15-1 What is astronomy?

Objective ▸ Explain what is meant by astronomy and how astronomy was used by ancient peoples.

TechTerms

- **astronomy** (uh-STRON-uh-mee): study of stars, planets, and other objects in space
- **solar system:** the sun and all the bodies that circle the sun

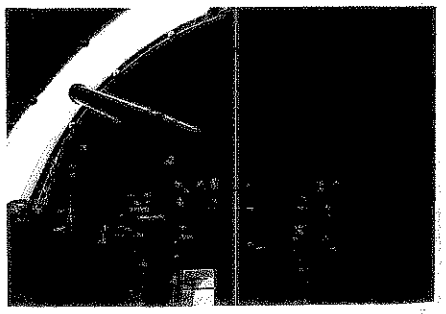
Ancient Astronomy People have studied and wondered about the skies for thousands of years. **Astronomy** (uh-STRON-uh-mee) is one of the oldest sciences. Astronomy is the study of the stars, planets, and other objects in space. Ancient clay tablets predicting eclipses of the sun date back to 131 BC. The planets Mercury, Venus, Mars, Jupiter, and Saturn were known more than 5000 years ago. No new planets were found until 1781 when Uranus was discovered.

List: Which of the planets were known in ancient times?

Uses of Astronomy Astronomy helped ancient peoples solve many problems. Most ancient societies were built around the changing seasons. Farmers had to know when was the right time to plant their crops. Astronomers were able to predict the coming of spring so that crops could be planted on time. Sailors were able to use the positions of the stars as a guide to help them find their way at sea.

Explain: Give two examples of how ancient peoples used astronomy.

Modern Astronomy Ancient astronomers made observations using only their eyes. Over time, new tools helped astronomers see farther into space. The Italian scientist Galileo (gal-ih-LAY-oh) first used a telescope to get a close-up look at the moon in 1609. In 1957, the first human-made satellite was launched into space by the Soviet Union.



Today, astronomers use telescopes, satellites, and space probes to make their observations. Astronomers are able to take close-up photographs of the planets and study stars billions of kilometers from the earth. What do astronomers study? Modern astronomers study the universe. The universe is everything that exists. Some astronomers, called cosmologists (coz-MOL-uh-jists), study how the universe began. Planetologists study the planets in the **solar system.** The solar system includes the sun and all of the bodies in space that circle the sun.

Describe: What do astronomers study?

Name _____ Class _____ Date _____

15–1 What is astronomy?

Lesson Review

Part A *Match each term in Column B with its description in Column A. Write the letter of the correct term in the space provided.*

Column A	Column B
_____ 1. study of stars, planets, and other objects in space	a. solar system
_____ 2. astronomers who study how the universe began	b. planetologists
_____ 3. the sun and all the bodies that circle the sun	c. cosmologists
_____ 4. first used a telescope to study the moon	d. astronomy
_____ 5. astronomers who study the planets	e. Galileo

Part B *Complete the following.*

1. Identify two ways that ancient peoples used astronomy. _____

_____

2. When was Uranus discovered? _____
3. When did Galileo use a telescope to look at the moon? _____
4. When was the first human-made satellite launched into space? _____
5. Identify three things that are part of the solar system. _____

_____

Skill Challenge

Skills: *defining, using resources, relating concepts*

Use a dictionary or other resources to define each of the terms listed. Explain how each term is related to astronomy.

1. **telescope:** _____

_____

2. **satellite:** _____

_____

3. **eclipse:** _____

_____

15-2 Why do scientists explore space?

Objective ▸ Explain how space exploration helps scientists learn about Earth and about the universe.

TechTerm

▸ **galaxy** (GAL-ack-see): large system of stars

Space Exploration The exploration of space began in 1957. In that year, the first artificial earth satellite was launched. This scientific instrument was launched as part of the International Geophysical Year, or IGY. The IGY lasted from 1957 to 1958. It was planned as a year of astronomical observations by scientists from many countries.

Today, scientists hope that space exploration will answer many questions about the universe. How was the solar system formed? Does intelligent life exist elsewhere in the universe? These are some of the questions that might be answered by space exploration.

Infer: Why do scientists explore space?

Studying the Universe Space exploration may provide clues to how the universe was formed. Scientists think that the universe began about 15 billion years ago. A huge explosion, called the "Big Bang," sent matter flying out in all directions. **Galaxies** were formed. A galaxy is a large collection of stars.

The most distant galaxies probably were formed at the time of the Big Bang. These distant galaxies are not visible from Earth. Pollution in Earth's atmosphere makes any kind of space observations difficult. Lights from nearby cities also make nighttime viewing difficult. City lights block out the faint light from distant stars, as sunlight does during the day.

Define: What are galaxies?

Hubble Space Telescope Astronomers are learning more about the universe using a telescope in Earth orbit. The Hubble Space Telescope was launched from the shuttle *Discovery* in 1990. The telescope is named after the American astronomer Edwin Hubble. Above the pollution, the atmosphere, and city lights, this telescope has observed and photographed distant galaxies that cannot even be seen on Earth. It can view planets as clearly as *Voyager* did.

Identify: What is the goal of the Hubble Space Telescope?

Name _____ Class _____ Date _____

15-2 Why do scientists explore space?

Lesson Review

Complete the following.

1. What do the letters IGY stand for? _____
2. What is a galaxy? _____
3. When was the International Geophysical Year? _____
4. What do the letters ISY stand for? _____
5. What will be the main goal of the ISY? _____
6. What are three problems of the earth that will be studied during the ISY? _____

_____

7. When will the ISY take place? _____
8. What is the Big Bang? _____

_____

Skill Challenge

Skills: *defining, inferring*

Use a dictionary to find the meanings of the terms indicated in ***bold type.*** *Then, answer the questions.*

1. **spinoff:** _____
2. **dehydrate:** _____
3. **metallized plastic:** _____
4. Why might foods be dehydrated before being taken into space? _____

_____

5. What foods do you eat that have been dehydrated? _____
6. How might metallized plastics be used in space travel? _____

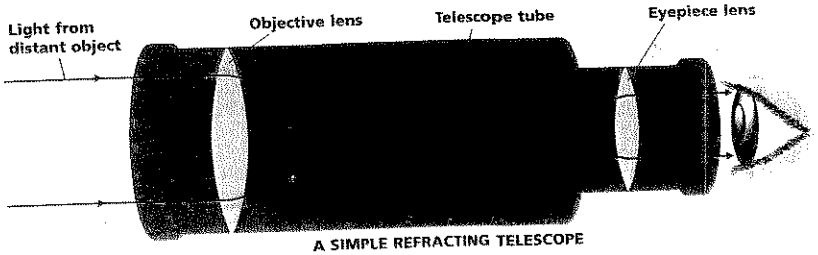
_____

7. How might metallized plastics be used on Earth? _____

_____

8. Why are metallized plastics and dehydrated foods examples of spinoffs that have resulted from space exploration? _____

15-3 How does a refracting telescope work?



A SIMPLE REFRACTING TELESCOPE

Objective ▸ Explain how a refracting telescope works.

TechTerms

- **convex** (kon-VEKS) **lens:** lens that is thicker in the middle than at the edges
- **refracting** (rih-FRAKT-ing) **telescope:** telescope that uses convex lenses to produce an enlarged image

Galileo's Telescope Galileo was the first person to look at the moon through a telescope. Have you ever looked through a telescope? If you have, you know that a telescope makes objects appear much nearer than they are. If you look at the moon through a telescope, you can see many features on the moon's surface that you cannot see with your eyes alone. Galileo looked at the moon soon after the telescope was invented. He was the first to see that the moon's surface is not smooth. Galileo saw craters, plains, and hills on the moon.

Name: What features did Galileo see on the surface of the moon?

Refracting Telescopes Galileo used a **refracting** (rih-FRAKT-ing) **telescope** to look at the moon. Galileo's refracting telescope was made of a tube with two lenses inside. A lens is a piece of glass that refracts, or bends, light. The telescope in the illustration is a simple refracting telescope. The lenses in a refracting telescope are **convex** (kon-VEKS) **lenses.** Convex lenses bulge outward. They are thicker in the middle than at the edges. When light passes through a convex lens, the light is bent inward, as shown in the illustration. The bent light produces an image that is larger than the image you would see with your eyes alone.

Describe: What kind of lenses are used in a refracting telescope?

Function of Lenses Each of the convex lenses in a refracting telescope has a special job. The lens at the far end of the tube is the objective (ob-JECK-tiv) lens. The objective lens collects light and brings the image into focus. The lens at the other end of the tube is the eyepiece lens. The eyepiece lens acts like a magnifying glass. It enlarges, or magnifies, the image formed by the objective lens. The objective lens and the eyepiece lens work together to produce a sharp, clear image of a distant object.

Name: What are the two lenses in a refracting telescope called?

Name _____ Class _____ Date _____

15–3 How does a refracting telescope work?

Lesson Review

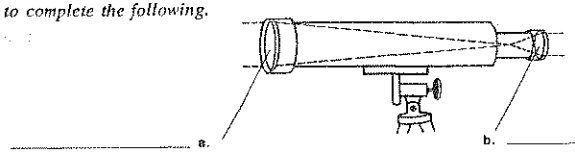
Answer the following questions. Write your answers in the spaces provided.

1. What is a telescope? _____
2. What features of the moon was Galileo able to observe with his telescope? _____
3. What kind of telescope did Galileo use? _____
4. What is a convex lens? _____
5. What is the job of the objective lens in a refracting telescope? _____
6. What is the job of the eyepiece lens in a refracting telescope? _____
7. Look at the illustrations. Which lenses are convex lenses? _____

Skill Challenge

Skills: *identifying, analyzing*

Use the diagram to complete the following.



1. Label the **objective lens** and the **eyepiece lens** of the refracting telescope.
2. The larger the objective lens of a telescope, the greater its light-gathering power. Would a telescope with a 5-cm lens or a 25-cm lens have more light-gathering power? _____
3. Doubling the size of an objective lens increases the light-gathering power of a telescope four times. How much more light-gathering power would a telescope with a 50-cm objective lens have than a telescope with a 25-cm objective lens? _____

15-4 How does a reflecting telescope work?

Objectives ▸ Explain how a reflecting telescope works. ▸ Contrast a reflecting telescope with a refracting telescope.

TechTerms

- **concave mirror:** mirror that curves inward
- **reflecting** (rih-FLEKT-ing) **telescope:** telescope that uses a concave mirror to collect light

Reflecting Telescopes Recall that a refracting telescope uses a convex lens to collect light. Another kind of telescope uses a mirror instead of a lens to collect light. This kind of telescope is called a **reflecting** (rih-FLECKT-ing) **telescope.** A simple reflecting telescope is shown in the illustration.

The mirror used in a reflecting telescope is a **concave mirror.** A concave mirror curves inward. In a reflecting telescope, a concave mirror collects light from distant stars and brings the light to a focus.

Define: What is a reflecting telescope?

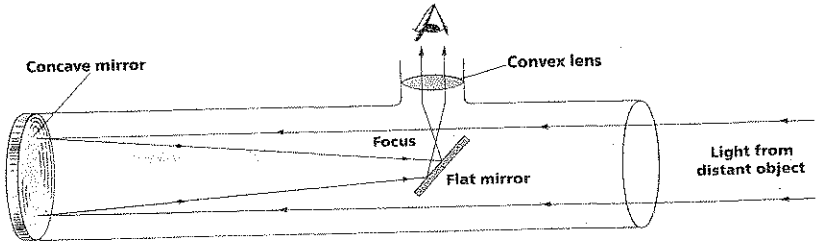
Newton's Telescope Isaac Newton, an English scientist, made the first reflecting telescope in 1668. Newton used a concave mirror to collect light and form an image. The concave mirror was only 2.5 cm across. Newton used a convex lens as an eyepiece to magnify the image. He could not look at the image formed inside the telescope tube. His head would have blocked the incoming light. Instead, Newton used a flat mirror to reflect the light to one side.

The illustration shows how the mirrors and lenses in Newton's telescope were arranged. Reflecting telescopes usually have the eyepiece at one side of the telescope tube. A camera can be attached to the eyepiece to take pictures of the images. The pictures can be stored and studied by astronomers at a later time.

Explain: Why is the eyepiece of a reflecting telescope at one side of the tube?

Modern Reflecting Telescopes Modern reflecting telescopes have very large mirrors. One of the largest reflecting telescopes is the Hale Telescope on Mt. Palomar in California. Its mirror is 5 m across. The mirror is so big that the astronomer using the telescope can sit inside the telescope. The astronomer sits high up near where the image is formed. The amount of light blocked by the astronomer is too small to affect the image.

Explain: Why does an astronomer using the Hale Telescope not have to sit at the side of the telescope?



A SIMPLE REFLECTING TELESCOPE

Name _____ Class _____ Date _____

15–4 How does a reflecting telescope work?

Lesson Review

Answer the following questions. Write your answers in the spaces provided.

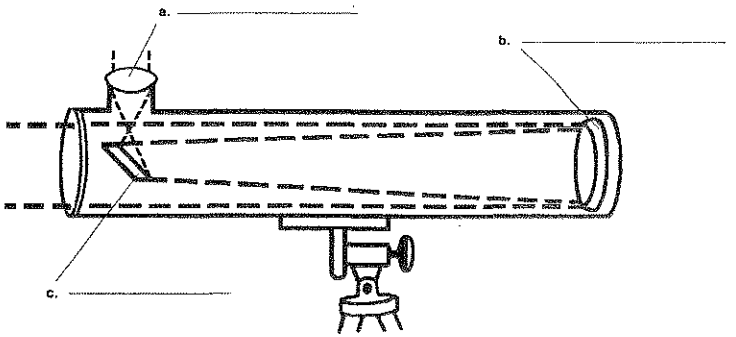
1. What is a reflecting telescope? _____
2. What kind of mirror is used to collect light in a reflecting telescope? _____
3. Which of the mirrors shown would most likely be used in a reflecting telescope? Explain your choice. _____

4. How does a refracting telescope differ from a reflecting telescope? _____
5. Who was the first person to use a reflecting telescope? _____
6. How do modern reflecting telescopes differ from those used at the time of Newton? _____

Skill Challenge

Skill: *identifying*

Label the parts of the reflecting telescope shown. Use the labels: eyepiece lens, small flat mirror, objective mirror.



15-5 What is a radio telescope?

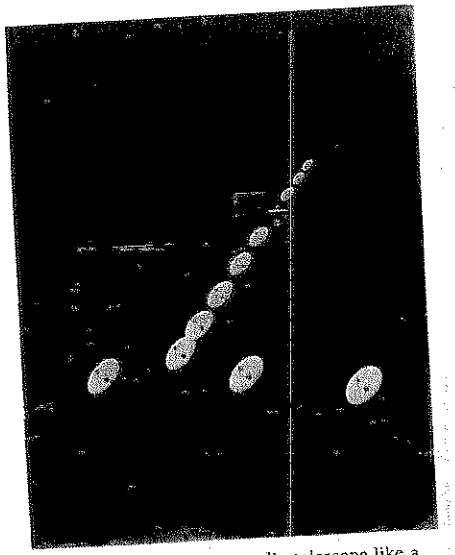
Objectives ▸ Describe how a radio telescope works. ▸ Recognize the advantages of a radio telescope.

TechTerm

▸ **radio telescope:** telescope that can receive radio waves from sources in space

Studying Stars Stars are usually not visible during the day. Are there stars in the sky during the day? Yes, but you cannot see them. You cannot see the stars during the day because of the sun. The sun is also a star. It is the closest star to Earth. The bright light of the sun hides the dimmer light from the distant stars. On rainy nights, clouds hide the stars. The light from the stars cannot get through the clouds. For this reason, you cannot see the stars on a cloudy night. An ordinary telescope, such as a refracting telescope or a reflecting telescope, cannot help you see the stars on a cloudy night.

Explain: Why can you not see the stars during the day?



Compare: How is a radio telescope like a reflecting telescope?

Radio Telescopes A **radio telescope** can pick up radio waves from sources in space. This telescope can find stars during the day or when the sky is covered with clouds. An American engineer, Karl Jansky, first heard radio signals from space in 1932. He found that the radio waves were coming from the center of our galaxy, the Milky Way. In 1944, Grote Reber built a radio telescope with a 9-m receiver, or antenna (an-TEN-uh). Using his telescope, Reber was able to make the first radio map of the Milky Way galaxy.

The antenna of a radio telescope works like a mirror in a reflecting telescope. The antenna collects and focuses radio waves given off by stars and other objects in space. The antenna transmits the radio waves to a receiver. An astronomer can "listen" to the stars using a radio telescope.

Advantages of Radio Telescopes There are three main advantages to using radio telescopes. First, a radio telescope can detect very distant stars and galaxies. Refracting or reflecting telescopes cannot pick up the faint light from these distant objects. Second, a radio telescope can be used in any kind of weather. Radio waves can travel through clouds in the earth's atmosphere. Reflecting or refracting telescopes can be used only on clear nights. Third, a radio telescope can be used during the day, when the stars are not visible. Reflecting or refracting telescopes can be used only at night, when the sun's light does not block the light from the stars.

Explain: Why can a radio telescope be used on cloudy nights?

Name _____ Class _____ Date _____

15–5 What is a radio telescope?

Lesson Review

Complete the following.

1. Why can you not see stars during the day? _____

2. What is a radio telescope? _____

3. What did Grote Reber do with his radio telescope? _____

4. How is the antenna of a radio telescope like the mirror of a reflecting telescope? _____

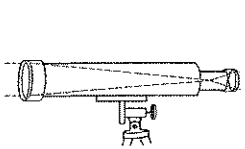
5. Identify one advantage of a radio telescope over a reflecting or a refracting telescope. _____

6. Why can a radio telescope be used on a cloudy night? _____

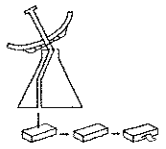
Skill Challenge

Skill: *identifying*

Identify the kind of telescope shown in each illustration. Write your answer in the space provided.



1. _____



2. _____

3. _____

15-6 How do astronomers measure distance?

Objective ▸ Identify two units of measurement that astronomers use to measure distance.

TechTerms

- ▸ **astronomical** (as-truh-NOM-ih-kul) **unit:** unit of measurement equal to about 150 million kilometers
- ▸ **light year:** unit of measurement equal to about 10 trillion kilometers

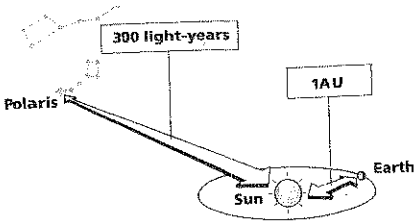
Measuring Distances Most distances on the earth can be measured in meters or kilometers. How would you measure the distance from the earth to the stars? You might use kilometers as a unit of measurement. However, astronomers have found that the distance to even the nearest star is too great to measure in kilometers. The distances are so great that the numbers are too large to work with easily. For example, the star Proxima Centauri (PROX-ih-muh sen-TOR-ee) is the closest star, other than the sun, to the earth. Proxima Centauri is 40,000,000,000,000 km from the earth. As you can see, this is a very large number. Astronomers had to invent special units to measure distances in space.

Explain: Why did scientists invent special units to measure distances in space?

Light Years Astronomers often measure the distance to an object in space in **light years.** A light year is equal to the distance light travels in one year. Light travels through space at a speed of about 300,000 km/sec. A light year is equal to almost 10 trillion km. Light from the sun reaches the earth in a little more than 8 minutes. Light from the North Star, Polaris (poh-LAR-us), takes about 300 years to reach the earth.

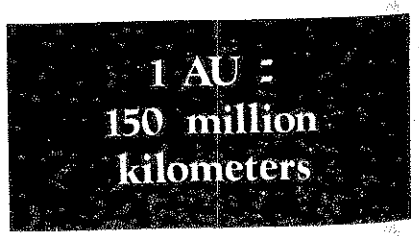
Interpret: How far, in light years, is Polaris from Earth?

Astronomical Units One of the units used by astronomers is equal to the distance from the earth to the sun. Do you know how far away the sun is from the earth? The sun is about 150 million km from the earth. Astronomers call this distance an **astronomical** (as-truh-NOM-ih-kul) **unit.** One astronomical unit, or 1 AU, is equal to 150 million kilometers. Table 1 shows the distances of the planets from the sun in astronomical units.



Planet	Distance
Mercury	0.4
Venus	0.7
Earth	1.0
Mars	1.5
Jupiter	5.2
Saturn	9.5
Uranus	19.2
Neptune	30.1
Pluto	39.4

Observe: What is the distance of Venus from the sun in astronomical units?



Name _____ Class _____ Date _____

15–6 How do astronomers measure distance?

Lesson Review

Write true if the statement is true. If the statement is false, change the underlined term to make the statement true.

_____ 1. A light year is equal to the distance that light travels in one day.

_____ 2. One light year is equal to a distance of about 10 trillion kilometers.

_____ 3. An astronomical unit is equal to the distance between the earth and the moon.

_____ 4. Proxima Centauri is the closest star to the earth other than the sun.

_____ 5. A light year is a smaller unit than an astronomical unit.

_____ 6. The distance from the sun to the earth is one light year.

_____ 7. Light travels at a speed of about 300,000 km/sec.

_____ 8. Light from the North Star takes about 8 minutes to reach the earth.

Skill Challenge

Skills: *analyzing, calculating, sequencing*

Use the table to answer the questions.

Table 1 Distances of Planets from the Sun in Astronomical Units

Planet	Distance
Mercury	0.4
Venus	0.7
Earth	1.0
Mars	1.5
Jupiter	5.2
Saturn	9.5
Uranus	19.2
Neptune	30.1
Pluto	39.4

1. How far is the earth from the sun in AU? _____
2. How far is Mercury from the sun in AU? _____
3. How much closer to the sun is Jupiter than Saturn? _____
4. How much farther from the sun is Pluto than Neptune? _____
5. Is Earth closer to Venus or to Mars? Explain. _____

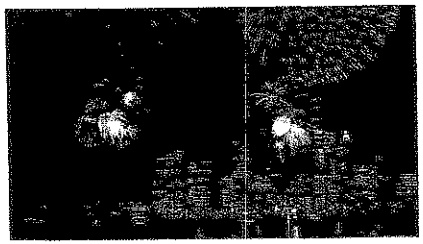
15-7 How does a rocket work?

Objective ▸ Describe how a rocket works.

TechTerm

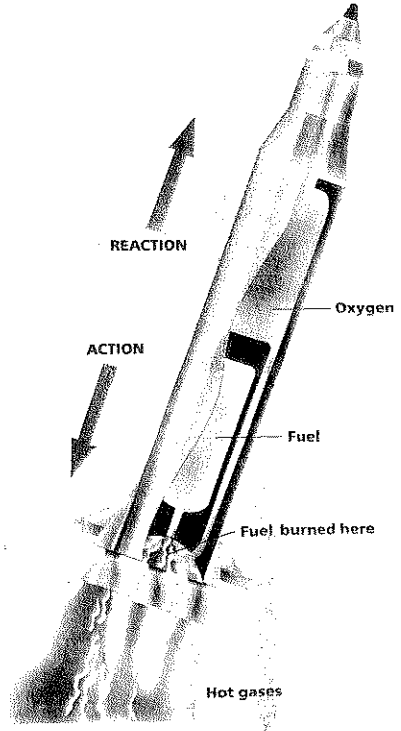
▸ **thrust:** force produced in a rocket engine

Rockets Rockets were invented by the Chinese more than 800 years ago. The ancient Chinese used rockets for fireworks and weapons. How does a rocket work? To understand how a rocket works, you must know about Newton's Third Law of Motion. Newton's Third Law of Motion says that for every action, there is an equal and opposite



reaction. For example, suppose you are sitting in a rowboat on a lake. You throw a rock into the lake. This is the action. At the same time, the rowboat moves backward slightly. This is the reaction.

State: What is the Third Law of Motion?



Rocket Engines The force that pushes a rocket forward is called **thrust.** The greater the thrust, the higher and faster the rocket will travel. What causes thrust? Fuel is burned inside a rocket engine. The fuel can be a solid or a liquid. As the fuel burns, hot gases inside the engine begin to expand. The expanding gases create pressure inside the engine. The pressure forces the hot gases out of the rear of the rocket. This is the action force. The rocket moves in the opposite direction. This is the thrust, or reaction force.

Define: What is thrust?

Rockets in Space A lot of thrust is needed for a rocket to escape the earth's gravity. To get into space, a rocket must reach a speed of more than 40,000 km/hr. Large amounts of fuel are needed to produce enough thrust to reach this speed. Rocket engines need oxygen to burn fuel. In space, there is no air to supply the oxygen needed to burn fuel. Rockets carry their own oxygen.

As a rocket moves farther away from the earth, the pull of the earth's gravity becomes weaker. Once the rocket is in space, there is nothing to slow down the rocket. The rocket does not need to burn fuel to keep moving. The rocket keeps moving in the same direction at a constant speed. Fuel is needed in space only to change the rocket's speed or direction.

Explain: Why must rockets carry oxygen?

Name _____ Class _____ Date _____

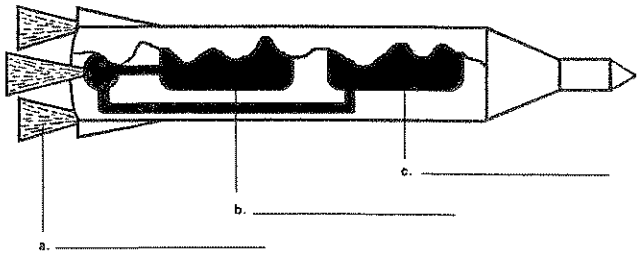
15–7 How does a rocket work?

Lesson Review

Complete the following.

1. Who invented rockets? _____
2. What does Newton's Third Law of Motion state? _____

   _____
3. What force pushes a rocket forward? _____
4. What causes thrust? _____
5. How fast must a rocket move to get into space? _____
6. Label the locations of the oxygen, the fuel, and the escaping gases on the diagram.



Skill Challenge

***Skill:** relating cause and effect*

Action-reaction movements are examples of cause and effect relationships. The action is the cause. The reaction is the effect.

Read each description below. Circle the word or words that describe the action. Underline the word or words that describe the reaction.

1. Air escaping from a balloon pushes the balloon through the air.
2. A rocket is thrust into space as gases near the back of the rocket escape under great pressure.
3. You are sitting in a row boat. When you cast your fishing line, you feel the boat move in the direction opposite where you cast your line.

15-8 What are satellites and probes?

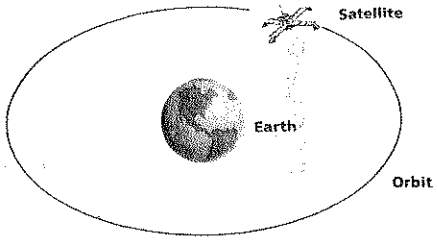
Objective ▸ Explain how artificial satellites and space probes are used to explore space.

TechTerms

- **orbit:** path of a satellite around a planet or other body in space
- **satellite** (SAT-uh-lite): natural or artificial object orbiting a body in space

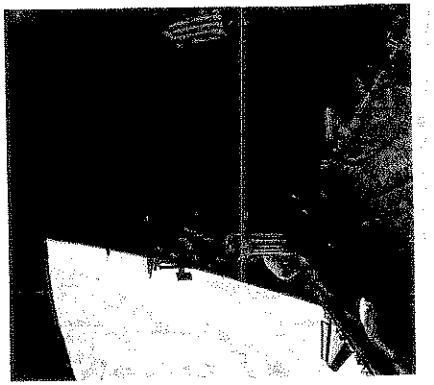
Artificial Satellites For thousands of years, astronomers were able to study the skies only from the surface of the earth. Then, on October 4, 1957, the Space Age began. On that day, the Soviet Union launched the first artificial **satellite** (SAT-uh-lite). This satellite was called *Sputnik*. A satellite is an object that follows a curved path around another body in space. The curved path of a satellite is its **orbit.** *Sputnik* orbited the earth every 90 minutes.

Since the launch of *Sputnik*, hundreds of artificial satellites have been placed in orbit around the earth. These satellites collect information about the sun, stars, planets, comets, and other bodies in the solar system. All of this information is sent back to Earth for scientists to study.



Name: What is the curved path of a satellite called?

Space Probes Space can be explored by people in spaceships. For example, six *Apollo* spacecraft landed astronauts on the moon and returned them safely to Earth. Space also can be explored by robot space probes. Many kinds of space exploration are best done with space probes. Space probes can go to places that would be too dangerous for astronauts. For example, part of the *Galileo* space probe sent to Jupiter entered the atmosphere of Jupiter in 1995. It radioed important information to Earth before being destroyed by the high temperature and pressure in the atmosphere.



Space probes can be sent on one-way missions. They do not have to return to the earth. Some space probes, such as *Voyager 1* and *Voyager 2*, have even been sent out of the solar system. The *Voyager* space probes were launched in 1977. In 1989, *Voyager 2* became the first human-made object to reach Neptune. At that time, Neptune was the farthest planet from the sun. Both space probes sent back exciting photographs of the outer planets. Scientists estimate that *Voyager 2* will continue traveling for thousands of years. They hope to continue receiving signals from both space probes at least until 2015, and perhaps until 2030.

Identify: What are *Voyager 1* and *Voyager 2*?

Name _____ Class _____ Date _____

15–8 What are satellites and probes?

Lesson Review

Match each term in Column B with its description in Column A. Write the correct letter in the space provided.

Column A	Column B
_____ 1. path of a satellite around another body in space	a. *Sputnik*
_____ 2. natural or artificial object orbiting a body in space	b. *Voyager 1* and *Voyager 2*
_____ 3. spacecraft that have landed on the moon	c. *Apollo*
_____ 4. first artificial satellite sent into space	d. satellite
_____ 5. examples of space probes	e. orbit

Skill Challenge

Skills: *identifying, relating concepts*

Use the diagrams to complete the following.

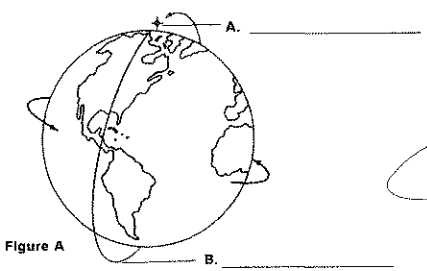


Figure A

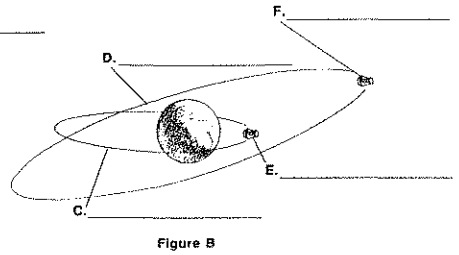


Figure B

1. Label the satellites and their orbits on Figures A and B.
2. A satellite that moves at a speed of exactly 28,000 km per hour will orbit the earth in a spherical orbit. Which satellite is orbiting the earth at a speed of 28,000 km/hr? _____
3. A satellite that moves at a speed between 28,000 km/hr and 40,233 km/hr will orbit the earth in an elliptical orbit. The faster the satellite is moving, the longer its ellipse. Which satellites are moving at the faster speed, the one in Figure A or the ones in Figure B? _____
4. Which satellite in Figure B is moving fastest? Explain. _____

_____

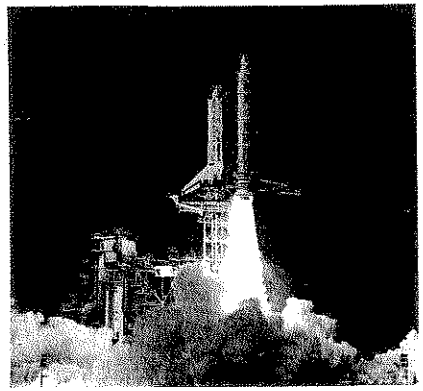
15-9 What is a space shuttle?

Objective ▸ Describe how a space shuttle works.

A Reusable Spaceship In the 1960s and 1970s, all space flights were made with spacecraft that could be used only once. This was very expensive and wasteful. In the late 1970s, the National Aeronautics and Space Administration, or NASA, had a better idea. NASA decided to build a spacecraft that could go into space and return many times. This new kind of spacecraft was called a Space Transportation System, or space shuttle.

Infer: Why was the space shuttle an improvement over earlier spacecraft?

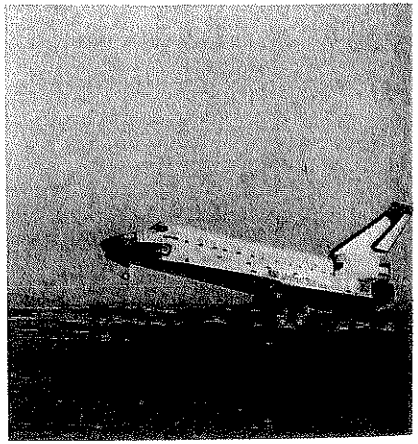
The Space Shuttle The space shuttle has three main parts. Two of the parts are needed to get the shuttle into space. They are the solid-fuel booster rockets and the liquid-fuel tank. The third part is the shuttle orbiter. The orbiter is the only part that goes into space.



How does the space shuttle get into orbit? At launch, both the booster rockets and the orbiter's rocket engines are fired. A few minutes after launch, the booster rockets separate from the orbiter. The booster rockets fall back into the ocean. They can be picked up and used again. The large liquid-fuel tank provides fuel for the orbiter's engines. The tank drops away before the orbiter reaches earth orbit.

Once the orbiter is in space, the engines are turned off. They are fired again to change the orbiter's speed and direction when the orbiter is ready to land. When its mission is over, the orbiter returns to Earth. The orbiter glides to a landing on a runway.

List: What are the three parts of a space shuttle?



Uses of the Shuttle The shuttle's cargo bay is designed to carry almost 30,000 kg of equipment into orbit. Satellites and space probes can be launched from the shuttle. Shuttle astronauts can repair satellites in orbit, or the satellites can be returned to Earth. The shuttle also can carry a laboratory called Spacelab in its cargo bay. In the future, the shuttle may be used to ferry people and supplies to a space station.

Name: What is the laboratory carried by the shuttle called?

Name _____ Class _____ Date _____

15–9 What is a space shuttle?

Lesson Review

Complete the following. Write your answers in the spaces provided.

1. What do the letters NASA stand for? _____
2. How does the space shuttle differ from earlier spacecraft? _____
3. What are the three main parts of the space shuttle? _____
4. What is the only part of the space shuttle that goes into space? _____
5. What is Spacelab? _____

Skill Challenge

Skill: *classifying*

Place a check mark beside each statement that is true about the space shuttle.

_____ 1. The space shuttle can be used only once.

_____ 2. The space shuttle can be sent into space and return many times.

_____ 3. The liquid fuel tank of the space shuttle is used to carry the space shuttle through space.

_____ 4. The booster rockets of the space shuttle separate from the orbiter soon after launch.

_____ 5. The space shuttle lands in the ocean when it returns to earth.

_____ 6. The cargo bay of the space shuttle can be used to carry satellites and space probes into space.

_____ 7. The space shuttle lands on a runway when it returns to Earth.

_____ 8. The space shuttle may be used to carry people and equipment to space stations in the future.

_____ 9. Booster rockets that fall into the ocean can be reused.

_____ 10. The space shuttle has a laboratory on board.