

Lesson Plan

Assessment
Cross-curricular

Paragraph checklist

Big Ideas

- Technology developed for space affects our lives

Learning Goals

- Think about the pros and cons of space exploration and decide why it is a good idea or not.
- Learn about the mechanics of a rocket launch
- Learn how astronauts live in space today

Specific Expectations:

- 1.2** evaluate the social and environmental costs and benefits of space exploration, taking different points of view into account
- 2.1** follow established safety procedures for handling tools and materials and observing the sun (e.g., use appropriate eye protection when testing a sundial)
- 2.3** use scientific inquiry/research skills (see page 15) to investigate scientific and technological advances that allow humans to adapt to life in space
- 3.3** explain how humans meet their basic biological needs in space (e.g., obtaining air, water, and food and managing bodily functions)
- 3.4** identify the technological tools and devices needed for space exploration (e.g., telescopes, spectroscopes, spacecraft, life-support systems)

Description:

This is **lesson 3** of a five-lesson unit in which the students plan and execute an interstellar mission. This lesson really focuses on launch and living in space. We will start however by defending our mission's value.

Materials/Resources:

Chris Hadfield reading, Slide Show
Balloons and String
Masking tape
Film canisters
ENO and water OR vinegar and baking soda OR Alka-Seltzer and water

Safety Concerns:

All students should be wearing safety goggles.

Introduction

Getting Started

The government has decided that before you can launch your space mission you need to defend the money you are spending on it. Their main concern is cost, when there are so many other priorities for money to be spent on.

- Benefits of a space program
 - If students did the reading “Chris Hadfield: Why we need a space program” then they can now participate in a discussion on this topic.
 - NOTE: The link for the reading is:
<http://www.tested.com/science/space/459079-astronaut-chris-hadfield-why-we-need-space-program/>
 - The reading is also attached to lesson 2 of this unit.
 - Otherwise, start with section three (“From Earth to Space”) of the Science North Space video or start the lesson with the Chris Hadfield reading, and then discuss.
- Do we go ahead?
 - Let the students take a vote.

Action

Great! You have chosen to continue your space exploration program! So let’s learn about launching rockets and actually launch them.

Activity 1: Launching a Rocket

- “Let’s start with the simplest example of rockets. A balloon. Do you think this is a rocket?”
 - Get a student or several students to blow up a balloon and then let it go. It will fly off.
 - It doesn’t quite fly like a rocket. BUT it does follow Newton’s Third Law. For every action there is an equal and opposite reaction.
 - The air rushes out through the nozzle
 - The balloon moves in the opposite direction.
- Not convinced? Let’s try this:
 - Thread a straw onto a string long enough to cross the room.
 - Get two students to hold the string.
 - Get volunteers to blow up the balloon and then tape it to the straw.
 - Let go.
 - What happened? (It moves straight along the line) Why?
 - The “nozzle” of the balloon flops around, changing the direction of flight constantly. When we add the string we force the balloon to move in one direction only.
 - You can clearly see that the balloon goes in the opposite direction from the airflow. By restricting the air flow through a nozzle a force is created that moves the balloon forward. This force is called thrust.
 - Rockets work in exactly the same way, but we use an explosive substance, rocket fuel, to create a pressurized gas that shoots out through the rocket’s nozzle.
 - Rockets do not need a string as the nozzle is made out of a solid material that doesn’t flop around!

- Optionally: show some images of rockets, can you see the nozzles? Can you see how they restrict the flow of gas to create the thrust? (See Slide Show for pictures)

Activity 2: Launching a film canister

- “OK. Let’s discuss rocket fuel. Who has an idea what we might use in real rockets to fuel them?”
 - Answer: Hydrogen & oxygen mix (very explosive). Also, rockets use solid fuels, sort of like gunpowder, that burns up gradually. On the space shuttle the big tank is for hydrogen and oxygen that burns out through the nozzles of the shuttle. The slimmer rockets on the side burn solid fuel.
- “While we don’t want to mix hydrogen and oxygen in class we can show the concept of combining two materials to create an explosive reaction. “
 - Use your choice of substances. Alka-Seltzer tablets and water have the most consistent results. You may want to take the students outside for this demo, as the rockets can fly quite high.
 - Fill a film canister about one quarter full of water. Drop a half a tablet of Alka-Seltzer into it and QUICKLY close the lid tightly. Turn the film canister over, so it sits on the lid. Either launch from a child’s hand (that is wearing protective goggles) or launch from the ground. **Safety: All students need to be wearing safety goggles.**
 - (For ENO and baking soda, fill the cap with powder, without having it overflow, then put the filled cap onto the canister).
- Explanation: “As we mix these two substances a gas is released in a chemical reaction. This builds up pressure in the canister until the cap blows off. The pressurized gas then escapes and the film canister shoots up. In a very similar way oxygen and hydrogen react together to create exploding gas that shoots a real rocket up into space.”
 - Repeat a few more times if there is demand for it.

We have blasted off. Our space mission has now reached the halfway point. We have successfully left Earth and we are now on a journey into the unknown. One day, humans could really find themselves on such a journey to a distant and unknown world. We do of course already have humans who live in space though – as they orbit around the Earth in the International Space Station.

One such astronaut was Chris Hadfield, the first Canadian commander of the International Space Station. He was on the station for over 5 months in 2013. He did many amazing videos showing how he lived in space. Let us watch a few of them!

Chris Hadfield Videos

Choose some of the videos from the Canadian Space Agency to show in class.

Consolidation/Extension

The following can be done at the conclusion of this lesson or as a homework assignment.

Now that we've watched Chris Hadfield in space it's time for you to imagine how you would spend your own time in space on a mission to a distant world. Here are a few options on what you can do:

- Write a paragraph about how you imagine you would pass the time in space.
- Make a drawing of yourself and what you're doing while on your space mission.

See the Paragraph Checklist for what items students can/should include in their responses.