed for the student-produced NASA Spotlight video on Mass and Weight. <https://youtu.be/lyKhxOKekw8>

1. Zenola has a wooden ball with a mass of 28 grams, a golf ball of 46 grams, and a metal ball of 110 grams. If she drops the balls at the same time in what order will the balls hit the floor?

- A. Wooden ball, then golf ball, then metal ball
- B. Metal ball, then golf ball, then wooden ball
- C. Golf ball and metal ball together, then wooden ball
- D. All three balls hit the floor about the same time

**This question is adapted from Page Keeley's Probe, Uncovering Students Ideas in Science Vol. 3 page 77.

2. The amount of matter in an object is called _____.

- A. weight
- B. mass
- C. density
- D. grams

3. The measure of how much gravity is pulling on an object is _____.

- A. weight
- B. mass
- C. density
- D. grams

4. The force of attraction between objects is called _____.

- A. weight
- B. mass
- C. gravity
- D. density

5. The force of gravity acting on an object is the object's _____.

- A. matter
- B. mass
- C. volume
- D. weight



**ANSWER
KEY**

**Mass and Weight Pre / Post Test
NASA Spotlight Interactive Lesson**

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