

Exploring Space: Past, Present, and Future

Textbook pages 432–449

Before You Read

Exploring and learning about space costs billions of dollars each year. Should we be spending so much money on space when there are still problems to solve here on Earth? Record your thoughts on the lines below.



Mark the Text

Identify Definitions

As you read this section, highlight the definition of each word that appears in bold type.



Reading Check

- Which space technology would you use to collect data on the surface of the Moon?
-

What technologies help us observe and explore space?

The universe is so large and distances are so vast that it will be many years—if ever—before we can view much of it directly. Even here, in our solar system, the only object beyond Earth that humans have ever set foot on is the Moon. Most of what we know of the solar system and the rest of the universe depends on indirect observation using a variety of technologies like the following.

Optical telescopes: devices that collect and focus visible light from distant objects.

Radio telescopes: devices that collect and focus radio waves from distant objects and convert these waves into other forms so we can visualize them.

Satellites: electronic devices put in orbit around Earth to collect and send data back to Earth. Some satellites are used in communications services. If a satellite is stationary above a fixed point on Earth, it is in a **geosynchronous orbit**.

Probes: space vehicles that are sent to other planets and space objects to fly past, orbit, or land on them. Space probes are usually designed to travel very great distances and carry instruments to collect and relay large amounts of data.

Rovers: robotic devices that are designed to move around on the surface of a planet or moon, collecting visual and other types of data. ✓

What are the rewards and risks of space travel?

Space travel is made possible by rockets—devices that transport materials and equipment (and sometimes human explorers) into space. Some of the many rewards related to space travel and its associated technologies are freeze-dried foods, cold-weather clothing, global positioning systems (GPS), and bicycle helmets. Risks include the possibility of equipment failure (and possible injury or death), hazards of pollution in orbit around Earth, and hazards associated with this pollution when it falls back to Earth. ✓

Should we be travelling into space?

This is an ethical question. **Ethics** considers questions about whether something is right or wrong. Another ethical question is “Should we be **terraforming** other planets or moons—making them suitable for supporting human life?” Answering ethical questions often involves strong opinions and debate. There are many types of questions that need to be considered about space travel, including the following ones about space resources.

Questions about using space resources	
Ethical	<ul style="list-style-type: none"> • How can we ensure that space resources will be used to help all people? • Do humans have the right to take resources from other parts of the solar system?
Environmental	<ul style="list-style-type: none"> • What are the effects of space travel on Earth’s natural systems? • What effects does removing resources have on other planets, asteroids, and moons?
Political	<ul style="list-style-type: none"> • Who owns space resources? • Who should decide how space resources will be used?

 **Reading Check**

2. Name one benefit and one risk of space travel.

Name _____

Date _____

Use with textbook pages 432–445.

Space exploration

Vocabulary

direct	rewards
ethics	risks
geosynchronous	rockets
indirect	rovers
optical	satellites
probes	terraforming
radio	

Use the terms in the vocabulary box to fill in the blanks. Each term may be used more than once. You will not need to use every term.

- Most of what we know of the solar system and the rest of the universe depends on _____ observation using a variety of technologies.
- _____ telescopes collect and focus the visible light from distant objects.
- _____ telescopes collect and focus radio waves from distant objects.
- _____ are put in orbit around Earth to send and receive data from Earth. If one stays in a fixed spot above Earth, it is in a _____ orbit.
- _____ are space vehicles that are sent to other planets and space objects to fly past, orbit, or land on them.
- _____ are robotic devices that are designed to move around on the surface of a planet or moon, collecting visual and other types of data.
- Space travel is made possible by _____, which are devices that transport materials and equipment (and sometimes human explorers) into space.
- _____ associated with space travel include freeze-dried foods, cold-weather clothing, global positioning systems (GPS), and bicycle helmets.
- _____ associated with space travel include possible injury or death and hazards of pollution.
- _____ considers questions about whether something is right or wrong.
- _____ other planets or moons means making them suitable for supporting human life.

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Exploring questions about space

What are your ideas about space travel?

1. Choose a question for each of the three following areas. You can use questions from the chart on page 183 or think of your own question for each area.
2. Explain your thoughts and ideas about an answer to each question. Back up your opinions with facts.

Question	Your ideas
(a) Ethical	
(b) Environmental	
(c) Political	

Use with textbook pages 439–445.

Technology for exploring space

Imagine that you have been selected to design a new technology for exploring space. You can design a new kind of telescope, probe, rover, satellite, or other technology.

1. Draw or describe your technology below. Label the main parts.



2. Describe what your technology does and how it works.

Name _____

Date _____

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Exploring space: past, present, and future

Match each Term on the left with the best Descriptor on the right. Each Descriptor may be used only once.

Term	Descriptor
1. _____ ethics	A. orbit is fixed above a spot on Earth
2. _____ geosynchronous	B. flies past, orbits, or lands on a celestial body to collect data
3. _____ optical telescope	C. electronic device put in orbit around Earth to relay information
4. _____ probe	D. considers whether something is right or wrong
5. _____ radio telescope	E. moves around and explores the surface of a planet
6. _____ rover	F. transforming a planet or moon into an Earth-like environment
7. _____ satellite	G. used to focus light from distant objects
8. _____ terraforming	H. collects radio waves and detects objects
	I. indirectly studies the solar system

Circle the letter of the best answer.

9. Which of the following is not a risk associated with space travel?
- A.** possible injury and death
 - B.** pollution in space
 - C.** pollution on Earth
 - D.** high cost of developing technologies

10. Why does most of our knowledge of the solar system depend on indirect observation?
- A.** There has not yet been enough study of the solar system.
 - B.** There are no tools for studying the solar system directly.
 - C.** Most of the solar system is too far away to study directly.
 - D.** It is too expensive to study the solar system directly.
11. Which of the following best describes rockets?
- A.** devices that orbit in a fixed position above Earth
 - B.** devices that fly past other planets
 - C.** devices that collect data and relay them to Earth
 - D.** devices that transport materials, equipment, and human explorers into space
12. Which of the following is/are examples of ethical questions?

I.	How much money does it cost to send a probe to Mars?
II.	How can we control the probe once it is on Mars?
III.	Should we share the information we get from the probe on Mars?

- A.** I only
- B.** II only
- C.** III only
- D.** I, II, and III