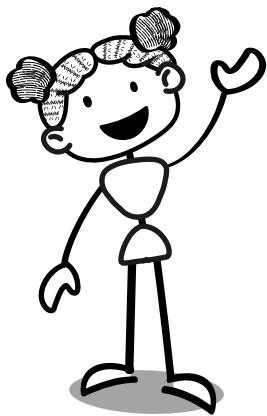


Discover!

A

EARTH & SPACE SCIENCE





Discover! Earth & Space Science A

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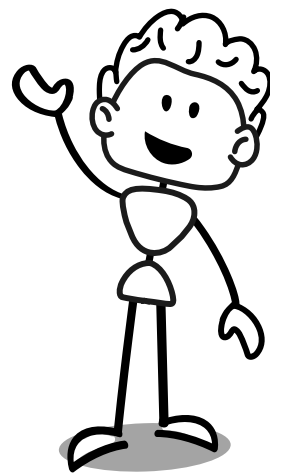
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Discover! Earth & Space Science A

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Student & Instructor Books

Worktext

- The carefully preselected scope and sequence integrates an engaging storyline with direct instruction, practice, application, and extension activities.
- The curriculum provides direct instruction and assessment opportunities that allow the student to gain knowledge, reflect on it, and apply it.
- The curriculum correlates to national standards and integrates a variety of learning preferences (styles) to meet the unique needs of the student.
- The worktext is organized and divided into units and chapters. Each unit ends with a review and an assessment to help the student recall learned knowledge.

Instructor Guide

- The instructor guide is specifically structured to complement the worktext and lab book.
- The instructor guide provides suggestions for the instructor to facilitate, support, and extend their student's learning.
- Instruction and curriculum are differentiated with remediation, enrichment, assessment, and supporting activities suitable for a variety of learning styles.
- Answer keys for all activities are provided.
- The back of the instructor guide provides full support for all lab activities and is organized to mirror the lab book's table of contents.

Lab Book

- The lab book, when used alongside the worktext, serves as a dynamic tool to enhance student understanding of scientific principles and processes.
- Each unit has at least one lab experience. Each lab has five sections.
 - **Start!:** This section introduces the lab content and establishes a clear connection between unit content and lab application.
 - **Spark:** In this section, the student engages with the lab by making predictions and researching pre-experiment questions.
 - **Search:** In this section, the student completes the steps outlined to engage with the experiment. The section emphasizes recording observations and making critical notes.
 - **Synthesize:** In this section, the student takes the data collected during the experiment to report findings, make inferences, and/or suggest further research.
 - **Stretch:** This section invites the student to take their experiments further.

Assessment Booklet

- Traditional unit assessments and performance assessments are provided in the assessment booklet. A copy of each traditional unit assessment and performance assessment is also provided in the instructor guide along with the answer key and rubric.
- Each unit assessment has two assessment options.
 - **Traditional Unit Assessment:** This is a traditional assessment (multiple-choice) with an answer key.
 - **Performance Assessment:** This is a performance-based option with a rubric.



Planning & Chapter Organization

Planning

- Each course is designed to cover approximately 160 days of instruction, with each chapter taking roughly 2 days to complete. This does not include time spent on the enrichment activities provided in the worktext sidebars and the instructor guide. These materials allow the instructor to customize the learning experience and encourage the student to dive deeper.
- It is recommended the student completes the **Explore** and **Read** pages on the first day and the **Practice** and **Show What You Know** pages on the second day.
- It is recommended that the student complete the unit lab(s) contained in the lab book PRIOR to the completion of the unit reviews/assessment chapter. The student should be able to complete a lab in one day (or do half of the lab on one day and half on another day). Because of the nature of experiments, some labs may require the student to engage with the procedures over several days. Please be sure to read through the unit lab experiments in advance to adequately plan for each unit's calendar of activities.
- For unit review/assessment chapters, it is recommended the student completes the **Review** pages and the first **Practice** page on the first day and the remaining **Practice** pages on the second day.

Chapter Organization

Chapter Overview

- The overview sets the student up for success with the chapter goals and objectives. The overview also facilitates the student's learning by identifying chapters they may need to review, highlighting relevant academic vocabulary, providing an optional extension activity and a BIG question that helps drive inquiry.

Explore

- The Explore section provides the student with an opportunity to discover new concepts within a real-world narrative.

Direct Instruction

- Direct instruction provides the student with the opportunity to read the content, write about it, and apply the concepts.
 - **Read:** Here, the student reads informational text to gain knowledge about the chapter topic.
 - **Write:** Here, the student reflects on what they have read by generating a written response.
 - **Apply:** Here, the student practices what they have learned using various activities such as graphic organizers, matching, drawing, experiments, and other hands-on activities.
 - **Practice:** Here, the student practices the objectives before moving on to the chapter assessment.

Show What You Know

- This assessment is carefully crafted to align with the chapter's objectives while providing the student an opportunity to demonstrate their knowledge of the material.

Extension Activities

- **Create:** These activities require the student to construct something. Examples may include a drawing, song, poem, model, etc.
- **Online Connection:** These activities require the student to use technology-based solutions to research and investigate concepts related to the chapter or create artifacts demonstrating their understanding.
- **Closer Look:** These activities require the student to make observations about the world around them, allowing them to generate predictions, inferences, or conclusions based on those observations.
- **Mini-Lab:** These activities require the student to engage in quick experiments to apply relevant scientific concepts while utilizing common household materials.
- **In Focus:** These activities require the student to apply one element of the engineering design process to an activity relevant to the chapter's content.

Earth & the Solar System

Because Andi hopes to become an astronaut one day, understanding Earth's place in the solar system is crucial to her success. Together, you will uncover the unique features that make Earth a remarkable celestial body nestled within the vast expanse of our solar neighborhood. You will examine the intricate relationships between Earth and the other planets, moons, and celestial objects that orbit the sun.

Earth's position within the solar system is unlike any other, offering a perfect balance of conditions that sustain life as we know it. You will spend some time mapping Earth's orbit around the sun, calculating its axial tilt, and studying its unique features, such as the presence of water and a breathable atmosphere. In addition to analyzing what makes Earth so special, you will join the search for life on other planets by identifying planets which share Earth's distinctiveness.

While Andi is set on being an astronaut, you aren't yet decided about your future. In this unit, you will explore professions that keep your feet on the ground even if your head is in the stars. Your youth spent making paper airplanes may someday lead to a future as a rocket scientist!

Burning questions about celestial bodies? Complete the Mini-Lab about meteoroids in this unit!

What is a schmoon? Check out the Weird Science article in this unit!

Big Questions of the Unit

What makes Earth different from other planets?

What are the outer planets, and how do they stay in orbit around the sun?

What are asteroids and comets, and what effects can they have on our planet?

What is an aeronautical engineer, and how do they assist in learning more about space and celestial bodies?



Chapter 19

Earth's Place in the Solar System

By the end of this chapter, you will be able to:

- explain how Earth's position and motion in the solar system affect its seasons, day, and night
- describe the main characteristics and features of Earth and how they are unique compared to other planets in the solar system
- discuss current research regarding planets in other solar systems that share features with Earth

Academic Vocabulary

Read the following vocabulary words and definitions. Look through the chapter. Can you find each vocabulary word? Underline the vocabulary word in your chapter and write the page number where you found each word on the blanks here.

- **axis:** a straight line about which a body or a geometric figure rotates or may be supposed to rotate (p. ____)
- **equinox:** either of the two times each year (around March 21 and September 23) when the sun crosses the equator and day and night are of approximately equal length (p. ____)
- **orbit:** a path followed by an object, such as a planet or a satellite, as it revolves around another object under the influence of gravity (p. ____)
- **revolution:** the action by a celestial body going round in an orbit or elliptical course (p. ____)
- **rotation:** one complete turn; the angular displacement required to return a rotating body or figure to its original orientation (p. ____)
- **season:** a period of the year characterized by or associated with a particular activity or phenomenon (p. ____)
- **solstice:** either of the two points on the ecliptic at which its distance from the celestial equator is greatest and which is reached by the sun each year, around June 21 and December 21 (p. ____)

Materials Needed

- | | |
|------------------------|-----------------|
| ■ drawing of a star | ■ pencil or pen |
| ■ flashlight | ■ skewer |
| ■ orange or small ball | ■ tape |
| ■ piece of white paper | |

THE BIG QUESTION

What makes Earth different from other planets?

EXPLORE

Winter break has just ended, and you meet your best friend, who is excited to tell you about his ski vacation. You think that doesn't sound very exciting. You shiver as you remember shoveling snow off the driveway this morning. You tell your friend you didn't know that it snowed in Florida! He laughs and explains he went water skiing, not snow skiing! As you both head off to go snow tubing, you wonder what seasons look like around the world. Do other people experience the same seasons you do? What about areas that seem to be warm year-round, especially those near the equator?

As you trudge up the snowy hill, you think about how much easier it would be to water ski without all of these bulky clothes you are wearing. Imagining the warm sun on your face and the water splashing around, you wonder what other activities you might experience during the different seasons. As a smile creeps across your face from your daydream about water skiing, your friend hits you with a snowball. Back to reality! You reach down and scoop up a big handful of snow, pack it tightly into a ball, and start a snowball fight. Those warmer days will just have to wait!

How many seasons do you experience where you live? Some areas experience four distinct seasons. Other areas do not have such drastic seasonal changes. However, all places on Earth experience seasons.

What do you think causes the changes between the different seasons? How do you think this affects life on Earth?



Japanese Cherry Tree in Four Seasons

MINI-LAB

How Light Moves

Investigate how light moves at different angles.

Materials: piece of white paper, flashlight, pencil or pen

Directions:

1. Place a piece of white paper on the table in front of you.
2. Hold the flashlight about 12 inches above the paper, pointed toward the paper.
3. Using a pencil or pen, draw around the light on the paper. What shape does the light make?
4. Now, move the flashlight in the shape of an arc. Does the shape the light makes on the paper change?
5. What happens if you move the flashlight closer to the table? Draw around the shape made at this angle. How are the two shapes different?

If the light is the sun, how does this affect Earth's surface? How does the angle of light received from the sun correlate to the seasons people experience?

Pull out your Lab Book and record your answers and reflections in the space provided for the Mini-Lab or make the appropriate notes in a regular notebook and share with your instructor.

Earth's Rotation and Orbit

The sun is setting after a long day of tubing. As the sky darkens, you wonder what really happens to the sun at the end of the day.

Earth rotates around an imaginary line that runs from the North Pole to the South Pole. This is Earth's **axis**, or the straight line about which a body or a geometric figure rotates. Earth's axis is tilted at 23.44 degrees. As Earth spins around its axis, one side faces the sun, experiencing daytime. The other side faces away from the sun, experiencing night. Earth makes one **rotation**, or one complete turn, every 24 hours. That explains why a day is 24 hours long.

Earth's year is determined by its **orbit**, or the path followed by an object as it revolves around another object under the influence of gravity. Earth's orbit is an ellipse, or oval-shaped path, around the sun. It takes Earth 365.25 days to make one revolution around the sun. A **revolution** is the action of a celestial body going around in an orbit or elliptical course. Since the orbit isn't a perfect circle, Earth isn't always the same distance from the sun. This movement, plus the tilt of the Earth on its axis, creates seasons. **Seasons**, or periods of the year characterized by or associated with a particular activity or phenomenon, occur because one hemisphere is tilted toward the sun. This means it receives more energy from the sun, which results in longer, warmer days. The other hemisphere, tilted away from the sun, experiences shorter, cooler days. Therefore, when it is summer in one hemisphere, it is winter in the other hemisphere.

Solstices occur when the distance from the celestial equator is greatest and represent the longest and shortest days of the year. The summer solstice occurs in the Northern Hemisphere on June 21st. The winter solstice occurs in the Northern Hemisphere on December 21st. In the Southern Hemisphere, the summer and winter solstices are reversed.

On the other hand, **equinoxes** occur when the sun crosses the equator and the length of day and night are of approximately equal length. These occur when the sun is directly over the equator. This results in day and night both being approximately 12 hours long. In the Northern Hemisphere, the spring (vernal) equinox occurs on or near March 21st; the fall (autumnal) equinox occurs on or near September 23rd. In the Southern Hemisphere, the vernal and autumnal equinoxes are reversed.

IN FOCUS

Earth's Seasons

To review seasonal differences, create a model to study how sunlight plays a role. You will need a small orange or styrofoam ball, a wooden skewer, a pen or marker, a flashlight, and a piece of paper.

1. Push a skewer through the middle of the orange so that it sticks out both ends.
2. Label the North and South Poles by writing N at one end of the skewer and S at the other end.
3. Halfway between the two poles, draw a line around the orange to represent the equator.
4. Draw a dot halfway between the North Pole and the equator and one directly opposite it.
5. Stabilize the flashlight to shine on the orange.
6. Keeping the N pointed toward the star, rotate the orange on its axis so that the light is pointing directly at the dot in the Northern Hemisphere.
7. Look at the shape the light makes on the orange at the dot.
8. Spin the orange around and compare the light on the dot in the Southern Hemisphere.

What can you infer from the shape of the two light beams?

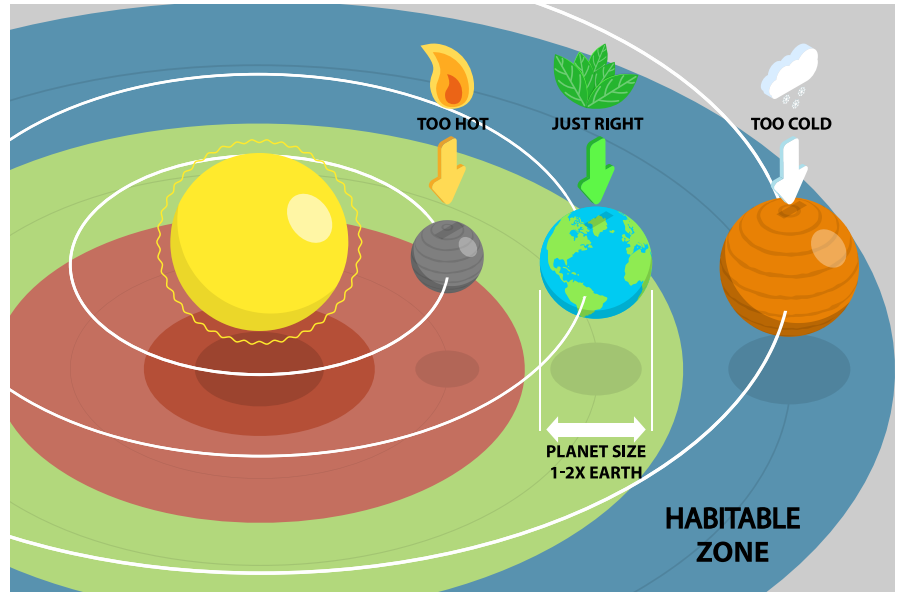
What Makes Earth Unique?

As you drift off to sleep after your adventure, you think about all the fun things people can do in different seasons all over the planet. You look out the window into the sky and wonder about other planets. Of all the discovered planets in the universe, Earth is very unique. Liquid water, plate tectonics, and an amazing atmosphere, among other things, work together to give Earth its most amazing feature — life!

Earth is the third planet from the sun. It lies in what scientists call the Goldilocks zone. This zone allows Earth to be just the right temperature, neither too hot like Venus nor too cold like Mars. Earth's temperature is perfect for keeping water in liquid form and sustaining life.

While other planets also have atmospheres, Earth is the only planet in the solar system with breathable oxygen. The ozone layer protects humans from dangerous UV radiation from the sun, but still allows the sun to warm Earth. Other planets' atmospheres vary in density and composition, and no other atmosphere in the solar system could sustain human life.

Scientists have been searching for another planet that could support life. Planets that are potentially habitable should have similar characteristics to Earth. They should be small enough to orbit in the Goldilocks zone of their star. The Goldilocks zone is the distance from a star that provides the right temperature for liquid water. On a planet that is too hot, water would evaporate. On a planet that is too cold, water would freeze. Several planets have been discovered that could possibly be another Earth.



WRITE

Essay

What characteristics and features of Earth make it unique from other planets in the solar system?

CLOSER LOOK

NASA Exoplanet Exploration

On NASA's Exoplanet Exploration website, search for futuristic technology. Select one of the technologies listed and explain how it works and how it is being used to discover new worlds.



Finding Another Earth

As you sleep, you dream about discovering a new planet like Earth. As you investigate the planet, you realize it is too far away to visit. As you start to develop an idea of how to get there, your alarm clock goes off. Even after waking up, you wonder how scientists can discover planets millions of light years away and know anything definitive about them. You decide to do some research into the search for other planets like Earth.

Scientists use space telescopes to discover new exoplanets. They look for planets that are located in the Goldilocks zone of the star they orbit and are also rocky planets like Earth. The Kepler Space Telescope discovered the first Earth-like planet located 500 light years from Earth in 2014. Kepler-425b and its star are the closest to Earth and our sun. Kepler 442-b is believed to receive enough light from its star to support a biosphere.

Similarly, the Trappist-1 system is located 40 light years from Earth and contains seven rocky planets. Trappist-1 e, f, and g could have liquid water on their surface, as they lie in the Goldilocks zone of their star. Some believe that the water on the Trappist planets evaporated years ago, while others believe that these planets could have had more water than Earth.

New, higher-powered telescopes are being developed to learn more about these planets. Currently, the James Webb Telescope, which was launched in December 2021, has a mission to study the atmosphere around Earth-like worlds and search for biosignatures, which are gases associated with past or present life. Telescopes today are being designed to search for worlds beyond our solar system while being able to block the light from their host stars, enabling it to see planets and planet-forming disks.



Essay

How do scientists discover other planets?



Finding an Earth-Like Planet

Why are scientists interested in finding another planet like Earth?

PRACTICE

Earth and Habitable Planets

1. How does the angle of the sun's rays striking Earth affect the climate of the area?

2. Explain how the tilt and orbit of Earth create the seasons.

3. What is the difference between the rotation of Earth and the revolution of Earth? Which one causes night and day?

4. List the features of Earth that are unique and life-sustaining.

5. How are exoplanets discovered?

6. What criteria do scientists use to classify a habitable planet?

REVIEW

In this chapter, you learned:

- Day and night cycles are created by Earth rotating around its axis every 24 hours.
- Seasons are created due to the combination of Earth's tilt on its axis and its orbital pattern around the sun.
- Earth has several unique features, including liquid water, an atmosphere that contains oxygen, and life.
- Scientists use telescopes and the rules of the Goldilocks zone to find possible habitable exoplanets.

Can you answer The Big Question?

What makes Earth different from other planets?

SHOW WHAT YOU KNOW

Use a word from the word bank to complete each sentence.

Word Bank: axis Goldilocks zone orbit solstice revolution

1. The habitable zone around a star where it is not too hot and not too cold for liquid water to exist on the surface of surrounding planets is called the _____.
2. The imaginary line that Earth rotates around is called its _____.
3. A(n) _____ occurs when the distance from the celestial equator is greatest and represents the longest and shortest days of the year.
4. A(n) _____ is the action by a celestial body going round in an orbit or elliptical course.
5. The path followed by an object as it revolves around another object under the influence of gravity is called its _____.

Read each sentence. Circle True or False.

6. True or False Earth's orbit around the sun lasts 365.25 days.
7. True or False Planets found outside the Goldilocks zone can support life.
8. True or False Scientists use telescopes like the Kepler Space Telescope to discover exoplanets.
9. True or False All exoplanets have the same characteristics as Earth.
10. True or False Seasons occur because of Earth's axis tilt and orbit around the sun.

Answer the following questions.

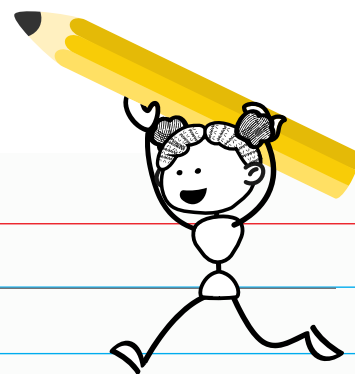
11. What characteristics make Earth different from other planets?

Choose the correct answer.

12. What causes day and night on Earth?
- A. Earth's orbit around the sun causes different parts of the planet to experience day and night.
 - B. The moon blocking the sun creates nighttime on Earth.
 - C. Earth's rotation around its axis causes one side of the planet to face the sun (day) while the other side faces away from the sun (night).
 - D. Clouds covering the sun cause Earth to switch between day and night.

Select all of the correct answers.

13. What criteria or data help a scientist determine if an exoplanet is Earth-like?
- | | |
|--|---|
| A. The planet lies in the Goldilocks zone of its star. | D. The planet's foundation is rocky. |
| B. The planet orbits a star similar to our sun. | E. The planet glows brightly and is easy to see from Earth. |
| C. The planet orbits more than one star at a time. | F. The planet is very far from its star. |



Think About It

I have learned...

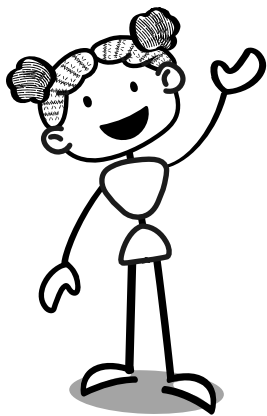
More Notes

I still have questions about...

Discover!

EARTH & SPACE SCIENCE

LAB BOOK



Discover! Earth & Space Science Lab Book

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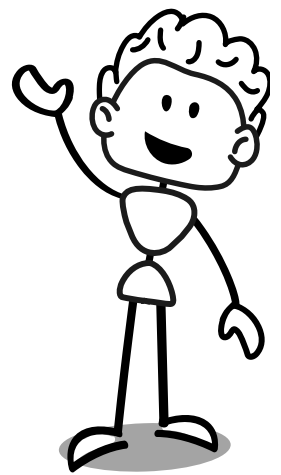


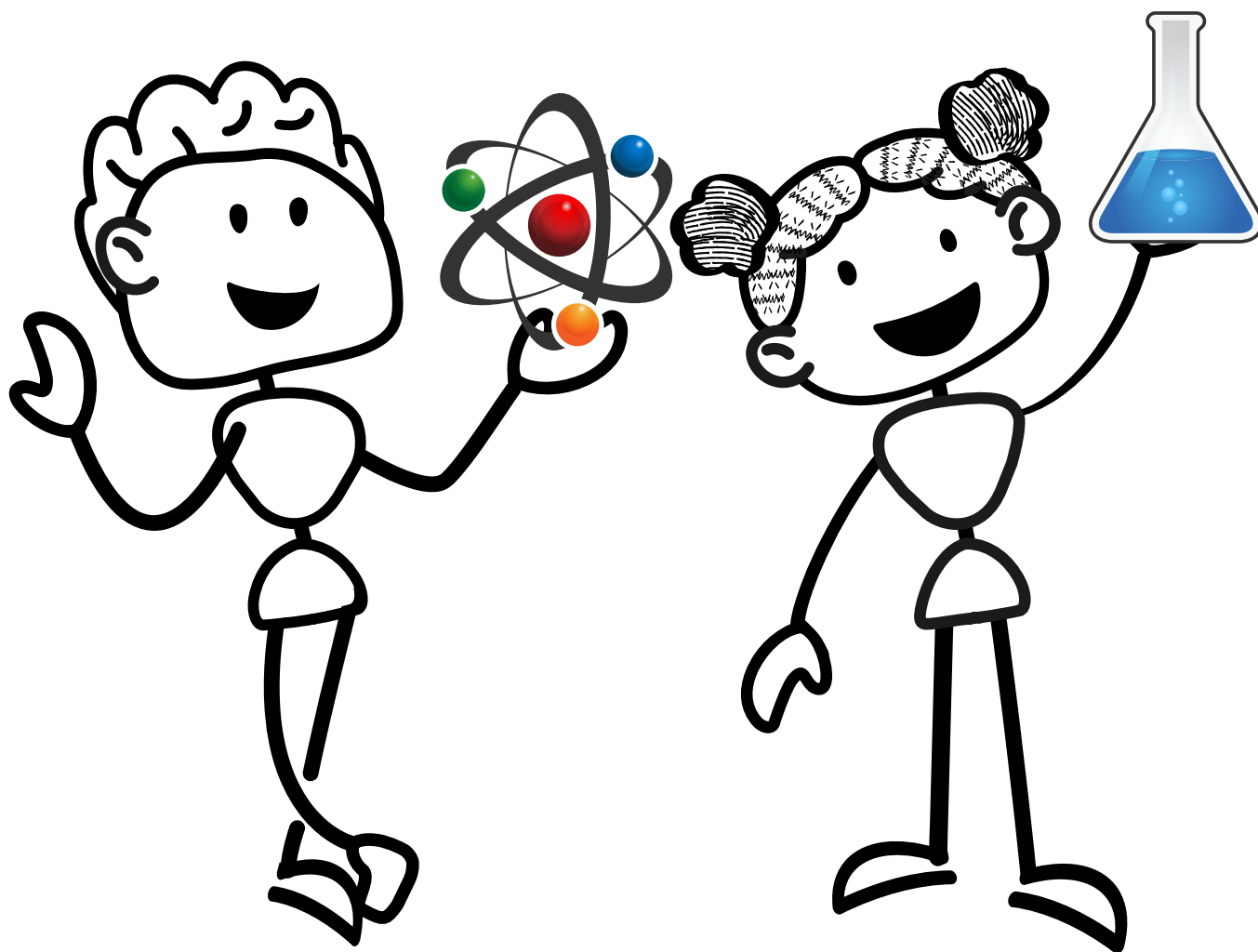
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How to Use This Lab Book

Lab Book

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 - **Synthesize:** In this section, the student takes the data collected during the experiment to report findings, make inferences, and/or suggest further research.
 - **Stretch:** This section invites the student to take their experiments further.
- A page for lab notes is provided with each lab. The student is encouraged to record their hypothesis, experiment observations, and experiment results in this section.



Eyes in the Sky

Upon completion of the lab, you will be able to:

- apply the engineering design process to complete a defined task
- evaluate and redesign a prototype against specific design conditions

Key Concepts

- The field of aeronautical engineering is concerned with the design, manufacture, testing, and maintenance of machines capable of flight.
- Aeronautical engineers explore systems that operate within Earth's atmosphere.
- Aeronautical engineers use a range of skills including analytical skills such as problem-solving, keen attention to detail, the ability to communicate with others, creativity, self-improvement, and the ability to use technical and scientific skills.

Materials

- 3 helium balloons
- a paper or plastic cup
- 1 meter of string or ribbon
- tape
- small digital scale
- a meter stick or ruler
- stopwatch
- 10 pennies and other small light objects like plastic beads

START!

Since career day, you have been obsessed with anything and everything related to flight and engineering, particularly in the space industry. So, when you see a flier for “A Day of Flight: A Free STEM Fair for Kids,” you immediately sign up. You walk into the fair and see flight everywhere. There is a paper airplane competition, a rocket-building booth, and even a drone flight school, but something unusual catches your eye. NASA is there, but not to show off rockets or space suits. They have a booth for the Balloon Program. “Why would NASA have a program for balloons?” you wonder.



Weather balloon monitoring from the upper atmosphere.



Balloons were some of the first flight machines and continue to be used in science today. The NASA Balloon Program sends balloons into the upper atmosphere to collect data, test new designs, and monitor environments. In this lab, you will design and build a balloon and basket (also called a gondola) to get a taste of balloon engineering. Your balloon and basket must be able to hold additional mass to do the following:

- ascend at 50-100 cm/sec
- maintain an altitude of 1 m for 30 seconds
- descend at 50-100 cm/sec

Write your predictions for how much mass your balloon and basket will need for each task in the table on the next page.

Can you write a hypothesis? Use the Lab Notes page to record your predictions about this assignment.



Procedure:

Step 1: Create a balloon and basket that can ascend and descend with different amounts of weight without and human support.

Step 2: Identify how much mass your system needs to perform specific tasks.

Step 3: Place your meter stick against a wall vertically.

Controlled Ascent: Ascend at 25-50 cm/sec

Procedures:

Step 1: Hold the cup on the floor near the meter stick.

Step 2: Release the system and start the timer.

Step 3: Stop the timer when the bottom of the gondola reaches 100 cm.

Step 4: Calculate the rate of ascent (rate = distance/time or $r = d/t$).

Step 5: Add and subtract mass until you reach the range for the rate of ascent.

Step 6: Use the scale to calculate the mass added to the cup to meet the range.

Step 7: Document the mass in the table.

Maintaining Altitude: Maintain an Altitude of 1 m for 30 Seconds

Procedures:

Step 1: Hold the bottom of the cup at 100 cm.

Step 2: Release the system to see if it maintains that altitude.

Step 3: Add and subtract mass until the system maintains that altitude.

Step 4: When you find a mass that seems to work, start your timer to make sure it can stay at 100 cm for 30 seconds.

Step 5: Calculate the mass added to the cup to meet the range.

Step 6: Document the mass in the table.

Controlled Descent: Descend at 25-50 cm/sec

Procedures:

Step 1: Hold the bottom of the cup at 100 cm.

Step 2: Release the system and start the timer.

Step 3: Stop the timer when the bottom of the gondola reaches the floor.

Step 4: Calculate the rate of descent.

Step 5: Add and subtract mass until you reach the range for the rate of descent.

Step 6: Calculate the mass added to the cup to meet the range.

Step 7: Document the mass in the table.

Procedure:

BALLOON ENGINEERING DESIGN		
Use the table below to record the data from each task.	Predicted Mass Needed (g)	Actual Mass Needed (g)
Ascend 25-50 cm/sec		
Maintain Altitude of 1 m for 30 Seconds		
Descend 25-50 cm/sec		

What is happening during the experiment? Use the Lab Notes page to record your observations about this assignment.

SYNTHESIZE

Congratulations! You've officially engineered your first balloon gondola system!

These simple system designs are used for important scientific research across many fields. Your designing, testing, and prototyping would be the first step in creating a working balloon system. How would this system look in real life? To continue in the engineering design process, you need to conceptualize a more realistic balloon system.

Imagine the cup actually holds a device used for early forest fire detection at medium altitudes.

Now that you know the masses needed for the balloon system to perform different tasks, you will need to redesign the system so that a ground operator could remotely add or subtract the mass needed to perform each function, descent, ascent, and maintaining of altitude. Consider the following constraint: anything released from the system into the environment cannot be toxic, leave residual waste (trash), or cause significant harm to animals in the ecosystem.



An early forest fire spotted from a balloon camera.

Sketch a new annotated design with this new situation and criteria in mind.

Can you describe any results? Use the Lab Notes page to record your observations about this assignment.

STRETCH

The NASA Balloon Program is looking at new and innovative ways to use balloons. As you know, Venus is closer to the sun than Earth, which, paired with its thick atmosphere, makes Venus too hot for terrestrial rovers. Balloons to the rescue! Engineers are designing a balloon to monitor Venus from the atmosphere, and their prototype applies some interesting design solutions to combat the harsh conditions. Engineers have added an aluminum coating to the balloon skin to reflect the sunlight away from the system. They have also added a Teflon™ layer to protect the balloon from the sulfuric acid in the atmosphere. Wherever there is a problem to solve, an engineer is there to take on the challenge!

LAB NOTES

Predict

Before starting this lab, I predict...

Observe

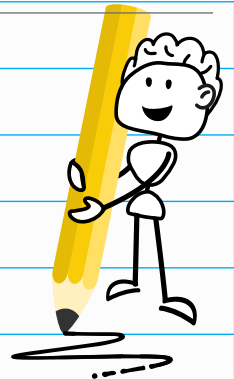
While completing the lab, I observed...

Explain

Upon completion of this lab, I learned...

Keep Going

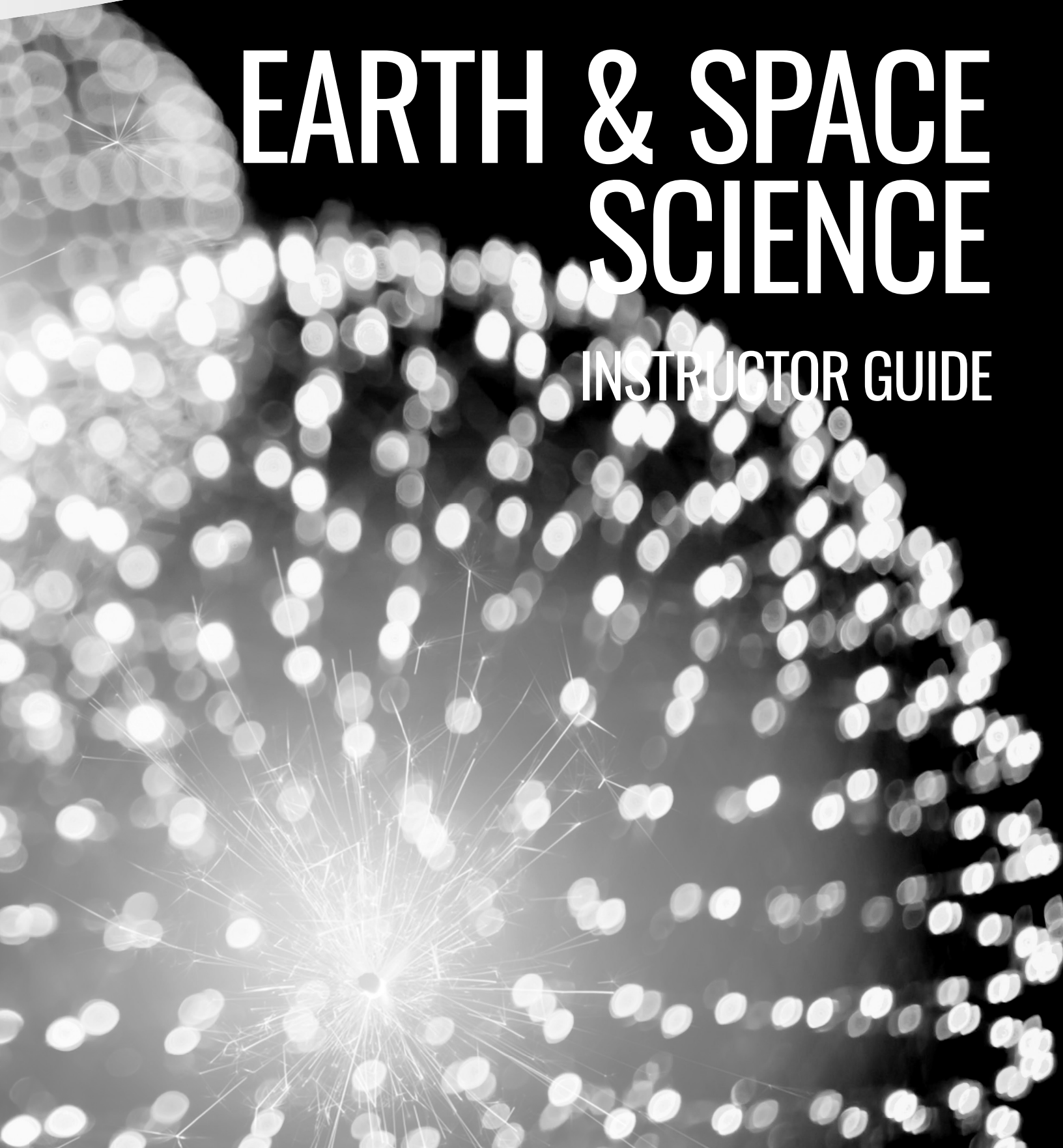
I still have questions about...



Discover!

EARTH & SPACE SCIENCE

INSTRUCTOR GUIDE



Earth & Space Science



Discover! Earth & Space Science Instructor Guide

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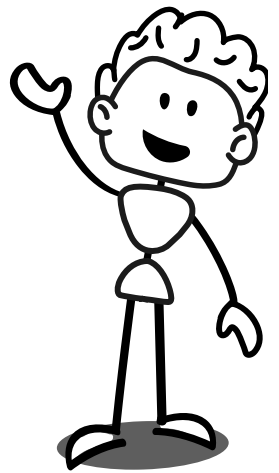
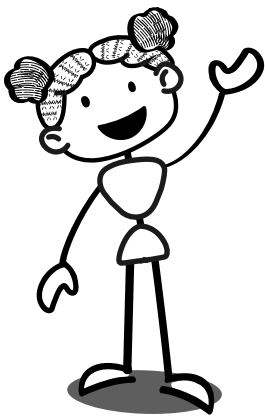


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Student Books, Instructor Guide, and Planning

Instructor Guide

- The instructor guide provides chapter-by-chapter guidance to facilitate your instruction.
- For your convenience, the objectives are provided at the beginning of each chapter.
- Each chapter provides suggestions for supporting your student with worktext activities and adapting the content to your student's learning preferences.
- Booster activities are provided for some chapters which provide your student an opportunity for repeated practice toward mastery of specific skills or concepts.
- Co-op activities are provided for many chapters and allow you to tailor the instruction with creative ideas for collaborative and group learning.
- Each chapter contains extension activities to enhance or extend the content for your student.
- Answer keys for all activities are provided in each chapter.
- The back of the instructor guide provides full support for all lab activities and is organized to mirror the lab book's table of contents.
- The unit assessments are included with each unit review as well as in the assessment booklet. Each unit has two options.
 - **Traditional Unit Assessment:** This is a traditional assessment (multiple-choice) with an answer key.
 - **Performance Assessment:** This is a performance-based option with a rubric.

Planning

- Each course is designed to cover approximately 160 days of instruction, with each chapter taking roughly 2 days to complete. This does not include time spent on the enrichment activities provided in the worktext sidebars and the instructor guide. These materials allow the instructor to customize the learning experience and encourage the student to dive deeper.
- It is recommended the student completes the **Explore** and **Read** pages on the first day and the **Practice** and **Show What You Know** pages on the second day.
- It is recommended that the student complete the unit lab(s) contained in the lab book PRIOR to the completion of the unit reviews/assessment chapter. The student should be able to complete a lab in one day or do half of the lab on one day and half on another day. Because of the nature of experiments, some labs may require the student to engage with the procedures over several days. Please be sure to read through the unit lab experiments in advance to adequately plan for each unit's calendar of activities.
- For unit review/assessment chapters, it is recommended the student completes the **Review** pages and the first **Practice** page on the first day and the remaining **Practice** pages on the second day.

Earth's Place in the Solar System

Chapter Objectives

By the end of this chapter, your student will be able to:

- explain how Earth's position and motion in the solar system affect its seasons, day, and night
- describe the main characteristics and features of Earth and how they are unique compared to other planets in the solar system
- discuss current research regarding planets in other solar systems that share features with Earth

Supporting Your Student

Explore

Have your student study the image. Discuss with them how each picture is alike and different. Your student may notice that the tree and location remain the same, but the colors, leaves, and temperature appear to change. Discuss what types of weather you experience in each season where you live. Next, discuss the types of activities that can be done in each season. For example, for winter, your student might mention skiing, sledding, and ice skating.

Areas along the equator experience seasons differently than those further away from the equator. They often refer to their seasons as the rainy season and the dry season. They do experience changes in temperature, but not as wide of a range as other parts of the world.

Mini-Lab (*How Light Moves*)

For this lab, your student may need help holding the flashlight and moving it in an arc across the paper to achieve different angles. To help them visualize this, place a bowl over the paper and have them follow the outline of the bowl to create an arc. Then, remove the bowl and have them repeat the arc while performing and recording the information required for the activity.

In Focus (*Earth's Seasons*)

This is an excellent way for your student to explore the effect of the sun on a planet's days and seasons. Be sure your student stabilizes the flashlight, as the sun does not move. To extend your student's learning, have them mark the orange with an approximation of

their home. Then, have them tell you what time of day and time of year their home is experiencing as they rotate the orange around its axis and revolve around the sun/flashlight. You can also extend your student's learning by having them change the distance between the orange and the flashlight. Have them explain to you how days and seasons are different when the planet is closer to the sun. Likewise, have them explain what changes when the planet is far from the sun.

Learning Styles

Auditory learners may **enjoy** making a podcast about exoplanet research.

Auditory learners may be **challenged** by researching and creating a compare and contrast between the exoplanet they choose and Earth.

Visual learners may **enjoy** making a powerpoint about exoplanet research and how seasons work.

Visual learners may be **challenged** by explaining answers aloud to questions.

Kinesthetic learners may **enjoy** you being the sun as they revolve around you using their orange model.

Kinesthetic learners may be **challenged** by reading large amounts and watching videos.

Extension Activities

Seasons Poster

Have your student create a poster that explains orbit and the seasons. Your student can draw or cut pictures out of magazines to add descriptions or activities, clothing, and other distinguishing characteristics of each season.

Online Research

Have your student research which exoplanets have been discovered and select one to study. Have them compare and contrast the features of this planet with those of Earth to determine which features make the planet habitable.

Earth's Place in the Solar System

Answer Key

Mini-Lab (*How Light Moves*)

Answers will vary. Possible answers: The area where the light is the most intense would be warmer than the areas around it. If the Northern Hemisphere is tilted toward the sun, it would receive the most heat; the heat would decrease the further south and further away from the sun you moved. This explains why the Southern Hemisphere is in winter, as it is further away from the direct rays of the sun because it is tilted away from the sun when the Northern Hemisphere is in summer.

In Focus (*Earth's Seasons*)

Answers will vary. Possible answer: Because the light is more intense on the dot in the Northern Hemisphere, it would mean that the Northern Hemisphere would be in a warmer season than the Southern Hemisphere.

Write (Essay)

Answers will vary. Possible answers: Earth is the third planet from the sun. It is the only planet in the Goldilocks zone, which means it is just the right temperature for keeping water in liquid form and sustaining life. Earth is the only planet with breathable oxygen and an ozone layer to protect humans from dangerous UV radiation from the sun while also allowing the sun to warm Earth.

Write (Essay)

Answers will vary. Possible answer: Scientists launch space telescopes with missions to travel to distant solar systems and find exoplanets.

Apply (*Finding an Earth-Like Planet*)

Answers will vary. Possible answer: Finding another planet like Earth would help answer the question if life existed anywhere else in the universe.

Practice (*Earth and Habitable Planets*)

1. The more direct the rays strike Earth, the warmer the area will be.
2. Earth's tilt creates an angle that positions the Northern or Southern Hemisphere closer to the sun at different points in its orbit around the sun. When the hemisphere is closer to the sun,

it receives more direct heat, resulting in warmer temperatures and longer days. The hemisphere further away from the sun experiences lower temperatures and shorter days.

3. Rotation is the spinning of Earth around its axis and causes day and night cycles. Revolution is the path around the sun that Earth takes that takes a year to achieve.
4. liquid water, oxygen in the atmosphere, life, atmosphere heating the surface, rocky planet
5. Scientists use telescopes to look for planets that would be in the Goldilocks zone around their stars.
6. For a planet to be habitable, it needs to be in the Goldilocks zone of their star and their star needs to be like our sun.

Review (*The Big Question*)

Answers will vary. Possible answers: The main difference between Earth and other planets is that Earth supports life. It also has an atmosphere with oxygen that heats the planet's surface, liquid water, and is a rocky planet. Earth sits in the Goldilocks zone because it lies just the right distance from the sun so it can support life and have liquid water due to temperature constraints.

Earth's specific path around the sun is also unique. Its path around the sun is elliptical or oval-shaped meaning that Earth is not at the same distance from the sun every day of the year. This also means that due to Earth's tilted axis, the Northern and Southern Hemispheres will either be tilted toward or away from the sun at different points on the path. When a hemisphere is closer, it will have warmer weather and longer days, and when it is tilted away from the sun, it will have cooler and shorter days.

Show What You Know

1. Goldilocks zone
2. axis
3. solstice
4. revolution
5. orbit
6. True
7. False

Earth's Place in the Solar System

- 8. True
- 9. False
- 10. True
- 11. Earth has an atmosphere that can support life as well as liquid water on its surface.
- 12. C
- 13. A, B, D