

BEFORE-VIEWING ACTIVITIES

Activity 1 Life in the Universe

Grades 2–5

Materials: Worksheet 1a (What is Life?)—see page 21

Purpose: To establish student interest in and common knowledge about concepts of Biology and Astrobiology, and to raise their own questions about scientific study of extraterrestrial life **prior to watching the film.**

Topic focus: Scientific ideas about the nature of life and the conditions that make it possible (on and off Earth).

Focus questions: What do you think is the difference between living and non-living things? What would you name as the basic requirements of life?

Disciplinary Core Ideas: Life Science

LS1A-Structure and Function

LS1B-Growth and Development of Organisms

Time allocation: 30 minutes

Teaching strategy: Think/Pair/Share



What to do:

Working as a class

Understanding and using definitions: How would you define life? What makes something ‘living’? What do you think might be some of the basic requirements of living things? What is living versus non-living? What would you list as the basic conditions needed for life to exist on Earth? What do scientists explore about life on Earth? Where is life on Earth found?

Working individually and then pairs

Reflecting on understandings: Hand out and go through **Worksheet 1a: What is life and what are its needs?** Ask students to record their initial ideas by completing the worksheet individually in preparation for sharing with a partner.

Working as a class

Using science: Discuss student ideas: How important is water to life? Could life exist without water? Why do living things need energy?

Drawing conclusions: Do you think there might be life elsewhere in the universe? How would we know? Begin a class PowerPoint listing the students’ questions about biology and astrobiology.

Extension: *The Search for Life in Space* describes one area that is at the frontier of science: discuss with students their ideas on what areas of knowledge being explored in science they find most interesting at this time.

Middle School

Materials: Worksheet 1b (Astrobiology—Are We Alone in the Universe?)—see page 22

Purpose: To establish student interest in and common knowledge about astrobiology by encouraging students to explore their own prior assumptions, knowledge, thoughts and questions about extraterrestrial life, prior to watching the film.

Topic focus: For students to consider scientific ideas about the nature of life and the conditions that make it possible (on and off Earth) and raise interest on the topic of the film by asking students to record what they currently know, think and wonder about the topic.

Focus questions: What do you think is the main reason we search for life in space? How important is this search to you? What do you think are the possibilities of life elsewhere in the universe (and should we be searching

for it)? What would you describe as the necessary conditions for life to exist and survive?

Disciplinary Core Ideas: Life Science

LS2B-Cycles of Matter and Energy Transfer in Ecosystems

Earth and Space Sciences

ESS1B-Earth and the Solar System

Time allocation: 30 minutes

Teaching strategy: Sharing prior knowledge using Think/Know/Wonder to raise student questions.

What to do:

Working as a class

Hand out and go through the task for Worksheet 1b. Ask students to offer their initial ideas about:

- a. What is life? How would you define it? What makes something 'living'?
- b. What are the basic conditions needed for life to exist?
- c. What are the chemical signatures of life? Where might these be found 'off Earth'?
- d. What do you think are the chances that we are alone in the universe? Do you think it is important to search?
- e. Why do we want to search for off-Earth life? Introduce and define the term 'astrobiology.'

Working in groups

Students complete Worksheet 1b in preparation for sharing and discussing as a class. Encourage question-raising about how scientists might explore these ideas and where students have learned about this in their schooling and everyday life.

Discuss students' ideas about three requirements of life listed in the film. How important is water to life? Could life exist without oxygen? Why do living things need energy?

Discuss with students their ideas on what areas of knowledge are suitable for exploration in science. Ask:

- a. What are some of the major areas of science that you think are important to pursue?
- b. How much do we know about life on Earth?
- c. Do you think there might be life elsewhere in the universe? How would we know?

Discuss responses to Question 4 on the worksheet to share students' current ideas about the topic of the film, to identify pre-existing areas of interest and share questions raised in preparation for watching.

Begin a class PowerPoint listing the students' questions about astrobiology and the search for life in space, which will be added to after watching the film. If students have little knowledge of space probes and their findings you might want to have the groups explore the NASA and ESA websites prior to watching the film.

Extension: Science fiction 'aliens.' Links to English and Media Arts outcomes.



Questions and Discussion Starters

The following is a list of possible discussion starters that teachers can consider using depending on their study focus. The questions are divided into four groups, corresponding to one of the four labelled sections of the film. These starters link directly to the activities that follow in this study guide.

Curriculum focus:

Life Sciences, Earth and Space Science.

These questions could be given as a handout along with **Worksheet 2: What I understand about the Search for Life in Space** for students to record responses after viewing.

Part 1

How, where and why do we search for extraterrestrial life?

1. Why do you think we search for extraterrestrial life?
2. What did the Voyager and Cassini probes find about the solar system's worlds?



3. What do astrobiologists understand as the basic requirements of life?
4. What are some of the 'surprises' that life comes up with?
5. How do you think the Hawaiian islands were colonised by life?

Part 2

What are the basic requirements of life?

1. What is the importance of water for life?
2. How do planets form?
3. What are some ways that living things gain water, energy and nutrients at extremes?
4. What evidence is there for life on Enceladus, Mars and the moons of Jupiter?
5. What is the likelihood of water on Mars, and how do we know?

Part 3

How are exobiologists searching for possibilities of life off Earth?

1. What are the basic requirements of life?
2. How do water bears (tardigrades) survive extremes?
3. How common do you think life in our solar system might be?
4. Would you be surprised if we found life somewhere else in our solar system?
5. Why are the possibilities more exciting beyond our solar system?

Part 4

What technologies are used by scientists to search for life inside and outside our solar system?

1. How can exoplanets be identified?
2. How does the Kepler space observatory identify planets?
3. What do exobiologists look for on exoplanets once they are discovered?
4. What are the biosignatures of Earth-like life?
5. How might space probes and telescopes help increase knowledge of possibilities of life on Mars and other worlds?

Worksheet 1a (Grades 2–5)

What Is Life and What Are Its Needs?

Work in groups of up to four.

Name(s):

Biology is defined as the study of life. Astrobiology is therefore ... ?

Focus question: What is life and how are scientists searching for life elsewhere in our solar system?

Your task: Record what you know about the requirements of life and the possibilities that life exists elsewhere in the universe.

What to do: Working alone, record your ideas about each of the questions listed below and then pair up with a partner to discuss your ideas.

1. What is life? Using your own words write a definition of 'life'.
2. What are some major groups of living things and how would you recognize them?
3. Basic requirements for life to exist include water, oxygen, energy source and a suitable temperature. Complete the table showing what you know about these basic requirements.
4. Where do you think scientists might look for life in other parts of the solar system? Why?

Extension: Frontiers of science: How important or interesting is the scientific study of astrobiology to you? Discuss with students their ideas on what areas of knowledge being explored in science they find most interesting at this time.

Requirements of Life

Requirement	Why is it important?	How do you know?
Water		
Energy		
Oxygen		
Temperature		

Worksheet 1b (Middle School) Astrobiology: Are We Alone in the Universe?

Work in groups of up to four.

Name(s):

Focus question: What do you think, know and wonder (TKW) about scientists searching for life elsewhere in the solar system and/or the universe?

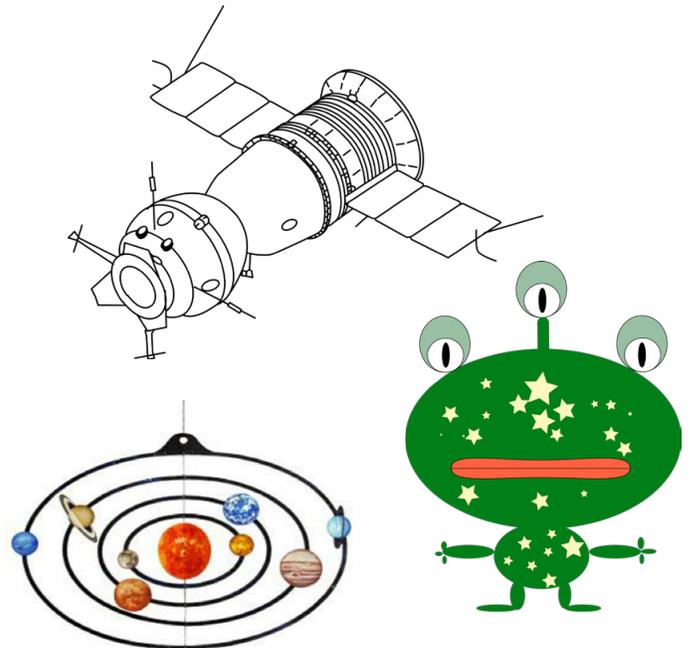
Your task: Record your ideas about astrobiology and the possibilities that life exists elsewhere in the universe.

What to do: Working alone, think about each of the questions listed below. Then, in your group, discuss and record:

- (a). one thing you think or know about the idea of the question; and
- (b). one question you have about the idea.

1. Do you **think** there might be life elsewhere in the universe? How would we know?
 - a. We think ...
 - b. We wonder ...
2. How much do you **know** about scientific understandings of the requirement for life on Earth?
 - a. We know ...
 - b. We wonder ...
3. What do you think are the main reasons people think we should, or should not, search for life off Earth?

Example images:



4. Is this a topic you think is worthy of scientific investigation (and funding)? How does it rate for you compared with other major areas of science that you think are important to pursue?
 - a. We know/think ...
 - b. We wonder ...
5. What would you expect to see and learn about in a documentary called *The Search for Life in Space*? Do you often watch, or like to watch, documentaries? How about documentaries about life, or about space? What questions do you hope might be addressed or answered in this film?

List two questions or ideas you think might be covered in the film to add to a class list for discussion as a class.

Extension: Explore 'aliens' presented in science fiction films and books. You might begin with HG Wells' *The War of the Worlds*.

	For (Positive)	Against (Negative)
a. We think ...		
b. What we would like to know...		

AFTER-VIEWING ACTIVITIES

Activity 2: What I Understand About the Search for Life in Space

Grades 2–5:

The task: Review the main ideas about the nature of life, its basic requirements and where it might be found (as covered in *The Search for Life in Space* and students' responses/reactions/ideas while watching the film).



Teaching Strategy: Whole class discussion (using selected questions as prompts).

What to do:

Before teaching, make a selection of the questions listed on Page 11.

Working as a class

Discuss each of the four sections of the film. Record students' ideas and questions raised as part of a class discussion.

Part 1 How, where and why do we search for extra-terrestrial life?

Part 2 What are the basic requirements of life?

Part 3 How are exobiologists searching for possibilities of life off Earth?

Part 4 What technologies are used by scientists to search for life inside and outside our solar system?

Have students select or create one or more questions to research further.

Middle School

Focus questions: What do we now know? What do we want to know?

Materials: Worksheet 2 (What I Understand About the Search for Life in Space)—see page 23

What to do:

Working as a class

Ask students what they think are the main ideas of astrobiology. What was shown in the film about what astrobiologists are most interested in exploring today?

Working in groups

Hand out Worksheet 2. Have students record what they know, think or feel about the content relating to the nature of 'life' in each of the four sections of the film:

Part 1 How, where and why do we search for extra-terrestrial life?

Part 2 What are the basic requirements of life?

Part 3 How are exobiologists searching for possibilities of life off Earth?

Part 4 What technologies are used by scientists to search for life inside and outside our solar system?

Working as a class

After recording their ideas on Worksheet 2, ask students to share in class discussion and add to the class ideas PowerPoint about what was covered in each of the four sections of the film (see Questions and Discussion Starters, page 11), and what they now think and feel about the topics covered.

Culmination/conclusions: Discuss student ideas and questions after they add to the class PowerPoint list of questions and ideas for further investigation. These might be used to guide students to develop their questions into projects and investigations. Display the class list of their ideas with their names next to their suggestions. As the work on the film progresses, tick off ideas that are covered in further activities, and add to and delete ideas as appropriate throughout the class study of the film as you review the activities covered.



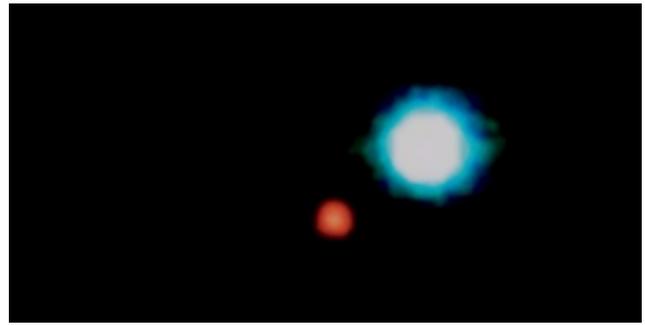
Worksheet 2 (Middle School)

What I Understand About the Search for Life in Space

Name(s):

The task: Review the main ideas about what life is, as covered in *The Search for Life in Space*, as well as your own responses, reactions and ideas while watching the film.

Focus question: Where can life exist and what are the basic requirements for life?



What to do: Respond to the ideas about the nature of life and where it might be found presented in each of the four sections of *The Search for Life in Space* by:

- a) In column 2, writing your answer to the question;
- b) Commenting in column 3 on what you **think** and **feel** about the ideas in that section of the film.

Further explorations: Add to a class list of **questions and activity ideas** relating to the nature of life you might be interested in exploring further:

Our Ideas

- 1.
- 2.

	How was the question answered:	What I/we think/feel:
Part 1 (00:50–10:00) How, where and why do we search for extraterrestrial life?		
Part 2 (10:00–18:00) What are the basic requirements of life?		
Part 3 (18:00–24:00) How are exobiologists searching for possibilities of life off Earth?		
Part 4 (24:00–31:00) What technologies are used by scientists to search for life inside and outside our solar system?		