Unit 3 Space Exploration

Using Your Appendices, page 87

1. The steps should include identifying the problem, designing criteria, planning and constructing, evaluating the plan.
2. The design should be tested to see if it met the design criteria or if it had obvious flaws.
3. Answers will vary. Some of the problems could include effects of gravity, Earth's orbit, how to support the elevator, types of construction materials needed, location on Earth, size needed.
4. Answers will vary. Training methods could include processes for problem solving, specialized training, group/team dynamics, practice sessions for predictable problems.

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

Reading Check, page 88

1. In the night sky, Polaris is the last star in the handle of Ursa Minor, or the Little Dipper.
2. A light-year is the distance light travels in one year.

Cloze Activity, page 90

1. celestial
2. Polaris
3. constellations
4. circumpolar
5. gravitational pull
6. solar system
7. star
8. galaxy
9. astronomical unit (AU)
10. light-year

Comprehension, page 91

1. Polaris or the North Star
2. Circumpolar constellations travel around a pole star (Polaris).
3. Our Moon, planets, stars, and collections of stars
4. The planets, including Earth, moons, and other objects that orbit the Sun.
5. Size, colour, temperature, and density can be used to classify stars.
6. Milky Way

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7. 30 AU

8. 0.72 AU

9. Light can travel 9.4 trillion km in one year.

10. The Andromeda Galaxy

Interpreting Illustrations, page 92

Ursa Minor Diagram: refer to illustration Description: Little Dipper, handle and cup, small ladle, contains pole star (Polaris)	Draco Diagram: refer to illustration Description: small diamond or square, long extension, myth: seen as a dragon
Ursa Major Diagram: refer to illustration Description: Big Dipper, handle with three main stars, myth: seen as a bear	Pegasus Diagram: refer to illustration Description: square shapes with extensions, myth: seen as a winged horse

Assessment, page 93

1. G

2. H

3. C

4. A

5. E

6. D

7. B

8. F

9. The stars in the night sky seem to move from East to West.

10. Billions and billions of galaxies exist in the universe.

11. 150 million km.

12. Astronomers use light-years because the distances between galaxies are so large.

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

Reading Check, page 94

1. The magnetosphere sets up a magnetic field that deflects the solar wind and keeps the charged particles from entering Earth's atmosphere.

2. An eclipse happens when Earth or the Moon is lined up in space so that it blocks the Sun's light for a short time.

Comprehension, page 96

1. The Sun was formed 5 billion years ago.

2. The effects of the strong gravitational forces are great pressure and heat.

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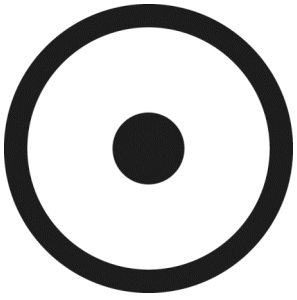
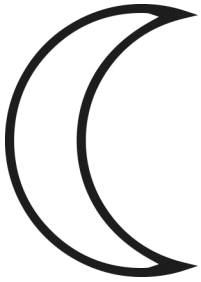
3. Life on Earth is protected by Earth's magnetic field and Earth's atmosphere.
4. The magnetosphere deflects solar wind and prevents much of it from entering the atmosphere.
5. Earth's atmosphere acts like a blanket that traps heat. The heat is redirected toward the surface of Earth.
6. The moon can affect the timing of when animals mate or when they lay their eggs.
7. Moonlight is sunlight reflected from the Moon's surface.
8. An eclipse occurs when Earth or the Moon is lined up in space so that it blocks the Sun's light.
9. The Sun's visible and invisible energy can damage or destroy parts of the eye that allow you to see. You could go blind.

Applying Knowledge, page 97

	The Sun	**The Moon**
1. Ancient symbol		
2. Distance from Earth	1 AU	0.003 AU
3. Size (diameter)	14 000 000 km	3475 km
4. Temperature range	6000°C to 15 000 000°C	-170° to 100°C
5. Rotation (number of days)	At the solar equator: 26 days At the solar poles: 37 days	27.3 days

6. The Sun gives off radio waves, microwaves, infrared waves, visible light, ultraviolet rays, and X-rays.
7. The gravitational pull of the Sun keeps the Moon in orbit.
8. Neil Armstrong was the first astronaut to step on the surface of the Moon.

Illustrating Concepts, page 98

1. Diagrams may vary, but should show the Moon between Earth and the Sun, and the Moon's shadow falling on Earth.
2. Diagrams may vary, but should show Earth between the Sun and Moon and Earth's shadow falling on the Moon.

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Assessment, page 99

1. C
2. A
3. H
4. B
5. F
6. G
7. E
8. D
9. Nuclear fusion happens when two hydrogen atoms fuse together to form a helium atom, and great amounts of energy are released.
10. Earth is positioned in the “Goldilocks zone” so the planet is not too hot and not too cold.
11. The phases of the Moon are caused by the amount of lit-up surface that we can see from Earth as the Moon orbits our planet.
12. The Sun is completely covered by the Moon leaving only a hazy, white glow like a halo.

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

Reading Check, page 100

1. Terrestrial refers to planets with Earth-like characteristics.
2. Asteroids, comets, or meteoroids

Cloze Activity, page 102

1. Mercury, Venus, Earth, and Mars
2. Jupiter, Saturn, Uranus, and Neptune
3. moon
4. Neptune
5. Jupiter
6. Jupiter, Venus
7. Uranus
8. Mars
9. Asteroid Belt, Mars, and Jupiter
10. trans-Neptunian
11. Pluto, Eris, Haumea, and Makemake

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Applying Knowledge, page 103

	Inner planets	Outer planets
1. Names of planets	Mercury, Venus, Earth, Mars	Jupiter, Saturn, Uranus, Neptune
2. Also known as	Terrestrial planets	Gas giants
3. Type of surface	Rocky, cratered	Gaseous
4. Relative size	Smaller than other planets	Larger than inner planets
5. Temperature	Higher average surface temperature	Very cold
6. Number of moons	Very few or none	Many
7. Presence of rings surrounding them	Do not have rings	Have rings
8. Oxygen present in atmosphere	• Not present on Mercury or Venus • Present on Earth and Mars	Not present

Illustrating Concepts, page 104

1. Asteroid Belt: label should be located between Mars and Jupiter
Kuiper Belt: label should be located beyond the orbit of Neptune
Oort Cloud: label should be located to the far right side of diagram.

2. Comets are formed of loosely held rock and ice.

3. Comets come from the Kuiper Belt and the Oort Cloud.

4. Meteoroids are formed of chunks of rock, metal or both.

Assessment, page 105

1. C

2. A

3. H

4. B

5. D

6. F

7. G

8. E

9. Mercury, Venus, Earth, and Mars

10. Jupiter, Saturn, Uranus, and Neptune

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11. An asteroid is a rocky object found between Mars and Jupiter while a meteoroid is a chunk of rock, metal or both shed from an asteroid or comet.

12. Halley's comet

Topic 3.4 What role does Canada play in space exploration?

Reading Check, page 106

1. Using probes to explore space keeps human beings from taking risks. Probes can carry instruments to take measurements and send the results back to Earth.

2. During a space walk, astronauts are at risk from being struck by space debris, being separated from the space station, or being harmed by equipment failure such as loss of air supply or holes in spacesuit.

Comprehension, page 108

1. The observatory built in Toronto in 1839 was constructed to study Earth's magnetic field.

2. Astronauts listed could include Dr. Marc Garneau, Dr. Roberta Bondar, Dr. Steven MacLean, Colonel Chris Hadfield, Dr. Robert Thirsk, Bjarni Tryggvason, Dr. Dave Williams, Captain Julie Payette.

3. Microvariability and Oscillations of Stars.

4. *NEOSSat* keeps watch for asteroids and other satellites to make sure they do not collide with each other or with Earth. This monitoring helps make the space above Canada safer for all of us.

5. The major components of the Mobile Service System designed by Canadians are *Canadarm2, Dextre*, and the *Mobile Base System*.

6. The *Canadarm 2* can be controlled from inside the space station or by remote control. The astronauts do not have to go outside the ISS to do repairs.

7. *Dextre* is designed to handle small objects and to complete delicate operations requiring tools.

8. If the *Mobile Base System* were damaged, the *Canadarm 2* and *Dextre* would not be able to attach to it. Astronauts would not be able to use the platform as a work place or storage area for their space walks. The track of the *Mobile Base System* could be damaged preventing the astronauts from doing repairs to those damaged areas of the space station.

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Applying Knowledge, page 109

	Description
Canadarm 2	• Acts as a platform for tasks in space. • Allows astronauts to control the arm and do repairs while inside the space station.
Dextre	• Allows astronauts to do delicate repairs and use tools from inside the space station.
Mobile Base System	• Acts as a base for *Canadarm2* and *Dextre*. • Can be a work platform and storage area for astronauts during space walks. • Track system allows astronauts to move *Canadarm2* and *Dextre* the full length of the space station.

Extension Activity, page 110

1. and 2. Accept all reasonable designs and descriptions. Students should be able to explain and provide labelled diagrams of their technology.

Assessment, page 111

1. D

2. G

3. B

4. C

5. A

6. E

7. F

8. A Canadian weather station designed to study Mars's polar climate was included on the space probe *Phoenix Mars Lander*.

9. *Canadarm 2* is larger and more flexible than the original *Canadarm*.

10. The *Mobile Base System* acts as a base for *Canadarm2* and *Dextre*, can be a work platform for astronauts and provides a storage area for astronauts on space walks.

Topic 3.5 How do we benefit from space exploration?

Reading Check, page 112

1. Benefits: learn about space, develop new technologies (spinoffs)
Risks: radioactive contamination; students may come up with other ideas on their own

2. Accept all reasonable answers. Look for evidence that student has thought about the question.

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Cloze Activity, page 114

1. spinoff
2. robots
3. UPC codes
4. Saturn
5. terraforming
6. water cycle
7. lunar
8. constellations
9. Yuri Gagarin
10. *Voyager* probes

Applying Knowledge, page 115

	Benefits	**Risks**
Nuclear-powered planetary probes	• nuclear power allows space probes to travel further	• possibility of nuclear contamination in space • potential danger to Earth as plutonium leaves Earth's atmosphere
Terraforming	• may allow future human colonies • may allow exploration of other areas of space	• changes to environment could cause unpredictable consequences
Other Issues: Answers will vary. Students should state at least one benefit and one risk.		

Extension Activity, page 116

Answers will vary. Students should include reasons, related to Canada's involvement, that support their opinion.

Assessment, page 117

1. C
2. F
3. E
4. D
5. A

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6. G
7. B
8. The orange-coloured fluid in the eyes of birds of prey led to the development of visor material used on space helmets for astronauts.
9. Answers may vary but could include quartz crystal watches, running shoes, cell phones, UPC codes, car brakes, sunglasses, robots, satellite technology.
10. Terraforming of Mars would involve major changes including creating a water cycle, plant life to generate and sustain an atmosphere, and nutrient cycles to sustain the plants.

Literacy Test Preparation, page 119

1. B
2. C
3. D
4. B
5. Answers may vary. Hazards could include radiation, extreme temperatures, radioactive dust, and equipment failure. Students should give details from the text to support their answers.

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