

Space Station Design Part 2 Grade 9 Applied – Space Exploration

Lesson Plan

Assessment
Cross-curricular

AFL, observation, handout

Big Ideas

- Celestial objects in the solar system and universe have specific properties that can be investigated and understood.
- Technologies developed for space exploration have practical applications on Earth.

Learning Goals

- What the word ‘Terrestrial’ means
- What parts of our solar system are Terrestrial
- Some characteristics of one part of our solar system (of your choosing).

Specific Expectations

- D2.1** use appropriate terminology related to space exploration
- D2.2** investigate patterns in the night sky and the motion of celestial objects
- D2.3** use a research process to compile and analyse information on the characteristics of various objects in the universe
- D3.1** describe the major components of the universe, the motion of the different types of celestial objects, and the distances between certain objects, using appropriate scientific terminology and units
- D3.2** compare the characteristics and properties of celestial objects that constitute the solar system, including their motion and their distance from other celestial objects in the solar system
- D3.3** identify the factors that make Earth well suited for the existence of life

Description

This is **lesson two** in a series of four lessons where students will be creatively introduced to a problem (How can we keep astronauts alive on a distant planet or moon), will self-direct the specific nature of their learning (choose a planet or moon), will research background details (planet research), and then develop solutions to the specific nature of their problem. This lesson will be organized around a Problem-Based Learning (PBL) Framework.

Materials

Superb Space Stations Part 2 visuals
Superb Space Stations- Choice

Safety Notes

No safety concerns

Introduction

- In a previous lesson, the class looked up the next pass over of the International Space Station and were assigned the task of looking for the station and observing its properties.
- The teacher should initiate a discussion about what was seen and record student observations on the board. Examples include:
 - "It was cloudy so I couldn't see it"
 - "It was just a bright dot"
 - "It was brighter than the stars"
 - "It moved REALLY fast"
- Students should be encouraged to observe another pass over in the next few days using binoculars if they have them available at home.
- In lesson 1, students created a list of things that astronauts need to survive and be healthy. In this period they will choose a terrestrial object in our solar system on which to build their space station. They must fully research the properties of the object in order to plan out the components of the space station.

Action

- In the accompanying slideshow (slide 3 of the 'Superb Space Stations Part 2 Visuals'), the teacher will ask students to consider what the term 'Terrestrial' means when applied to space objects.
 - The teacher should give wait time for students to consider then might use Think/Pair/Share and discuss as a class.
- (slide 4) Students must think of terrestrial objects in our solar system.
 - The teacher might instruct students to use the Rally Robin technique.
 - With a partner, students will write one terrestrial object on a sheet of paper, then 'rally' the paper to their partner.
 - The partner must then write a terrestrial object and rally the paper back.
 - This continues until they can't name any more terrestrial objects.
 - The class should go through the picture on slide 4 together and name the 4 terrestrial planets.
- (slide 5) Students should consider what the 4 terrestrial planets have in common (being close to the sun and inside the asteroid belt) and discuss as a class.
- (slide 6) Students should Rally Robin or brainstorm with their partner as many other terrestrial objects as they can think of (encourage them to start with our own moon).
- (slide 7) The teacher will draw the students' attention to the fact that most (all?) moons in the solar system are terrestrial and will discuss which moons correspond with which planets.
- (slide 8) Students will be told that they must choose a terrestrial object from the picture on slide 8 to host their space station (other than earth of course, and mars if the movie 'The Martian' was used in lesson 1).
 - The teacher should draw students' attention to the relative size of many of the moons (some are bigger than certain planets).
- Students should be placed in their groups from Lesson 1 and given Superb Space Stations-Choice.

- In their groups students will choose a terrestrial object and conduct research on the properties of that object.
 - The teacher should instruct them to keep in mind throughout their research that they will need to keep humans alive on this planet or moon.
 - Students should be encouraged to use school or personal electronic devices, text-books, and other available print resources.
 - If searching electronically, the teacher might suggest the following resources:
 - <http://solarsystem.nasa.gov/planets/>
 - <http://space-facts.com/>
 - The appropriate Wikipedia entry on a given object (these pages tend to be EXCELLENT!)
- Students should be expected to struggle and may need support in the following areas:
 - Question 4 - If researching a moon rather than a planet, one full rotation may not equal a day-night cycle.
 - Question 10 - Similar to question 4. Students can use the orbital period of the associated planet.
 - Question 16 - The teacher may want to include a mini-lesson on calculating time when given speed and distance. Students will need to research the AVERAGE distance of their object from earth (a simple Google search will likely suffice) then turn that distance into metres and divide by the speed of light (299 792 458 m/s). This result will yield the number of seconds to send a signal ONE-WAY. They would double this for a return signal. Students may want to convert seconds to minutes for ease of understanding.

*Note: All pictures used courtesy of Wikipedia and from the creative commons

Consolidation/Extension

Students should hand in their research to the teacher or bring it home in order to finish before the next class. If time remains, students should rank the factors of their terrestrial object from easiest to overcome to hardest to overcome.