



Lesson 1

Topic: Space-based discoveries

Exploring life on the International Space Station (ISS)

Lesson concepts

The Earth is part of a system of planets orbiting around a star (the sun)
Important contributions to the advancement of science have been made by people
Ideas and explanations can be communicated

Learning alerts

- Be aware of students thinking that the ISS took off from Earth to get into orbit like the space shuttle and that it will come back to Earth in a similar fashion.

Suggested next steps for learning:

- Inform students that the initial parts of the ISS were delivered by space shuttle with the rest of the ISS being constructed in space, over a period of two years and that it will stay in space until it is disassembled.

Lesson notes

In this lesson, students will learn about the International Space Station (ISS). They will learn about how the people who work on the ISS have made contributions to science and how these contributions can affect life on Earth. Students will need to access the internet for part of this lesson to track where the International Space Station is. If students do not have access to the internet, they can skip Questions 2,3, and 5.

Lesson answers

1. **For example:** Humans explore space to find out what other celestial bodies are out there, what things from outer space affect humans on Earth and to discover new life.
2. a. Students mark the location of the ISS on the world map.
b. Students indicate whether the ISS is in the northern hemisphere (above the equator) or the southern hemisphere (below the equator).
3. **Sheet 1** answers attached.
4. Personal response required.
5. a. Students mark the location of the ISS on the world map.
b. Personal response required.





Lesson 2

Topic: Exploring space

Exploring the Earth's moon

Lesson concepts

The Earth is part of a system of planets orbiting around a star (the sun)

Science involves gathering data and using evidence to develop explanations of events and phenomena

Important contributions to the advancement of science have been made by people

Ideas and explanations can be communicated

Learning alerts

- Students thinking that landing on the moon is a simple and routine operation.
- Students thinking we now know all there is to know about the moon.

Suggested next steps for learning:

- Ensure that students know that landing on the moon is a complex operation.
- Explain that scientists continue to study the moon because there are still things to discover about it.

Lesson notes

In this lesson students will explore our moon and understand the key events of the Apollo 11 mission.

Lesson answers

1. For example: the moon has craters on its surface, astronauts have landed on the moon, the moon has various phases, and the moon has no atmosphere or cloud and little gravity.
 - a. Craters
2. For example:
 - The moon is about 384 400 kilometres from Earth
 - The surface of the moon has many things on it such as craters, lava plains, mountains and valleys
 - The moon has no atmosphere or cloud
 - The surface temperature at the moon's equator during the day is 116 °C and at night is -178 °C
 - The moon's highest mountains are 5 000 metres.

Other responses such as the depths of the craters, no active volcanoes and the presence of water may also be useful information for scientists to consider.



- a. **For example:** In planning a mission to the moon the temperature of the moon would need to be considered. Equipment and space suits for astronauts would need to be designed to withstand the various temperatures of the moon. The distance of the moon from Earth would need to be considered when planning a mission to the moon as enough fuel, oxygen and water would need to be allocated for the distance travelled. The terrain on the moon would need to be considered when planning a mission to the moon in designing landing gear suitable for landing on the moon's surface and coping with the terrain. Knowing the location of mountains and deep craters to avoid landing in an inaccessible area might also be useful.
3.
 - a. Soviet Union and the United States
 - b. The spacecrafts launching from Earth were required to land and take off from the moon and were too large.
 - c. True
 - d. The weight of the module
 - e. The Apollo 11 mission was a success because it used a landing vehicle designed for the unique conditions of the moon. The lander landed safely and was able to take off safely.
4. **Sheet 2** answers attached
5. No answer required.
6. For example: the footprint left on the moon will be there for 10 million years; there are no active volcanoes on the moon; it would take 130 days to drive to the moon.

Lesson 3

Topic: Exploring space

Investigating exploration of Mars 1

Lesson concepts

The Earth is part of a system of planets orbiting around a star (the sun)
Science involves gathering data and using evidence to develop explanations of events and phenomena
Important contributions to the advancement of science have been made by people
Ideas, explanations and processes can be communicated

Learning alerts

- Be aware of students thinking that all missions to explore Mars involve landing on the planet.

Suggested next steps for learning:

- Ensure students know that some missions orbit planets to take photos and collect data.



Lesson notes

In this and the next lesson, students explore the planet Mars and information collected about Mars from various Mars missions.

Lesson answers

- 1. For example:** it is the fourth planet from the sun, it is red in colour, it has two moons, and it has a rocky and dusty surface.
 - a. For example:** Mars is a sphere. Mars looks reddish/orange in colour and has patches of blue and white on either end of the planet. It has different shades of colour on its surface.
 - Mars is the fourth planet from the sun, Earth is the third. Mars and Earth are neighbouring planets. .
 - c. For example:** to find out more about it, to find out if there is water on Mars, to find out if there is life on Mars, because it is so close to Earth.
- 2. For example:** 'Manned' means people travel on the spacecraft, 'unmanned' means there are no people on the spacecraft, just computers or robots. The missions to Mars have all been unmanned.
 - The three types of spacecraft are orbiters, landers and rovers. An example of an orbiter is *Odyssey*; an example of a lander is *Viking*; an example of a rover is *Curiosity*.
 - Orbiters fly over and orbit a planet collecting data; landers land on the surface, make observations and collect samples from one spot; rovers move over the surface making observations and gathering samples.
- Curiosity* is a rover designed to travel over the surface of Mars and make observations and collect samples. It landed on Mars on August 5, 2012.
 - b. For example:** People at NASA were so excited about the successful landing of *Curiosity* because there was a lot of research and preparation dedicated to this mission. Knowing that they could see Mars close up and gather data about it would have been very exciting.
- Curiosity* has sent communications back to Earth and used a remote sensor mast to acquire images of Mars.
 - Activities performed by *Curiosity* include scooping soil, taking images and videos used to assess the success of the scooping and sampling process activities, and dropping soil off to the rover's observation tray for assessment by the team of scientists.
- 5. For example:** the discovery of forms of life.

Other responses such as the depths of the craters, no active volcanoes and the presence of water may also be useful information for scientists to consider.



Lesson 4

Topic: Exploring space

Investigating exploration of Mars 2

Lesson concepts

The Earth is part of a system of planets orbiting around a star (the sun)

Science involves gathering data and using evidence to develop explanations of events and phenomena

Important contributions to the advancement of science have been made by people

Ideas, explanations and processes can be communicated

Learning alerts

- Be aware of students thinking that all missions to explore Mars involve landing on the planet.

Suggested next steps for learning:

- Ensure students know that some missions orbit planets to take photos and collect data.

Lesson notes

- In this lesson, students will learn about two past probes sent to Mars: *Odyssey* and *Viking*.

Lesson answers

1. For example: Mars has ice, it has poles, its surface is rocky, there are volcanoes on Mars, and no one has found life or liquid water on Mars.
2.
 - a. No answer required.
 - b. *Odyssey* has found evidence of vast supplies of frozen water beneath the surface.
 - c. *Odyssey* has helped develop the most detailed global Martian map, been the main communications relay for data sent home by Mars rovers, *Spirit* and *Opportunity* and the *Phoenix* lander, and collects thousands of images and data about Martian geology and climate.
 - d. *Odyssey* orbits Mars and *Curiosity* has landed on Mars.
3.
 - a. 1975
 - b. There was a second *Viking* launched.
 - c. 6 years
 - d. The *Viking* mission mapped the entire planet and charted seasonal changes.
 - e. The *Viking* mission provided the first image of the surface of Mars.



The International Space Station

1. What is the International Space Station (ISS)?

For example: The International Space Station (ISS) is a spacecraft which orbits Earth and has astronauts from different countries living and working on it. It is the biggest manned object in space; a man-made satellite orbiting Earth.

2. What is the purpose of the ISS?

For example: The purpose of the International Space Station is to serve as a research facility for astronauts from different countries. Research is focused on human health and exploration, technology testing for enabling future exploration, research in basic life and physical sciences and Earth and space sciences.

3. What are some examples of what the astronaut crews do on the ISS?

For example: Astronauts carry out investigations and observations including; observing Earth from different angles over long periods of time, investigating how living things and materials behave in space, how the human body functions in space and testing new materials and new technologies.

4. How does the work carried out by the ISS astronauts contribute to science and affect life on Earth?

For example: The work carried out on the ISS contributes to our scientific understanding in many ways. By observing Earth from different angles, we learn of large-scale changes in our environment, including weather patterns and global change. When investigating how different fluids, metals and other materials respond in space without the effect of gravity, scientists learn about viruses, proteins and enzymes. This scientific understanding could lead to new treatments for a variety of diseases and conditions. The work carried out on ISS will help scientists understand the effects of space travel on the body; this scientific understanding will help to develop solutions for long-term space travel. New materials and technologies used and tested in space can also contribute to science, for example, the microgravity conditions which allow scientists to study physics in a new way could lead to new industrial products like lighter, stronger metals to new materials for contact lenses.



Apollo 11 mission

Mission date:

July 16, 1969

Mission objective:

Perform a manned lunar landing on the moon and return to Earth

Astronauts on the mission:

Neil Armstrong, Buzz Aldrin and Michael Collins

Time taken to get to the moon:

Three days

Name of the lunar lander:

Eagle

Name of the command module:

Columbia

Samples collected:

Soil samples, rocks

Write three examples of how the Apollo 11 mission has contributed to our knowledge of space.

1. The Apollo 11 mission allowed us to collect rock samples that have provided information about the universe from billions of years ago.
2. The Apollo 11 mission has allowed us to set up and conduct scientific exploration and experiments on the moon's surface. This gives us knowledge about things like the moon's surface, moonquakes, the internal structure of the moon and magnetic fields.
3. The Apollo 11 mission allowed scientists access to photographs and video footage of the moon and space. This contributed to our knowledge of the moon's terrain, images of the Earth from the moon and other celestial bodies in space.

Other interesting facts:

Astronauts set up experiments and took photographs of the surface of the moon.