

Red Edition
Grade 3–4
reading level

Purple Edition
Grade 4–5
reading level

Objectives

- Explore the solar system.
- Describe the Sun.
- Compare the planets and their moons.
- Discuss dwarf planets, asteroids, comets, and meteoroids.
- Understand stars and constellations.
- Define *galaxies*.
- Explain what makes up the universe.
- Describe ways that scientists study and explore space.

Reading Comprehension Skills

Preview the Book ♦ Main Idea and Details

Skillbuilders are available for this title.

Supporting English Learners

Set Objectives Motivate English Learners, and help them work toward clearly defined goals. Determine both content and language goals for students. Identify what they should know about objects in the solar system and beyond. Discuss the Find Out About statements before reading each section. Read the statements slowly and clearly to help students connect spelling with pronunciation. Review academic vocabulary, such as *study* and *explore*, to ensure that the goals are understood.

Summary

The Delta Science Content Reader *Our Solar System and Beyond* first introduces students to Earth and its neighbors in our solar system—the Sun, other planets, moons, dwarf planets, asteroids, comets, and meteoroids. Students then learn about other stars and galaxies beyond our solar system and the composition of the universe as a whole. The book concludes with a discussion of some methods scientists use to study and explore space.

Science Background

A solar system consists of a star and all the objects that revolve around it. Our solar system includes our Sun (a star), eight planets, their moons, and many smaller celestial bodies such as asteroids and comets. Like other stars, our Sun is an extremely hot ball of glowing gases that produces tremendous amounts of heat and light.

The path of an object around another object in space is an orbit. Gravity holds objects in their orbits. Gravity is the force of attraction that exists between all objects. Gravity keeps planets and other objects in their orbits around the Sun and keeps moons in their orbits around the planets.

The inner planets—Mercury, Venus, Earth, and Mars—are closest to the Sun. They are characterized by solid, rocky surfaces and have few or no moons. Jupiter, Saturn, Uranus, and Neptune are the outer planets. These planets are far colder than the inner planets due to their greater distance from the Sun. They are extremely large, are composed mostly of gases, and have rings and many moons.

Our Sun is but one of a vast number of stars in space. People who lived in ancient times often viewed patterns of stars in the sky as shapes of people, animals, or events. These patterns are called constellations. We now know that our Sun is one of the billions of stars in the Milky Way galaxy, which is itself but one of countless massive star clusters scattered throughout the universe. By using equipment such as telescopes and space probes, scientists continue to discover more about the universe and our place in it.



What Is in Our Solar System? (pages 2–15)

Before Reading

Discuss the Cover

Cover Image Discuss the image on the cover of *Our Solar System and Beyond*. Use the information on the inside front cover to support the discussion. Emphasize that the planets are actually very far apart in space, but seeing them together helps us compare them.

Science Statement Discuss the science statement. Ask: *How do you think the planets are alike and different?* (Answers will vary.)

Build Reading Skills (page 2)

Preview the Book Use Build Reading Skills on page 2 to review how to preview the book. Discuss the steps. Then model previewing the Table of Contents.

Think Aloud *The Table of Contents lists what is in the book. In this book, there are two main sections and a Glossary. I read the titles of the main sections and learn that in the first main section, I will read about what is in our solar system. In the second main section, I will read about what is beyond our solar system.*

Guide students as they finish previewing *Our Solar System and Beyond*. Focus on nonfiction text features.

- Prompt them to look at the headings, photographs, captions, and diagrams. Ask questions such as *Why do you think that feature is there? How will it help you understand what you read?*
- Prompt them to look at the bold Vocabulary words. Guide the class in looking up a Vocabulary word in the Glossary.

Students can apply the skill in the Reflect on Reading activity on page 15.

K-W-L Chart Have students begin a K-W-L chart. They should add to it after each section.

What I Know	What I Want to Learn	What I Learned
Earth is a planet.	What are other planets like?	

Make a Connection (page 3)

Make a Connection Discuss the Make a Connection question. Use this discussion to build background and activate prior knowledge about what is in our solar system. (Possible answers: Mercury, Venus, Mars, Jupiter, Saturn, Uranus, Neptune)

Find Out About Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

Vocabulary Read the Vocabulary words aloud. Explain to students that they will see these words in bold in this section. Start a word web on the board with *Our Solar System* in the center. Have students add examples of objects in the solar system to the web as they read.

During Reading

About the Solar System (page 4)

- Encourage students to think about why people once thought that the Sun moved around Earth. Emphasize that Earth’s rotation on its axis and revolution around the Sun are what cause the apparent motion of the Sun and stars around Earth.
- Point out the phrase “not to scale” at the bottoms of the pictures on pages 4 and 5. Explain that this means that the sizes of the Sun and the planets and the distances between them are not what they would be if you shrunk them down to the size of these pictures. Note that if you made a picture of the solar system to scale in which the Sun was 1 centimeter wide, Neptune would have to be about 32 meters away!
- Discuss the picture on page 4. Ask: *What do the thin green lines around the planets show?* (the planets’ orbits, the paths they take as they revolve around the Sun)
- Discuss the picture that shows how a planet rotates on page 5. Ask: *Is it daytime or nighttime on the side of Earth facing the Sun?* (daytime) *What happens as Earth rotates and that side of Earth turns away from the Sun?* (It becomes nighttime.)

- Remind students that gravity is stronger between objects that have more mass. Then discuss the chart on page 6. Ask: *Do you think Mercury has more or less mass than Earth? Explain.* (I think it has less mass. If you weigh less on Mercury than on Earth, that means the force of gravity is less, which means Mercury has less mass.)

✔ **Checkpoint** (page 6) (A solar system is a star and all the planets and other objects that revolve around that star.)

The Sun (page 7)

- Ask: *Why do living things need the Sun?* (Plants need sunlight to make their own food. Energy in that food passes to animals that eat plants. The Sun's energy also helps Earth stay at temperatures that support life.)

✔ **Checkpoint** (page 7) (The Sun looks larger to us than other stars do because the Sun is so much closer to us than they are.)

The Planets (page 8)

- You may wish to display a photograph of Venus in the sky to help students understand why this planet is sometimes called the “morning star” or the “evening star.” Point out that while Venus is the brightest object in the night sky after the Moon, like the Moon, it does not make its own light—the light we see is light reflected from the Sun.
- Point out the word *dense* in the first paragraph on page 9. Explain that something that is dense has a lot of mass for its size. For example, a baseball and a tennis ball are about the same size. However, a baseball is heavier because it has more mass. Thus it is more dense than a tennis ball.
- Ask: *What are some things the inner planets have in common?* (Possible answers: They are small and dense. Their surfaces are solid and rocky. They have few or no moons.)
- Ask: *What are some things the outer planets have in common?* (Possible answers: They are very cold. They have rings and many moons. They are made mostly of gases.)

- Discuss the facts given for each planet on pages 10–13. Explain that diameter is the length of a straight line passing from one side of a circle or sphere to the other side, through its center. Recall that a day is the amount of time a planet takes to rotate once on its axis. A year is the amount of time a planet takes to revolve around the Sun once. To make comparisons easier, the planets' days and years are described in terms of Earth days and years.

- Ask: *What does it mean that a day on Venus is longer than a year on Venus?* (It takes more time to rotate once on its axis than it does to revolve around the Sun once.)

- Ask: *What makes Earth different from the other planets?* (It is the only planet known to support life.)

- Ask: *What is the largest planet in our solar system?* (Jupiter)

✔ **Checkpoint** (page 13) (Possible answers: Inner planets: closer to the Sun, smaller, warmer, have solid, rocky surfaces, have few or no moons; Outer planets: farther from the Sun, larger, colder, no solid surfaces—made mostly of gases, have rings and many moons)

Other Objects in the Solar System

(page 14)

- Pluto is an example of how science changes when new information becomes available. Ask: *What led scientists to decide that Pluto should be called a dwarf planet and not a planet?* (They found other faraway objects like Pluto.)
- In 2006, scientists adopted a new definition of a planet. The 2006 definition is based on three criteria: the celestial object (1) orbits the Sun, (2) is massive enough that its gravity makes it form a nearly round shape, and (3) clears, or sweeps up, all other bodies in the neighborhood of its orbit. When this definition was created, Pluto was reclassified as a dwarf planet due to its small size and the fact that it does not clear the path of its orbit.
- Ask: *Where are most asteroids in the solar system found?* (in an area between Mars and Jupiter called the asteroid belt)

- Ask: *What is the difference between a meteoroid and a meteorite?* (A meteoroid is a small piece of rock, metal, or both in space. A meteorite is a piece of a meteoroid that hits Earth's surface.)
 - Discuss the photographs of the comet and the meteor on page 15. Explain that a comet is visible in the sky for many nights in a row, while a meteor can be seen only for a second or so. However, students are much more likely to see a meteor because meteors are much more common.
- ✓ **Checkpoint** (page 15) (Possible answer: Asteroids are made of rock, metal, or a mixture of the two. Most are found in the asteroid belt. Comets are made of frozen gases, ice, rock, and dust. They revolve around the Sun in long, elliptical orbits.)

After Reading

Reflect on Reading (page 15) Remind students to read the captions when they look at the pictures. (Possible answer: The picture on page 5 helped me understand how Earth rotates on its axis.)

Apply Science Concepts (page 15) This activity applies concepts from Find Out About on page 3. (Possible answer: The planets would have very little heat or light. They would not travel in orbits, because it is gravity between the Sun and the planets that keeps them in their orbits. Since they would not have a star to revolve around, the planets would not be part of a solar system.)

What Is Beyond Our Solar System?

(pages 16–23)

Before Reading

Build Reading Skills (page 16)

Main Idea and Details Use Build Reading Skills on page 16 to review identifying main idea and details. Discuss the tips. Then model identifying the main idea in the first paragraph on page 19.

Think Aloud *To find the main idea, I ask myself, What is this paragraph mostly about? As I read, I learn that a constellation is a group of stars that make a pattern in the sky. I think this must be the main idea.*

Guide students as they identify details in the paragraph that support this main idea. Students can apply the skill in the Reflect on Reading activity on page 23.

Make a Connection (page 17)

Make a Connection Discuss the Make a Connection questions. Use this discussion to build background and activate prior knowledge about what is beyond our solar system. (Possible answers: I see stars and what look like colorful clouds. I think other solar systems are beyond ours.)

Find Out About Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

Vocabulary Read the Vocabulary words aloud. Explain to students that they will see these words in bold in this section. Start a word web on the board with *Universe* in the center. Have students add information to the web as they read.

During Reading

Other Stars (page 18)

- Emphasize that a star's color and temperature are closely related. Generally, blue or white stars are hotter than orange or red stars. However, even the coolest stars are extremely hot.
- Discuss the photograph of the Big Dipper on page 19. Ask: *Are stars in a constellation always close together in space?* (No, they may actually be very far apart.)
- Ask: *Why do the constellations appear to move slowly across the sky at night?* (because Earth rotates)
- Emphasize that Earth's revolution around the Sun causes our view of the constellations to change from season to season. Some constellations that are visible in winter in the Northern Hemisphere, such as Orion, are present in the daytime sky in summer, when they are invisible due to the Sun's light.
- Because the Southern Hemisphere faces a different part of space, constellations are visible in the sky at different times of year than they are in the Northern Hemisphere. A few constellations can be seen from only one hemisphere or the other and are visible year-round.

- ✔ **Checkpoint** (page 19) (Possible answers: by size, brightness, color, and temperature)

Galaxies (page 20)

- Ask: *What is a galaxy?* (a huge collection of stars, dust, and gas held together by gravity)
- Ask: *Imagine scientists discover a new galaxy. Do you think they would expect to find other galaxies in the same part of space? Why or why not?* (Possible answer: Yes, because galaxies are often found in groups, or clusters.)
- Discuss the photograph of the Whirlpool galaxy. Ask: *How do you think this galaxy got its name?* (Possible answer: It looks as if it is swirling like a whirlpool.) *What kind of galaxy is it?* (spiral)
- Ask: *What galaxy is our solar system a part of?* (Milky Way galaxy) *What kind of galaxy is the Milky Way?* (spiral)
- Discuss that our Sun is but one of the estimated 100 billion stars in the Milky Way galaxy. Our solar system is located in one of the spiral arms of the Milky Way. From Earth we can see other stars in our galaxy besides our Sun.
- Discuss that distances from Earth to other stars, as well as stars' distances from one another, are so great that we measure them in light-years. One light-year is the distance light travels in one Earth year, or about 9.5 trillion kilometers.
- ✔ **Checkpoint** (page 20) (Spiral galaxies: shaped like pinwheels, with "arms" that swirl out; Elliptical galaxies: oval shaped; Irregular galaxies: no regular shape)

The Universe (page 21)

- Discuss the photograph of galaxies. Explain that this is an actual photograph taken by the Hubble Space Telescope. It is not like the planet illustration on the cover, where images were cut and pasted together. Images like this one show how huge space is and how much it contains.
- Ask: *What is between objects in space?* (empty space)
- ✔ **Checkpoint** (page 21) (all of space and everything in it)

Studying and Exploring Space (page 22)

- Ask: *What does it mean that telescopes' lenses magnify objects?* (This means that objects look closer and larger when seen through the lenses.) *How does this help scientists study space?* (We can see many more space objects using a telescope than we can see with our eyes alone.) Note that objects can be seen in more detail when magnified with a telescope. This is also part of how telescopes help scientists study space.
- Remind students that an atmosphere is a layer of gases around a space object. When seen through Earth's atmosphere, space objects can look blurry or twinkly. By placing telescopes on high mountains where the atmosphere is thinner or above the atmosphere in orbit around Earth, scientists can get clearer images of space.
- Ask: *How do scientists use space probes to study space?* (They send them to planets, moons, asteroids, and comets. The probes carry cameras and tools, but not people. The probes send information back to Earth.)

- ✔ **Checkpoint** (page 23) (Possible answers: using telescopes, spacecraft, and space probes)

After Reading

Reflect on Reading (page 23) (Possible answers: Main idea: A galaxy is a huge collection of stars, dust, and gas held together by gravity. Details: A galaxy may have hundreds of billions of stars. Billions of galaxies are in space. Our solar system is part of the Milky Way galaxy. Galaxies are often found in groups, or clusters. Galaxies are grouped, or classified, by shape.)

Apply Science Concepts (page 23) This activity applies a concept from Find Out About on page 17. Encourage students to think about practical matters such as distance, size, cost, and risk when considering the advantages of space probes. (Possible answer: Space probes can travel to planets, moons, asteroids, and comets and send information back to Earth. This means scientists can study space objects more closely than with telescopes. The planets and other objects in space are very far apart. Space probes can travel far away to places where it might not be easy or safe for people to go.)

➡ **Continued on last page**

Name: _____

Date: _____

Test: Our Solar System and Beyond

Part A: Vocabulary

asteroid	comet	constellation	meteor
orbit	solar system	star	universe

Choose the correct vocabulary word for each sentence. Write the word on the line.

1. Every _____ in space is a huge ball of very hot, glowing gases.
2. All the planets and other objects that revolve around the Sun are part of its _____.
3. Earth's _____ is the path it takes as it moves around the Sun.
4. Scientists are studying a small, rocky _____ in the area between Mars and Jupiter.
5. When an icy _____ moves near the Sun, a tail of gas and dust forms behind it.
6. The brightly burning _____ made a streak of light in the sky as it fell toward Earth.
7. The Big Dipper is part of the _____ Ursa Major.
8. Everything on Earth and in space is part of the _____.

Part B: Science Concepts

Mark the best answer to each question.

9. Think about visiting a planet with more mass than Earth. What would your weight be there?
(A) less than on Earth
(B) same as on Earth
(C) more than on Earth
(D) no weight at all
10. The Sun looks larger to us than other stars do because it is _____ than other stars.
(A) bigger
(B) closer
(C) brighter
(D) hotter

Test: Our Solar System and Beyond (continued)

11. What is one way dwarf planets are different from planets?

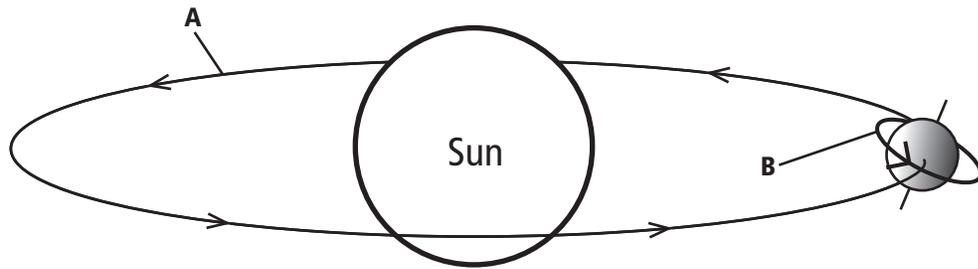
- (A) They are smaller than planets.
- (B) They revolve around moons.
- (C) Tails of gas and dust form behind them.
- (D) They are larger than planets.

12. Which of these is a kind of galaxy?

- (A) cluster
- (B) round
- (C) curved
- (D) spiral

Write the answer.

13. Planets move in two ways. Label the movements marked A and B. Tell which movement decides the planet's day and which decides its year.



A

B

14. Scientists are studying a planet in our solar system. The planet is made mostly of gases. Is this an inner planet or an outer planet? Explain. What other features does this kind of planet have?

15. Describe telescopes. How do they work? How are they used to study space?

Let's Review

(inside back cover)

Have students complete their K-W-L charts before answering these questions. Possible answers are shown.

- 1. Cover Connection** (A solar system is a star and all the planets and other objects that revolve around that star. The Sun is the star at the center of our solar system. Earth is one of eight planets in our solar system. Our solar system also includes smaller objects, such as asteroids and comets.)
- 2.** (A star is a huge ball of very hot, glowing gases. The Sun is the most important star to life on Earth because most living things depend on light and heat from the Sun. Plants need light energy from the Sun to make their own food. Energy in that food passes to animals that eat plants. The Sun's energy also helps Earth stay at temperatures that support life.)
- 3.** (A galaxy is a huge collection of stars, dust, and gas held together by gravity. Our solar system is part of the Milky Way galaxy. It is a spiral galaxy.)
- 4. Main Idea and Details** (Gravity is the force that keeps the planets in their orbits around the Sun. Gravity pulls all objects toward one another. Gravity is stronger between objects that have more mass and between objects that are closer together.)
- 5. Write** (Stories will vary but should include facts about at least three of the planets described on pages 10–13. Details might include information about each planet's size, surface, temperature, atmosphere, length of day and year, moons, or rings.)

Try It! Tell students to choose and label the fruits and vegetables so that their relative sizes are similar to the relative sizes of the Sun and the planets. Students should note that their model is like the real solar system because the Sun and planets are mostly round, are in the same order, and vary similarly in size. The model is different because the sizes of the planets and the Sun and the distances between them are far greater and vary far more, the composition of objects in the solar system is very different, and there is nothing in the model representing other space objects such as asteroids and dwarf planets.

Science at Home Have students do this activity at home with a family member. A park or field with few lights is a good place to look for constellations. Suggest that students draw easily identifiable constellations such as Orion and Cassiopeia.

Answers to Test

(Teacher's Guide pages 6–7)

1. star **2.** solar system **3.** orbit **4.** asteroid **5.** comet **6.** meteor **7.** constellation **8.** universe **9.** C **10.** B **11.** A **12.** D **13.** A: revolve, year; B: rotate, day **14.** It is an outer planet. Outer planets are made mostly of gases, but inner planets are solid and rocky. Outer planets are very cold and huge. They have rings and many moons. **15.** Telescopes are tools that have rounded pieces of glass called lenses. The lenses magnify objects. We can see many more space objects using telescopes than we can see with our eyes alone. Scientists use telescopes that are on Earth and in space.

ADDITIONAL ASSESSMENT OPPORTUNITIES Use the Checkpoints, Reflect on Reading, and Apply Science Concepts features and Let's Review questions as additional assessment opportunities.

Delta Science Content Readers are 24-page nonfiction student books with informative, engaging text and full-color photos and illustrations. The readers present key science content and vocabulary found on state tests, present key reading skills and strategies useful for reading informational text, support and extend the experiences and content of hands-on activities, promote scientific inquiry, and serve as a home-school link. They are available in two editions: Red Edition for Grades 3–4 and Purple Edition for Grades 4–5.

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