How the Universe Works

Grades: 4th, 5th, 8th

Duration: 30 Min

Program Description

Understand how the mechanics of the Sun, Moon, Earth, and Solar System produce the changes we feel and see on Earth, from phases of the Moon (4th grade) and cycling seasons to the proper motion of celestial objects. This presentation shows you how the Universe changes within different time periods, beginning with what we experience in just one day and then imagining the changes we would observe if we could live for thousands of years.

Louisiana GLE:

Science

Grade 4

2. Pose questions that can be answered by using students' own observations, scientific knowledge, and testable scientific investigations (SI-E-A1)
7. Use the five senses to describe observations (SI-E-A3)
11. Combine information, data, and knowledge from one or more of the science content areas to reach a conclusion or make a prediction (SI-E-A5)
12. Use a variety of appropriate formats to describe procedures and to express ideas about demonstrations or experiments (e.g., drawings, journals, reports, presentations, exhibitions, portfolios) (SI-E-A6)
64. Describe and sequence the phases of the Moon and eclipses (ESS-E-B2)
65. Compare a solar and a lunar eclipse (ESS-E-B2)
66. Diagram the movement of the Moon around Earth and the movement of Earth around the Sun (ESS-E-B2)
67. Explain the changing appearance of the Moon and its location in the sky over the course of a month (ESS-E-B3)
69. Explain how technology has improved our knowledge of the universe (e.g., Hubble telescope, space stations, lunar exploration) (ESS-E-B6)

English Language Arts

Grade 4

34. Adjust pacing to suit purpose, audience, and setting when speaking
35. Interpret, follow, and give multi-step directions
37. Demonstrate active listening strategies, including asking questions, responding to cues, and making eye contact
38. Adjust speaking content according to the needs of the audience

Science and Inquiry

Grades 5 – 8

2. Identify problems, factors, and questions that must be considered in a scientific investigation (SI-M-A1)
3. Use a variety of sources to answer questions (SI-M-A1)

Science

Grade 5

40. Describe the significance of Polaris as the North Star (ESS-M-C1)
41. Explain why the Moon, Sun, and stars appear to move from east to west across the sky (ESS-M-C1)
43. Describe the characteristics of the inner and outer planets (ESS-M-C2)
44. Explain rotation and revolution by using models or illustrations (ESS-M-C4)
45. Identify Earth's position in the solar system (ESS-M-C5)

English Language Arts

Grade 5

Speaking and Listening

Standard 4

32. Adjust diction and enunciation to suit the purpose for speaking
33. Use complete sentences and standard English grammar, diction, syntax, and pronunciation when speaking
35. Restate or describe oral directions/procedures for tasks
36. Adjust volume and inflection to suit the audience and purpose of presentations
38. Demonstrate active listening strategies
39. Deliver formal and informal presentations for a variety of purposes, including:
41. Participate in group and panel discussions

Science

Grade 8

39. Relate Newton's laws of gravity to the motions of celestial bodies and objects on Earth (ESS-M-C3)
40. Identify and illustrate the relative positions of Earth, the Moon, and the Sun during eclipses and phases of the Moon (ESS-M-C4)
42. Interpret a scale model of the solar system (ESS-M-C5)
45. Explain how seasonal changes are caused by the tilt of Earth as it rotates on its axis and revolves around the Sun (ESS-M-C7)

Key Terms:

astronomical year – The period of time during which Earth completes a single revolution around the sun, consisting of 365 days, 5 hours, 49 minutes, and 12 seconds of mean solar time.

calendar year – n the Gregorian calendar the year begins on January 1 and ends on December 31 and is divided into 12 months, 52 weeks, and 365 or 366 days

lunar eclipse – Obscuration of the full moon when it passes through the shadow of the earth

lunar month – The average time between successive new or full moons, equal to 29 days, 12 hours, 44 minutes. Also called *synodic month*

moon – A natural satellite revolving or orbiting around a planet

rotation/spin – the movement of an object in a circular motion about an internal point or axis

orbit/revolution – the path an object makes going around another object; circular motion about an external point

planet – a celestial body larger than an asteroid or comet, illuminated by light from a star, such as the sun, around which it revolves or orbits

proper motion – the measurement of the annual motion of a star

solar eclipse – a blocking of the light from the Sun by the Moon or, equivalently, the Moon's shadow crossing the Earth's surface. The darkest part of the shadow, from which the Sun is entirely hidden, is the umbra. The outer part of the shadow, from which part of the Sun can be seen, is the penumbra.

Connections to Permanent Exhibits:

Space Center
1st Floor
Phases of the Moon – Understand the phases of the moon better by demonstrating the reflection of sunlight for a given moon phase

2nd Floor
Planet Kiosks – These give some general characteristics of the planets; located on the 2nd floor on the Space Center

Web Resources:

NASA For Kids NASA
http://www.nasa.gov/audience/forkids/home/index.html

This website is loaded with activities, games, and more designed to introduce the young, future generations to the concepts of space science. There is a coloring book you can download, or, for those students already familiar with computers, you can color in pictures by using the mouse

NASA
www.nasa.gov

The main page of NASA allows a user to look at a variety of topics of space-related sciences.

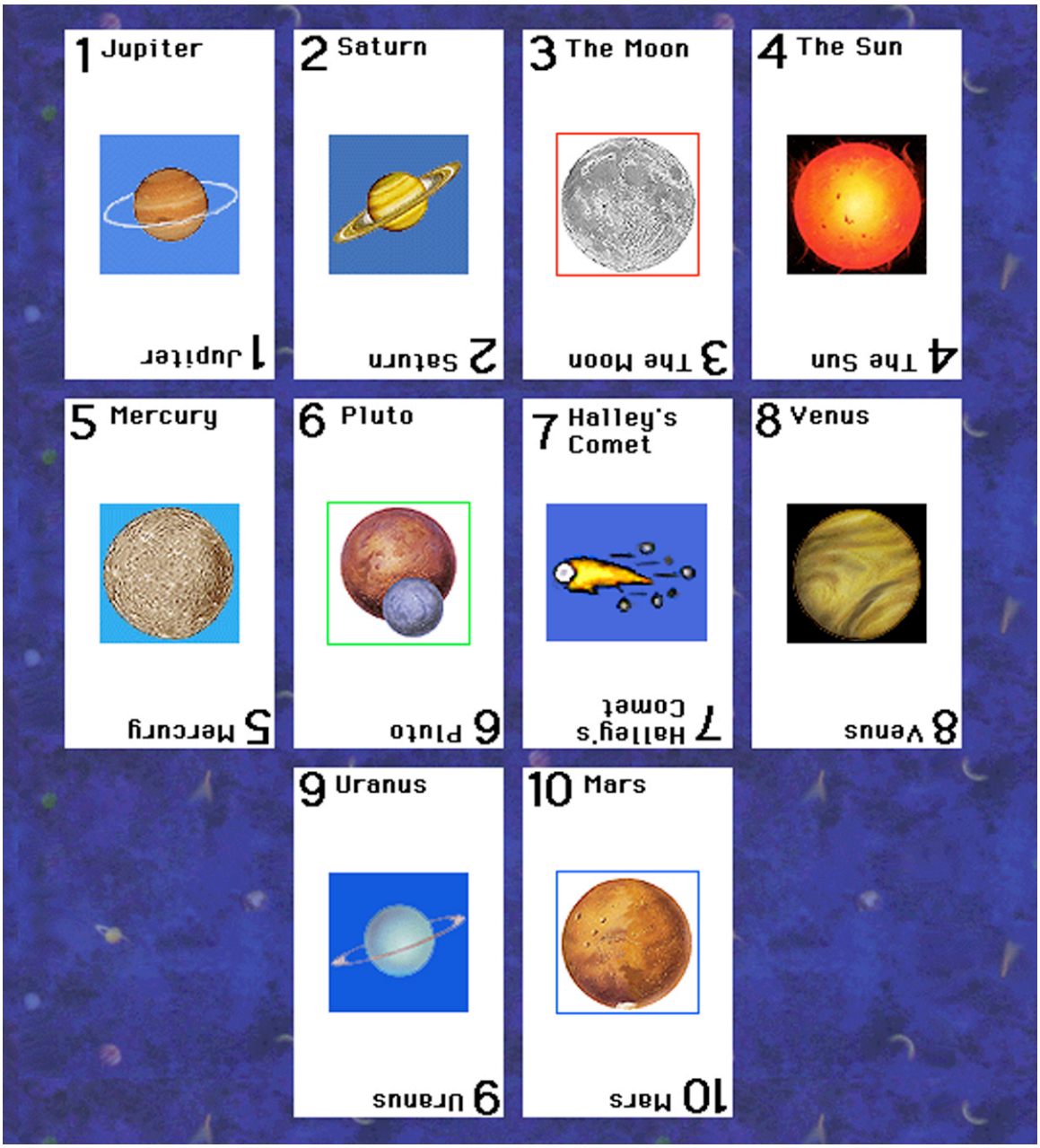
NASA Quest NASA
http://quest.nasa.gov/

This website contains a host of educational games that can be used in a classroom setting using a computer.

Pre-Visit Activities

Solar System Shuffle
Find out what your students know about the planets of the solar system before they come to Sci-Port. Print off these cards and have the students answer the questions on this interactive website. This is appropriate for 4th and 5th grade.

This website is found on-line at
http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level1/activity/solar_system_shuffle.html



The Solar System-Kids Astonomy.com
Take your students on a tour of the solar system. This website provides information about each planet's core, rotation, revolution, distance from the sun, and average temperature as well as an up-to-date picture of the planet. This website is appropriate for middle school.

This interactive website is found at
http://www.kidsastronomy.com/solar_system.htm

Post-Visit Activities

How Can I Learn More About Eclipses?- Optical Microscopy at the National High Magnetic Field Laboratory
The moon revolves around the Earth and the Earth and moon revolve around the sun. As this occurs, some of the sun's light is blocked by the moon's shadow or by the Earth's shadow. When the Earth's shadow falls upon the moon, a lunar eclipse occurs; conversely, when the moon's shadow falls upon the Earth, a solar eclipse occurs. One way to demonstrate a solar eclipse would be to use a wall clock or other large circular object and a coin or other small circular object. If the clock is the Earth and the

coin is the moon, you can position them so that the coin eclipses the clock. These activities are appropriate for upper elementary and middle school.

Communication - Encourage students to design a way to demonstrate both solar and lunar eclipses to someone who does not understand them. Students should be able to discuss shadows, light, and clarity of images that are produced when there is a bright light source, like the sun. Challenge students to use sunlight to provide the distinct shadows they need, and have them present and explain their models to the class.

Cultural Interpretations - People from many cultures have developed myths and legends about eclipses. Some have believed that an eclipse is a sign of impending natural disaster, such as a flood or an earthquake. Others thought that an eclipse foretold the death or downfall of a ruler. The Chinese once believed that an eclipse of the sun occurred because a dragon was eating the sun. As a result, the Chinese would produce great noise such as drumming and banging on pans to frighten the dragon away and to bring back the sunlight.

Have students research myths or legends about eclipses from other cultures. There are, for instance, many Native American myths and legends that are based on solar and lunar eclipses. Sharing the Kalispel story "How Coyote Was the Moon," might be a good way to get students talking about the moon and what it looks like. See the story below:

Coyote as the Moon

The Kalispel

The Moon had been stolen! The clansmen asked, "Who will take the place of the Moon?" Yellow Fox agreed to try, but he was too bright and made the Earth hot at night. Coyote then tried. He was a good mood, not to bright and not too dim, but he could see what everyone was doing. When he saw someone doing something dishonest he would always shout "HEY!" and tell on them. Finally, the people who wished to do things in secret got together and said "Coyote is too noisy. Let's take him out of the sky." So someone else became the moon. Coyote can no longer see what everyone else is doing but he still tries to snoop into everyone else's business.

Also, ***Keepers of the Earth*** by Michael J. Caduto and Joseph Bruchac (ISBN 1555910270) is an excellent source of Native American myths and legends that enhance classroom science. Science activities accompany each of the stories.

Role Play - Have students design a skit or play that illustrates various cultural beliefs about eclipses. These skits could be performed for the rest of the class as they study how different cultures interpret the meaning of eclipses.

Medical Research - Whenever a solar eclipse occurs, we are warned by the media and the medical community not to look directly at the sun. While looking directly at the sun is never a good idea, it is particularly harmful during a solar eclipse. Encourage students to find out why this is true. They should list reasons why the sun's rays are particularly concentrated, describe cases of actual damage to the eye caused by looking at the sun, and list sources for their information. Then, they could design a way to present this information to a larger audience: the school, other classes, or the general public.

History - It is believed that Christopher Columbus used his knowledge of solar eclipses to impress West Indian natives. Because he knew when an eclipse was to occur, he was able to use the natural event to solidify his power over the native population. Discuss with students the quote "knowledge is power" and have students brainstorm and research other instances where knowledge of the natural world translates into power for those who "own" the knowledge.

Reading - Read to the students ***A Connecticut Yankee in King Arthur's Court*** by Mark Twain (ISBN 0553211439). This is a wonderful story of a man who travels back to the time of King Arthur and must frequently outsmart Merlin. It includes an episode in which he uses the knowledge of when a solar eclipse occurred to save his own life.

Writing - Obtain an almanac and provide students with a list of dates when solar eclipses occurred. Have them choose a date and then write a story in which the solar eclipse plays an important part. Use ***A Connecticut Yankee in King Arthur's Court*** as a guide.

A good Java applet to show the principles of a basic solar eclipse is found at
http://micro.magnet.fsu.edu/primer/java/scienceopticsu/solar/index.html

A good Java applet to show the principles of a basic lunar eclipse is found at
http://micro.magnet.fsu.edu/primer/java/scienceopticsu/lunar/index.html

Solar System Quiz-Kids Club-NASA
Have your students take a quiz about the solar system after their visit to Sci-Port to see what they learned.

This interactive quiz is found on-line at
http://www.nasa.gov/audience/forkids/kidsclub/flash/games/levelfive/KC_Solar_System.html

Lunar Phases Interactive-McGraw Hill
Everyone is aware that the Moon changes its appearance from day to day. This Interactive will show you why, and allow you to understand how the Moon's phases are linked to where and when each phase appears in the sky. If it's sunset, and the Moon is directly overhead, what phase must it be? Is it possible to see the full Moon during the day? What exactly does a "waxing gibbous" Moon look like? Playing with this Interactive will give you a real understanding of how the interplay between Moon, Earth, and Sun creates what we see. There are instructions on how to manipulate the interactive as well as an exercise designed to help the students understand the phases of the moon and their timing. You may want to print out the questions below to go with this interactive. This activity is appropriate for middle school students.

This interactive is found on the webpage
http://highered.mcgraw-hill.com/sites/007299181x/student_view0/interactives.html#

Names:_____

Lunar Phases Interactive

1.At what time of day does the observer leave the dark side of the Earth and enter the sunlit side.

2.Describe the relative positions of the observer and the Moon
a. When the Moon is rising in the landscape view

b. When the moon is at its peak altitude in the landscape view

c. When the Moon is about to set in the landscape view

3. a. How many days are there between the New Moon and the Full Moon?

b. How many days are there between the New Moon and the Third Quarter Moon?

4.Is it ever possible to see the Moon at noon?

5.Pause the march of time, and set the clock to midnight to answer these questions:
a. On what day is the Moon first visible at midnight?

b. For how many days is the Moon visible at midnight?

6.You go outside at midnight tonight and see the Moon low in the sky to the west if you go outside at midnight tomorrow, where will the Moon be?

7. a. According to someone who watches the sky from midnight to 3 AM tonight which way does the moon appear to move?

b. According to someone who takes snapshots of the Moon at midnight only, and compares his/her snapshots on successive night, which way does the Moon appear to move?

c. Can you explain why these two answers are different?

8. a. Is the word “calendar really an accurate description of the arrangement of days in the panel on the right?

b. How many are on each page of a real civil calendar?

c. How many days are on each page of the calendars of other cultures like the Jewish or Islamic cultures?