Muse® Teacher Guide: March 2021

MUSe.

Far Away Worlds

3, 2, 1...Blast Off! This issue of MUSE magazine examines the enormous amount of research, construction and problem solving that must take place on Earth before inhabiting an exoplanet can become a practical reality. Although this possibility may be 'light years' away, readers will learn how scientists are taking 'a giant leap for mankind' in the right direction!

CONVERSATION QUESTION

How are we searching for life on other planets?

TEACHING OBJECTIVES

- Students will learn about the search for habitable planets.
- Students will learn how the Caris Mirror Lab is playing an integral part in the search for exoplanets.
- Students will learn how researchers are studying the possibility of triggering long periods of dormancy in humans.
- Students will compare and contrast the different scenarios in which life on other planets is possible.
- Students will demonstrate the ability to properly sequence and explain a studied process.
- Students will analyze problem and solution relationships.
- Students will work collaboratively to 'discover' a new planet.
- Students will write a persuasive essay.
- Students will use a mathematical process to solve a science-based word problem.



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

SELECTIONS

- No Place Like Home Expository Nonfiction, ~1100L
- Life at First Sight
- Expository Nonfiction, ~1100L
- Wake Me Up When We Get There
- Expository Nonfiction, ~1100L

No Place Like Home

pp. 16-19, Expository Nonfiction Explore the elements of space with astrophysicist, Avi Loeb. Many experts agree that alien life forms exist in the cosmos...do YOU?



RESOURCES

Compare and Contrast

OBJECTIVES

- Students will learn about the search for habitable planets.
- Students will compare and contrast the different scenarios in which life on other planets is possible.
- Students will work collaboratively to 'discover' a new planet.

KEY VOCABULARY

- astrophysicist (p. 17) an expert in the study of space, planets and the universe
- *radiation* (p. 18) emission of energy that comes from a nuclear reaction
- *cosmos* (p. 19) every physical thing the universe

ENGAGE

Conversation Question: How are we searching for life on other planets?

Post the title of the article, "No Place Like Home". Ask students what that phrase means to them personally and invite them to share their thoughts. Then have them consider the meaning of the phrase on a global level. How did the interpretation of the words change?

INTRODUCE VOCABULARY

Post the key vocabulary and discuss the definitions. Guide students to notice that all of the words are nouns, however one is a person, one is a place and one is a thing. Have students identify the type of noun for each term, and then write a complex sentence using each word correctly.

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. What is the most logical way to search for habitable planets?
- 2. What is the Goldilocks zone?
- 3. Why are space programs planning missions to investigate Europa and Enceladus?
- 4. Why was discovering phosphine in Venus' clouds a sign of possible life?
- 5. What could provide heat to a planet, other than a star?
- 6. Explain the three factors that would make a particular galaxy a good place for life to arise?

SKILL FOCUS: Compare and Contrast

INSTRUCT: Students will compare and contrast different scenarios in which life on other planets is possible. Instruct pairs of students to revisit the text and to underline information that will be helpful for this purpose. Introduce the graphic organizer, *Signs of Life*, and have the partners record the data on their charts.

ASSESS: Reconvene and review *Signs of Life* worksheet with the class. Reiterate that the chart focuses on where, how and when. Write a paragraph explaining WHY we are searching for other habitable planets. Which scenario from the chart seems the likeliest? Explain.

EXTEND

Science Have students work with their partner from the SKILL FOCUS activity above to 'discover' their own habitable planet. They will choose a name, location and create a drawing to represent the planet. Instruct the groups to use information from the article, in addition to other resources to explain why their planet is habitable. They will create a poster announcing their discovery to share with the class. Encourage them to include special features and fun facts that highlight their extraordinary finding.

Signs of Life

Compare and Contrast Use information from the article to compare the different scenarios in which life on other planets may be possible. Record 'how' and 'when' life is plausible in each environment.

Where?	How?	When?
Life beneath ice-covered seas		
Life way above a planet's surface		
Life on a planet with no star		
Life in other galaxies		

Life at First Sight

pp. 32-35, Expository Nonfiction

This article introduces students to the Caris Mirror Lab, where the search for exoplanets begins. Readers will learn how giant mirrors are made and how they are helping to create an extraordinary telescope that scientists hope will document signs of life on other planets.



RESOURCES

Sequencing a Process

OBJECTIVES

- Students will learn how the Caris Mirror Lab is playing an integral part in the search for exoplanets.
- Students will demonstrate the ability to properly sequence and explain a studied process.
- Students will write a persuasive essay.

KEY VOCABULARY

- *apparatus* (p. 34) the technical equipment or machinery needed for a particular activity or purpose
- *turbulence* (p. 34) violent or unsteady movement of air or water
- *exoplanet* (p. 35) a planet that orbits a star outside the solar system.

ENGAGE

Conversation Question: How are we searching for life on other planets?

Inform students that "Life at First Sight" is an informational article that presents the reader with an abundance of information about the giant mirrors being created at Caris Labs. These amazing structures are a key component of the Giant Magellan Telescope that is searching for extraterrestrial life. On page 34 of the text, it sates that the giant mirror will measure 27.5 feet (8.4 m) in diameter. Review the definition of 'diameter' and have the students arrange themselves in a circle of this size so that they can appreciate the enormity of this mirror.

INTRODUCE VOCABULARY

Post and discuss the key vocabulary words and definitions on the board. Then display the following cloze sentences and have students supply the correct word: The plane hit quite a bit of ______ during our flight. / You will need an instrument much stronger than your backyard telescope to see an ______. / Crews wearing a breathing ______ spent more than five hours fighting the fire.

READ & DISCUSS

Post and discuss the questions prior to reading. Read the article aloud, pausing when answers to the questions are revealed and encourage students to elaborate.

- 1. What are the mirrors produced by Caris Labs made of? Why is their unique design necessary?
- 2. How is the giant mirror transported to its destination?
- 3. Why is the Atacama Desert an optimal place for the observation?
- 4. Explain the construction of the GMT and its significance.
- 5. What are some of the obstacles that are hindering the search for signs of life on other planets?

SKILL FOCUS: Sequencing a Process

INSTRUCT: Review the article and guide students to notice that there is a long and difficult process involved in making a huge mirror for the GMT. Distribute the *Extraterrestrial Reflections* graphic organizer and instruct students to condense the process into four important steps that detail the specific sequence that Caris Labs must follow to produce a perfect mirror.

ASSESS: Circulate as children are working and have students retell the process in their own words. Collect and evaluate charts for accuracy.

EXTEND

Language Arts The final sentence of the article asks the question, "Are we alone in the universe?" Allow a few minutes for open discussion and then tell the class that they will be writing a persuasive essay that supports their position on this issue. Remind students that the purpose of this type of essay is to convince the reader that the writer is making a valid claim. Research to support claim will be needed. (A persuasive essay should include introduction, thesis, main body, and conclusion.)

Extraterrestrial Reflections

Sequencing a Process Reread the article and highlight sentences that detail the process involved in making the giant mirror for the Giant Magellan Telescope (GMT). Condense the process into four steps and explain each step in the proper order.



Wake Me Up When We Get

There

pp. 38-40, Expository Nonfiction

Students will learn how scientists are taking cues from the Animal Kingdom and applying them to our Space Program. Different forms of hibernation are being studied to determine how to induce 'hyper sleep' in humans, so that long space voyages to other planets will be possible.



RESOURCES

Problems and Solutions

OBJECTIVES

- Students will learn how researchers are studying the possibility of triggering long periods of dormancy in humans.
- Students will analyze problem and solution relationships.
- Students will use a mathematical process to solve a science-based word problem.

KEY VOCABULARY

- hibernation (p. 40) extended period of an animal spending the winter in a dormant state
- torpor (p. 40) a state of inactivity necessary for survival of cold conditions that involves physiological changes related to body temperature, metabolism and water balance

ENGAGE

Conversation Question: How are we searching for life on other planets?

Show a video clip from the 2016 motion movie picture, "Passengers" that shows characters sleeping in suspended animation on a journey through space. The passengers are on a 'routine' journey through the cosmos, destined for their new home. Discuss why 'sleep mode' would be necessary, and how likely it is that scientists will figure out how to induce this type of sleep in the near future. There are many sci-fi movies and books that depict this scenario. Invite students to share examples.

INTRODUCE VOCABULARY

Post the key terms and meanings and instruct students to read through the definitions. Have them infer which word indicates a deeper state of inactivity (hibernation). Expand student knowledge by introducing the word 'estivation'. Referred to in the article, though not mentioned by name, this is a specific form of hibernation that takes place during summer months, so that certain animals (some reptiles, amphibians, fish, etc.) can survive hot and dry conditions.

READ & DISCUSS

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

- 1. What conditions do we believe are necessary to support life on other planets?
- 2. What is one of the biggest obstacles when considering space travel to other planets?
- 3. How do scientists think that mammals survived the environmental changes that triggered the extinction of dinosaurs?
- 4. What options are researchers considering to trigger torpor?
- 5. Other than hibernation, what other factors complicate plans to journey beyond our solar system?

SKILL FOCUS: Problem and Solution

INSTRUCT: Inform students that they will be rereading the article with a partner and highlighting passages that depict how researchers are addressing problems regarding the feasibility of traveling light years away to new planets. Distribute copies of the graphic organizer, *Fast Asleep,* and tell students that they will be responsible for recording the problem/solution relationships from the article. Pairs should discuss their findings as they work and consult with other groups if necessary.

ASSESS: Review the information that the students listed on their charts. Evaluate the thoroughness and accuracy of their statements.

EXTEND

Mathematics The article states that the nearest exoplanet is 4.2 light years away. Assuming it would take about 37, 200 years to travel one light year, how long would it take to reach the exoplanet? Use the Read-Draw-Write process to show your mathematical thinking.

Fast Asleep

Problems and Solutions Refer to the article to identify and record problems that researchers are currently addressing in efforts to secure the possibility of humans inhabiting other planets in the future. Use the 'solutions' column to explain how these problems are being approached.

Problems	Solutions
(What's needed?)	(What's being done?)
Planetary Conditions	
Travel Conditions	

Explain how a radical evolution in our understanding of the universe could affect the reality of humans inhabiting other planets.