Muse® Teacher Guide: March 2024

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Moon's Ascending

In September of 1962, John Kennedy proclaimed to the world, "We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard." And indeed, in 1969, two American astronauts left footprints on the moon. This issue of MUSE magazine explores humans' past and present fascination with the moon.

CONVERSATION QUESTION

How do moons affect planets?

TEACHING OBJECTIVES

- **Students will learn about the conspiracy theories surrounding the 1969 moon landing.**
- **Students will learn how tides affect the push and pull of the moon.**
- **Students will learn why Pluto was reclassified as a dwarf planet.**
- **Students will compare and contrast theories and realities.**
- **Students will obtain information from a nonfiction text.**
- **Students will identify parts of the Scientific Method.**
- **Students will debate the authenticity of America's first moon landing.**
- **Students will represent tidal data on a line graph.**
- **Students will use a mathematical process to solve a theme-based word problem.**

In addition to supplemental materials focused on core STEM skills, this flexible teaching tool offers vocabulary-building activities, questions for discussion, and cross-curricular activities.

SELECTIONS

- **Don't Fly Me to the Moon**
  Expository Nonfiction
- **The Power of Tides**
  Expository Nonfiction
- **The Truth About Pluto**
  Expository Nonfiction

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Don't Fly Me to the Moon

pp. 16–21, Expository Nonfiction

Hailed as the greatest American space event of the time, the landing of Apollo 11 in 1969 is categorized by some as a hoax. This article explains how some seemingly suspicious details have simple explanations.

RESOURCES

Compare and Contrast: Moon Madness

OBJECTIVES

- Students will learn about the conspiracy theories surrounding the 1969 moon landing.
- Students will compare and contrast theories and realities.
- Students will debate the authenticity of America's first moon landing.

KEY VOCABULARY

- ***thermosphere* (p. 17)** the outermost layer of the atmosphere, where air becomes extremely thin and temperature increases steadily with altitude
- ***transmission* (p. 21)** the act of transferring something from one spot to another

ENGAGE

Conversation Question: How do moons affect planets?

Show the class the original footage of the first moon landing in 1969, easily available online. Then discuss the existence of a group of people called "no-moonies" who maintain that the landing was a hoax orchestrated by NASA. Discuss other conspiracy theories and ask why such beliefs can be alluring...but also very dangerous.

INTRODUCE VOCABULARY

Post and read aloud the vocabulary words. Tell students that many new vocabulary words will have Greek and Latin roots, as well as prefixes and suffixes. This knowledge can help readers determine the meaning of an unfamiliar word. Break apart the terms and show the root meanings. Then compare to actual definitions.

thermo = hot; heat / **sphere** = cosmos

trans = across / **mission** = to send

Ask: *How does knowing the meaning of roots, prefixes, and suffixes help to give meaning to unfamiliar words?*

READ & DISCUSS

Reinforce comprehension of the concepts presented in the article by using the following questions to direct discussion.

1. Why do "no-moonies" claim that the 1969 landing never happened?
2. Why do scientists believe that proving no-moonies wrong is important for science and for humanity's future?
3. What is "confirmation bias"?
4. Explain the sources of light on the moon and how they can produce visually confusing results in photos.
5. What made the moon landing and return even more dramatic?

SKILL FOCUS: Compare and Contrast

INSTRUCT: Students will compare and contrast conspiracy theories with legitimate science. Discuss the elements on the graphic organizer, *Moon Madness*. Instruct pairs of students to revisit the text and to underline information that will be helpful for completing the worksheet. Have the partners record the data on the chart but instruct them to complete the THINK TANK assignment independently.

ASSESS: Reconvene and review the *Moon Madness* worksheet. Invite students to read their comparison paragraphs aloud.

EXTEND

Communications: Review with the class that no-moony conspiracy theorists believe that the moon landing was a NASA hoax. Divide the class into two groups—the scientists and the no-moonies. Have students use information from the article to formally debate the topic. Tell students that the goal of a debate is to develop and challenge beliefs in order to establish truth. Debate should include: introduction, claims, evidence, a rebuttal, and a conclusion.

Moon Madness

Compare and Contrast Record the information on the chart and then complete the assignment in the THINK TANK.

Elements	No-Moony Theories	Scientific Facts
Lack of Stars		
Directions of Shadows		
Waving Flag		

THINK TANK: Choose one of the elements from the chart and compare and contrast the facts and the theory in paragraph form.

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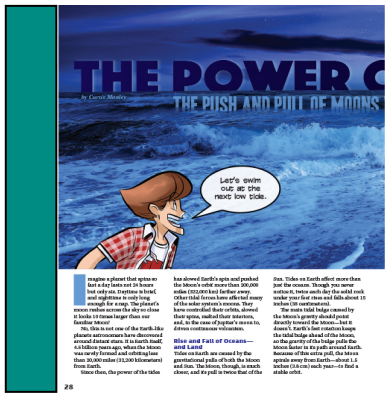
The Power of Tides

pp. 28–30, Expository Nonfiction

Tides on Earth are caused by the gravitational pulls of both the moon and the sun. Readers will explore how the tides affect more than just our oceans.



RESOURCES

Obtain Information: Tidal Flow

OBJECTIVES

- Students will learn how tides affect the push and pull of the moon.
- Students will obtain information from a nonfiction text.
- Students will represent tidal data on a line graph.

KEY VOCABULARY

- ***evolutionary* (p. 29)** relating to a process of gradual change and development
- ***friction* (p. 29)** the resistance that one surface or object encounters when moving over another
- ***volcanism* (p. 30)** the eruption of molten rock from inside the Earth to the surface

ENGAGE

Conversation Question: How do moons affect planets?

Discuss with the class that the moon's pull causes high and low tides. (Note: High tide is when water advances to its furthest extent on the shoreline. Low tide is when it recedes to its furthest extent.) Present students with a variety of scenarios and tell them to stand up if it pertains to high tide and to sit down if it refers to low tide. **Examples:** *this tide is better for fishing; this tide is better for beachcombing; this tide is better for launching a boat, etc.*

INTRODUCE VOCABULARY

Display the following statements and underline the key vocabulary terms. Review how to infer the meanings of new words by using context clues and background knowledge. Then have partners work together to determine the meaning of each word. Reveal definitions.

- The circling of domesticated dogs before they go to sleep is linked to evolutionary behaviors of the wolf.
- When you rub your hands together, the friction causes heat.
- Threats to life from earthquakes exceed that from volcanism.

READ & DISCUSS

Pose the following questions to prompt meaningful discussion. Students should use complete sentences and details to answer each question.

1. How was the orbit of the moon around Earth different 4.5 billion years ago?
2. How have tidal forces affected many of the solar system's moons?
3. Why does the moon spiral away from the earth?
4. How is orbital resonance maintained?
5. How has tidal heating caused changes on the surfaces of different moons?

SKILL FOCUS: Obtain Information

INSTRUCT: Guide students to obtain information from the text, captions, and graphics in the article. Remind them that the article was written to provide readers with interesting facts about the power of the tides. Introduce the *Tidal Flow* worksheet and instruct students to unscramble the words in the word box and then correctly complete the sentences.

ASSESS: Review the worksheet with the class. Challenge students to scramble five additional words from the article for a partner to solve.

EXTEND

STEM: Have the class view a local tide chart from a recent month, available online. Students will create a line graph to represent the heights of the high and low tides over the course of a month. Once the graph is complete, have pairs of students work together to look for patterns and trends in the data and try to explain them. (**Examples:** *Why is there usually a greater range between high tide and low tide during the full moon? How can tides be predicted?)*

Tidal Flow

Obtaining Information Reread the article and gather information to complete the worksheet.

PART I: *Unscramble the words in the boxes below.*

sanocner _____	aitbolr _____	nomos _____	aloniittaravg _____	mvosilnca _____
citrifon _____	edartroger _____	dialt _____	iooatntr _____	tinoluvoerya _____

PART II: *Use the unscrambled words to correctly complete the sentences below.*

1. Tides on Earth are caused by the _____ pulls of both the Moon and the Sun.
2. Many moons show _____ caused by tidal heating.
3. _____ from the tides' rise and fall slows a moon's spin until it keeps the same face toward its host planet at all times.
4. A _____ orbit is one in which the moon moves in the direction opposite to the planet's spin.
5. Earth's fast _____ keeps the tidal bulge ahead of the Moon.
6. George Darwin figured out _____ changes in the Moon's orbit and the length of Earth's day.
7. Moons in _____ with other moons are subject to continuously varying tidal forces.
8. All of the solar system's large _____ are tidally locked.
9. An _____ period is the time it takes one body to make a complete orbit around another.
10. _____ forces can affect moons by controlling their orbits and slowing their spins.

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The Truth About Pluto

pp. 32–35, Expository Nonfiction

Originally gaining status as our solar system's ninth planet over 75 years ago, Pluto was reclassified as a dwarf planet in 2006. Readers will discover the technology and scientific methods that resulted in the formal change.

RESOURCES

Scientific Method: Pluto Problems

OBJECTIVES

- Students will learn why Pluto was reclassified as a dwarf planet.
- Students will identify parts of the Scientific Method.
- Students will use a mathematical process to solve a theme-based word problem.

KEY VOCABULARY

- ***rigorous* (p. 33)** extremely thorough, exhaustive, or accurate
- ***innovation* (p. 34)** a new method, idea, or device

ENGAGE

Conversation Question: How do moons affect planets?

Present the title of the article, "The Truth About Pluto," and have students share what they know about the topic. Many students may know that it was stripped of its planet status, but most will not know that Pluto was named by an 11-year-old girl. Give students a few moments to discuss what they would name a newly discovered planet.

INTRODUCE VOCABULARY

Post the key terms and discuss the definitions. Then display the following questions and have students supply the correct answers.

1. *Which do NOT take **rigorous*** effort?

a) marathon training b) reading a blog c) studying for exams d) eating

2. *Which is NOT an **innovation** of the 21st century*?

a) autonomous vehicles b) 3D printing c) telephone d) bluetooth

READ & DISCUSS

Read the article aloud with the class. Have students reread the article in small groups to answer the questions below. Share responses.

1. Why was Pluto a loveable symbol for an underdog?
2. How is Galileo's work an early example of the "scientific method in action"?
3. Explain the two main categories that the planets in our solar system fall into.
4. Why did some scientists think that Pluto was too much of an outlier to be considered a planet?
5. How did new information about objects in the Kuiper Belt lead to Pluto's reclassification?

SKILL FOCUS: Parts of an Experiment

INSTRUCT: The five key components of the scientific method are: question, hypothesis, experiment (procedure), observation, and conclusion. This method is important in obtaining new information and for finding out how things work. Present the *Pluto Problems* worksheet and tell students that they will need to define each part of the process and then identify an example of each step.

ASSESS: Collect the worksheet to assess the students' ability to correctly identify the parts of an experiment. Remediate if necessary.

EXTEND

Mathematics: Display the following fact: ***A day on Pluto is 153 hours*.** Have students use the RDW process (Read-Draw-Write) to solve the following mathematical questions:

A) ***How much longer is a day on Pluto than a day on Earth?*** (Ans: 129 hours)
B) ***How many hours are in a week on Earth?*** (Ans: 168 hours)
C) ***How many hours are in a week on Pluto?*** (Ans: 1,071 hours)
D) ***How many hours shorter is an Earth week than a Plutonian week?*** (Ans: 903 hours)

Pluto Problems

Scientific Method Use information from the article, and other resources if necessary, to complete this page.

Part I: Provide a definition for each part of the Scientific Method.

QUESTION:	HYPOTHESIS:	

PROCEDURE:	OBSERVATION:	CONCLUSION:

Part II: Identify the statements below as representing one of the parts of the Scientific Method. (Q, H, P, O, C)

_____ 1. At the Lowell Observatory in Flagstaff, young astronomers tested some planet-hunting techniques.

_____2. Pluto does not meet the scientific criteria for being classified as a planet.

_____3. If Pluto does not fit into one of the two categories (terrestrial or gas giant), then it is not a planet.

_____4. Is Pluto a planet?

_____5. Modern astronomers used new telescopes to observe the Kuiper Belt and located other rocks the size of Pluto.