

SUGGESTED REFERENCES

- **Asteroids, Comets and Meteors (Worlds Beyond)**, by Ron Miller
- **A Look at Jupiter (Out of This World)**, by Ray Spangenburg and Kit Moser
- <http://en.wikipedia.org/wiki/Asteroid> and http://en.wikipedia.org/wiki/Near-Earth_asteroid
From Wikipedia, the free encyclopedia, two detailed reviews covering the history of asteroids, groups of asteroids, and spectral types. Includes tables of largest and notable asteroids. The second entry covers near-Earth asteroids and the threat they pose to Earth.
- http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level1/asteroids.html
From the "StarChild" service at NASA's Goddard Space Flight Center, an introduction to the Asteroid Belt written for young people. Information available at two levels.
- <http://www.kidsastronomy.com/asteroid.htm>
A simple guide to the Asteroid Belt for young people.
- http://www.esa.int/esaKIDSen/SEM99WJD1E_OurUniverse_0.html
From the European Space Agency's Kids website, an accessible summary of asteroids and meteorites for young people.
- [http://en.wikipedia.org/wiki/Jupiter_\(planet\)](http://en.wikipedia.org/wiki/Jupiter_(planet))
From Wikipedia, the free encyclopedia, an introduction to Jupiter, its internal composition, atmosphere, rings, magnetosphere and moons, with an overview of the exploration of the planet by spacecraft.
- http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level1/jupiter.html
From the "StarChild" service at NASA's Goddard Space Flight Center, an introduction to Jupiter written for young people. Information available at two levels.
- <http://www.kidsastronomy.com/jupiter.htm>
A simple guide to the planet Jupiter for young people.
- <http://www.dustbunny.com/afk/planets/jupiter/>
From the "Astronomy for Kids" website, a handy summary of Jupiter.

NATIONAL SCIENCE EDUCATION STANDARDS

Grades 5-8:

Earth Science

Earth in the Solar System

Science and Technology

Understanding about Science and Technology

Grades 9-12:

Physical Science

Motions and Forces

Science and Technology

Understanding about Science and Technology

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

SCIENCE SCREEN REPORT

Science Brought To Life In The Classroom

SCIENCE SCREEN REPORT is a proud participant in the Presidential Awards for Excellence in Mathematics and Science Teaching. For more information visit www.nsf.gov/pa

1000 Clint Moore Road, Suite 211, Boca Raton, FL 33487
tel: 1.800.232.2133 email: info@ssrvideo.com
www.ssrvideo.com

COPYRIGHT © 2006 Allegro Productions, Inc. All rights reserved.

SCIENCE SCREEN REPORT

VOLUME 36 ISSUE 6

ASTEROID "The Threat" & JUPITER "The King Planet"



Accreditation Board
for Engineering
and
Technology



Presidential Awards
for Excellence in
Mathematics
and
Science Teaching



Junior Engineering
Technical Society
www.jets.org

SYNOPSIS

An impact with extraterrestrial bodies is a common experience for all planets in the Solar System. The inner planets are most at risk of impact from bodies that lie in the Asteroid Belt between Mars and Jupiter. In this program, students will see how we are preparing our planet for a possible impact and how we are using spacecraft to learn more about the asteroids.

Beyond the Asteroid Belt lies the largest planet in the Solar System, Jupiter. Students will learn that with over 60 moons, Jupiter has its own mini solar system. A detailed study of Jupiter's four largest moons reveals that one, Europa, may even be able to support life.

CURRICULUM UNITS

- ASTRONOMY
- PHYSICAL SCIENCE
- PHYSICS
- INTEGRATED SCIENCE

RUNNING TIME

2 X 10:00

BACKGROUND

Beyond Mars is the Asteroid Belt, thousands of rocky bodies left over from the formation of the Solar System. These bodies might have come together to form a fifth rocky planet except for the gravitational influence of Jupiter.

Various spacecraft including the Hubble Space Telescope and the NEAR Shoemaker that landed on the asteroid Eros have studied these objects. The asteroids range in size up to 500 kilometers in diameter.

Every so often the asteroids collide with each other and some of the fragments can move into orbits that carry them closer to Mars. Then Jupiter's gravity may influence these objects to take a new trajectory toward the Earth. Many such asteroids have struck us in the past. Some scientists theorize that an asteroid impact off the Yucatan Peninsula in Mexico was the cause of the mass extinction that killed off the dinosaurs. The impact crater is now buried beneath a forest and the Gulf of Mexico.

Bodies such as Mercury and the Moon are pockmarked with craters that are easily visible, but on Earth, our vegetation, weather and oceans obscure most impacts. Australia's desert has some of the best preserved impact sites on Earth.

While an asteroid impact may only occur once in 100 million years, smaller bodies reach us every day. Every year, 16-thousand tons of debris rain in from space. Most are harmless meteors that burn up in the atmosphere in a spectacular display. A piece that reaches the ground is called a meteorite.

While meteorites usually cause little damage, asteroids could be a major threat. How do we protect ourselves? One of the jobs of our system of telescopes is to catalog and track these near-Earth objects. Once an object is identified, radar is used to determine the objects size, shape and rotation.

So far, no asteroids are on a collision course with Earth, but what would we do if one did head our way? Engineers and scientists are working together to devise several strategies that might give us a chance to deflect these bodies from striking Earth. One strategy is to use a solar reflector to burn a hole in the asteroid and jet the asteroid to a safer trajectory.

While asteroids are among the smallest objects in the Solar System, Jupiter is the largest planet. It is larger than all the other planets combined. Composed mostly of hydrogen and helium, it is a whirling ball of gas that rotates on its axis once every 10 hours.

Jupiter does not have a solid surface. Bands of soupy gases blow in opposite directions. Eddies of gas and storms race around the planet, the biggest is the Great Red Spot, an anti-cyclone three times the size of Earth. Jupiter's atmosphere is 18 times denser than Earth's. The wispy stratosphere tops five cloud layers. The middle layer is smelly ammonium-hydrosulfide. Below are water ice crystals, and then water. Deeper still, hydrogen turns liquid. At the core, hydrogen becomes a metallic liquid at temperatures of 20-thousand degrees Celsius.

Jupiter has a huge magnetic field as a result of the metallic hydrogen core that conducts electricity. Like a doughnut within the field is a ring of electrically charged particles called the Io-torus that carries two trillion watts of power. The generator is Io, Jupiter's closest moon. Io has no craters because constant volcanic eruptions renew the surface and feed charged particles into the Io-torus. Its surface is the most volcanically active body in the Solar System. Scientists predict that the cause is gravitational flexing, the pull of Jupiter and the moon Europa.

Jupiter's other large moons: Europa, Callisto and Ganymede also have unusual characteristics. Europa is completely covered by ice. Underneath the ice scientists think an ocean lies, heated by hydrothermal vents. The same vents on Earth may have been the source of our first living organisms. Ganymede is larger than the planet Mercury. Callisto is the outermost of the four big moons. Jupiter has at least 60 moons.

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.

Know by Grade 8

- Large numbers of chunks of rock orbit the sun. Some of those that the Earth meets in its yearly orbit around the sun glow and disintegrate from friction as they plunge through the atmosphere - and sometimes impact the ground. Other chunks of rocks mixed with ice have long, off-center orbits that carry them close to the sun, where the sun's radiation (of light and particles) boils off frozen material from their surfaces and pushes it into a long, illuminated tail.

Know by Grade 12

- Increasingly sophisticated technology is used to learn about the universe. Visual, radio, and x-ray telescopes collect information from across the entire spectrum of electromagnetic waves; computers handle an avalanche of data and increasingly complicated computations to interpret them; space probes send back data and materials from the remote parts of the solar system

Section G - Forces of Nature

Know by Grade 8

- The sun's gravitational pull holds the Earth and other planets in their orbits, just as the planets' gravitational pull keeps their moons in orbit around them.

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

CRITICAL THINKING EXERCISES

1. DESCRIBE why asteroids sometimes leave their orbit and travel towards the Sun.
2. COMPARE the size and composition of Jupiter's largest moons: Europa, Io, Ganymede and Callisto.
3. EXPLAIN how scientists can determine the composition of Jupiter.
4. EXPLAIN how Near-Earth Objects are identified and tracked.
5. EXPLAIN why the debris in the space between Mars and Jupiter never formed into a planet.
6. CALCULATE with data from the nine planets website, the relative sizes of Earth and Jupiter.

VOCABULARY

Crater

Aurora

Asteroid

Io torus

Meteor

Hydrothermal vent

Meteorite

Near-Earth Object

Stratosphere

CAREER POSSIBILITIES

■ PHYSICIST

■ ENGINEER

■ ASTROPHYSICIST

■ ASTRONAUT

■ ASTRONOMER

■ GEOLOGIST