

Lesson Plan

Assessment
Cross-curricular

Lists with prompts
Health, P.E., Technology

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

- Some ways that Canadians have contributed to space exploration
- What ways space travel is dangerous to humans
- Things that humans need to stay alive and healthy society.

Specific Expectations

- D1.1** research the challenges associated with space exploration, and explain the purpose of materials and technologies that were developed to address these challenges and how these materials and technologies are now used in other fields of endeavor
- D1.2** assess the contributions of Canadians to space exploration
- D2.1** use appropriate terminology related to space exploration
- D2.2** investigate patterns in the night sky and the motion of celestial objects
- D2.4** investigate a technological challenge related to the exploration of celestial objects that arises from the objects' specific properties, and identify the solution that has been devised
- D3.3** identify the factors that make Earth well suited for the existence of life

Description

This is **lesson one** 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 1 Visuals

Safety Notes

No safety concerns

Introduction

- In a previous lesson, it would be helpful for students to have created the International Space Station as a model, an activity provided by NASA (open source): https://www.nasa.gov/pdf/616947main_Build_Station_Simulation.pdf
- To present the problem (learning hook) read the following script:

(Scene opens on Canadian Space Agency logo. Text appears which reads, “year 2024 - CSA secret briefing”. Prime Minister appears on camera.)

“Young scientists of the Canadian Space Agency, this is your Prime Minister speaking. What I’m about to reveal to you is top secret and for your eyes and ears only. As you know, Canada has made many noteworthy contributions to space exploration. The Canadarm, used to grasp and move payloads for space shuttles was designed and built by Canadians. The first model was made in 1981, and it was used in 90 shuttle missions until it was retired in the year 2011. Of course, Canadarm2 is still being used today on the International Space Station. We’ve also had some pretty amazing people involved in the space program. Roberta Bondar is Canada’s first female astronaut and the first neurologist in space. She spent more than 10 years as NASA’s head of space medicine. You’ve also no doubt heard of Chris Hadfield, the first Canadian to walk in space and Canada’s first astronaut to command the International Space Station. Of course, our crowning achievement was our mission to Mars in 2050. Now it’s your turn. We’re looking to a new generation of space explorers. Young, bright, and brave people ready to explore the further reaches of our solar system. Your mission, should you choose to accept it, is to put together a team of 4-6 astronauts to explore one of the terrestrial objects in our solar system that hasn’t yet been explored by humans. You’ll be expected to establish a base there and will have to live there for 6 years before your return journey. You won’t have enough room on your ship for food for 6 years so you’ll have to plan how you’ll feed yourself, among countless other things that you’ll need to survive. We already have a ship ready to take you but we haven’t yet chosen a destination. It’ll be up to you to choose what planet or moon you think we should explore and completely design a space station for that planet or moon. I should warn you that we will have many groups of astronauts working on this challenge and we can pick only one to put our resources behind. Do your research well, work hard, and remember to consider every little detail. Thinking of all the details required to survive on another planet or moon may mean the difference between life and death. Good luck!”

There an inspirational student geared video about Space Exploration included with these lesson plans. See the video link with this lesson plan.

Action

- Now that the problem has been proposed, the teacher will use media to guide students through a brainstorming process of common factors that astronauts need to stay alive. This can be completed with free online videos (see the Canadian Space Agency) and can be enhanced by showing short sections of prominent Hollywood movies if available.
- Students should be placed in their working groups in which they will complete the PBL project. Groups of 2-4 are recommended with 3 likely being ideal.

- Each group should be provided with portable whiteboards or chart paper and will create a T-chart as shown below (See slide 4 of the ‘Superb Space Stations Visuals’)

Need	How to meet it
Food Water Breathable Air	

- To begin, students should write down, in the left column, all of the things that they can think of that we need to stay alive.
 - The lists will likely be short and include “Food, water, shelter, air”. These can be shared or read openly.
 - The teacher should tell students that the list of things that we need to stay alive and healthy is actually REALLY long but we take most of it for granted because we live on earth under conditions that we evolved in.
- The teacher will show the following clips (in no particular order) and groups will be asked to identify human needs from these clips.

Media Type	URL	Suggested Needs to Identify
Tour of the ISS	https://www.youtube.com/watch?v=WkYz43qALMU	Exercise, Work area, Oxygen, Water
Cleaning yourself in space	https://www.youtube.com/watch?v=nPUvzn3CTQc	Personal sanitation
Brushing teeth in space	https://www.youtube.com/watch?v=3bCoGC532p8	Personal sanitation
Pooping in space	https://www.youtube.com/watch?v=MgMYqxdVAIA	Waste disposal, Water
Reclaiming water	https://www.youtube.com/watch?v=BCjH3k5gODI	Water
Exercising in space	https://www.youtube.com/watch?v=Wam7poPzG1w	Exercise
Radiation in space	https://www.youtube.com/watch?v=OMQOkL2zDas	Radiation protection
Sleeping in space	https://www.youtube.com/watch?v=UyFYgeE32f0	Sleep

- These may be discussed openly and the teacher should provide frequent prompts.
- During this part, students may wish to begin writing down solutions on how to meet these needs.
 - This is not a necessity but students may wish to begin making these notes as they go.
 - Note: How to meet the needs will be explicitly worked on in Space Station Design Part 3.
 - Other needs that might be considered include: Electricity, Light, Entertainment, Rules, Duty/Job/Sense of purpose, etc.
- Students should be given some time (~5 mins) to discuss and brainstorm in their own groups any other needs that an astronaut might have.
- Students should share their list of needs in one of the following fashions.

GALLERY WALK:

- Students will display their chart paper or whiteboards around the exterior of the room and rotate around in order to see all other student work.
- They return to their boards and add at least 3 needs that they found important.

GOOGLE DOC:

- Students have access to a shared online workspace where they list all needs that they have been able to come up with, creating one master list accessible to all.

ROUND ROBIN:

- Groups are prompted to share, with the rest of the class, one need that they have on their board.
 - The teacher writes this down on the class board.
 - Groups follow in order listing one need until no groups can list any more creating one master list on the front board.
- If time remains, students should begin to consider ways to meet needs that they have identified.
 - They should be encouraged to engage their imaginations and not get bogged down in technical details (ex. An ‘oxygenator’ may be described by students as “Thing that makes air breathable again”.)

Consolidation/Extension

SEE THE REAL ISS IN THE NIGHT SKY (See slide 5)

- To finish the period, students should be informed that they could actually see the International Space Station fly overhead on most clear nights.
- The teacher should go to <http://spotthestation.nasa.gov/> and enter the location information. Students should be encouraged to do this on their own devices (if they have them) at the same time. If a flyover is happening before the next class, students should create a digital or physical reminder and will be expected to report on what they observe. Note: this is an excellent opportunity to discuss directions and degrees above the horizon.