

# Solar Eclipses

## Pre-Reading

### A. Warm-Up Questions

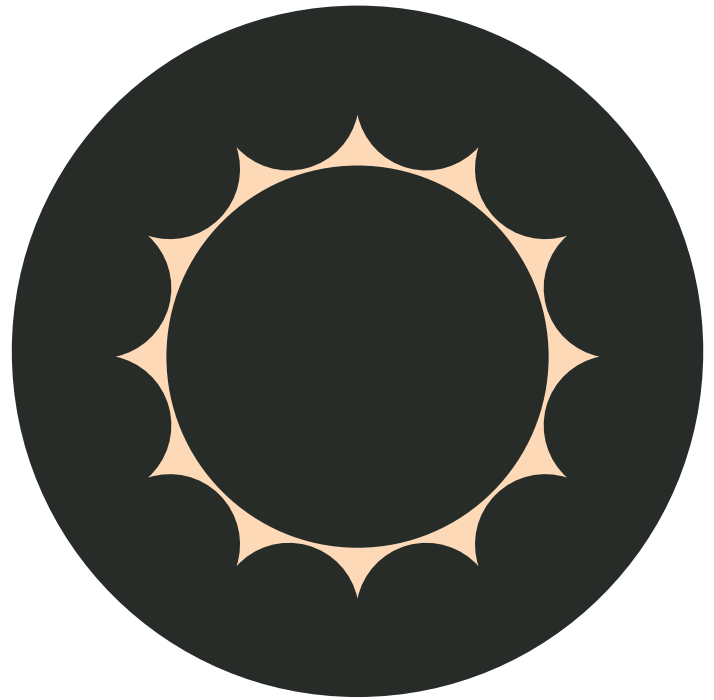
1. Do you know what a solar eclipse is?
2. What is another type of eclipse?
3. Have you ever seen an eclipse?
4. Why is it dangerous to look at a solar eclipse?
5. What's the difference between a partial and a total solar eclipse?

### B. Vocabulary Preview

Match up as many words and meanings as you can.

Check this exercise again after seeing the words in context on pages 2 and 3.

- |                     |   |
|---------------------|---|
| ___ 1. phase        | a) in a position that leans to one side               |
| ___ 2. illumination | b) not entirely, only partly                          |
| ___ 3. momentarily  | c) amazing to see                                     |
| ___ 4. alignment    | d) for a short time                                   |
| ___ 5. angle        | e) all in the same position                           |
| ___ 6. spectacular  | f) the lighting up of something                       |
| ___ 7. reflect      | g) a recurring stage in a process                     |
| ___ 8. civilization | h) to throw back light or an image                    |
| ___ 9. partially    | i) an evil spirit                                     |
| ___ 10. demon       | j) a stage of cultural development in a specific area |



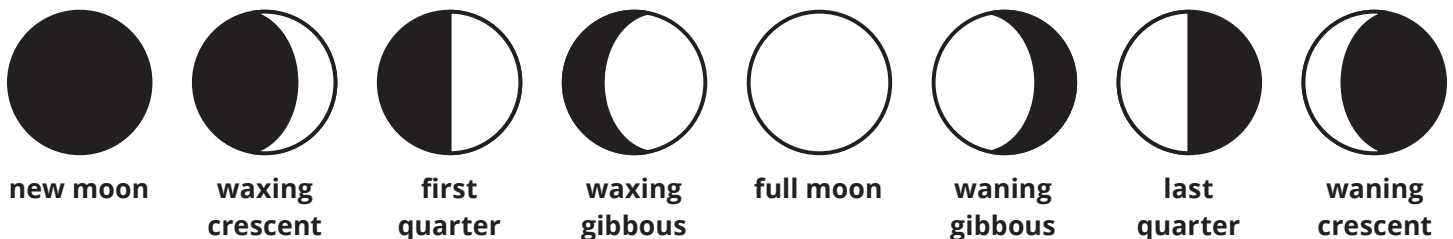
## Pre-Reading cont.

### C. Information Preview

Before you learn about solar eclipses, it's useful to know some basic facts about the Moon.

#### The Phases of the Moon

1. Only one side of the Moon, the *near side*, is visible from Earth. This is because the Moon's rotational period (on its axis) and its orbital period (around the Earth) are practically the same. Since the *far side* is never illuminated, we don't see it.
2. The amount of **illumination** that we see as the Moon orbits Earth is called a **phase**. The Moon has eight phases, beginning with new moon when it is invisible from Earth. As the Moon *waxes* it becomes more visible. As it *wanes*, it becomes less visible. It takes about 29.5 days for the Moon to go through all of its phases. This is how we get the word "month."



#### Note:

The diagram above depicts how the Moon appears from the Northern Hemisphere. In the Southern Hemisphere, the phases are the same, but the Moon appears upside down.



#### Capitalization:

When referring to celestial bodies by name in a scientific text, it is common to style them as **proper nouns** (*the Sun, the Moon, Earth*) to distinguish them from other suns, moons, etc.

In non-scientific texts, these words are typically written as **common nouns** (*sun, moon, earth*). Moon phases (*new moon, full moon, etc.*) are not capitalized.

## Reading

1. A *solar eclipse* occurs when the Moon passes between the Sun and Earth and casts a shadow that **momentarily** blocks out the light. This only happens during a new moon **phase**. The Sun, Moon, and Earth must also be in **alignment**. Since the Moon orbits Earth at a slight **angle** of about five degrees, this alignment is rare.
2. A *total solar eclipse* is when the alignment is perfect. For a short time, the Moon completely blocks the Sun, and the only light that shines is a fiery glow from the Sun's atmosphere. This **spectacular** light is called the *corona*.
3. To experience a total solar eclipse, you have to be in the exact location on Earth that is experiencing the full shadow of the Moon (the *umbra*). This is called the *path of totality*. If you are near the edge of the shadow (the *penumbra*), you will experience a *partial solar eclipse*. This is when the Sun and Moon are not quite aligned, so only part of the Sun is blocked from Earth.
4. Sometimes the Moon is farther away from Earth and appears smaller in the sky. During this type of eclipse, the Moon won't completely block the Sun but will cast a shadow on its center, leaving a ring of light. This is called an *annular solar eclipse*.
5. Another type of eclipse is a *lunar eclipse*. This is when the Earth's shadow blocks the Sun from **reflecting** off the Moon. A *total lunar eclipse* only occurs during the full moon phase if the Sun, Moon, and Earth are in perfect alignment. There can be up to four solar eclipses and three lunar eclipses each year.
6. Long ago, ancient **civilizations** came up with a variety of reasons why the Sun sometimes disappeared fully or **partially**. The Chinese blamed a hungry dragon. Native Americans blamed an angry bear. The Greeks considered it a sign from the gods that disaster was coming. People in many parts of the world made loud noises to try to scare away the **demons** and get the Sun back.

*On August 21, 2017, a total solar eclipse was visible from a thin band across the continental US.*

*The next total solar eclipse visible in North America is on April 8, 2024.*

## Comprehension

### A. True or False?

Read the statements below.

If the statement is true, write T beside the sentence.

If it is false, write F and correct the information.

- \_\_\_\_\_ 1. A solar eclipse occurs when Earth's shadow blocks the Sun.
- \_\_\_\_\_ 2. The Moon orbits Earth at an angle of five degrees.
- \_\_\_\_\_ 3. The ring that you see in an annular solar eclipse is called the corona.
- \_\_\_\_\_ 4. You can only see a total lunar eclipse during the new moon phase.
- \_\_\_\_\_ 5. The ancient Chinese thought a dragon ate the Sun during a solar eclipse.

### B. Ask & Answer

Practice asking and answering the following questions with your partner.

Then write your answers in complete sentences in your notebook.

- 1. What is the reading mainly about?
- 2. What phase must the Moon be in for a total solar eclipse to occur?
- 3. What is the difference between a partial solar eclipse and a total solar eclipse?
- 4. What is the identifying feature of an annular solar eclipse?
- 5. How does a lunar eclipse occur?
- 6. Why does the reading mention a bear and a dragon?
- 7. Why would ancient civilizations bang pots and pans during solar eclipses?

## Vocabulary Review

### A. Matching

Match the scientific words to their descriptions. Use each answer only once.

- |                               |   |
|-------------------------------|---|
| _____ 1. total solar eclipse  | a) the edge of a shadow   |
| _____ 2. the path of totality | b) the location on Earth where a total solar eclipse is visible |
| _____ 3. lunar eclipse        | c) an event where the Moon completely blocks the Sun            |
| _____ 4. penumbra             | d) the fiery light of the Sun's atmosphere                      |
| _____ 5. new moon             | e) the lunar phase when the Moon is invisible from Earth        |
| _____ 6. corona               | f) an event where Earth's shadow blocks the Sun from the Moon   |

### B. Complete the Sentences

Complete the sentences using vocabulary from page 1.  
You may need to change the word forms.

1. Seeing the lunar eclipse was a \_\_\_\_\_ event.
2. I'll be with you \_\_\_\_\_. I just have to grab a coffee.
3. The colors from the artwork \_\_\_\_\_ on the window.
4. You are \_\_\_\_\_ to blame. You left the door open.
5. The shelf isn't level. It's on an \_\_\_\_\_.
6. She's just going through a \_\_\_\_\_. All teenagers do.
7. They used fire and smoke to cast out evil \_\_\_\_\_.
8. The desks and chairs need to be straight. I want everything in perfect \_\_\_\_\_.

## Discussion

1. Have you ever seen a solar or lunar eclipse?  
Describe your experience.
2. Are you interested in learning about the science of the universe? Why or why not?
3. Which country (if any) do you think will be next to land on the Moon? When do you predict this will happen?
4. Should schools in the path of totality close for a total solar eclipse? Why might this be a safety precaution?
5. What does it mean when people say, "Let's hope Mother Nature cooperates"? Why might this expression be used on the day of an eclipse?

## Grammar in Context

### SOLAR ECLIPSE SAFETY

1. It is always dangerous to look directly at the Sun. You can burn the retinas of your eyes. During a solar eclipse, it is tempting to stare at the Sun because it is a spectacular event and because it feels more comfortable than usual, but staring at the Sun at any time can cause severe eye damage or blindness.
2. To experience a solar eclipse, you must wear protective eye wear. Purchase special glasses that are specifically meant for viewing eclipses. These may be called "solar viewing glasses," "eclipse glasses," or "personal solar filters."
3. You must not view a solar eclipse with the naked eye, and you also must not view one through sunglasses, a camera, binoculars, or a telescope. In addition, you must not use solar viewing glasses with magnifying equipment because solar viewing glasses are not strong enough to protect you when the Sun is magnified. You have to purchase "solar filters" to safely view a solar eclipse from binoculars or a telescope.
4. The only time it is safe to look up at the Sun without protective eye wear is during the final stage of a total solar eclipse when the Sun is completely blocked out (*totality*). You must keep your glasses on until the last bead of light disappears. You don't have to wear your glasses during totality. In fact, you have to take them off or you won't see anything. As soon as the Sun begins to appear again, you must look away or put your protective eye wear back on.
5. Alternatively, you can view the solar eclipse indirectly by making a simple pinhole camera.

## Grammar Review

### A. Expressing Necessity or Obligation

Use the modals *have to*, *must*, *must not*, and *not have to* to express necessity or obligation.

#### modal + base verb

- You **have to** protect your eyes.
- You **must** buy special glasses.
- You **must not** use your eclipse glasses with binoculars.
- You **don't have to** keep them on during totality.\*

**\*Note:**

Remember that "not have to" means it is *not required*.

### B. Asking if Something Is a Necessity

Use *have to* to ask if something is a necessity.

- Q: Do I **have to** wear these to watch the eclipse?  
A: Yes, you must. / Yes, you have to wear them.
- Q: Do I **have to** keep them on still?  
A: No, you don't. You can take them off now.

## Assessment

### Task 1

Work with a partner. Pretend one of you is a parent and the other is a child. The child will ask questions about viewing a solar eclipse. The parent will explain how to do it safely. Perform your role-play for your teacher using the following modals:

- have to
- not have to
- must
- must not

### Task 2

For homework, rewrite *Solar Eclipse Safety* from page 6 in your own words. Alternatively, your teacher may ask you to paraphrase it orally. Use the following modals:

- have to
- not have to
- must
- must not

### Task 3

Your teacher will share instructions with you on how to make a solar eclipse viewer. Follow the instructions and show your teacher your creation. Try it out!