Unit 3 Space Exploration

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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.

Overall Expectations

- **D1** analyze the major challenges and benefits of space exploration, and assess the contributions of Canadians to space exploration
- **D2** investigate the properties of different types of celestial objects in the solar system and the universe
- **D3** demonstrate an understanding of major astronomical phenomena and of the principal components of the solar system and the universe

Materials

Please see page TR-32 for a list of the materials required for this unit and other units.

Overview

In this unit, students will learn about the celestial bodies they see in the night sky and other objects in the universe. They will also explore the technologies, especially Canadian technologies, that help scientists and astronauts investigate the universe.

Using the Unit Opener

- Ask students if they are familiar with the image on pages 162 and 163. Explain that it is from the movie *E.T.: The Extra-Terrestrial* (1982). Ask if students have seen the movie. Suggest that students share a brief summary of what the movie was about. Ask students why the authors of the textbook may have selected this particular image as the opening picture in this unit.
- Ask students why this song may have been chosen to be included in this textbook.
- Have students read the word balloons on pages 164 and 165 as a preview to what they can expect to learn in the unit.
- Have students read the question on page 163, "How does the human imagination help us investigate space?" Have a class discussion about this question. Ensure that English language learners understand what is meant by the human imagination. Record students' insights on the board or on a piece of chart paper. You may wish to point out to students that many science fiction ideas that were fantasy when they were first thought of are now fact. For example, in the *Star Trek* television series, which first aired in 1966 (more than 40 years ago), the characters used "communicators"—hand-held wireless communication devices. Today, we have cellphones that look and function very much like these science fiction devices.
- DI Read or ask a volunteer to read aloud the lyrics for the song "Moonshot" by Canadian Buffy Sainte-Marie. If possible, play the song for students, to benefit musical learners. It is available at **www.scienceontario.ca**. Ask students to consider the song and think about what the writer, Buffy Sainte-Marie, is saying. Ask, "Is she excited about space exploration?" "Do you think she is in favour of space exploration? Why or why not?"
- Students can review the Key Terms in the Unit using **BLM 3-3 Key Terms in Unit 3**.

Preparing for the Unit Projects

- Read the Looking Ahead to the Unit 3 Project section to the class. Then allow students to read the projects themselves, on pages 232 and 233, including the assessment checklists. Encourage students to consider the tasks that would be involved in each project and choose the one that they would most like to do.
- Provide instructions on how you would like students to set up their project planning folder(s). Rather than using a file folder, where loose pages can fall out, consider using a portfolio-style folder that can be closed securely. (These can be purchased at a dollar store.)
- Have students write an "action plan" or "to-do list" of the tasks they will need to accomplish to be successful with their project(s). You may want to provide them with the assessment rubric at this planning stage so they understand what is expected of them.
- Once a week, allow students 10 minutes or so to review their unit project materials and move forward in their preparations.
- Space Thirst (on page 232), as an investigation, is better done in class with partners or in small groups.
- You may wish to have students work individually or with a partner for The Costs and Benefits of Space Travel, on page 233. Provide students with **BLM G-12 Scientific Research Planner** or **BLM G-15 Worksheet for Investigating Issues** to help organize their research.

Get Ready

- Students will think critically to anticipate problems related to space exploration.
- Students will analyze problems and possible solutions.
- Students will write numbers in scientific notation.
- Students will compare large numbers.
- Students will state their opinions clearly, and support them with evidence.

Students can review some of these skills on **BLM 3-2 Skills for Unit 3**.

Get Ready Answers

1. a) v.
b) vi.
c) i.
d) ii.
e) iii.
f) iv.

2.

Comparing Stars and Planets	
Characteristics of Stars (like our Sun)	**Characteristics of Planets**
• Stars are huge balls of burning gas. • Stars vary in size, colour, temperature, and density. • Stars emit light. • Stars can be organized into patterns called constellations. • The planets in our solar system orbit a star called the Sun. • Earth's rotation causes the stars to appear to move from east to west across the sky.	• Planets are spheres. • Planets vary in size, colour, temperature, and density. • Planets reflect light. • Planets revolve around the Sun. • Planets rotate on an axis.

3. a) rotation
b) revolution
c) orbit

4. a) shorter
b) 12 times
c) once

5. a) 4
b) 1
c) 3
d) 2

Inquiry Check

6. Answers may vary. For example: ability to handle emergency situations; long-term supply of food; communication with Earth

7. Students' answers will vary. They should provide appropriate reasoning to support their opinion, and be respectful of others' opinions.

8. Astronauts can spend time learning about their weightless environment. Also, the expensive trip is only worthwhile for a long stay.

Numeracy and Literacy Check

9. 1.2756×10^4

10. The Moon's diameter is almost one quarter of Earth's, so Earth's diameter is four times as large as the Moon's.

11. Students' blogs will vary. Ensure they make reference to the data in the table and support their opinions with appropriate reasoning.

Assessment OF Learning for Unit 3		
Activity	**Evidence of Learning**	**Supporting Learners**
Unit Inquiry Investigation, page 232	Students present an effective plan to purify a water sample, possibly through evaporation, straining, or bleaching. They record their results and answer Analyze and Interpret questions 1 to 7.	• Provide students with several possible purification options and have them select one to investigate. Examples and instructions can be found at **www.scienceontario.ca**.
Unit Issue Analysis Project, page 233	Students write a "to-do" list of what they need to research. They also provide a complete list of sources and research details. Their T-chart information details costs and benefits. Their final report clearly states their findings and recommendation.	• Provide students with **BLM G-13 Citing Sources** to record their research sources. You may wish to provide **BLM G-15 Worksheet for Investigating Issues** to help them organize their results and recommendations.

Assessment FOR Learning		
Tool	**Evidence of Learning**	**Strategies and Tools**
Get Ready question 2, page 166	Students identify that stars are huge balls of burning gas and that there is only one in our solar system. Other stars we see in the sky are very far away. Students should know that there are eight planets in our solar system, some rocky and some gaseous.	• Students may believe that Pluto is a planet and that we have nine planets in our solar system. Explain that Pluto is now classified as a dwarf planet since scientists have discovered other objects in our solar system, such as Eris, Ceres, Haumea, and Makemake that have changed our understanding of planets. • Use a different graphic organizer, such as a Venn diagram or a concept map, to relate and classify characteristics of stars and planets as a class.
Get Ready question 3, page 166	Students are aware that Earth rotates on its axis and orbits the Sun.	• Show students a globe and demonstrate the rotation of Earth on its axis. Have a student represent the Sun and demonstrate Earth's orbit around the Sun.
Get Ready question 5, page 166	Students are familiar with each of the space technologies shown.	• To help English lanuage learners, simplify the language used, for example, "Match the technologies (inventions) with the pictures below."
Get Ready questions 6 to 8, page 167	Students predict possible challenges of space exploration and suggest reasonable solutions.	• Students may not be familiar with the International Space Station (ISS). Bring in photographs of the ISS and explain to students that this station is now orbiting Earth with astronauts working on it. Tell students where they can look for the ISS in the night sky. • Choose a situation more familiar to students, such as staying home alone for a short time, and have them predict challenges that may occur and develop strategies to overcome them.
Get Ready question 9, page 167	Students are familiar with representing large numbers in scientific notation.	• Provide students with **BLM G-24 Using Scientific Notation** for additional practice.