

SUGGESTED REFERENCES

- **The Sun, Mercury and Venus (Solar System)**, by Linda Elkins-Tantor
- **Venus Revealed: A New Look Below the Clouds of Our Mysterious Twin Planet**, by David Harry Grinspoon
- [http://en.wikipedia.org/wiki/Mercury_\(planet\)](http://en.wikipedia.org/wiki/Mercury_(planet))
From Wikipedia, the free encyclopedia, a detailed entry on the planet Mercury, its internal structure, orbit, rotation and exploration by spacecraft.
- http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level1/mercury.html
From the "StarChild" service at NASA's Goddard Space Flight Center, an introduction to the planet Mercury written for young people. Information available at two levels.
- <http://www.dustbunny.com/afk/planets/mercury/>
From the "Astronomy for Kids" website, a good summary on the planet Mercury.
- <http://nssdc.gsfc.nasa.gov/planetary/factsheet/mercuryfact.html>
NASA's Mercury fact sheet.
- [http://en.wikipedia.org/wiki/Venus_\(planet\)](http://en.wikipedia.org/wiki/Venus_(planet))
From Wikipedia, the free encyclopedia, a comprehensive entry on the planet, its mythology, atmosphere, surface and exploration by spacecraft.
- http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level1/venus.html
From the "StarChild" service at NASA's Goddard Space Flight Center, an introduction to the planet Venus written for young people. Information available at two levels.
- <http://www.dustbunny.com/afk/planets/venus/>
From the "Astronomy for Kids" website, a handy summary on the planet Venus.
- <http://nssdc.gsfc.nasa.gov/planetary/factsheet/venusfact.html>
NASA's Venus fact sheet.

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*

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INSIDE TRACK "Mercury" & VENUS "Hostile Planet"



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SYNOPSIS

The inner planets, Mercury and Venus are rocky worlds with fascinating histories. Mercury has double sunrises and a day twice as long as its year. There may even be ice in the deepest craters at the poles, deposited by comets; they are permanently shadowed from the Sun.

At one time, Venus might have been Earth's twin, but scientists speculate that a maturing Sun doomed Venus. Its environment is brutally hot and constantly being covered by molten lava oozing from thousands of volcanoes.

CURRICULUM UNITS

- ASTRONOMY
- PHYSICAL SCIENCE
- PHYSICS
- INTEGRATED SCIENCE

RUNNING TIME

2 X 10:00

BACKGROUND

The formation of the Solar System included not only the formation of the Sun, but also the formation of the planets. While we tend to think of planet formation as a smooth process, it was more like bowling balls crashing into one another, with ones slightly larger gaining mass and the smaller ones losing mass or being destroyed.

The four inner planets: Mercury, Venus, Earth and Mars are all rocky. When the solar system was formed, the Sun captured most of the lightest elements and the remaining light elements were captured by the gas planets: Jupiter, Saturn, Uranus and Neptune.

Mercury is the smallest inner planet and the closest to the Sun, only 58 million kilometers away. It has the smallest orbit of all the planets; its year is just 88 days. The year on Mercury is shorter than its day. A day on Mercury lasts 176 Earth days. Because Mercury has an elliptical orbit, when it passes close to the Sun it speeds up, when it is farthest away it slows down. This means that when it is nearest the Sun it gets a double sunrise.

Scientists predict that early in its history, a large planetesimal body may have struck Mercury. The impact might have blown off its outer mantle. That would explain why Mercury has an iron core that is 70% of its volume, twice the proportion of the other rocky planets.

Mercury's surface is a record of the early Solar System. Four billion years ago, another planetesimal created a 1,300-kilometer wide crater, the Carolis Basin. Inside the crater are smaller impact craters that caused the basin to fill with lava. Although it was active volcanically for the first billion years, it has not been active since.

Daytime temperatures on Mercury top 450 degrees Celsius; at night the temperatures drop to -180 degrees. Radar mapping of the planet suggest that there might be permanent ice deposited by comets in deep craters perpetually shadowed from the Sun's glare. Only about half the planet has been photographed, so new missions will tell us more about its atmosphere, strong magnetic field, and hidden secrets in its craggy surface.

While we can see the surface of Mercury easily because of its thin atmosphere, Venus is always shrouded in clouds. The second closest planet to the Sun, Venus orbits the Sun at a distance of about 108 million kilometers. It is almost the same size as Earth, but its environment is much hotter.

It takes 225 days for Venus to orbit the Sun. It rotates very slowly, once every 243 days and in the opposite direction of the Earth. Scientists predict that a giant planetesimal struck Venus, altering its tilt and maybe even flipping it over.

85% of the surface of Venus is made up of volcanic shields and flowing lava. There is evidence of two continents, one with mountains, canyons and a giant plateau where the peak of the Maat Mons volcano stands five kilometers above the average elevation of the planet.

The atmosphere is soup-like, 90 times denser than Earth's. It blankets the planet and keeps the global temperature at a near constant 475 degrees Celsius, the hottest planet in the Solar System. Venus is the most volcanically active body in the Solar System, its sulfurous fumes adding to the toxic atmosphere.

In many ways, Venus is Earth gone wrong. It has a runaway greenhouse effect, a choking atmosphere containing 96% Carbon Dioxide and temperatures hot enough to melt lead. But what made Venus so much different than Earth?

Early on, Venus was far enough from the Sun to have continents, oceans and possibly simple life forms. As the Sun matured, its luminosity increased and Venus heated up. These possible oceans would have boiled dry and turned Venus into the suffocating, smog-ridden greenhouse we see today.

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 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/bencho/bolintro.htm*

CRITICAL THINKING EXERCISES

1. COMPARE the orbits of Mercury and Venus.
2. DISCUSS whether or not Venus could be made habitable by humans.
3. EXPLAIN why Venus has a higher average temperature than Mercury even though it is farther from the Sun.
4. CALCULATE how many kilometers the Messenger spacecraft will travel before inserting into the orbit of Mercury.
5. EXPLAIN how scientists know that Mercury is no longer volcanically active.

VOCABULARY

Basin

Coronae

Crater

Elliptical orbit

Luminosity

Planetesimal

Plateau

Radio Telescope

Volcanic shield

CAREER POSSIBILITIES

- PHYSICIST
- ASTROPHYSICIST
- ASTRONOMER
- ENGINEER
- ASTRONAUT