[Download all associated files for this lesson from our website](http://peer.tamu.edu/DLC/NSF_Resources.asp?ID=1151&type=browse&num=10&terms=&content=allcontent&subject=allsubjects&grade=allgrades&query=query&hl=no&count=537&number=6&view=yes).

**Summary:** This lesson introduces various topics involved in manned space exploration. The purpose of this lesson is to identify the accommodations, considering the characteristics of our solar system, that enabled manned space exploration. Students will learn about the multiple characteristics of our solar system, as well as human accommodations that allow humans to explore space. Students will also learn about the effects of space on the human body and the need for a space suit, proper nutrition, and exercise while in space.

**Keywords:** Space exploration, shuttle, astronaut, space station, space food, slingshot effect

**Subject TEKS:** Science 7.9B: Identify the accommodations, considering the characteristics of our solar system that enabled manned space exploration.

**Grade Level:** 7th

**Learning Objectives:**

* Students will be able to define all terms in the vocabulary list.
* Students will be able to identify characteristics of our solar system and human accommodations that enable manned space exploration.
* Students will be able to identify different equipment used to study in space.
* Students will understand what allows objects to remain in orbit.
* Students will understand the need and importance of space suits.
* Students will understand the need for proper nutrition and exercise while in space.

**Time Required:** 1.5 - 2 hrs (Iron in Cereal activity needs an hour to prepare – see activity plan for instructions).

**Materials:**

* Paper and pencil
* Computer and projector
* Falling Coffee Cup
	+ Styrofoam coffee cup
	+ Sharp pencil
	+ Catch bucket
	+ Water
* Candle Under Water
	+ Water
	+ 2 glass cups
	+ Colored dye
	+ A saucer plate
	+ A candle
	+ Kitchen lighter
* Iron in Cereal - if materials are unavailable, a video of this demonstration can be seen here: <http://www.youtube.com/watch?v=pRK15XSqtAw>
	+ Plastic ziplock bag
	+ Box of Total cereal (or any cereal that has 100% of the iron in the nutrition label)
	+ Box of sugary cereal with little to no Iron listed in the nutrition label to be used as a comparison (this is box is optional and can be used to compare cereals to find which one has enough iron to meet your daily recommended needs).
	+ Strong magnet
* Visualizing Microgravity - if materials are unavailable, a video of the demonstration is here: <http://pbskids.org/dragonflytv/show/microgravity.html>
	+ Small HD Digital Video camera (HDE-S80)
	+ 8 GB Memory microSD card
	+ Deep plastic bin with lid
	+ Duct tape
	+ Small inflatable pool
	+ Clear, plastic cup with lid
	+ Seltzer tablet
	+ Water
	+ Cotton balls
	+ Computer with video viewing software that can reduce video speed

**Expendable Activity Cost:** ~$35

**Background and Concepts for Teachers:**

Browse and review these listed websites:

* What is a spacewalk?

<http://www.nasa.gov/audience/forstudents/5-8/features/what-is-a-spacewalk-58.html>

* Space suits

<http://www.howstuffworks.com/space-suit4.htm>

* Space station

<http://www.pbs.org/spacestation/station.htm>

* Space shuttle

<http://science.howstuffworks.com/space-shuttle.htm>

* Space food fact sheets

<http://www.nasa.gov/audience/formedia/presskits/spacefood/factsheets.html>

* Bathroom in space

<http://science.howstuffworks.com/bathroom-in-space.htm>

**Vocabulary/Definitions:**

* **Vacuum** – a volume of space mostly empty of matter such as oxygen to breathe
* **Astronomical unit** – the distance between the Earth and Sun
* **Slingshot effect** – the use of energy from gravitational fields of planets or moons to change the speed or shape of a spacecraft’s orbit
* **Space shuttle** – a reusable spacecraft which carries a crew and equipment into space and then returns to Earth
* **Space station** – spacecraft that allows long-term observations and experiments to be carried out in space
* **Low Earth orbit** – anywhere from 99 to 1,200 miles above Earth
* **Mission control** – teams of experienced engineers and technicians that keep track of astronauts in space and help them complete tasks
* **Astronauts** – a person trained to be part of a spacecraft crew
* **Space walks** – an activity in which an astronaut moves and does work outside a spacecraft while in space
* **Space suits** – a complex system of garments that allow astronauts to work safely outside their spacecraft
* **Weightless environment** – an environment found in space where no forces act on astronauts or spacecraft
* **Microgravity** – when effects of gravity are greatly reduced

**Lesson Introduction/Motivation:**

* Going over “Newton’s Webquest” lesson will help students understand about Newton’s Three Laws of Motion and gravity.
[Download all associated files for "Newton's Webquest" lesson from our website](http://peer.tamu.edu/DLC/NSF_Resources.asp?ID=841&type=browse&num=10&terms=&content=allcontent&subject=allsubjects&grade=allgrades&query=query&hl=no&count=537&number=6&view=yes).
* Short YouTube video “Why Explore Space?”

<http://www.youtube.com/watch?v=tyaItdHZr9s>

**Presentation/Explanations:**

Go over the PowerPoint in presentation mode to get a feel for the animations present on slides. There are several short YouTube clips hyperlinked on slides to emphasis the material on the slide. In the notes section of the slide are occasional definitions and clarifications.

**Activity:**

Class experiments: instructions and materials on activity worksheets. Before starting experiments, have students read the experiment and form hypothesis of what they think will happen. Write a list of these different hypotheses on the board. Students will fill out the conclusions of their experiments on the activity worksheets to be turned in for a grade.

* Falling Coffee Cup
* Candle Under Water
* Iron in Cereal - If materials are unavailable, a video of this demonstration can be seen here: <http://www.youtube.com/watch?v=pRK15XSqtAw>
	+ This activity needs to be prepped an hour before completed – see Activity Plan.
* Visualizing Microgravity – if materials are unavailable a video of the demonstration is here: <http://pbskids.org/dragonflytv/show/microgravity.html>

Online activities:

The below links are to fun, online games or experiments that are interactive for the students. Teacher may pick and choose which to do. Be sure to watch over

* **Clickable Suit** – This is an interactive site containing the multiple parts of a space suit. Students can click on any single part of the suit and it will direct to a page explaining the part in greater detail.

**Requires**: Computer and projector

<http://www.nasa.gov/audience/foreducators/spacesuits/home/clickable_suit.html>

* **Station Spacewalk** – This is an online game where students are tasked with multiple spacewalk missions while on the ISS. Limited oxygen supply during the EVAs adds to the exciting thrill of completing missions.

**Requires**: Computer lab

<http://www.nasa.gov/multimedia/3d_resources/station_spacewalk_game.html>

* **NASA Spacesuit** – This is an interactive site with the different space suits USA has utilized over the past years. The introduction consists of a video explaining the need of a protective suit in space.

**Requires**: Computer and projector

<http://www.nasa.gov/externalflash/nasa_spacesuit/>

* **NASA Space Shuttle System** – This is a website explaining the different aspects of a space shuttle. There are multiple tabs that students can explore to learn more about the history and different parts of a shuttle system. The rollout process, in which the space shuttle and rockets are moved to the launch pad, is also explained.

**Requires**: Computer lab

<http://www.nasa.gov/externalflash/the_shuttle/>

* **Gravity Assist** – This is an online interactive site where students can learn about the slingshot effect utilized by spacecraft. Students can visualize how speed and trajectory of a satellite can change due to planetary gravitational effects.

**Requires**: Computer lab

<http://messenger-education.org/Interactives/ANIMATIONS/grav_assist/gravity_assist_menu.html>

* **Astronomical Distances** – This is an online site where students can alter the speed of a spacecraft leaving Earth and see how long it’ll take them to reach various plants and galaxies.

**Requires**: Computer Lab

<http://janus.astro.umd.edu/astro/distance/>

**Lesson Closure:**

At the end of the course, ask students to reflect on what they learned about Space Exploration. Things such as definitions and examples of the covered topics could be discussed. This could either be done in an interactive manner with the whole class or individually on paper.

**Safety Issues:**

**Fire advisory!** The activities involve fire! Have a fire extinguisher on hand and clear away your fireproof work station/bench of anything that might catch on fire (notes, sweaters, etc.). Gather all experiments’ waste products in a bucket filled with water to ensure extinction of any residual embers. Teachers can perform the activities as a demonstration for the entire class if fire hazards are an issue.

**Resources:**

* Space Station Clothing

<http://spaceflight.nasa.gov/living/spacewear/index.html>

* Living in Space

<http://www.pbs.org/spacestation/station/living_spacesuit.htm>

* How Space Shuttles Work

<http://science.howstuffworks.com/space-shuttle1.htm>

* NASA’s Space Shuttle

<http://www.space.com/10727-nasa-space-shuttle-spacecraft.html>

* Falling Coffee Cup activity adapted from

<http://quest.nasa.gov/space/teachers/liftoff/micro.html>

* Candle Under Water activity adapted from

<http://www.mocomi.com/zone/candle-under-water/>

* Visualizing Microgravity activity adapted from

<http://pbskids.org/dragonflytv/show/microgravity.html>

**References:**

All images found on Google.

**Author:** Graduate Fellow: Bagrat Grigoryan & Jennifer Graham