**Reasons for the Seasons**

 60 Minute Space Science Lesson

 Planetarium and Observatory

 Program

 Grades: 5-7

**TEACHER GUIDE**

**Reasons for the Seasons**

**Description**

In the planetarium, students will be introduced to the nighttime sky. After identifying the major constellations and planets visible in the current evening sky, students will explore why the planet Earth has seasons. Students will also compare and contrast the skies visible at the Earth’s equator and North Pole to see how they differ from the skies of northern Ohio.

**Ohio’s Learning Standards**

**Grade 5:** Earth and Space Science – Cycles and Patterns in the Solar System

* The Sun is one of many stars that exist in the Universe.
* Most of the cycles and patterns of motion between the Earth and Sun are predictable.

**Grade 6:** Earth and Space Science – Matter and Motion

* There are two categories of energy: kinetic and potential.
* An object’s motion can be described by its speed and the direction in which it is moving.

**Grade 7:** Earth and Space Science – Cycles and Patterns of Earth and the Moon

* The relative patterns of motion and positions of the Earth, Moon, and Sun cause solar and lunar eclipses, tides, and phases of the moon.
* Thermal-energy transfers in the ocean and the atmosphere contribute to the formation of currents, which influence global climate patterns.

**Objectives**

* Identify planets visible to the unaided eye in the evening/morning sky.
* Name at least three constellations visible in the evening/morning sky.
* Explain the significance of the tilt of the Earth’s axis and orbit in determining seasons and that different places on Earth have different seasons.
* Describe that, in the case of Earth, the varying distance of our planet from the Sun does not determine the seasons.
* Name other planets that have seasons, some caused by the tilt of their axes, some by the varying distance of the planet from the Sun.

# If this will be your first trip to the Museum for your students you may want to review the following:

**Before Your Museum Visit**

# What is a Museum?

# What is our purpose for visiting The Cleveland Museum of Natural History?

# How should we handle objects at the Museum?

# Introduce the vocabulary and additional resources provided below

**Vocabulary**

**Axis** - The imaginary straight line about which a planet spins, or rotates. The Earth's axis passes through the north and south poles, and through the center of the Earth.

**Climate** - The average weather at a certain place over a period of many years.

**Equator** - The line drawn around the Earth, halfway between the north and south poles.

**Equinox**- The time of year in March and September when the Sun is located directly over the Earth’s equator. Daylight is equal in both the northern and southern hemispheres. The Sun is visible from both poles.

**North Star** - The star in the sky towards which the Earth's axis is pointed in the northern hemisphere. Its proper name is "Polaris", and the star is the only one in the sky that does not move.

**Observatory ‑** A building equipped with a telescope for viewing the real sky.

**Planetarium ‑** A machine which projects images of stars, the Sun, Moon, and planets onto a domed ceiling. The machine rotates to illustrate celestial movements. Also a building or room housing such a device.

**Revolution -** The movement of an object in a path (orbit) around another object. Planets revolve around the Sun, and moons revolve around their parent planets.

**Rotation -** The spinning of planets and moons about their axes.

**Solstice -** The time of year in December when the Sun is located directly over the Tropic of Capricorn, it is winter in thenorthern hemisphere and summer in the southern hemisphere. The Sun is visible for 24 hours per day from the South Pole. Also the time of the year in June when the Sun is located directly over the Tropic of Cancer, it is summer in the northern hemisphere and winter in the southern hemisphere. The Sun is visible for 24 hours per day from the North Pole.

**Weather** - The state of the air or atmosphere at a given time or place, including the temperature, cloudiness, pressure, humidity, etc.

**Extension Activities**

1. Ask if any students have visited a planetarium before and have them relate their experience to the class.
2. Ask students why we need the Sun - make a list of ways we use solar energy. Point out that the Sun is the source of the Earth's weather and also is the beginning of the energy flow in the food web.
3. A bare light bulb and globe can be used to represent the Sun and Earth in the classroom. Have students copy outlines of constellation patterns on sheets of paper and arrange them on classroom walls at appropriate positions. Note that only observers on the unlit (nighttime) half of the globe will be able to see stars and constellations. The stars in the direction of the Sun will not be seen. As the globe is moved around the light bulb (the Earth orbits the Sun), explain that different stars and constellation patterns are visible at different times of the year.
4. Keeping the axis of the globe tilted in a constant direction, walk the globe around the light bulb and note the various effects of the sunlight upon the Earth. (When the northern hemisphere is tilted toward the Sun, the season is summer for that hemisphere - note the light hits the northern hemisphere at a higher angle than the southern hemisphere, which is experiencing winter.)
5. Spin the globe while it is positioned at summer in the northern hemisphere. Note that the North Pole and much of the extreme northern hemisphere is continually bathed in light (24 hours of daylight in the summer). Would you expect the days to be longer or shorter in the summer months?
6. The Earth orbits the Sun almost in a circle, but it is slightly closer to the Sun in January than in July. Place the globe about three meters from the light bulb to represent the average distance of the Earth from the Sun. A difference of three centimeters towards or away from the light bulb represents the varying distance of the Earth from the Sun. It is the tilt of the Earth's axis rather than the distance from the Sun that determines our seasons.
7. Pluto's orbit about the Sun is not circular, and at times the planet is very much closer to the Sun than at others. This affects the planet's weather far more than the tilt of its axis. Place a baseball three meters from the light bulb in the center of the room to represent the average distance of Pluto from the Sun (Pluto is actually 40 times farther from the Sun than the Earth). A difference of 75 centimeters towards or away from the light bulb represents the varying distance of Pluto from the Sun. Pluto's icy surface melts slightly when closest to the Sun, and at that time the planet develops a thin atmosphere. When farthest from the Sun, Pluto's wispy atmosphere refreezes onto its surface.

**Online Resources for Teachers and Students**

Click the link below to find additional online resources. These websites are recommended by our Museum Educators and provide additional content information.

CMNH Educators regularly review these links for quality. Web addresses often change so please notify us if any links have issues. Please note that aside from our own Museum website, the Museum is not affiliated with and does not endorse these online resources.

Cleveland Museum of Natural History https://[www.cmnh.org](http://www.cmnh.org/)/edlinks

**Materials for Loan**

If you’re interested in additional resources be sure to check out the following ERC materials or browse ERC materials online at

 <http://cmnh.hosting.l4u.com>

Related ERC kits for this topic include:

**Real Reasons for the Seasons:** This guide from helps students understand what causes our planet's seasons. The Sun-Earth connection, latitude and longitude, hemispheres, and tilt of the Earth are just a few of the concepts covered in this kit.

**OTHER ITEMS:**

**Portable Planetarium**: Launch into space from your own classroom! The STARLAB Portable Planetarium allows you and your students to step into the universe and explore interactive, cross-curricular lessons about astronomy, history and more. This inflatable planetarium can hold 30 students and requires teacher training and reservations through the ERC.

The Educator Resource Center offers educator workshops, thematic teaching kits, animal dioramas, and more for loan to area teachers.

Contact the ERC at 216-231-2075 for information on individual or school membership.

Visit the Museum’s ERC website for more information on workshops https://[www.cmnh.org/ERC](http://www.cmnh.org/ERC)

**Hours**

* Monday through Friday, 1 to 5 PM
* Wednesday, 1 to 6 PM
* Saturday, 9 AM to 2 PM

**Educator Resource Center (ERC)**