

Discover!

General Science 1

**SAMPLE
PDF**



**INSTRUCTOR
GUIDE**

Lesson Objectives

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

- identify some of the tools that astronomers use to observe and study the sky, such as telescopes, binoculars, cameras, and computers
- explain how different types of telescopes work and what they can reveal about the universe, such as optical, radio, infrared, X-ray, and gamma-ray telescopes
- compare and contrast the advantages and disadvantages of ground-based and space-based telescopes
- demonstrate how to use a simple telescope or binoculars to observe the moon, planets, stars, and constellations

Supporting Your Student

Read (*Tools of Astronomers*)

This section is designed to give your student a brief introduction to the idea that astronomers and stargazers have been using instruments to study the night sky since the beginning of time. It might be helpful to ask your student beforehand to list off the tools or devices they use to help with daily life (ex: dishwasher, computer, lights, etc.).

Read (*Spaced-Based Telescopes*)

The main focus of this section is to distinguish between ground-based and space-based telescopes. If your student is struggling, focus on the advantages and disadvantages of each type. Remind your student that not all celestial objects can be observed from Earth due to their electromagnetic radiation and Earth's atmosphere. Have your student think about what it would take to fix a telescope in space.

Read (*How to Use a Telescope*)

This section might be challenging if you do not have a telescope for your student to use. (In a pinch, your student can pretend to use a paper towel roll as a telescope.) If your student does not have a telescope to practice on, use this section to talk about technology, tools, and the importance of following

procedures and practicing patience when learning something new.

Mini-Lab

Have your student build this telescope with trial and error. When your student starts to look at an object, it would be easier for them to start with an object that is close to them, like a tree or another object not in the sky. It would also be easier to have your student practice during the day. Once they have mastered how to focus on an object in space, have them look at night or two hours after sunset.

Learning Preference/Styles

Auditory learners may **enjoy** talking about the disadvantages and advantages of the space-based versus ground-based telescopes.

Auditory learners may be **challenged** by describing details of the visual examples in the text to improve their visual skills.

Visual learners may **enjoy** looking at examples of space-based and ground-based telescopes online to see the differences and similarities.

Visual learners may be **challenged** by building paper models.

Kinesthetic learners may **enjoy** taking a walk and talking about the different types of telescopes.

Kinesthetic learners may be **challenged** by verbally summarizing the information.

Booster Activity

Telescope Debate: Ground-Based vs. Space-Based Telescopes

Overview: In this activity, your student will discover more about types of telescopes and their benefits.

Explain to your student that they will be engaging in a debate. A debate is a discussion in which partners take turns expressing their ideas/arguments about a topic to find the best solution. To prepare for a debate, your student needs to collect information to argue for both sides of the argument. A debater who can argue both sides can anticipate the opponent's moves.

Step 1: Create a statement that has at least two sides. Examples: 1) Space telescopes are too expensive, so all new telescopes should be ground-based. 2) Earth's atmosphere limits too much information, so more space telescopes should be built. 3) A topic created by your student after researching telescopes.

Step 2: Create for and against facts. Have your student use index cards to record for and against statements of facts. Remember, numerical data makes powerful facts for arguments.

Step 3: Create a concluding statement for and against. Your student should prepare a summary statement of 100 to 150 words stating why one side of the argument is better than the other. There will be two statements, one for and one against.

Step 4: Have your student explain both sides of the argument to you. Then, ask them which side they would prefer to take in an actual debate. Why did they pick that side?

Extension Activities

Memory

Using the vocabulary words on Page 1, write a type of telescope on one side on an index card. Then, write the definitions to those types on another index card. Mix the two sets of index cards together and place them face down on a table. Have your student choose two cards. If they match, they can keep the cards and go again. If they do not match, they should flip them over and try again.

RoShamBo

This is a version of Rock, Paper, Scissors. Choose three of the six types of telescopes: binoculars, optical, radio, x-ray, infrared, and gamma. Have your student create a hand signal for each telescope. Using the advantages and disadvantages of the three telescopes, put the telescopes in order of most wins to least wins — each must lose to one and win to another. To play, count to three, then you and your student will show a hand signal without saying what the telescope is. Figure out who wins and keep playing.

Answer Key

Explore

Answers will vary. Possible answer: Humans study space because it is the unknown and some people think there might be life out there. The tools they need are ones that can see far and magnify faraway objects.

Write (Short Answer)

Answers will vary. Possible answer: Some of the tools I use could be the same as astronomers. Astronomers would use computer apps, just like I do.

Write (Short Answer)

Answers will vary. Possible answer: The advantages of radio telescopes are they can be used during the day and can be used during bad weather.

Mini-Lab

Answers will vary. Possible answers:

1. When you move a magnifying glass toward the object, it gets smaller. When you move it away, it gets bigger.
2. Under different magnification, the image will appear closer, so one can see more detail of the objects.
3. Other possible observations are that the image can look upside down.

CHAPTER 47

Tools of Astronomy

Practice (Astronomy Tools)

	Ground- or Space-Based	What does it observe?	Advantages	Disadvantages
Binoculars	Ground	stars, planets	handheld, cheap	not very powerful
Optical	Ground	stars, planets	portable	not very powerful, cannot see far objects
Radio	Ground	composition, structure, and motion	can be used any time of day and in any weather	fixed to Earth and large dish
Infrared	Space	heat	powerful, see things that the naked eye cannot see	expensive, cannot see from Earth
X-ray	Space	density, temperature, and composition	powerful, see things that the naked eye cannot see	expensive, cannot see from Earth
Gamma	Space	size and structure	powerful, see things that the naked eye cannot see	expensive, cannot see from Earth

Review (The Big Question)

Answers will vary. Possible answer: No, there are many things in the universe that emit different electromagnetic radiation that our naked eyes cannot see.

Show What You Know

1. C
2. A
3. B
4. D
5. True
6. False
7. True
8. False
9. Answers will vary. Possible answer: The two types of ground-based telescopes are optical telescopes and radio telescopes. Optical telescopes provide clear visual images that astronomers can count and categorize manually. Radio telescopes provide data that require computer programs to interpret.

In Focus

Answers will vary. Allow your student to be as creative as they can with this. Possible answer: Place a video camera and time lapse camera on a satellite that can be repositioned to look at different parts of the sky. The cameras should be able to record several different types of electromagnetic radiations.