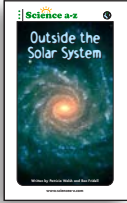


Outside the Solar System

INTRODUCTION



This book is available at three reading levels, as indicated by the one, two, or three dots beside the Science A-Z logo on the front cover.

This guide offers general instructions that can be used with any or all of the multilevel books. When appropriate, tips are provided for modifying the instruction for a specific level. The dots in this guide indicate elements of the instruction that are only applicable to certain book levels.

- can only be used with low level
- can only be used with middle level
- can only be used with high level
- | can be used with low and middle levels
- | can be used with middle and high levels
- | can be used with all three levels

Each book is available for printing or projecting and is also available as an eBook for students to access on [Kids A-Z](#). The *Nonfiction Books* and their accompanying quizzes are available in both English and Spanish.

BOOK SUMMARY

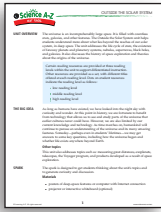
The book *Outside the Solar System* begins by discussing the history of space exploration. Then the book takes the reader on an imaginary journey from Earth into the distant reaches of the universe beyond our solar system. Along the way, the reader encounters and learns about a variety of deep-space features, including stars at different life-cycle stages, exoplanets, nebulas, supernovas, black holes, and galaxies. Near the end of the book, readers are encouraged to think about how the universe may have begun and to appreciate the wonders of space.

Labeled photographs and diagrams support the text.



Preview the book title, cover, and table of contents with students. Ask them to predict what the book will be about. Invite students to preview the remainder of the book, looking at the images, captions, and special features as well as the section heads and the glossary. Encourage them to use this information to continually make and revise their predictions while reading.

Vocabulary



Instruction for the unit's vocabulary terms can be found in the *Unit Guide*. It defines core and other key science terms and suggests resources you can use to teach vocabulary before, during, or after the reading.

These terms are found in the glossary. Certain terms are only found in certain book levels, as noted.

astronomer	big bang theory	black hole	cluster
cosmologist	deep space	exoplanet	galaxy
light-year	luminosity : :	nebula	orbit
solar system	star	supernova	telescope

Reading Strategy

Ask and Answer Questions

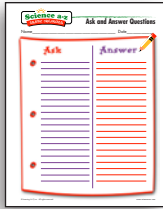
Explain to students that good readers usually ask themselves questions as they read. Sometimes they wonder what will happen next in a story. Sometimes they don't quite understand something they read in a book or are curious to learn more about a topic.

Think-aloud: *Asking myself questions as I read makes me want to keep reading to find answers. If I find the answers, my curiosity is satisfied. I might even come up with new questions. If I don't find the answers, it makes me want to read more or look in other places.*

- :|: Model asking questions while reading from the Exploring Space section of the book (pages 5–6). You can use the following questions as examples:
 - *How can people use stars to navigate?*
 - :|: ▪ *What makes modern telescopes better than early telescopes?*
 - *Why haven't people traveled beyond the Moon yet?*
 - *Are we more likely to learn more about deep space by looking through telescopes or by traveling there?*

Think-aloud: *As I was reading, I had a lot of questions. I don't think these pages answer all of them, but now I want to keep reading to see whether I can find out some of the answers. I know that I may have to look in other places to find the answers.*

Discuss other ways students can find answers to their questions. But emphasize to students that asking questions in their mind makes the reading more interesting, even if they don't find all the answers. Allow for more practice, gathering questions that students have as they read.



Download and print the *Ask and Answer Questions Graphic Organizer*. Have students record questions in the left-hand column, and if they find answers, have them record these in the right-hand column. Unanswered questions may spark further research.

TIP The *Graphic Organizer* can also be used with each of the *Quick Reads* or other unit resources.

As students read, they should use other reading strategies in addition to asking and answering questions.



The book begins with an introduction to deep space. After students read this section, you may want to check for understanding by having them review this section and then encourage students to share their own experiences with looking into space at night.

Review the key science terms in each section before students read. Encourage students to read one section at a time and then discuss in pairs, in groups, or as a class what they read. (See *Discussion Questions*.)

Students can read the special features of the book to build on the concepts within each section. Some vocabulary terms can be reinforced in these features.

Comprehension Skill Focus

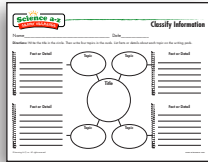
Classify Information

Explain to students that a book such as *Outside the Solar System* includes a lot of facts about space exploration and deep space. Sometimes, putting those facts into groups can help students better understand and remember what they have read. Ask students how they would put the information from this book into groups.

TIP The table of contents and section headings can be used to identify good ways to classify information from the book.

List the groups that students have suggested on the board or on separate pieces of butcher paper, leaving room to list facts beneath each heading. Select one fact or detail at a time from random pages in the book to read to the class. Have students identify the category in which each fact belongs and then write the fact or detail on the board beneath the appropriate topic. For example, *the color of a star is determined by the temperature of its surface* could be written under a heading called *All About Stars*.

Once the class has added a number of facts and examples to the lists, review the skill of classifying information as a way of organizing facts in a manner that makes them easier to understand and remember. In the process of classifying, students will also reread portions of the text and review key facts, which will reinforce the content of the book.



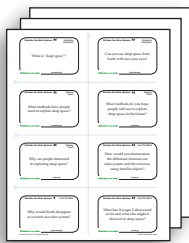
Download and print the *Classify Information Graphic Organizer*. Prepare the sheet before making copies by writing *Deep Space* in the central circle. Have students label the ovals with four sections from the book. Then instruct students to write one or more facts or details about each section on each notepad.



The *Graphic Organizer* can also be used with each of the *Quick Reads* or other unit resources.

As students read, they should use other comprehension skills in addition to classifying information.

Discussion Questions



Use the *Discussion Cards* during or after reading. The cards are structured so they can be used for whole-group discussion or assigned to individuals, pairs, or groups. Choose the activity that best serves your purposes. It may be helpful to allow students to use their book and completed *Graphic Organizer(s)* as they try to answer the questions. Here are some suggested activities:

- Divide the class into groups and have each group discuss the questions from a section of the book. Then have groups report their responses to the class.
- Have all groups discuss all the questions and then discuss the similarities and differences among the groups' answers.
- Place discussion cards at centers and have groups talk about or write their responses as they rotate through them.
- Have each student choose a card and write an answer on the back. Collect the cards and review them with the whole class.
- Assign certain questions to groups or individuals for homework.

Each question can be answered with certain book levels, as noted with dots in the upper left corner. You may want all students to think about all the questions, even if their book level is not noted on certain cards. The book section or topic most closely related to the question appears on each card. Question types are noted in parentheses.

All questions can be answered with all three book levels except where noted.

Introducing Deep Space

- What is *deep space*? (remembering)

- Can you see deep space from Earth with just your eyes? (understanding)

Exploring Space

- What methods have people used to explore deep space? (remembering)

- What methods do you hope people will use to explore deep space in the future? (evaluating)
- Why are people interested in exploring deep space? (analyzing)

Out of This World

- How would you demonstrate the difference between our solar system and the universe, using familiar objects? (applying)
- Why would Earth disappear as you left our solar system? (understanding)
- What has Voyager 2 discovered so far and what else might it discover in deep space? (creating)

Among the Stars

- What are the two closest stars to Earth? (remembering)
- How much farther from Earth is Alpha Centauri than Proxima Centauri? (analyzing)
- What would a constellation look like if you passed it in a spacecraft? (applying)
- If you flew between two stars in deep space, how might they be similar and different? (applying)
- Why does the Sun look so much bigger in the sky than any other star? (understanding)

- Why do you think the measurement unit of light-years was created? (analyzing)
- Why might a star in the night sky look blurry, even through a telescope? (understanding)

Star Life Cycles

- How would you compare the life cycle of a star to the life cycle of a human? (analyzing)
- How do nebulas and supernovas each form? (remembering)
- If you were a star, which life-cycle stage do you think you would enjoy the most, and why? (evaluating)

Watch Out for Black Holes

- Why should you avoid a black hole if you travel in deep space? (understanding)

The Search for Planets

- How can cosmologists tell that exoplanets exist without being able to see them? (understanding)
- What tools do astronomers use to find distant planets? (remembering)
- What do you think a faraway planetary system might look like? (creating)

Swirling with the Galaxies

- What is a galaxy? (understanding)

- How are galaxies put into categories, and in which category does the Milky Way belong? (remembering)
- What other things besides galaxies, including everyday items on Earth, can be found in clusters? (applying)

An Expanding Universe

- How does the big bang theory explain the origin of the universe? (understanding)

- If the big bang theory is correct, what do you think will happen to the universe if it keeps expanding? (analyzing)

Conclusions

- How is deep space different from the space within our solar system? (analyzing)
- Now that you have read this book, will you feel differently when you look into space? Explain. (evaluating)

Math Moment Solution

- |:|: The following Math Moment is found on page 8, phrased slightly differently in each level of the book:

Math Moment

The distance between stars is so great that scientists use a measurement called a *light-year* to measure it. One light-year is the distance that light travels in one Earth year. One light-year is about 9.5 trillion kilometers (5.9 trillion mi.). About how many kilometers (or mi.) from Earth is our closest star neighbor?

Below is one approach to helping students solve the problem. If appropriate, allow the use of calculators. To help students get started, say:

Before solving this problem, what information will we need to know? (The length of a light-year in kilometers or miles and the number of light-years to our closest star neighbor, which are both found in the book.)

Our nearest star neighbor, Proxima Centauri, is about 4.2 light-years from Earth. To find out how many kilometers (or miles) this is, we can multiply 4.2 by the number of kilometers (or miles) in one light-year. It may be easiest to leave off the trillions for now and to use smaller numbers at first. But we must remember that our answer is in trillions of kilometers (or miles):

Kilometers: $4.2 \times 9.5 = 39.9$; therefore the distance is about **39.9 trillion kilometers**, or **39,900,000,000,000 kilometers**.

Miles: $4.2 \times 5.9 = 24.78$; therefore the distance is about **24.78 trillion miles**, or **24,780,000,000,000 miles**.

For rounding purposes, students may estimate the distance from Earth to Proxima Centauri to be approximately **40 trillion kilometers** or **25 trillion miles**.



Encourage students to reread the book.

Reflect on the Reading Strategy: *Ask and Answer Questions*

Review the strategy of asking and answering questions. Invite students to share how this strategy helped them understand what they read and made them want to read more.

Enduring Understanding

In this book, students have read about deep space and the special features that exist beyond our solar system. Discuss the following with students:

- *Now that you know more about the universe, what do you think the goals of space exploration should be in the future?*

Home Project

On a clear night, encourage students to observe the night sky with their family. Have each student choose a small section of sky and then draw and/or describe everything they see there, including stars, planets, constellations, airplanes, and satellites. If they have access to binoculars or a telescope, encourage them to use these tools. Back in class, let students share their observations, notes, and drawings with the class, including a description of how the rest of the class can locate their section of sky.

Assess

Download and print the appropriate reading level and language of the *Book Quiz* or have the student take the eQuiz on **Kids A-Z**.

Use the *Nonfiction Retelling Rubric* to assess understanding.

Quick Check: For individual or group assessment, have students respond orally or in writing to the following question:

- *What are three kinds of features found in deep space, and how would you describe each one?*

