

Space Systems & Travel

Objective:

Students will learn about the International Space Station: life on board the station and what astronauts do on the ISS. Students will also experiment with Newton's Third Law of Motion by designing a Bubble Powered Rocket. Next Gen Science Standard: ESS1.A. PS2.A and PS2.B.

Docent Lab Guidelines & Tips:

Depending on how much time your teacher allows you may not get through all the activities. Feel free to pick what works best for your time schedule.

This lab runs best with at least one docent per table group.

If docents would like to speed up the Bubble Rocket experiment you can pre-cut the pieces before the class arrives. If not it's always good for the kids to practice their cutting skills.

Reserve the science room on the Science Lab Master Schedule. Please make sure you add at least 30 minutes of setup time and at least 30 minutes of clean up time to the overall class time.

Safety glasses are required if doing the Bubble Powered Rocket experiment.

If there is time, review the student's observation as a group the last 5-10 minutes of class.

General Lab Outline (Note: class doesn't have to go in this order)

ACTIVITY 1: INTERNATIONAL SPACE STATION: Show a short video on the International Space station.

Video Name: ***Take a Tour of the Space Station***

By: SciShow Kids

Run Time: 3 mins. 14 secs.

Link: <https://www.youtube.com/watch?v=SOCixRhRGDw>

After the video engage the students in a discussion on what they think life would be like on the ISS and how it differs from living on Earth. What do you think astronauts study on the ISS?

Activity: Packing for a Year on the International Space Station

Divide the students into groups. Provide each group with a worksheet and pencils. Each group is to imagine they have been selected by NASA to live and work on the ISS for a year. NASA will provide them with all the essentials: food, water, air, clothing and bedding. What would you bring to keep happy for a year? **The goal: everything for the ENTIRE GROUP must fit inside a 1 cubic meter box.** Students will list their items on the worksheet. Alternatively you can provide the students with butcher paper and crayons/markers and have them draw what they would bring to scale. They can place it on the box to see if it all fits.

See worksheet for additional information.

This activity takes about 15 minutes if students just list items on the worksheet. Add more time if drawing.

After time is up the docent can invite students to share some of the items on their list with the class.

ACTIVITY 2 – MAKE AND LAUNCH ROCKETS: Show the class a short video on how rockets are launched into space based on **Newton's Third Law – for every action there is an equal and opposite reaction.**

Video Name: *I Didn't Know That – How Rockets Work*

By: National Geographic

Run Time: 2 mins. 18 sec.

Link: <https://www.youtube.com/watch?v=C1TuxJRszVo>

For a group demonstration the docent can blow up a balloon and let it go.

This is an example of Newton's Third Law.

Activity: Making a Bubble-Powered Rocket.

Divide the class up into table groups. This experiment works best if there is one docent per table. Each student will have the opportunity to build a paper rocket using the provided template and launch it outside. The fuel for this experiment will be a vinegar or water and Alka-Seltzer tablets placed inside a 35mm film canister. Vinegar adds more power but water works fine too.

When placing the body of the rocket on the film canister make sure students leave a gap above the bottom of the film canister. This ensures the rockets sits flat on the ground.

Students will need help taping their rockets.

Students must wear safety glasses when launching their rocket.

For additional information see Bubble Rocket Instructions by NASA.

This experiments takes about 30-45 minutes.

Tips:

Make a sample rocket(s).

If time is limited or if there is a concern with student's fine motor skills precut the pieces before class.

It is helpful for each docent to stay with their table group when launching the rockets outside. Some students will need help putting the film canister lid back on.

Students will need help cutting the scotch tape.

Open the individual Alka-Seltzer tablet packets before class starts and pre-cut them. Place the prepared tablets in containers. One for each table.

ACTIVITY 3 – DESIGN AN ASTRONAUT SUIT: Show a short video on the importance of space suits used on the ISS and what important features it has. In the future, astronauts hope to explore the planet Mars but the environment on this

planet is different from Earth or the Moon.

Video Name: ***Our World: Learning About Astronaut Suits On-board the International Space Station***

By: NASAeClips

Run Time: 4 mins. 35 secs.

Link: <https://www.youtube.com/watch?v=bmqvgSbWxqM>

Activity: Design a Spacesuit for Mars.

Each student will get a worksheet with space provided for them to draw/design a spacesuit and describe its special features. Remind the students that the astronauts are much closer to the sun and that when they are designing a spacesuit, they need to be thinking about how to also protect the astronauts from the sun's harmful rays (UV rays) as well as more heat from being closer to the sun. This activity takes about 20-30 minutes.

See worksheet for additional information.

Additional Fun NASA videos on the ISS if docents would like to show the class.

Video Name: Wringing Out Water on the ISS – for science

By: Canadian Space Agency

Run Time: 3 mins. 15 secs.

Link: <https://www.youtube.com/watch?v=o8TssbmY-GM>

Video Name: 5 Mind-Blowing Facts about Space Walks

Run Time: 1 mins. 29 secs.

Link: <https://www.youtube.com/watch?v=T2dFuEgaKsw>

Video Name: Tim Peake plays 'water ping pong' in space

By: Guardian Science & Tech

Run Time: 1 mins. 35 secs.

Link: <https://www.youtube.com/watch?v=NFlyqjOgGJI>

Video Name: Cooking in Space: Whole Red Rice & Turmeric Chicken

By: European Space Agency

Run Time: 3 mins. 50 secs.

Link: <https://www.youtube.com/watch?v=4exaXdPKS3Y>

General Information for the Docents

International Space Station Facts—

The ISS is a habitable artificial satellite in low earth orbit. It was launched in 1998 (18 years ago and has been continual inhabited since then). It is set up for

microgravity and other space environment scientific experiments as well as testing equipment for Mars and Moon travel.

Set in orbit 205-270 miles above earth.

It takes about 8 minutes to get into space but then takes up to 3 days to reach and dock onto the ISS.

Currently there have been 47 crews (missions) to the ISS. You can see what goes on by logging onto the NASA website.

Astronauts must train 2 years to live on the ISS.

Stays on the ISS are from 4 months to 1 years.

There are no showers or running water on the ISS.

Every flat surface can be used as a workstation. This includes the walls and ceilings.

Fifty-two computers control the systems on the ISS.

The ISS weighs almost one million pounds (approximately 925,000 pounds).

That's the equivalent of more than 320 automobiles.

The ISS measures 357 feet end-to-end. That's equivalent to the length of a football field including the end zones (well, almost – a football field is 360 feet).

The ISS has 2 bathrooms, a gym and more room than a 6 bedroom house.

The ISS was built to be a space environment research laboratory and observatory, where crew members could conduct experiments in many scientific fields including: biology, human biology, physics, astronomy, and meteorology.

The station also provides valuable opportunities to test spacecraft systems and equipment and act as a staging base for possible missions to the [Moon](#) or [Mars](#).

The ISS has been visited by astronauts and cosmonauts from 15 different nations. There has been a total of 352 flights to the ISS, by 211 individual people, 31 of these were women, and 7 were 'space tourists' (as of 2013).

As of 2013, 76 people have visited the ISS on two occasions, 25 people have made three trips to the station and amazingly 5 people have been four times.

On average the ISS travels at 27,724 kilometers (17,227 mi) per hour.

The space station completes 15.5 orbits a day, which means the crew members on board the station experience a sunrise or sunset every 92 minutes.

The Cupola module in the ISS has a 7 window observatory area which has been compared to the 'turret' of the Millennium Falcon in the movie Star Wars.

The ISS is arguably the most expensive single item ever built. As of 2010, the cost of the station is believed to be \$150 billion.

Newton's Third Law

The third law of motion states that if a body exerts a force on a second body, the second body exerts a force that is equal in magnitude and opposite in direction to the first force. So for every action force there is always a reaction force. No force can occur by itself