

SUGGESTED REFERENCES

- <http://teacher.scholastic.com/researchtools/articlearchives/space/moon.htm>
Answers some of the most common questions young people ask about the Moon. Written by an astronomer.
- http://coolcosmos.ipac.caltech.edu/cosmic_kids/AskKids/moon.shtml
More answers to common questions about the Moon, written by an astronomer. What is a blue moon? When did astronauts drive lunar rovers on the Moon? How many pounds of moon-rocks were brought back to Earth?
- <http://en.wikipedia.org/wiki/Moon>
From Wikipedia, the free encyclopedia, detailed information about Earth's nearest neighbor in space.
- <http://www.pa.msu.edu/people/frenchj/moon/index.html>
John French's most useful project shows a picture of the Moon for each night during the cycle of the lunar phases - from new moon to new moon.
- <http://www.mreclipse.com/Special/SEprimer.html>
Eclipse guru Fred Espenak's own website packed with useful, easy-to-understand background information about the Sun, Moon and eclipses of the Sun and Moon.
- <http://en.wikipedia.org/wiki/Eclipses>
From Wikipedia, the free encyclopedia, detailed information about eclipses of the Sun and Moon and how they occur.
- <http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html>
NASA's eclipse home page, containing everything you want to know about eclipses of the Sun and of the Moon. Details of past, present and future eclipses. Includes predictions and maps for future eclipses.
- <http://www.mreclipse.com/Special/photo.html>
A sub-section of Fred Espenak's website containing a gallery of beautiful and stunning photographs of eclipses and other celestial phenomena.

NATIONAL SCIENCE EDUCATION STANDARDS

Grades 5-8:

Earth and Space Science
Earth in the Solar System

Physical Science
Transfer of Energy

Grades 9-12

Earth and Space Science
Origin and Evolution of the Earth System

Physical Science
Motions and Forces

*Source: National Science Education Standards, 1996, National Academy Press

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SCIENCE SCREEN REPORT

VOLUME 36 ISSUE 2

MOON "Our Partner in Space"

& JAW DROP "Eclipses & Auroras"



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SYNOPSIS

The formation of the Moon was a cataclysmic event in the history of the Earth. In this program students will see that it was probably a giant impact on Earth that caused the material that formed the Moon to break away from the Earth. Students will see how the Moon affects many phenomena on Earth including our tides and our climate.

The Moon also helps cause solar eclipses. Students will see how it is possible for the tiny Moon to completely block the Sun's rays. Students will also get a chance to experience the Aurora Borealis when particles from the solar wind are electrified by their interaction with the Earth's magnetic field and our atmosphere.

CURRICULUM UNITS

- PHYSICAL SCIENCE
- PHYSICS
- INTEGRATED SCIENCE

RUNNING TIME

2 X 10:00

BACKGROUND

Scientists predict that the Moon was formed about 50 million years after the formation of the Earth. The impact theory suggests that a protoplanet as large as Mars struck the still molten Earth. The impact sent debris into space that was captured by Earth's gravitational field. Both Earth and its new Moon then cooled and formed into the layers we see today.

At the time of its formation, the Moon was much closer to the Earth than it is today. As a result, the Moon's orbit was "captured." This caused the Moon to turn once on its axis during each orbit around the Earth, this is why the Moon always presents the same face to Earth.

The Moon produces no light; it shines because it is reflecting light from the Sun. The Moon orbits the Earth every 27.3 days. The lunar phases result because different parts of the Moon are lit at different times, during the new Moon phase the half that is lit is not the half we see.

The Moon does not have an atmosphere; the temperatures can range from 120 to -160 degrees Celsius. Because of its small size, the Moon's gravity is only one-sixth that of the Earth.

The Moon is pulling away from the Earth about 4 centimeters per year. The cause is tidal drag- the gravitational pull exerted by the Moon on our oceans, the same pull that creates our tides. This drag is slowing the spin of the Earth. As the Moon and Earth move farther apart, our day lengthens.

The Moon is just the right distance from the Earth and the Sun to sometimes create an amazing phenomenon, the solar eclipse. The Moon is 400 times smaller (in diameter) than the Sun and right now it is 400 times closer to us than to the Sun. So about 70 times a century, the Moon completely obscures the solar disc.

A total eclipse has several phases. The partial phase lasts up to 90 minutes as the Moon creeps across the solar face. Totality can last up to 7.5 minutes; the only part of the Sun that is visible is the corona, the Sun's outer solar atmosphere. On Earth light levels drop dramatically. As the totality ends, sunlight will begin to show through the Moon's mountains. A solar eclipse is one of the most amazing sights in all of nature.

Solar eclipses occur about once per year, lunar eclipses occur up to three times a year. Lunar eclipses occur when the Earth is aligned directly between the Moon and the Sun. When the Moon moves into the Earth's shadow, our atmosphere bends the sunlight and projects a reddish tint on the Moon.

There is another light show we can see near the poles of the Earth. This light show is caused by the solar wind interacting with the Earth's magnetic field. The wind is made up of electrically charged particles and gases. This wind flows around the Earth and some particles spiral down magnetic field lines towards the poles. There they collide with particles in the atmosphere and release light that is visible as an aurora.

Sometimes the Sun erupts with a massive explosion called a coronal mass ejection. The ejection speeds up the solar wind and sends a shockwave hurtling towards Earth. The shockwave pushes against our magnetic field or magnetosphere and creates geomagnetic storms and spectacular auroras. It also affects satellite transmissions and can knock out power lines.

ADVANCED ORGANIZERS

Prior to viewing this program, students should have some understanding of the following Benchmarks for Science Literacy, Oxford University Press which are excerpted and, in some cases, abbreviated below. Refer to the Benchmarks for more information.

Benchmark 4: The Physical Setting

Section A - The Universe

Know by Grade 8

- Nine planets of very different size, composition, and surface features move around the Sun in nearly circular orbits. Some planets have a great variety of moons and even flat rings of rock and ice particles orbiting around them. Some of these planets and moons show evidence of geologic activity. The Earth is orbited by one moon, many artificial satellites, and debris.
- The Moon's orbit around the Earth once in about 28 days changes what part of the Moon is lit by the Sun and how much of that part can be seen from the Earth - the phases of the Moon.

Know by Grade 12

- Weather (in the short run) and climate (in the long run) involve the transfer of energy in and out of the atmosphere. Solar radiation heats the land masses, oceans, and air. Transfer of heat energy at the boundaries between the atmosphere, the land masses, and the oceans results in layers of different temperatures and densities in both the ocean and atmosphere. The action of gravitational force on regions of different densities causes them to rise or fall. Such circulation, influenced by the rotation of the Earth, produces winds and ocean currents.

Section F - Motion

Know by Grade 8

- An unbalanced force acting on an object changes its speed or direction of motion, or both. If the force acts toward a single center, the object's path may curve into an orbit around the center.

Know by Grade 12

- Accelerating electric charges produce electromagnetic waves around them. A great variety of radiations are electromagnetic waves: radio waves, microwaves, radiant heat, visible light, ultraviolet radiation, x rays, and gamma rays. These wavelengths vary from radio waves, the longest, to gamma rays, the shortest. In empty space, all electromagnetic waves move at the same speed...the "speed of light."

**Benchmarks can be found at www.project2061.org/tools/benchol/bolintro.htm*

CRITICAL THINKING EXERCISES

1. EXPLAIN how a solar eclipse occurs.
2. DESCRIBE how the solar wind interacts with the Earth's atmosphere and magnetosphere to produce an aurora.
3. EXPLAIN how the Moon affects tides on Earth.
4. EXPLAIN why we can never see the dark side of the Moon here on Earth.
5. DESIGN an experiment to calculate the diameter of the Moon.
6. EXPLAIN why the Moon has so many impact craters.

VOCABULARY

Aurora

Core

Corona

Crater

Ecliptic plane

Lunar Eclipse

Magnetosphere

Mare

Penumbra

Solar Wind

Tidal Drag

Umbra

CAREER POSSIBILITIES

- GEOLOGIST
- PHYSICIST
- MECHANICAL ENGINEER
- ASTRONAUT