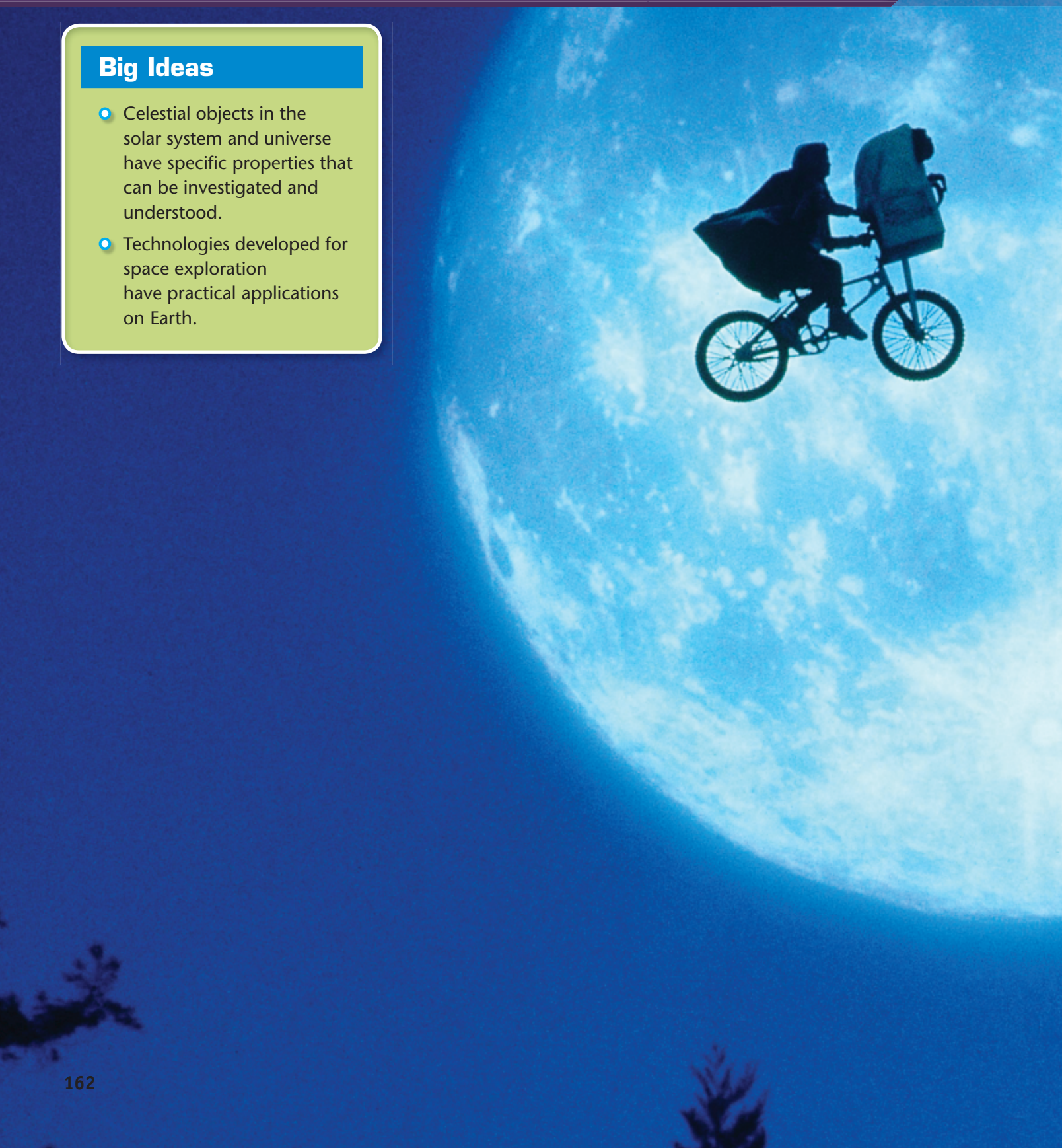
Unit 3 Space Exploration

Big Ideas

- Celestial objects in the solar system and universe have specific properties that can be investigated and understood.
- Technologies developed for space exploration have practical applications on Earth.



"Moonshot" by Buffy Sainte-Marie

off into outer space you go my friends
we wish you bon voyage
and when you get there we will welcome you again
and still you'll wonder at it all
see all the wonders that you leave behind
the wonders humble people own
I know a boy from a tribe so primitive
he can call me up without no telephone
see all the wonders that you leave behind
enshrined in some great hourglass
the noble tongues, the noble languages
entombed in some great english class
off into outer space you go my friends
we wish you bon voyage
and when you get there we will welcome you again
and still you'll wonder at it all

Science helps us explain the universe, technology helps us explore it, and imagination links the two together.

How does the human imagination help us investigate space?

Unit 3 At a Glance

In this unit you will learn about objects in the solar system and the universe. You will find out about their specific properties and how these properties can be investigated. You will also learn about the technologies developed for space exploration, and how they are used in space and on Earth.

***Think** about answers to each question as you work through the topic.*

Topic 3.1: What do we see when we look at the night sky?

Key Concepts

- We see stars that we organize into patterns.
- We see celestial objects of the universe.
- We see objects separated by immense distances.

Earth and Space Science: Space Exploration

Topic 3.5: How do we benefit from space exploration?

Key Concepts

- We develop technologies that shape our lives.
- We are challenged to think and act locally, globally, and universally.
- We gain a deeper appreciation for ourselves and our home planet.

Topic 3.4: What role does Canada play in space exploration?

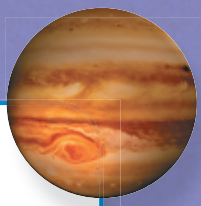
Key Concepts

- Canada contributes people and technology to explore space.
- Canada helps build the future of space exploration.

Topic 3.2: What are the Sun and the Moon, and how are they linked to Earth?

Key Concepts

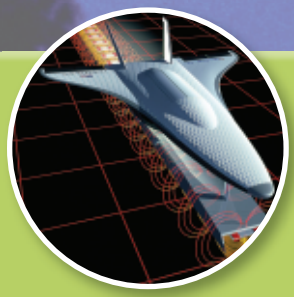
- The Sun is our nearest star.
- Interactions of Earth and the Sun make life possible.
- The Moon is our nearest neighbour in space.
- The Sun, Moon, and Earth interact to create eclipses.



Topic 3.3: What has space exploration taught us about our solar system?

Key Concepts

- The four inner Earth-like planets are small and rocky.
- The four outer "gas giant" planets are large and ringed.
- Rocky chunks of various sizes make up the rest of the solar system.



Looking Ahead to the Unit 3 Project

At the end of this unit, you will do a project. The **Inquiry Investigation** challenges you to find a way to purify waste water for human consumption in space. The **Issue to Analyze** examines the costs and benefits of three different space technologies used to carry equipment into space. Read pages 232–233. With tips from your teacher, start your project planning folder now.

Get Ready for Unit 3

Concept Check

1. Match each term with its correct definition below.

a) planet
b) meteorite
c) Moon
d) star
e) Earth
f) comet

i. Earth's natural satellite
ii. emits light
iii. much of its surface is covered with water
iv. has a tail consisting of gas and dust
v. orbits stars and reflects light
vi. 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. Use a word from the box below to answer each of the following questions. Write your answers in your notebook.

a) Which term describes Earth's turning on its axis?
b) Which term describes Earth's movement around the Sun?
c) Which term means the same thing as the answer to b)?

revolution	rotation	orbit

4. 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) Is Jupiter's day longer or shorter than Earth's?
b) How often would Earth have winter in 11.86 Earth-years?
c) How often would Jupiter have winter in 11.86 Earth years?

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 enabled 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* include:

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 3.475×10^3 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 blog expressing your opinion on the money spent by the federal government for space exploration (see the table below). Support your viewpoint with examples.

Federal Spending in Canada in 2004

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