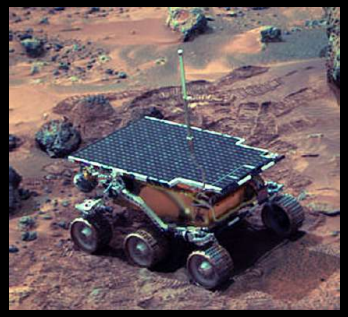
Life in Outer Space

How Humans Meet Their Needs in Space

- Human space history
- The ISS
- Obtaining O_2 and removing CO_2
- Eating in space
- Sleeping in space
- Showering and using the bathroom in space
- Experiments in space
- Getting sick in space
- The negative effects of microgravity
- Long-term solutions to life in space



What have we done so far in Space?

- October 4, 1957: First Artificial Satellite
  - **The Soviet Union ushers in a new era with the launch of Sputnik 1.**
- January 31, 1958: First Successful American Satellite
- April 12, 1961: First Human in Space
  - Soviet Union launches cosmonaut Yuri A. Gagarin on a 108-minute flight. Gagarin circles the Earth once at a peak altitude of about 200 miles (320 kilometers) above Earth.

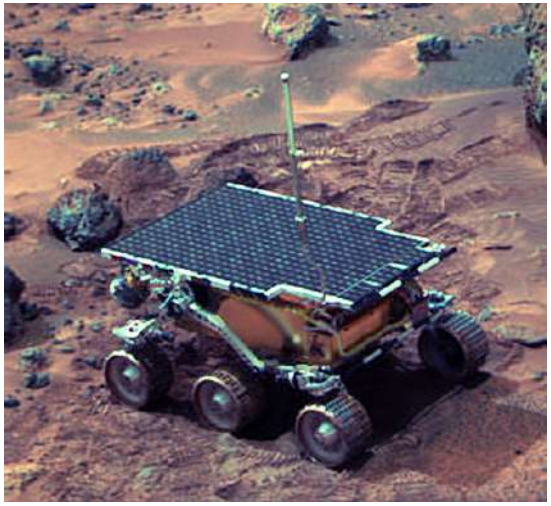
What have we done so far in Space?

- **<u>July 20, 1969: First Manned Moon Landing</u>**
  - The lunar module of Apollo 11 touches down on the moon. Neil Armstrong and Edwin "Buzz" Aldrin, Jr., descend to the surface.
- August-September, 1977: Voyagers 1 and 2 Launched
  - Travelling at 62,000 km/h, they are now about 19 billion km away from Earth and in September of 2013, left our solar system

What have we done so far in Space?

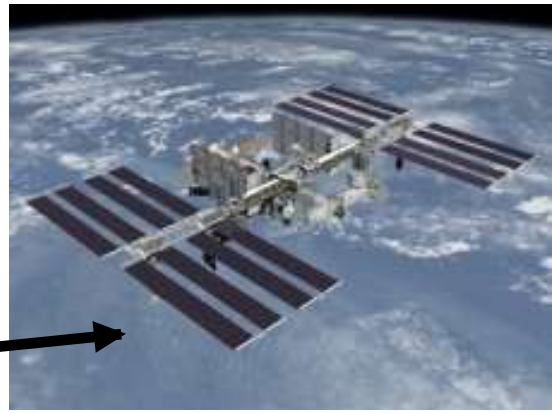
- April 25, 1990: Hubble Space Telescope Deployed
  - Has given us beautiful pictures ever since

- July 4, 1997: First Mars Rover Sojourner, Lands on Mars



The International Space Station (ISS)

- Collaborative efforts between the U.S., Russia, Canada, Japan, and the participating countries of the European Space Agency
- Price tag of about 100 billion U.S. dollars
- Started in 1998, completed 2011 → 13 years
- Is about the size of an American football field
- Solar powered
- Weighs about 1 millions pounds
- Our microgravity research base where experiments that couldn't be done on Earth are performed
- Home to 3 astronauts at a time
- **ISS missions usually last for about 6 months**



Predict (P), Observe (O) and Explain (E)

- On the following slides I want you to create a POE for the following two situations.

1. Make your Prediction then we will watch the video.
2. While we are watching the video, complete the observation section.
3. Following the video we will have a discussion where you can complete the Explanation.

What Happens to Tears in Space

Predict:

Observe:

Explain:

Wringing out a washcloth in Space

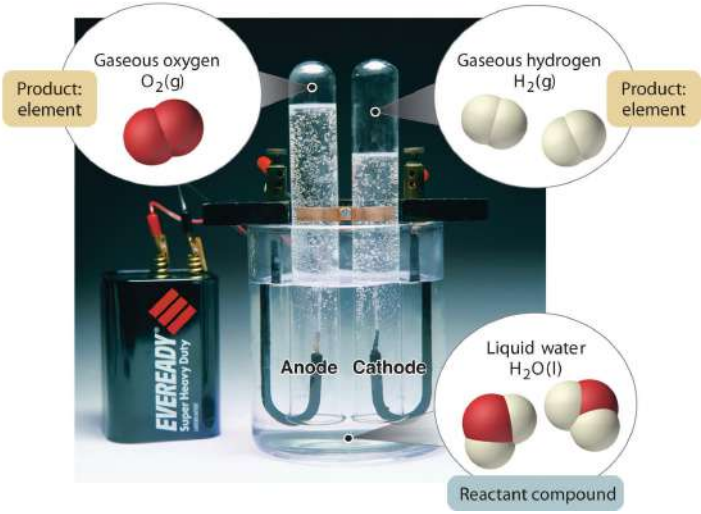
Predict:

Observe:

Explain:

Obtaining Oxygen and Removing Carbon Dioxide

- Most of the oxygen comes from a process called "electrolysis," **which uses electricity to split water into hydrogen gas and oxygen gas.**



- Charcoal filters help remove CO_2 from the air. It is then sent into space.

What and how astronauts eat?

- Not quite the Star Trek food replicator
- In space travel's early years, astronauts used straws to suck dehydrated, paste-like food out of tubes.
- Today, astronauts on the space shuttle eat food in much the same way as they do here on Earth although sometimes it floats away.

What and how astronauts eat?

- Food is carefully contained and drinks are packaged as dehydrated powders. The astronauts add water to beverages before drinking.
- **<u>Foods are either partially or completely dehydrated to prevent them from spoiling.</u>**

How do astronauts sleep in space

- Each member has their own sleeping area
- Since they are weightless, astronauts attach themselves to a wall so they don't float around and bump into something
- Crew members usually sleep in sleeping bags

How do astronauts shower and use the bathroom in space

Very Carefully! Take notes in the space below while you are watching the video clips.

- Showering in space

- Washing your hair in space

What is the main reason for the ISS?

- **Research, Research and more Research**
- The uniqueness of microgravity allows scientists to do many experiments and make discoveries they couldn't do on Earth

Some examples include:

- Discovery of Dark Matter
- Health Affects
- Cancer Research

Lots of other experiments are currently being done. Here are 10 of the coolest

10) Creating the coldest place in the universe. Most of space is already chilly at around 454 degrees below 0 Fahrenheit, but the ISS is going further.

9) Floating, 3-D Mapping Robots. Google and the ISS will team up to create robots with advanced mapping skills self-navigate o assist astronauts and make repairs at the station.

8) Making the coolest home videos ever. The ISS team has installed 4 video cameras on the station's exterior. They are always on, streaming videos of the home planet that are viewable online.

7) Space gardening. In an effort to someday provide astronauts with fresh veggies the ISS is trying to grow plants in microgravity.

6) The ISS is searching for ways of extinguishing fires more safety.

5) ISS scientists are working on what is called 'supercritical water' that actually helps start fire.

4) Cancer-fighting capsules to better target cancer to reduce side effects.

3) Fruit fly studies. Observing them in space allows researchers to see how gravity can affect systems, as well as the impact space travel has on people.

2) Natural disaster assessment. The ISS has a remote camera that can zero in on areas affected by catastrophic events. Among the things it can do is help relief organizations find their way to the people in need.

1) Launching satellites. Sending satellites into space from Earth is expensive and complicated. The Japanese Aerospace and Exploration Agency has made the process a whole lot more cost-effective and efficient by installing a small craft launcher onto the ISS.

What if you get sick in space?

- Getting sick in space can be very dangerous as the nearest doctor is very far away
- Also, the immune system can go on the fritz in space which means it takes longer to get better
- Many medical instruments and medicine are included in the Space Shuttle's medical kit. These kits are used to treat minor illness and injuries during the flights

Our bodies in microgravity

- The absence of forces against the muscles (caused by microgravity) **has significant short and long-term health consequences**

Interplanetary Travel

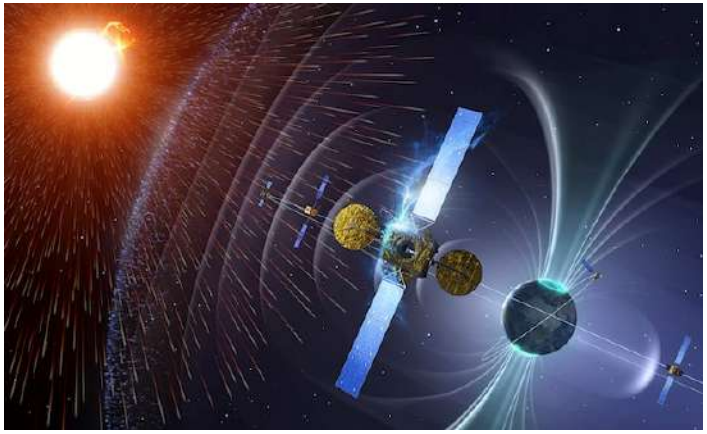
- Currently astronauts have a rigorous exercise regime to limit these effects

Health affects of being in microgravity long-term

- Eyesight
  - blurred vision
  - flatting eye balls, swelling of the optic nerve, build-up of fluids
- **Muscle atrophy (muscles break down/become weak)**
- Bones become weak
  - Calcium and phosphorus is removed
  - 2% bone loss per month

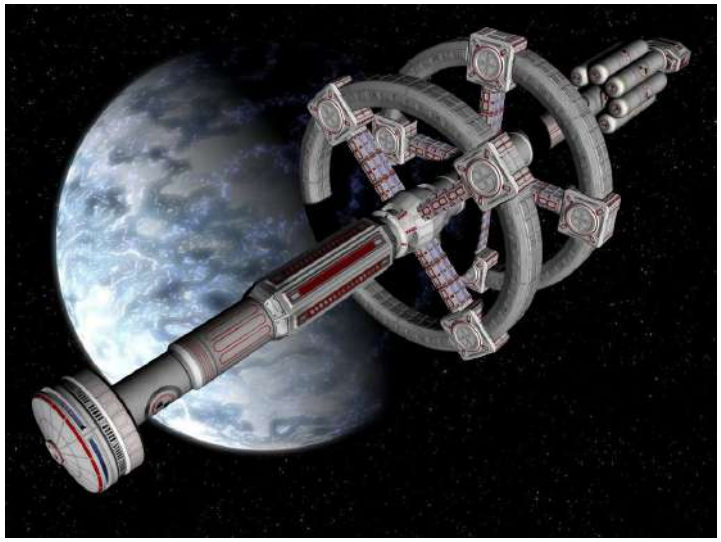
Health affects of being in microgravity long-term

- Disorientation → Nausea
- Change in appearance due to fluid shift
- Physiological (mental) effects
- Radiation
  - Can lead to various cancers and possible death



Long-term solutions

- **<u>Any mission to Mars or beyond must simulate gravity for the health of the astronauts</u>**



- Can be done using the principals of circular motion
  - As the space ship spins, it will simulate gravity in the spinning region