

Name: _____

Date: _____



Astrobiology, OSIRIS-REx and The Search for the Origins of Life

Important Vocabulary

Astrobiology:

Evolution:

Asteroid:

Meteorite:

Biosphere:

Organic compounds:

Carbonaceous chondrites:

OSIRIS-REx mission:

Vocabulary List

Astrobiology: The scientific study of life in the Universe. It explores questions about life's origin, evolution, and potential distribution on other planets, moons, and celestial bodies beyond Earth.

Evolution: The process by which different living organisms are thought to have developed and diversified from earlier forms during the history of the Earth.

Asteroid: A small rocky object that orbits the Sun, primarily found in the asteroid belt between Mars and Jupiter. They vary in size, from tiny particles to larger bodies, and are remnants from the early days of our solar system.

Meteorite: A piece of rock or metal that falls from space and lands on Earth's surface. It comes from asteroids or other celestial bodies and can vary in size from tiny fragments to larger masses.

Biosphere: Refers to all the places in the Universe where life exists, including Earth and any other planets, moons, or celestial bodies that may support living organisms.

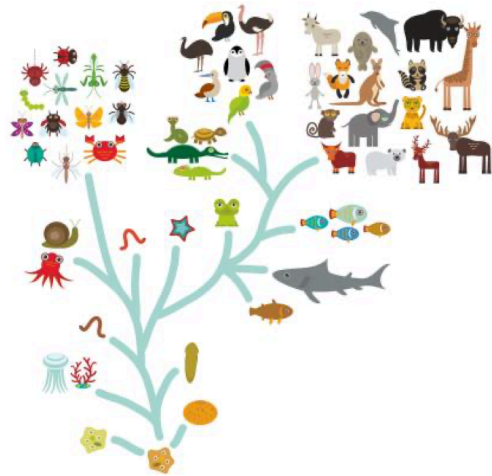
Organic compounds: A type of molecule that contains carbon atoms bonded together, often combined with other elements like hydrogen, oxygen, nitrogen, or sulfur. Organic compounds are the building blocks of living things and play essential roles in many chemical processes.

Carbonaceous chondrites: Special rocks from space that contain carbon, a key ingredient for life. They are time capsules from the early solar system, helping scientists learn about how planets formed and how life might have started.

OSIRIS-REx mission: A NASA spacecraft mission led by the University of Arizona, designed to study and collect a sample from an asteroid named Bennu. One of its main goals is to learn more about the origins of our solar system and the potential for life on other celestial bodies.

Evolution & Natural Selection Review

_____ causes life to
_____ over time!
Living organisms need certain
environmental conditions to
_____ and _____.
_____ has an environment that
has allowed life to evolve to its
current state!



Looking at Earth & Space: Group Activity

Instructions: With your group, consider what is essential for life to exist on Earth. Use the knowledge that you already have from your life and from the science classes you have had. Then, think of what Astrobiologists should look for when planning missions to search for life, or searching for signs of life, or clues about the origins of life on Earth.

1) What are some of the important characteristics and features of Earth's environment that support life?

2) List 5 things that Earth's environment has that help life exist there:

1. _____
2. _____
3. _____
4. _____
5. _____

3) Try to think of at least two things besides the environment that might influence where Astrobiologists send missions to look for life, searching for signs of life or clues about the origins of life on Earth!

1. _____

2. _____

4) What do you think Astrobiologists should look for when searching for signs of life beyond Earth?

1. _____

2. _____

3. _____

Be an Astrobiologist! Group Activity

Instructions: With your group, analyze the data provided. Out of the 11 possible targets, choose the 3 you would propose as mission targets for searching for signs of life or clues about the origins of life on Earth. Use the information from the previous part of the lesson to help you think about what to look for!

Target	Object Type	Possible Water	Habitable zone?	Oxygen	Temperature*	Gravity**	Estimate Travel Time***
Mercury	Planet	Yes (frozen at the poles)	No	Yes	800 F to -230 F	38%	6.5 years
Venus	Planet	No	No	No	900 F	91%	100-200 days
Mars	Planet	No	Yes	Yes (trace)	70 to -225	38%	6-9 months
Ceres	Dwarf Planet	Yes	No	No	-100 to -225	3%	3-4 years
Europa	Moon	Yes	No	Yes	-225	1.3%	5-7 years
Ganymede	Moon	Yes	No	Yes	-171 to -297	2.5%	5-7 years
Enceladus	Moon	Yes	No	No	-330	1%	7-12 years
Pluto	Dwarf Planet	Yes (frozen in mantle)	No	No	-387	16%	9.5 years
Bennu	Asteroid	No	No	No	240 to -100	>1%	2.25 years
Saturn	Planet	No	No	No	-288	9500%	6-7 years
Kepler 186f	Exo-Planet	Yes (possibly on surface)	Yes	Possible	-121 °F	? (could be similar to Earth)	~771,000 years****

*in degrees Fahrenheit ** % of Earth's gravity *** Estimate travel times based on previous missions or limits of current technology

****500 light-years from Earth. Using the speed of the fastest spacecraft as of 2021, the Parker Solar Probe, it would take over 771,000 years to reach Kepler-186f.

Be an Astrobiologist! Group Activity

Instructions: After analyzing the data above, answer the following questions to reflect on why you chose what you did!

1) What did your group consider to be the 3 most important things when deciding on targets?

Why?_____

Why?_____

Why?_____

2) What are some variables that were not included in the table that might be important when deciding where to send a mission?

The OSIRIS-REx Mission: Notes

OSIRIS-Rex launched in _____ to collect samples of the asteroid called _____.

After arriving at the asteroid, OSIRIS-REx spent ____ years studying the asteroid before tagging the asteroid to collect samples.



OSIRIS-REx is the first U.S. mission to _____ and _____ a sample of an asteroid.

The sample from Bennu was returned to Earth on September ____, 2023.

The scientists expected the asteroid to be like sand, but it was full of large_____.

Asteroids are important because they are remnants from the earliest beginning of our_____.

Some of the sample is being studied at _____.

After dropping off the sample, the spacecraft started its journey to another asteroid called_____.

OSIRIS-REx open-ended questions

Why did scientists, including astrobiologists, choose the asteroid Bennu as a mission target?

What could we learn about the origins of life on Earth and life in the Universe from Bennu?

What are some factors or reasons you think should guide NASA and mission designers in choosing missions?