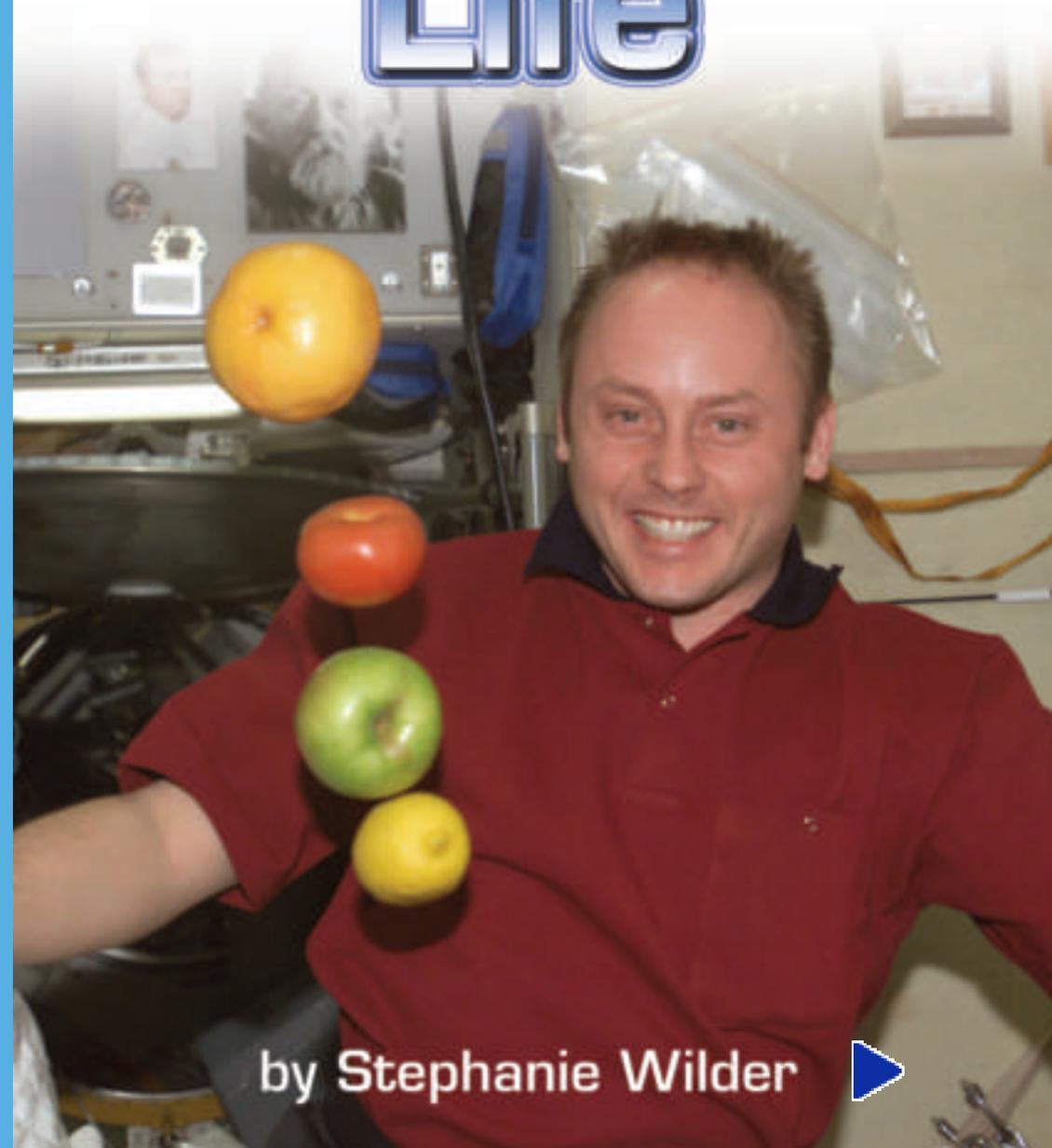


Science

Science

Space and Technology

# Space Station Life



Genre	Comprehension Skill	Text Features	Science Content
Nonfiction	Compare and Contrast	<ul style="list-style-type: none"> <li>• Captions</li> <li>• Labels</li> <li>• Glossary</li> </ul>	Solar System

Scott Foresman Science 3.16



by Stephanie Wilder



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## Vocabulary

asteroid  
orbit  
planet  
solar system

## Extended Vocabulary

bicycle ergometer  
EMU  
iodine  
microbes  
microgravity  
resistance  
simulators

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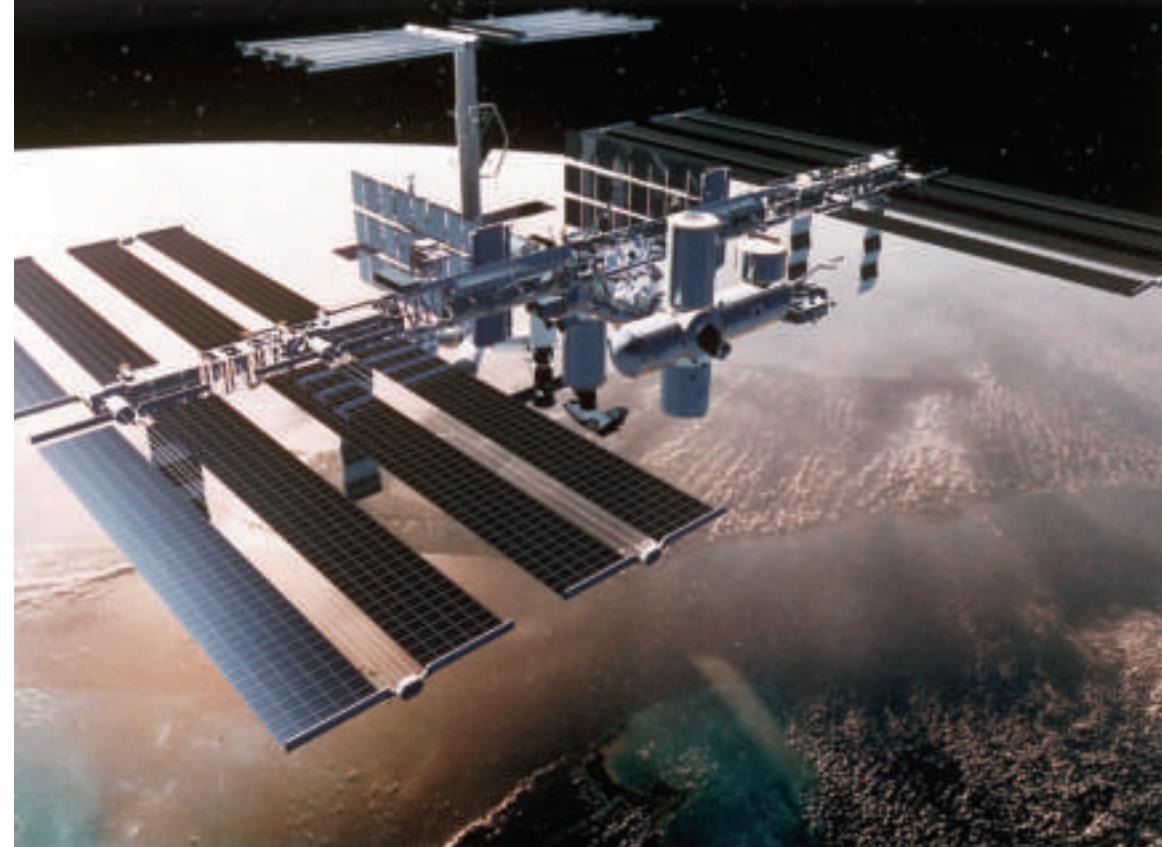
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# Space Station Life

by Stephanie Wilder





## What You Already Know

The solar system is made up of the Sun, the nine planets, and asteroids.

The Sun is a star. Like most stars, it is a giant ball of gas. The Sun is 1.4 million kilometers wide. That's 109 times wider than the Earth! Energy from the superhot gases that make up the Sun heats the nine planets.

The nine planets that orbit around the Sun are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto.

Asteroids are chunks of rock that also orbit around the Sun. They are mostly found in a belt between Mars and Jupiter. This asteroid belt breaks the planets into two groups. Mercury, Venus, Earth, and Mars are the inner planets. Jupiter, Saturn, Uranus, Neptune, and Pluto are the outer planets.



asteroid



Most of the planets are made of rock, like Earth. But some are made of gas like the Sun. These planets are called the gas giants. They are Jupiter, Saturn, Uranus, and Neptune.

Of the nine planets, only Earth can support a wide variety of living things. Advances in science now let astronauts explore more of the solar system.

In this book you will learn about the lives of the astronauts who live and work aboard the International Space Station. They orbit around Earth and study our solar system from space.

**Saturn is a gas giant.**





# A View From Above

Sixteen countries, including the United States and Russia, work on building and maintaining the International Space Station. In 1998, the first two parts of the station were launched. In 2000, astronauts, who are also scientists, began living and working on the space station.

The International Space Station orbits Earth about 16 times a day. It is around 360 kilometers above Earth. Its astronauts gather data, do experiments, and learn to live without gravity. The information they send back to Earth helps us understand more about life in space.



The International Space Station orbits high above Earth.



waving good-bye

The space station cabin is about the size of a three-bedroom house. Three astronauts live in the cabin at a time. The astronauts work, sleep, and eat in the same few rooms. They even exercise in the space station! The space station's lack of gravity makes even basic activities very difficult.

Astronauts need to go on space walks, or trips outside the space station, to fix parts of the station or to add new parts to it. Astronauts need protection when they go on space walks. They get this protection from special suits called Extravehicular Mobility Units, or EMUs. These special suits keep astronauts' bodies under the correct temperature and pressure conditions, and provide them with air. The

EMUs also have jet packs so astronauts can return to the station in an emergency.





# Getting Ready

Astronauts go through a lot of training before they can live aboard the space station. Simulators are used on Earth to show astronauts what their work will be like in space. They learn to control a model of the space station's robotic arm and practice the things they will need to do on space walks.



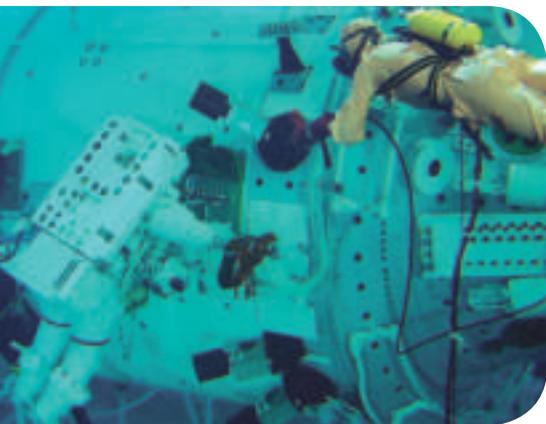
**Astronauts practice with zero-gravity conditions on special aircraft.**



Even though the International Space Station was started in 1998, parts of it are still being built.

Some of these parts are added in space! When the space station is done it will have six laboratories and weigh over one million pounds.

**Training for Extravehicular Activity is done in underwater tanks.**



Different countries are making different parts of the space station. When a piece is finished, either the United States or Russia sends it into space. Scientists think it will require 44 trips to take all the parts into space.

Lots of special tools are needed to add the new parts to the space station. Astronauts use robots to do some of the work. They also use special hand tools that work in space.

When it is finished, the space station will have about one hundred sections all bolted together. It will be able to support a crew of seven astronauts.





# Maintenance



**Space stations need a lot of maintenance.**

In order to finish building the space station, astronauts must go on space walks to put the pieces together. It will take around 160 space walks to complete the station. The astronauts use robots to help with some of the work. Robotic arms are particularly useful. They help astronauts to move large pieces of the station. All of this work is done using tools and robots the astronauts practiced using on Earth.

Astronauts are always fixing small problems on the space station. When small problems are taken care of right away, fewer big problems develop! It is expensive and risky to make trips to the space station. Not very many trips are made each year. That means the astronauts on the International Space Station need to fix most problems on their own!



**Astronauts must wear special spacesuits to protect them during space walks.**



**Astronauts enter the space station through a special "doorway" called an "airlock."**





# Space Science

Astronauts aboard the International Space Station are figuring out better ways for humans to live in space. They are also doing research that is important to life on Earth today. One of the ways the astronauts learn about life in space is by conducting experiments.

Microgravity is the very slight amount of gravity felt while in orbit. Experiments in microgravity help astronauts understand all kinds of things about human biology. They observe things about the human body that can't be studied on Earth.



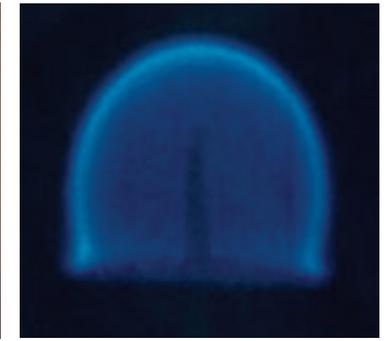
**Microgravity Science Gloveboxes, such as this one, help astronauts carry out experiments.**



A candle flame in space looks very different because of zero gravity.



**flame on Earth**



**flame in space**



In space, materials burn very differently than they do on Earth. By studying how fire and flames behave in space, astronauts can learn how to better fight fires. They also hope to learn how cleaner-burning furnaces can be constructed. Astronauts on the space station use gloveboxes, similar to the one shown, to conduct experiments with fire safely. It is also useful for astronauts to study plant life in space. Then they can learn how plants grow and change in microgravity. Besides studying the effects of microgravity, scientists hope to study Earth from space. They want to learn things about our world they couldn't learn on the ground.

**Space station research includes the study of growing plants.**



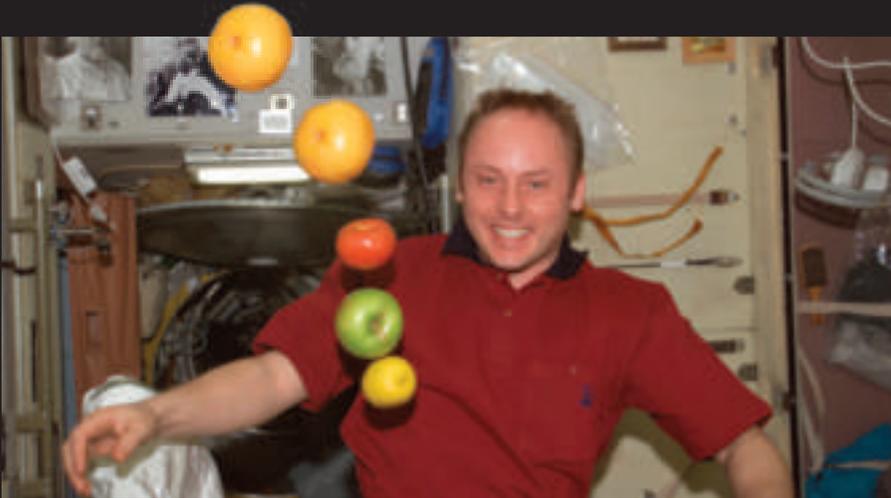


# Everyday Life

Microgravity is great for scientific research. Unfortunately, it makes everyday life a little tricky.

Everything that the astronauts eat must be stored aboard the space station. Their food must last for months on end, so water is removed.

Water is a very important resource on the space station. Since the supply is limited, it must be recycled and reused. Astronauts need to drink lots of water since it is taken out of their food. Astronauts must add iodine to their water to keep away microbes that can make them sick.



Food can be difficult to eat in space.



Exercise is a very important part of life on the space station.

Microgravity causes muscles and bones to become weak, since they are not used as much. That means astronauts need to exercise a lot while in space to stay healthy. They exercise at least once a day while on a mission.

You cannot lift weights in space for exercise. In microgravity, weights don't weigh anything! So, for exercise, astronauts use resistance. They strap themselves into a treadmill and use something called a bicycle ergometer. A bicycle ergometer is similar to a stationary bicycle. It is bolted to the floor and has a seat belt. On a bicycle ergometer, astronauts can pedal with their feet just like on Earth. Or they can stand on the ceiling and pedal with their arms! Microgravity allows astronauts to exercise in unusual ways.



**Astronauts must exercise constantly in order to stay healthy in space.**

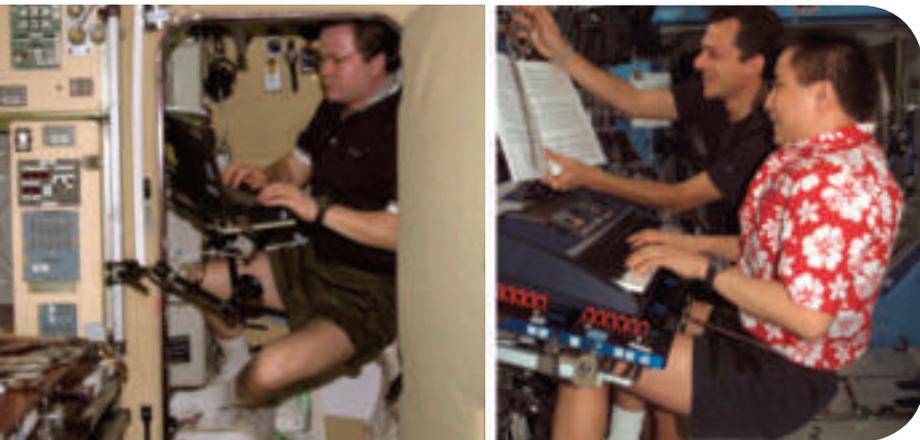




## Taking It Easy

The astronauts aboard the space station are given lots of time to relax each day. They can read books, watch movies, and call or e-mail home. They can also enjoy the special view of Earth from the station's cockpit window.

After work and relaxation comes sleep, of course. Sleeping in space is a little different from sleeping on Earth. Instead of a bed, astronauts sleep in special sleeping bags that are attached to the wall. It may seem strange, but astronauts would float around the cabin if they did not sleep this way! These sleeping bags even have arm straps so that astronauts' arms don't start floating while they sleep.



**This astronaut is sending an e-mail message.**

**Some astronauts play music to help them relax.**



**A spacecraft docks to allow for an exchange of crews.**



## Crew Exchange

After a few months, the space station's old crew gets replaced by a new crew. The new crew must bring all their own food and any supplies the space station needs. The old crew updates the new crew on all the changes made to the space station. Once the new crew is in place, the old crew can return to Earth and continue their normal lives!



# Glossary

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<b>bicycle ergometer</b>	a piece of exercise equipment, like a bicycle, used by astronauts in space
<b>EMU</b>	Extravehicular Mobility Units, worn by astronauts when working outside the space station
<b>iodine</b>	a chemical element used to make drinking water safe
<b>microbes</b>	tiny living things that can cause disease
<b>microgravity</b>	an environment where there is almost no gravity
<b>resistance</b>	to push with force against something
<b>simulators</b>	machines that re-create space station conditions for practice

## What did you learn?

1. When was the International Space Station started? How is it put together?
2. What must astronauts wear on a space walk?
3. What kinds of experiments do astronauts do onboard the space station?
4. **Writing in Science** In this book you have learned about how astronauts train to work on the space station. Write to explain the training they go through, using examples from the book.
5.  **Compare and Contrast** Compare and contrast the ways you exercise and relax with the ways astronauts in space do.

