Saskatchewan Parks Classroom Resources

Activity Summary:

In this activity, students will learn about the obliquity of Earth and the resulting change in seasons, the Giant Impact Hypothesis, and the lunar phases. At the end of this worksheet, students are asked to image what our seasons would look like if Earth didn't tilt.

Activity Name: A Reason for the Season

Curriculum Outcomes: SS6.2

Information for Teachers

A Note from SaskParks, to You:

These resources were created by SaskParks' Visitor Experience team to bring joy of nature exploration to your classroom. We hope that your class is able to enjoy the outdoor experience that our parks have to offer by utilizing these activities designed to inspire learning!

How to Print This Activity:

1. Open this file in Adobe Acrobat
2. Select "Print"
3. Select the number of copies you want to print
4. Under "Pages to Print" select "Pages" and in the space to the right, type in "4 - 10"
5. Select "Print" in the bottom right hand corner

Additionally, if you wish to print this as a smaller booklet, follow steps 1 - 4 above, and then:

1. Under "Page Sizing & Handling," select "Booklet"
2. Select "Print" in the bottom right hand corner
3. Once printed, fold the booklet down the middle of the page. No staples required!

It is recommended you print one copy to start to ensure it prints correctly.

A Reason for the Season

Summary

In this activity, students will learn about:

- the obliquity of Earth
- how Earth's tilt causes the seasons
- the difference between the March equinox, June solstice, September equinox, and December solstice,
- Giant Impact Hypothesis, and
- the lunar phases

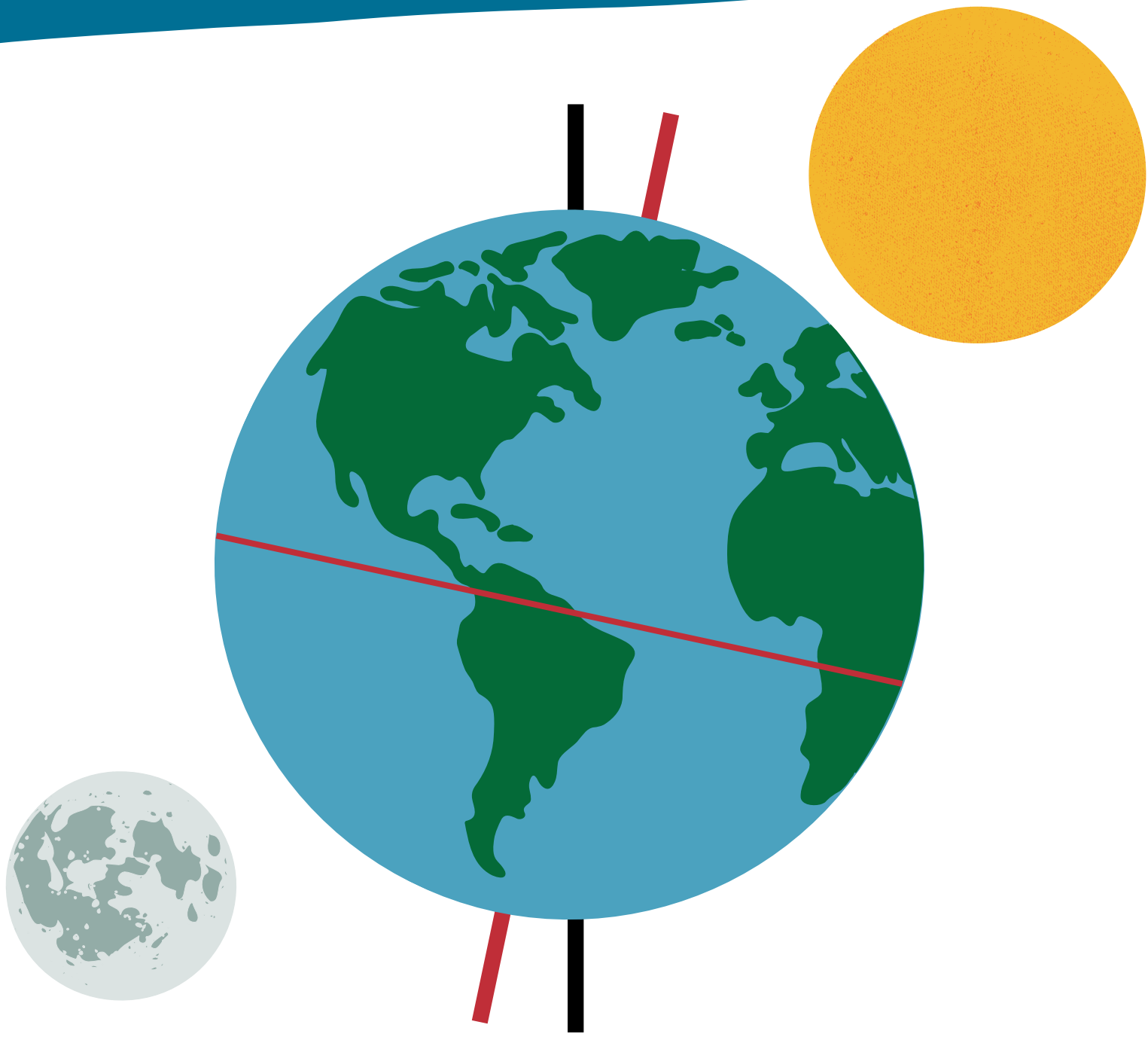
At the end of this worksheet, students are encouraged to use the information they have been provided to imagine what our seasons would look like if Earth wasn't tilted. After imagining Earth's new seasons, they are to compare answers with a classmate.

The Answer

If Earth was no longer tilted, and instead the poles pointed directly up and down, we would have no seasons. We would still have different weather conditions across different regions of Earth (the North Pole compared to the Equator, for example), but not all regions would be habitable. For example, the poles would receive almost no sunlight at any point of the year and would experience eternal winter and eternal dusk. Weather would be warmest at the equator and would get cooler as it moved closer to the poles. But individual places would not have seasons!

SASKATCHEWAN PARKS

A Reason for the Season



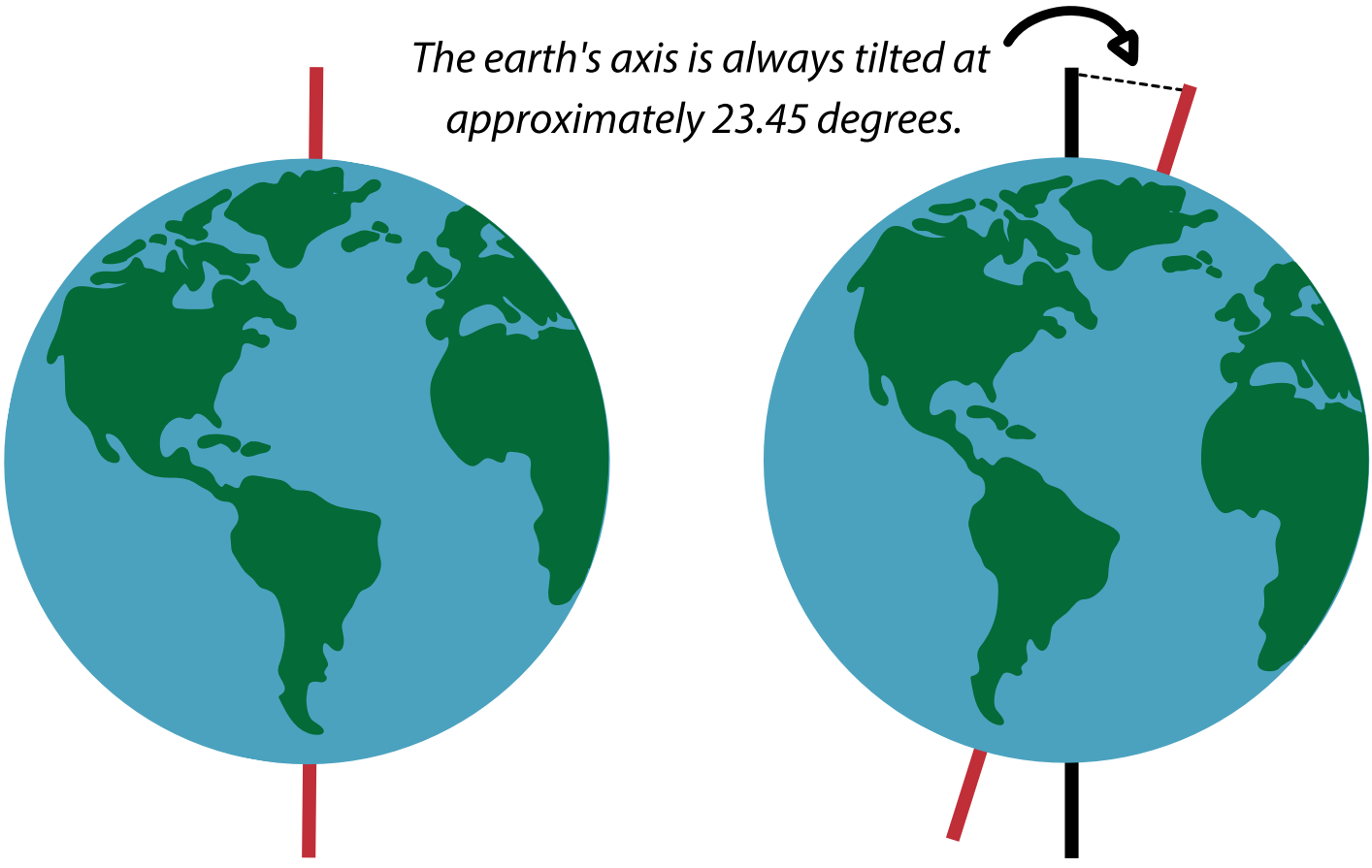
SASKATCHEWAN PARKS

Why do we have seasons?

Earth's Tilt

Earth's orbit is not a perfect circle. In fact, it's somewhat lopsided, so there are times of the year when Earth is closer to the sun. Why then, when Earth is closest to the sun, does the Northern Hemisphere experience winter? And why, when Earth is farthest from the sun, does the Northern Hemisphere experience summer? The answer is that the difference in Earth's distance from the sun throughout the year is not significant enough to make a difference in the weather we experience.

Seasons are a result of the way Earth is tilted. Earth sits on an imaginary axis that extends from the north pole to the south pole. Earth rotates around this axis once per day, which is why we have day and night. Because of this axial tilt, we experience four seasons.



It's the Tilt!

23.45 Degrees

Earth's Northern axis is always pointing in the same direction. But Earth's Northern axis with respect to the sun changes as we orbit around the sun. When the Northern Hemisphere is pointing toward the sun for half of the year, we experience warmer weather. When the Northern Hemisphere is pointing away from the sun for the other half of the year, we experience colder weather.

When the Northern Hemisphere is oriented toward the sun we experience warmer temperatures due to an increase in solar radiation. Sunlight hits Earth at a more direct angle. When the Northern Hemisphere is oriented away from the sun we experience colder temperatures due to a decrease in solar radiation. Sunlight hits Earth at a less direct angle. (Fun Fact: Seasons in the Southern Hemisphere occur at opposite times of the year to those in the Northern Hemisphere!)

Some Definitions

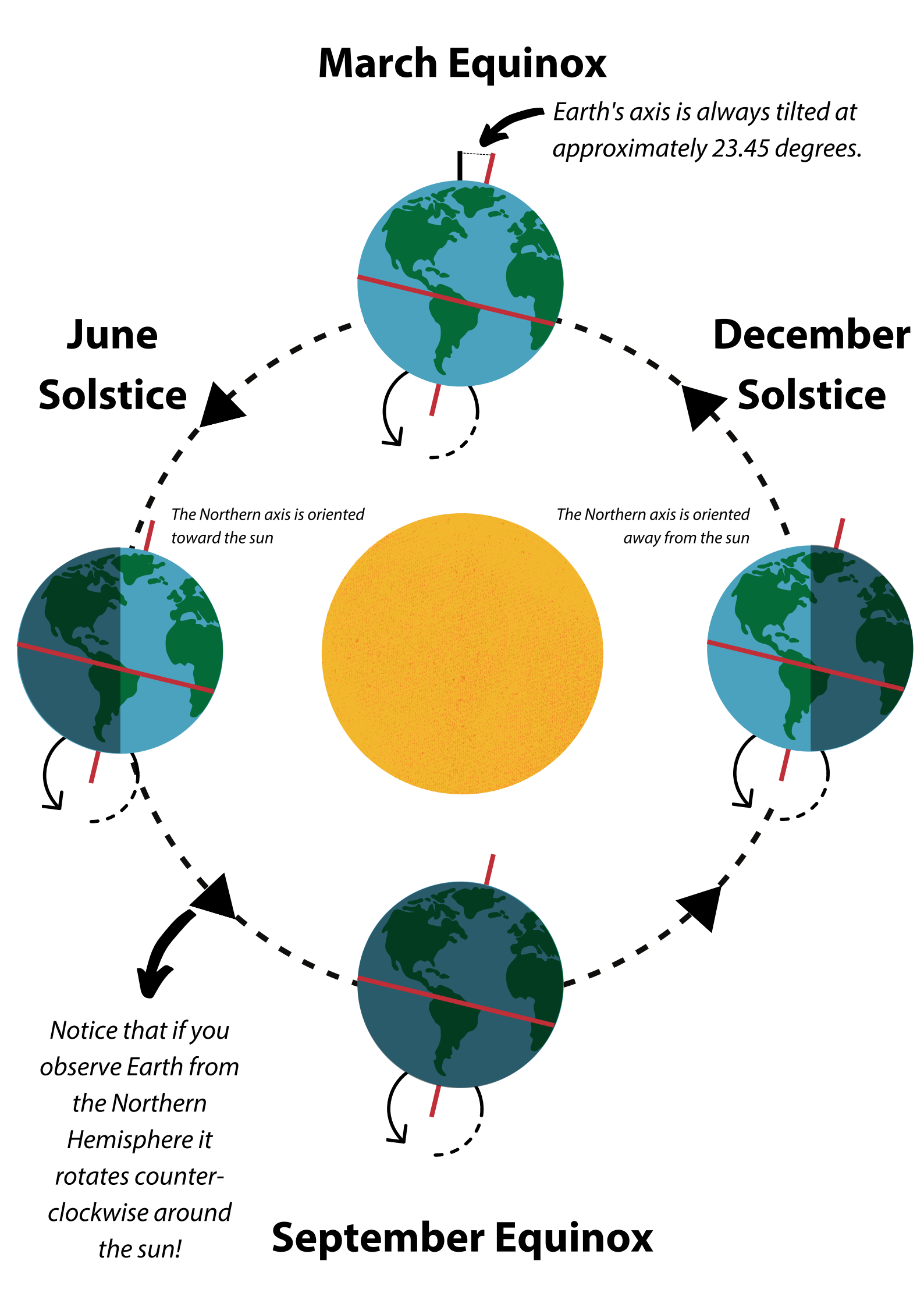
March Equinox: The March equinox occurs when the center of the Sun is on the same plane as Earth's equator. Simply put, Earth's axis isn't tilted toward or away from the Sun and hours of day and night are almost equal. It's now Spring!

June Solstice: The June solstice occurs when the North Pole is at its maximum tilt toward the Sun. It's the longest day of the year. It's Summer!

September Equinox: The September equinox is similar to the March equinox. The center of the Sun is on the the same plane as Earth's equator and hours of day and night are almost equal again. It's Fall!

December Solstice: The December solstice occurs when the North Pole is at its maximum tilt away from the Sun. It's the shortest day of the year. It's Winter!

To better visualize this phenomenon, see the diagram on the next page.


March Equinox
Earth's axis is always tilted at approximately 23.45 degrees.
June Solstice
December Solstice
The Northern axis is oriented toward the sun
The Northern axis is oriented away from the sun
Notice that if you observe Earth from the Northern Hemisphere it rotates counter-clockwise around the sun!
September Equinox

The Obliquity of Earth

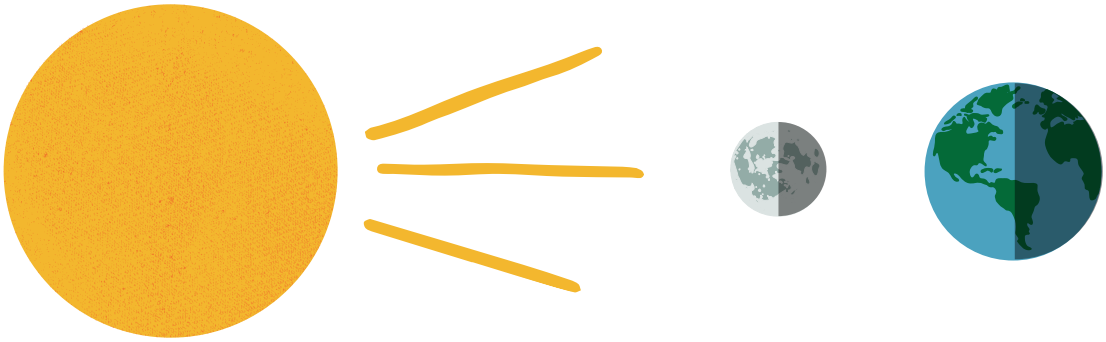
In astronomy, obliquity is a fancy word for axial tilt. It's the angle between Earth's rotational axis and Earth's orbital axis--23.45 degrees!

Giant Impact Hypothesis

It's believed that around 4.5 billion years ago Earth was hit by something very large (believed to be an ancient planet named Theia) that caused Earth to be somewhat tilted. This theory also explains how the moon was formed. When this large object smashed into our planet, it blasted a big hole in the surface, sending dust and debris into the surrounding orbit. Over time, this rubble formed our moon.

Lunar Phases

Now that the moon is in the picture, why do we have lunar phases? Put simply, the moon reflects sunlight. When sunlight is reflected off of the far side of the moon, we see the new moon.

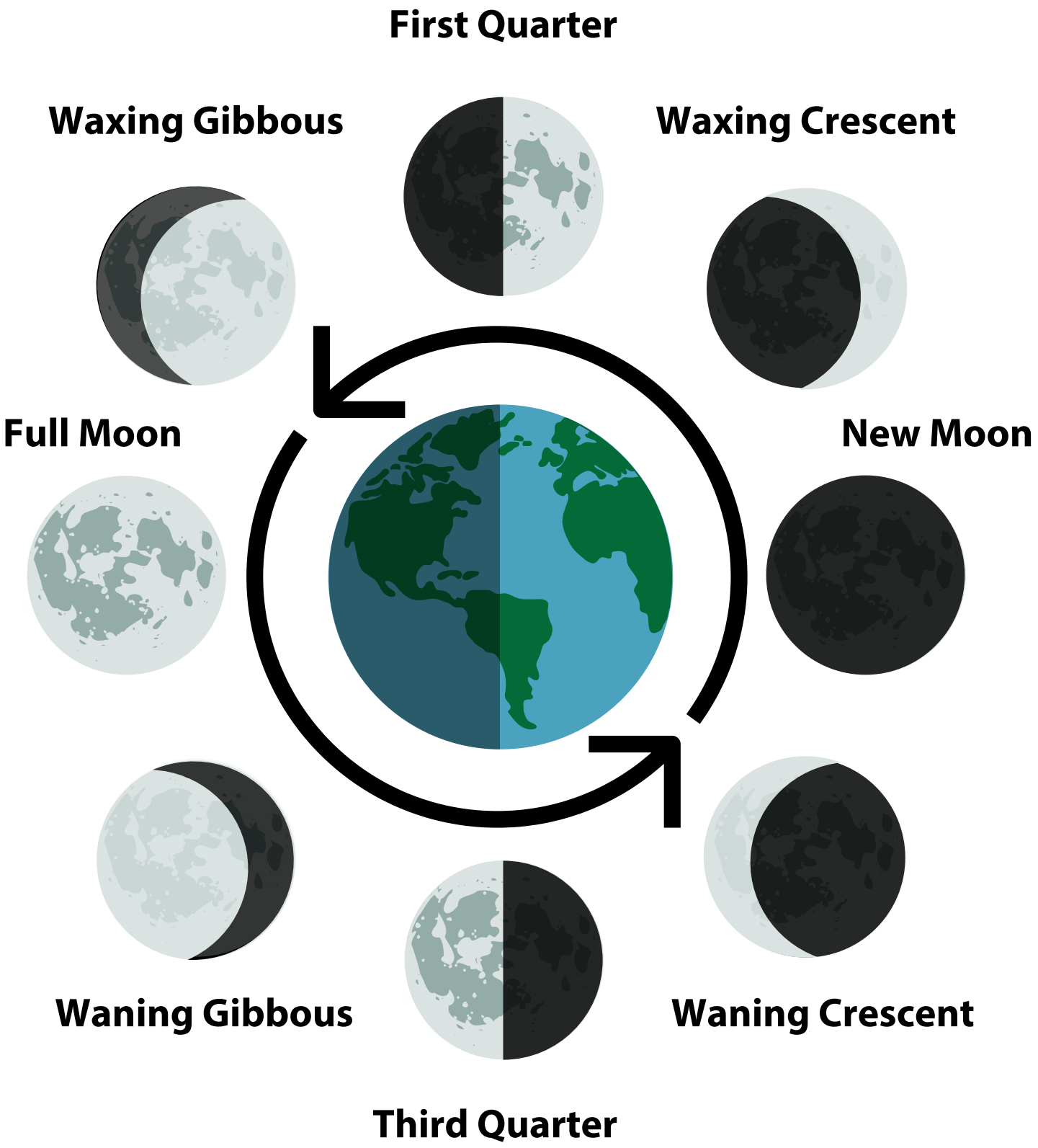


When sunlight reflects on the near side, we see the full moon.

**neither diagram is to scale*

We always see the same side of the moon because it revolves around Earth. However, every night the moon looks slightly different. Sometimes we see a full, bright moon, and sometimes we barely see the dimly lit moon. And in between, we see gibbous, quarter, and crescent moons.

Let's examine these lunar phases below. The phases shown here are what we see on Earth during each part of the moon's orbit around our planet.



What if Earth didn't tilt?

Activity

Imagine Earth never tilted when it was hit by Theia. What seasons would we have? Think of your answer and write it below. When you're finished, share your answer with a classmate!