



Sample Lesson: “Moonbase and Space Law”

Objective

Discuss possible construction plans for a lunar settlement, taking into account the lunar environment and any hindrances, etc.

National Standards Met

NCSS 3—People, Places and Environments

NSES 2—Physical Science

NSES 4—Earth and Space Science

Moon Base and Space Law

Objective

- Students will learn about how harsh an environment space is, the necessities in space survival, planning and producing a finished product (moon base drawing), and space lawmaking.

Suggested Grade Level

9-12

Subject Area(s)

Earth & Space Science

Astronomy

Social Studies

Law

Timeline

(2) 90 minute blocks or (3-4) 50 minute periods

Background

This lesson is designed to be taught after some groundwork has been laid and should be part way through a space unit. Students should already be familiar with the U.S./U.S.S.R. space race and the Apollo 11 mission. They should also be familiar with basic space law including the various treaties that deal with space policy between nations.

Apollo 11 was the mission in which the first man to step foot on the moon took place. On July 20, 1969, Neil Armstrong stepped off the Lunar Module and stated, "That's one small step for man, one giant leap for mankind".

The moon's gravity is 1/6th that of the earth's. This means that a man weighing 360 pounds (total with a flight suit) would only weigh 60 pounds on the moon. The moon has no atmosphere, and therefore has no oxygen. It is also devoid of a magnetic field. These conditions make it a harsh environment to live in, and a moon colony would be necessary for extended survival on the lunar surface.

Biosphere II is a multimillion-dollar scientific experiment performed near Oracle, Arizona. This large 'dome' theoretically contained all the necessary plants/animals/biogeochemistry necessary to be self-sustaining without any outside help. Seven 'biospherians' entered on September 26, 1991, hoping to survive a full two years in the dome without outside help. They crew were only able to survive for 18 months when the oxygen levels dropped below sustainable levels. As it turns out, the concrete used to form the outside walls was reacting with the oxygen in the air, forming calcium carbonate and sucking oxygen out of the system.

Space Law is new and still quite undefined in many aspects. Many countries have signed the various treaties proposed by the United Nations, while others have not. Those nations that have chosen not to sign certain treaties such as the Outer Space Treaty (1967), Rescue and Return Agreement (1968), Liability Convention (1972), Registration Convention (1975), and the Moon Treaty (1984), are not required to keep the policies outlined therein.

Materials

White paper
Color Pencils
Markers
Rulers
Lined Paper

Lesson

1. Attention Getter – Have students respond to the following situation in groups of 2-4. Your spaceship failed and your crew has crash landed on the moon, about a days walk from your intended destination, the moon colony. You are able to salvage the following items from the wrecked ship: (2) 70kg oxygen tanks, solar powered heating unit, signal mirror, batter powered heating unit, matches, signal flares, solar powered communications radio, food, water, magnetic compass, constellation map, Time magazine, yo-yo, rope, umbrella, extra clothes, and a tool box. Unfortunately, your crew can only choose 6 items to bring with you on your journey back to the moon colony. You crashed on the dark side of the moon, and will be in darkness the entire trip back. Choose which items your crew would bring with you and explain why.
2. Part 1 – Show a short film clip of Biosphere II (whether it be from a video or else from a website). Discuss the experiment. What are the necessities to sustain human life? Is a permanent moon colony possible? What is necessary for survival on the moon?
3. Part 2 - “Moon Base Drawings” – Students are to design and plan their own moon base/moon colony. They will do a quick sketch of their colony as a rough draft that must include labels of all the necessary things to sustain life. This rough draft must be initialed by the teacher (to check for all the necessities such as food production, water storage, oxygen, etc.) before they begin their final draft, which must look professional and be in color. Tell the students that they have unlimited resources in building their moon base, and they must plan on living there indefinitely, so they can make it as comfortable and fun as possible (the kids like that part, ie. shopping malls, restaurants, etc.) but it must also be logical and functional. Their rough and final drafts will take some time to complete.
4. Part 3 – “Lawmaking Scenario” – When the students have completed their moon bases, set the stage for the following scenario: Your moon base

has been built and functioned perfectly for quite some time. Other moon colonies have been built by various world countries, and many communications satellites have been put into orbit around the moon to enhance earth/moon communication. All of a sudden one day, something disastrous happens. A Chinese satellite repairman who has been hired by a Russian satellite company to repair one of their orbiting satellites makes a critical error – he accidentally drops one of the wrenches he is working with and it floats off into space...unfortunately at that same moment a United States spacecraft, while coming in for a landing, hits the wrench traveling at 17,500 mph and is absolutely destroyed, including all crewmembers. The ship then crashes into your moon base, causing excessive damage, but no loss of life.

5. Part 3 (continued) - Put students in groups of 3-4 and have them discuss the following questions. They must write out their answers and be prepared to share with the class.
 - a. Who is responsible for this catastrophe?
 - b. Who should pay for the repairs? Why?
 - c. What laws should you enact, or what treaties should be created to
 - 1) Help deal with possible future situations like this?
 - 2) What are the foreseeable difficulties in creating space laws?
 - d. Wrap-up – Discuss the importance of space law especially in lieu of the disaster that occurred on the moon. Have groups share their ideas.

Extensions

Have students research space treaties on the internet and compare the real treaties to the class's proposals.

Have students build a 3D model of their moon base or write a 1 page essay explaining what life in their moon base would be like.

Watch "Discovery School: Satellites" Video and discuss the issue of space junk. Have students research Biosphere II on the internet.

Evaluation/Assessment

- Assessment of student learning will take place throughout as the class discusses the moon crash scenario, and the lawmaking discussion. Teacher needs to check for understanding during the class discussion.
- This lesson includes many different parts, so break up the students' grades into individual parts, such as separating out grades for the moon base drawing and group lawmaking parts.
- Since students must have their rough drafts initialed by the teacher, the grading of the final copy should be based on quality of work and creativity.

Resources

Biosphere II website

Google search on space treaties

Space Foundation Graduate Course materials for Rocketry & The Biology of Living in Space specifically including the Space Law handouts, and Space Debris summary.

www.hq.nasa.gov/office/pao/History/ap11ann/introduction.htm

www.cde.state.co.us/action/standards/national.htm

http://biology.kenyon.edu/slonc/bio3/2000projects/carroll_d_walker_e/biosphere.html