

UNIT

*The Study of the Universe*

3



# BIG IDEAS

- Space exploration has generated valuable knowledge but at enormous cost.
- Different types of celestial objects in the solar system and universe have distinct properties that can be investigated and quantified.
- People use observational evidence of the properties of the solar system and the universe to develop theories to explain their formation and evolution.

Canadarm2, shown here supporting an astronaut, plays a major role in constructing the International Space Station (ISS). The ISS is a large complex of laboratories orbiting in space. Aboard the ISS, researchers from many countries investigate the effects of space travel on humans and materials. Scientists also investigate Earth and space itself from the ISS.

Despite their great contributions to scientific knowledge, space research and exploration are tremendously expensive. For example, Canadarm2 cost \$600 million to design and build. Other benefits help offset such costs, however. For example, robotic expertise gained by developing Canadarm2 led to neuroArm, shown in the inset photograph. This robotic device allows brain surgeons to operate on their patients with great precision.

In this unit, you will learn about space exploration and our current understanding of the universe, including the solar system.

***Why is it important to find out how space travel affects people and materials?***

## **Chapter 7** The Night Sky



## **Chapter 8** Exploring Our Stellar Neighbourhood



## **Chapter 9** The Mysterious Universe



# Get Ready for Unit 3

## Concept Check

1. Match each term with its correct definition below.

- |                  |          |
|------------------|----------|
| a. planet        | e. star  |
| b. meteorite     | f. Earth |
| c. Moon          | g. comet |
| d. asteroid belt |          |

- i. Earth's natural satellite
- ii. emits light
- iii. located between Mars and Jupiter
- iv. much of its surface is covered with water
- v. has a tail consisting of gas and dust
- vi. orbits stars and reflects light
- vii. stony or metallic matter that has fallen to Earth

2. With a partner, brainstorm ways in which stars differ from planets. Organize your comparisons in a table like the one below. Alternatively, make a Venn diagram to compare and contrast stars and planets.

### Comparing Stars and Planets

Characteristics of Stars (like our Sun)	Characteristics of Planets

3. It takes 11.86 Earth-years for Jupiter to revolve around the Sun. Each Jupiter day is 9 h, 50 min, and 30 s long.

- a. Which of the above statements describes Jupiter's period of rotation?
- b. Which statement describes Jupiter's period of revolution?
- c. What are the periods of rotation and revolution for Earth?

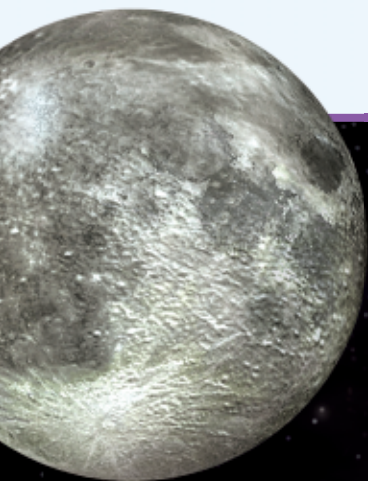
4. Match each cause to an effect in the table below. Write each of your answers as a complete sentence in your notebook.

### Cause-and-Effect Relationships

Cause	Effect
a. Earth's rotation on its axis causes ...	i. the seasons
b. Earth's revolution around the Sun causes ...	ii. ocean tides
c. The Moon's gravitational pull on Earth causes ...	iii. Earth's orbit
d. Earth's tilt on its axis causes ...	iv. day and night
e. The Sun's gravitational pull on Earth causes ...	v. yearly periods

5. Each of the following space technologies is illustrated below. Match each technology to its corresponding illustration.

- a. *Discovery* space shuttle
- b. Atlas V rocket
- c. the Hubble Space Telescope
- d. the International Space Station



## Inquiry Check

Scientific and technological advances have allowed humans to adapt to life in space. However, astronauts face many challenges while living in space. For example, some of the needs that must be met while living on the International Space Station are the following:

- a. elimination of human waste
  - b. regular exercise to maintain muscle and bone density
  - c. a long-term supply of drinkable water
- 6. Think Critically** Using jot notes, add three to five more challenges to the list.
- 7. Analyze** How might some of these challenges be overcome? Choose one challenge from the list above and one from your own list, and discuss your recommendations in a small group.
- 8. Think Critically** The average stay for an astronaut on the International Space Station is six months. Why do you think astronauts remain on the International Space Station for this period of time?

## Numeracy and Literacy Check

Astronomers commonly use scientific notation to express the sizes of objects in space and distances between them. For example, the diameter of the Moon is 3475 km, or  $3.475 \times 10^3$  km.

- 9. Convert** The diameter of Earth is 12 756 km. Express this measurement in scientific notation.
- 10. Compare** How much larger is the diameter of Earth compared to the diameter of the Moon?
- 11. Writing** While risky and expensive, space exploration technology is beneficial. For example, the technology used for fuel pumps in space shuttles is also used to make better artificial hearts. Write a brief letter to the editor of your local newspaper expressing your opinion on the money spent by the federal government for space exploration (see table). Support your viewpoint with examples.

Federal Spending in Canada in 2004

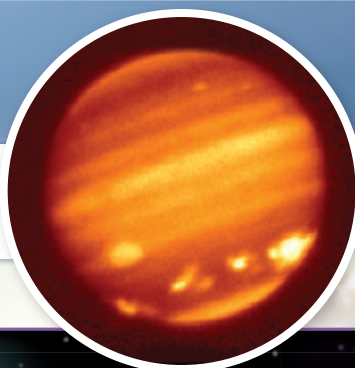
Area	Money Spent (millions of dollars)
Environmental initiatives	900
Defence	9 800
Health care	99 000
Space exploration	308

### Looking Ahead to the Unit 3 Project

At the end of this unit, you will have an opportunity to apply what you have learned in an inquiry or research project. Read the Unit 3 Projects on pages 390-391. Start a project folder now (either paper or electronic). Store ideas, notes, news clippings, websites, and lists of materials that might help you to complete your project.

#### Inquiry Project

Investigate how to simulate a cosmic event.



#### An Issue to Analyze

Decide whether Canada should continue to fund costly space missions.