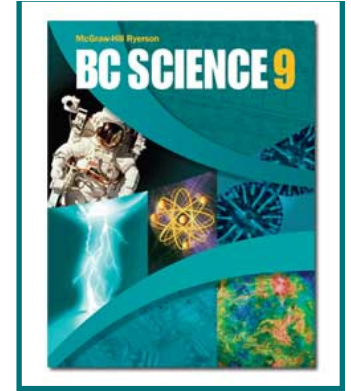


12.3 Exploring Space: Past, Present and Future

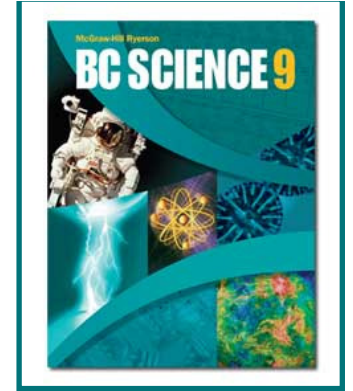


- Until the invention of the telescope, knowledge of space was very weak, and mythology and speculation were the rule.
- The telescope was invented in the 17th century by the Dutch eyeglass maker Lippershey.
- There are two main types of optical (light) telescopes: refracting and reflecting.
 - Refracting telescopes use lenses to gather and focus light
 - Reflecting telescopes use mirrors to collect light and project it onto an eyepiece.

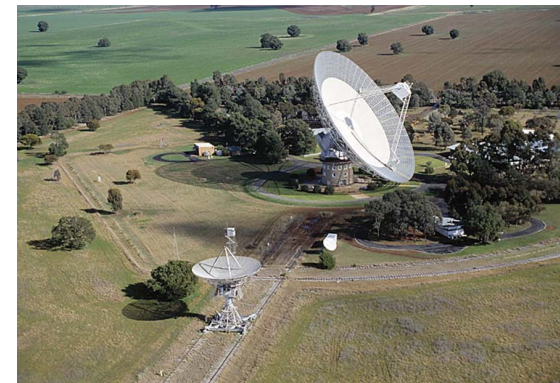


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Non-Optical Telescopes



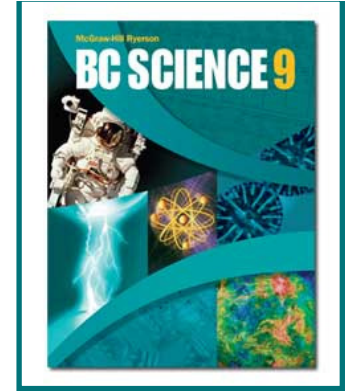
- Early optical telescopes improved viewing of space greatly, but other electromagnetic waves could also be used to gather information about space.
 - X-rays, gamma rays and radio waves can all be gathered and analyzed to learn about space.
 - Radio telescopes look like satellite dishes.
 - By joining radio telescopes together in a network, results can be obtained as though one very large telescope was being used.



From the Commonwealth Scientific and Industrial Research Organization

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Space-based Observation



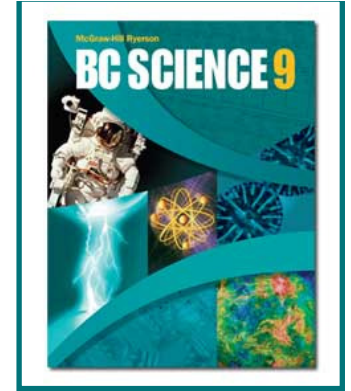
- As good as many of the telescopes on Earth are, by moving outside the atmosphere, space-based observation has become our most powerful method of space observation.
 - Satellites launched from Earth provide us with communication and safety every day.
 - Geosynchronous satellites orbit at the same rate as the Earth rotates, and stay above one point.
 - Probes launched from Earth have visited Venus, Mars and Saturn's moon Titan, and have traveled through space to the far reaches of our solar system.
 - Rovers are used to maneuver scientific equipment after landing on planets and moons.



The surface of Saturn's moon Titan.

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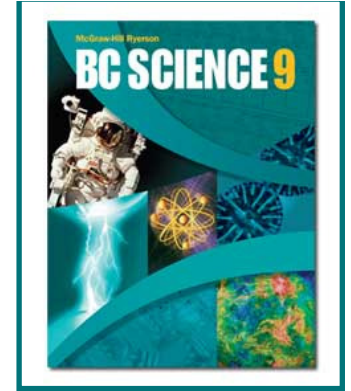
The Technology of Space Travel



- The challenge of using rockets to launch scientific equipment - and astronauts - into space now sees us attempting to establish colonies in space.
 - A rocket is used whenever we want to get something - called a payload - into space.
 - The rocket has a large amount of thrust, and very little drag, in order to break through the Earth's atmosphere.
 - The space shuttle program also uses rockets for launch, but also relies on having the equipment return to Earth safely for return trips.
 - The International Space Station is an attempt to provide a location in space from which to operate without needing to always use rockets to get there.

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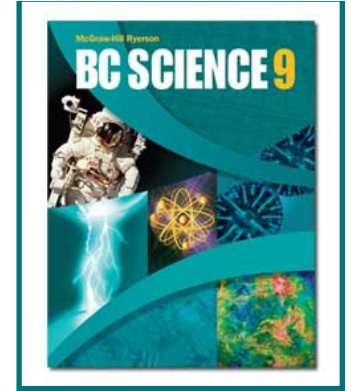
Space Travel



- Early attempts at space travel were unmanned, or carried animals. In the past 40 years, we have sent humans into space, as well as having them return safely.
 - International collaboration promotes friendly politics.
 - Canadians have aided in space travel by contributing to the development of the International Space Station, as well as work on the Canadarm system for the Space Shuttle, as well as sending astronauts on space missions.
 - Many technological advancements have occurred due to research done for space travel.
 - Soon, average citizens may be able to afford to travel into space for recreational purposes.
 - Terraforming is a process where previously uninhabitable locations, such as the Moon or Mars, would be changed to look and function as Earth does.

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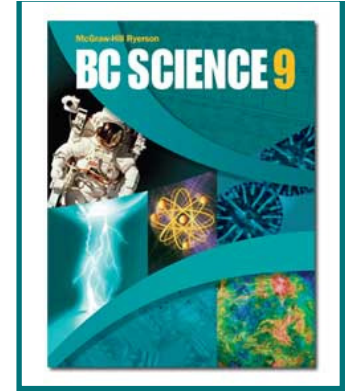
The Risks of Space Travel



- Perhaps more than in any other area, space travelers rely heavily on the equipment used for travel to provide safety.
 - Two shuttle failures have resulted in the loss of several astronauts.
 - Our equipment is very sensitive to the debris found in space, from large fuel tanks to small flecks of paint.
 - Sometimes, this debris can also re-enter the Earth's atmosphere and threaten us on the surface.
 - Space poses a huge advantages to those who control it, and have access to its resources.
 - Environmental, safety and political concerns can arise if we do not use space ethically.

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New Ideas for Interplanetary Travel



- To reach farther into space, particularly for manned missions, new methods of transportation will be necessary.
 - Our current space travel technology uses very large amounts of fuel to travel relatively short distances with very few passengers.
 - The 'space sled' uses magnetic technology to help propel a small craft without the use of much fuel.
 - A 'space elevator' would be very useful for moving people and materials into space without the constant use of rockets.

Take the Section 12.3 Quiz

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