



The Bigger the Heart, the Bigger the Attraction

Relative Gravity and Gravitational Force



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Grade Level	8th Grade	Time Frame	2-3 class period(s)
Subject	Science	Duration	90 minutes
Course	Earth Science, Physical Science		

Essential Question

How do physical properties influence gravitational interactions?

Summary

This lesson builds upon students' understanding of gravity and guides students to understand that gravity is attractive, correlates with mass, and inversely correlates with distance. Students conduct a lab then evaluate various statements about gravity based on their understanding of the lab. At the end of the lesson, students create a Claim, Evidence, Reasoning (CER) statement in which they summarize their understanding of gravity.

Snapshot

Engage

Students respond to a gravity pick-up line and compare the sun to a black hole.

Explore

Students conduct a gravity bucket lab and discuss factors that influence gravity.

Explain

Students evaluate the accuracy of several statements and examine the reasoning behind each one.

Extend

Students compare and contrast the gravity on different planets in the solar system.

Evaluate

Students write a Claim, Evidence, Reasoning (CER) statement that compares a black hole to the sun.

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD304: Determine how the values of variables change as the value of another variable changes in a simple data presentation

IOD402: Compare or combine data from a simple data presentation (e.g., order or sum data from a table)

SIN301: Understand the methods used in a simple experiment

EMI501: Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with two or more data presentations, models, and/or pieces of information in text

Next Generation Science Standards (Grades 6, 7, 8)

MS-PS2-4: Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

Oklahoma Academic Standards (8th Grade)

8.PS2.4: Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

8.PS2.4.1: Gravitational forces are always attractive.

8.PS2.4.2: There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass(e.g., Earth and the sun).

Attachments

- [Always, Sometimes, or Never True Answer Key—The Bigger the Heart, the Bigger the Attraction.docx](#)
- [Always, Sometimes, or Never True Answer Key—The Bigger the Heart, the Bigger the Attraction.pdf](#)
- [Always, Sometimes, or Never True—The Bigger the Heart, the Bigger the Attraction - Spanish.docx](#)
- [Always, Sometimes, or Never True—The Bigger the Heart, the Bigger the Attraction - Spanish.pdf](#)
- [Always, Sometimes, or Never True—The Bigger the Heart, the Bigger the Attraction.docx](#)
- [Always, Sometimes, or Never True—The Bigger the Heart, the Bigger the Attraction.pdf](#)
- [Claim, Evidence, Reasoning—The Bigger the Heart, the Bigger the Attraction - Spanish.docx](#)
- [Claim, Evidence, Reasoning—The Bigger the Heart, the Bigger the Attraction - Spanish.pdf](#)
- [Claim, Evidence, Reasoning—The Bigger the Heart, the Bigger the Attraction.docx](#)
- [Claim, Evidence, Reasoning—The Bigger the Heart, the Bigger the Attraction.pdf](#)
- [Gravity Bucket Lab—The Bigger the Heart, The Bigger the Attraction - Spanish.docx](#)
- [Gravity Bucket Lab—The Bigger the Heart, The Bigger the Attraction - Spanish.pdf](#)
- [Gravity Bucket Lab—The Bigger the Heart, The Bigger the Attraction.docx](#)
- [Gravity Bucket Lab—The Bigger the Heart, The Bigger the Attraction.pdf](#)
- [Gravity Comparative Analysis—The Bigger the Heart, the Bigger the Attraction - Spanish.docx](#)
- [Gravity Comparative Analysis—The Bigger the Heart, the Bigger the Attraction - Spanish.pdf](#)
- [Gravity Comparative Analysis—The Bigger the Heart, the Bigger the Attraction.docx](#)
- [Gravity Comparative Analysis—The Bigger the Heart, the Bigger the Attraction.pdf](#)
- [Lesson Slides—The Bigger the Heart, the Bigger the Attraction.pptx](#)

Materials

- Lesson Slides (attached)
- Claim, Evidence, Reasoning handout (attached; one per student)
- Gravity Bucket Lab handout (attached; one per student)
- Always, Sometimes, or Never True handout (attached; one per group of three students)
- Always, Sometimes, or Never True Answer Key document (attached; one for teacher use; optional)
- Gravity Comparative Analysis handout (attached; one per student)
- Buckets (3.5 gallon or larger; two per lab group)
- Nylon fabric
- Bungee cords

- Scale
- Baseball
- Marble
- Steel ball
- Cue ball
- Wood ball

10 minutes

Engage

Teacher's Note: Lab Preparation

This lesson includes a lab during the Explore phase. The lab includes gravity buckets which must be set up prior to the lab. See the Explore section for details on how to set up and use the buckets.

Use the attached **Lesson Slides** to guide the lesson. Introduce the lesson using the title on **slide 2**. Transition through **slides 3–4** to introduce the essential question and lesson objectives.

Display **slide 5** and share the quote, “Even if Earth didn’t have gravity, I’d still fall for you.” Have students explain why the quote is funny on a piece of paper. Invite a few students to share out their responses.

Display **slide 6** and play the [GIF](#) that compares the mass of a black hole to the mass of the sun. Distribute one copy of the **Claim, Evidence, Reasoning** handout to each student and have them respond to the question on the slide in the left column of the handout.

Teacher's Note: Handout Use

Have students keep their handouts in a safe location so they may use it later or consider collecting the handouts and returning them during the Evaluate phase of the lesson. If you use a science journal or in your class, you could alternatively have students recreate the handout in their notebooks.

30 minutes

Explore

Teacher's Note: Lab Preparation

Prepare the gravity buckets prior to having students conduct the lab. The set up procedures are listed below.

1. Stretch the fabric over the open hole of the bucket.
2. Use the bungee cord to secure the fabric. See the picture below.
3. Repeat for each pair of buckets per lab group.
4. Place a baseball, marble, steel ball, cue ball, and wood ball next to each pair of buckets. You may also choose to have students share sets of balls.



Display **slide 7**. Organize students into groups of three and distribute one copy of the **Gravity Bucket Lab** handout to each student. Have students begin conducting the lab and remind them to record data and observations. As students follow the procedures on their handouts and conduct the lab, walk around the room to assist students and answer questions as needed.

Teacher's Note: Tips for a Successful Lab

This lab works best with groups of three students. Larger groups could lead to some students being left out. If you choose to create larger lab groups, due to limited supplies or space, consider assigning roles to every student in the group to ensure that all students are involved.

As students work, ensure that you are available to answer their questions and assist with lab procedures. Look out for groups that are struggling and approach these groups with questions to guide their thinking in the right direction. As you interact with groups, remind them that labs are about exploring and making observations, even if they don't understand exactly why certain things happen during the lab.

Once the majority of students have completed the lab, regain students' attention and show **slide 8**. Use the questions on the slide to guide a discussion over the concepts from the lab.

25 minutes

Explain

Reorganize students into new groups of three and have students bring their **Gravity Bucket Lab** handout along to their new group. Arrange each group so that students are grouped with any of the members from their lab groups. Present **slide 9**. Pass out one copy of the **Always, Sometimes, or Never True** handout to each group.

Teacher's Note: Always, Sometimes, or Never True

The [Always, Sometimes, or Never True](#) instructional strategy encourages students to evaluate their own interpretations of statements, or “rules,” and assess the veracity of various statements. Activities based around this strategy can prove challenging. Encourage students to work with their groups to complete the handout and prompt them to consider various examples and counterexamples of each statement.

Encourage students to work together with their group members to determine which statements are always true, which statements are sometimes true, and which statements are never true. Allow students time to complete the handout using their prior knowledge and information from the lab.

Have students set aside their handouts in a safe place before the next activity. Do not reveal the correct answers yet.

30 minutes

Extend

Have students remain in their groups. Display **slide 10** and pass out one copy of the **Gravity Comparative Analysis** handout to each student. Have students work in their groups to read the data table present on their handout and respond to questions about the data. Encourage students to use their knowledge from earlier activities to complete the handout.

Draw students' attention back to their Always, Sometimes, or Never True handout. Ask them if the data from the Gravity Comparative Analysis handout changed any of their responses or provided them with any new examples or non-examples.

Transition through **slides 11–26** to review each statement from the Always, Sometimes, or Never True handout. Encourage students to share out how they responded to each statement, then reveal the correct response. As you share the correct categorization for each statement, ensure that you address any examples or non-examples that didn't properly align with a statement. Assist students in understanding how their examples do fit with another statement or concept, or why incorrect examples don't align with certain concepts.

15 minutes

Evaluate

Show **slide 27** and replay the video from the Engage phase that compares a black hole to the sun.

Have students return to their Claim, Evidence, Reasoning handouts. Introduce the components of a [Claim, Evidence, Reasoning \(CER\)](#) response using the following information present on the slide.

- **Claim:** Write a statement about the difference between the gravitational pull of the sun compared to that of a black hole.
- **Evidence:** Provide 2–3 examples of observations from the lab or class activities that support your claim.
- **Reasoning:** Use scientific terminology and explanations to explain how your evidence supports your claim.

Encourage students to formulate a response that incorporates the data from the gravity bucket lab, the Gravity Comparative Analysis handout, and the statements from the Always Sometimes, or Never True activity. Remind students that they must back up their claim with specific evidence from the lesson.

Consider collecting students' CER statements as [Exit Tickets](#). You may also consider using these statements as a formative assessment of the lesson.

Resources

K20 Center. (n.d.). Always, sometimes, or never true. Strategies. <https://learn.k20center.ou.edu/strategy/145>

K20 Center. (n.d.). Bell ringers and exit tickets. Strategies. <https://learn.k20center.ou.edu/strategy/125>

K20 Center. (n.d.). Claim, evidence, reasoning (CER). Strategies. <https://learn.k20center.ou.edu/strategy/156>

NASA. (2008, October 20). *BHBuckets2* [Photograph]. NASA. <https://nightsky.jpl.nasa.gov/news/398/>

NASA. (2008, October 20). *Gravity buckets: Explore black holes and gravity with a bucket and fabric*. Night Sky Network. <https://nightsky.jpl.nasa.gov/news/398/>

Puiu, T. (2017, March 16). *The mass of a supermassive black hole relative to the Sun explained in one crazy GIF* [GIF]. ZME Science. <https://www.zmescience.com/space/supermassive-black-hole-vs-sun/>