Teacher Idea Kit

OASIS IN SPACE

A Space Science Program for Grades 6 – 12

Presented by

ABBITT PLANETARIUM

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Oasis in Space
Suggested for Grades 6 – 12

Objectives

After visiting the planetarium for Oasis in Space, the student should be able to:

1. Explain the structure of the solar system.
2. Name at least three places in our solar system where water can be found.
3. Discuss the search for life on other planets and the significance of water to that search.

State Standards of Learning Objectives

This planetarium presentation meets the following Virginia State SOLs:

Science: 6.8, ES.3

Vocabulary

asterism:	A picture made of stars in the sky; an unofficial constellation. The Big Dipper is an asterism. Many cultures around the world created their own system of asterisms from the stars visible from their home.
civilization:	A particular society or group of people at a particular time and place.
constellation:	A picture made of stars in the sky which has been accepted as one of 88 official patterns by the International Astronomical Union. Ursa Major is a constellation.
life:	While difficult to define (and perhaps moving us into the realm of philosophy), most scientist would accept the basic concept that anything which can respirate (breathe), consume nutrients (eat), eliminate wastes, and reproduce is alive.
nebula:	A cloud of gases in space. When a nebula contracts, it can form a star. Some nebulae are large enough to produce multiple stars.
planet:	A non-luminous body which has a unique orbit around a star. Planets do not produce their own light, but shine by reflecting the light of their star.
solar system:	A star and its associated planets, dwarf planets, moons, asteroids and comets. Our solar system contains one star, 8 planets, 3 dwarf planets, over 150 moons, and numerous asteroids and comets.
standing stones:	Large, often vertical, stone pillars or slabs, sometimes organized into circles or other shapes. Many such sets of standing stones have carefully created astronomical alignments. Stonehenge is an example of a set of standing stones.
star:	A collection of gases with internal temperatures and pressures high enough to allow for nuclear fusion. Stars generate their own light, and this energy production balances the force of gravity, keeping the star stable.
water:	A compound made of 2 hydrogen and 1 oxygen atoms. Water is the most basic ingredient for life as we know it. Over 70% of the Earth's surface is covered by water.

Background Material for Oasis in Space

We are surrounded by water. It is readily available in our homes. We cook with it, drink it, play in it, work with it. A planet with no water could not support life as we understand it. While life needs water to exist, it also needs other favorable conditions. An atmosphere protects the planet, moderates the temperature, and is a source of biochemicals. On Earth, life has been found at temperatures between -15°C to 115°C. Any hotter, proteins and DNA break down; any lower, cellular reactions proceed too slowly. Life also needs a source of energy, which may be sunlight or chemical. Finally, life needs nutrients, or materials to build and sustain itself.

Students are most likely aware of the NASA focus on returning men to the Moon, and then traveling further on to Mars. Mars and Europa (one of Jupiter's moons) are two top contenders for harboring life in our solar system, either now or in the past. It is now almost certain that they have liquid water. Mars has an atmosphere and temperatures between -133C° and 27C°. It is close enough to the Sun for the Sun to be a source of energy. Europa is far away from the sun, but may have internal heating to provide energy and keep its possible large ocean melted. Both bodies, like most bodies in our solar system, have the organic compounds. And yet, these are not the only places where water can be found in space.

In this program, students will receive an overview of the orbiting bodies of the solar system and some of their characteristics. Before the show, you may want to discuss with your class some of the factors that make a planet favorable for life. Students should be prepared to think critically about the evidence presented in the planetarium show and be ready to ask questions after the program.

Concepts Covered During the Planetarium Visit

1. The solar system consists of a single star, the Sun; a group of eight planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune; and numerous smaller bodies such as dwarf planets, asteroids and comets. Many of the planets have moons orbiting them, some of which are unique worlds in their own right.

2. Water can be found in numerous places in our solar system. Water was likely a significant component of the nebula from which the Sun and planets formed, and therefore, water is quite common throughout the bodies of our solar system.

3. In the search for life, scientists look not just for water, but for liquid water. Water in its liquid state is necessary for life as we know it. Solid water (ice) or water vapor does not possess the necessary chemical properties to aid in the formation of life. There is mounting evidence for the presence of liquid water both on Mars and on Europa, one of the moons of Jupiter.

Pre-Visit Activities
We recommend that you conduct at least one of these activities with the class before your visit to the planetarium theater. Be sure to raise questions that can be left unanswered until the discussion period in the show.

1. Talk about the possibility of extraterrestrial life. What is required for life as we understand it? How would extraterrestrial creatures meet these life needs?

2. Create a scale model of the solar system. This can be a challenging activity if you want your solar system to have the same scale for both the sizes of the planets and their distances apart. To do this, you will need a large area to work in, and some very small models for your planets. Discuss the sizes of the planets and the vast distances in space. Do you think it would be easy or difficult for us to find and communicate with an alien civilization? For help in determining the sizes of your planets and the distances they should be apart, visit http://www.exploratorium.edu/rohn/solarsystem

3. Observe the Moon. What does the surface look like to you? Draw what you see. Can you identify any features on the surface? What do you think they are?

Post-Visit Activities
We recommend that you conduct at least one of these activities with your class following their visit to the planetarium theater.

1. Investigate why liquid water rather than just water is so critical to life. Have students place a spoonful of calcium chloride (driveway-melt salt) and a spoonful of sodium bicarbonate in a large plastic baggie, seal, and shake. Nothing happens. Now add 1/3 of a cup of water to the bag, seal and shake. The bag inflates with carbon dioxide gas – water facilitated the chemical reaction. Try this again, but add 1/3 of a cup of ice to the baggie. Unless sufficient time passes for the ice to begin to melt, nothing will happen. Many chemical reactions only take place in the presence of liquid water. Be sure to dispose of your experiments carefully.

2. Discover how planetary geologists can identify places on other worlds where water must once have flowed. Prepare a large pan with sand, and prop one end up a little so water can run downhill. Be sure there is a way for the water to run off and be caught (a hole in the bottom of the pan, and a bucket to catch overflow). Now slowly pour small streams of water on the top of your slope. Moistening the sand first will help keep too much from running off. Using a small stream of water should allow you to see it carve channels as it runs down the hill. Let your pan of water dry out. Notice that the dry riverbeds remain! These kinds of markings can be found on the surface of Earth as well as Mars.

3. Which place in the solar system other than the Earth do you think is most likely to harbor life? Why?

Recommended Books and Web Sites
NASA's Future Exploration Homepage:
http://solarsystem.nasa.gov/multimedia/downloads/SSE_Roadmap.pdf
Johnson Space Center: www.nasa.gov/centers/johnson/home/index.html
NASA Explores the Possibility of Life in Our Solar System:
http://nai.arc.nasa.gov/astrotech/solarindex.cfm
Cosmos by Carl Sagan
StarDate: http://stardate.org/
Virginia Living Museum and Abbitt Planetarium: http://www.thevlm.org