Touring the Night Sky

8.1

People have been fascinated by the wonders of the night sky for thousands of years. **Astronomy** is the branch of science that studies objects beyond Earth, in what we sometimes refer to as "outer space." Any object in space—for example, the Sun or the Moon—is considered to be a **celestial object**. Everything that physically exists is part of what we call the **Universe**. We can see many of the celestial objects in the Universe by simply gazing up at the sky (Figure 1).

astronomy the scientific study of what is beyond Earth

celestial object any object that exists in space

Universe everything that exists, including all energy, matter, and space

Figure 1 You do not need a telescope to begin exploring the night sky.

Stars

Most of the bright points of light that we see in the night sky are stars. A **star** is a massive celestial body composed of hot gases that radiates large amounts of energy. Stars appear tiny in the sky because they are so far away. We are able to see many stars in the night sky because they are **luminous**, which means that they produce and emit light. Astronomers have located billions of stars, many of which we cannot see with the unaided eye.

star a massive collection of gases, held together by its own gravity and emitting huge amounts of energy

luminous producing and giving off light; shining

Our Star, the Sun

The Sun is a star (Figure 2). Compared to other stars, the Sun is average in size. Nevertheless, the Sun has a mass that is almost 340 000 times that of Earth and a volume that is 1 300 000 times the volume of Earth!

These very large numbers (or very small numbers) can also be written in scientific notation—a number between 1 and 9 multiplied by powers of 10. For example, the number 340 000 can be written as 3.4×10^5. To convert numbers written in scientific notation, such as 1.3×10^6, just move the decimal place to the right (for positive exponents) or to the left (for negative exponents) as many places as the exponent indicates. (In this case, move the decimal 6 places to the right: $1.3 \times 10^6 = 1\ 300\ 000$.)

The Sun appears to be so much bigger and brighter than other stars in the sky because of its proximity to Earth: it is only 1.5×10^8 km away. The next closest star is nearly 300 000 (4.3×10^{13} km) times farther away than the Sun. Since it is relatively close to Earth, we can see details on the surface of the Sun that we cannot see on more distant stars.

MATH TIP

Scientific Notation

To convert numbers written as scientific notation, just move the decimal place to the right (or to the left) as many places as the exponent indicates.

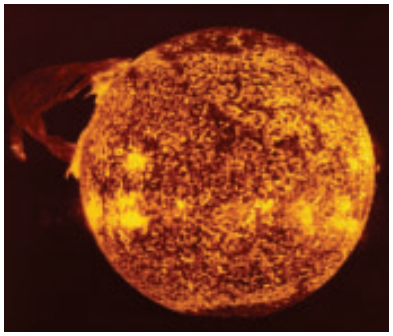

Figure 2 The Sun is a star—an enormous ball of hot, glowing gases.

Life would not be possible on Earth without the energy produced by the Sun. The Sun gives off visible light and other forms of radiant energy, as well as releasing what is called the solar wind—a stream of high-energy particles. Only a small fraction of the Sun's light reaches Earth, but it is enough to keep water in its liquid state and provide life on Earth with the energy needed for survival.

Planets

planet a large, round celestial object that travels around a star

A **planet** is a large celestial object that travels around a star. There are eight planets travelling around the Sun—Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. Each planet differs from the other planets in size, composition, atmosphere, and length of day and year. The four planets closest to the Sun are known as the terrestrial planets. They have a hard and rocky surface similar to Earth's. The next four planets are composed mostly of gases and liquids. They are known as the gas giants.

Planets are non-luminous. Although they do not produce and emit light, we can see planets because they reflect light from luminous objects, such as the Sun and other stars. There are five planets visible with the unaided eye—Mercury, Venus, Mars, Jupiter, and Saturn.

DID YOU KNOW?

Only Eight Planets?

Until recently, Pluto was considered to be the ninth planet. However, Pluto was reclassified as a "dwarf planet" in 2006.

Our Planet, Earth

Solar System the Sun and all the objects that travel around it

satellite a celestial object that travels around a planet or dwarf planet

orbit the closed path of a celestial object or satellite as it travels around another celestial object

Earth is the third planet from the Sun and the fourth largest in the **Solar System**, which consists of the Sun, together with all the planets and celestial objects that travel around it. Earth is a terrestrial planet composed primarily of rock. Like the other planets, Earth is in constant motion. (You will learn more about this in Section 8.5.) Earth differs from the other planets in the Solar System because it has a diversity of life forms and large quantities of water.

Moons

A moon is a type of **satellite**: a celestial object that travels around a planet or dwarf planet in a closed path. The closed path of a celestial object or satellite as it travels around another (usually larger) celestial object is called an **orbit**. Although some planets have moons in orbit, others do not. For example, Mercury and Venus do not have moons in orbit, whereas Jupiter and Saturn each have 60 or more moons.

Figure 3 The Moon reflects the Sun's light, which makes it appear bright in the night sky.

Earth's Companion, the Moon

Earth has one natural satellite called the Moon. The Moon is non-luminous. We are able to see it only because sunlight reflects off its surface (Figure 3).

Although the Moon appears to be the biggest and brightest celestial object in the night sky, it is small compared to the planets. It has a diameter four times smaller than that of Earth. It appears large because it is close to Earth. However, it is an average distance of 384 000 km away from Earth—about 55 times the distance between Vancouver, British Columbia, and St. John's, Newfoundland.

Galaxies

Within the Universe are huge collections of stars, gas, dust, and planets, which we call **galaxies**. Astronomers looking through telescopes are discovering that there are billions of galaxies scattered throughout the Universe.

galaxy a huge, rotating collection of gas, dust, and billions of stars, planets, and other celestial objects

READING TIP

Finding the Main Idea

Words that are repeated can provide clues to the main idea. For example, you might notice that in this sub-section the word "galaxies" is repeated in the heading, text, sidebar glossary, illustration, and caption. It is also in bold in the first sentence of the first paragraph. By using these clues, you can focus on determining the main idea about galaxies.

Our Galaxy, the Milky Way

Earth is part of the Milky Way galaxy. It contains more than 200 billion stars, including the Sun. It also contains many other celestial objects. From Earth, the Milky Way appears as a hazy band of white light in the night sky.

Astronomers and scientists continue to study stars, planets, galaxies, and other celestial objects in order to learn more about the Universe and our place in space. (Figure 4).

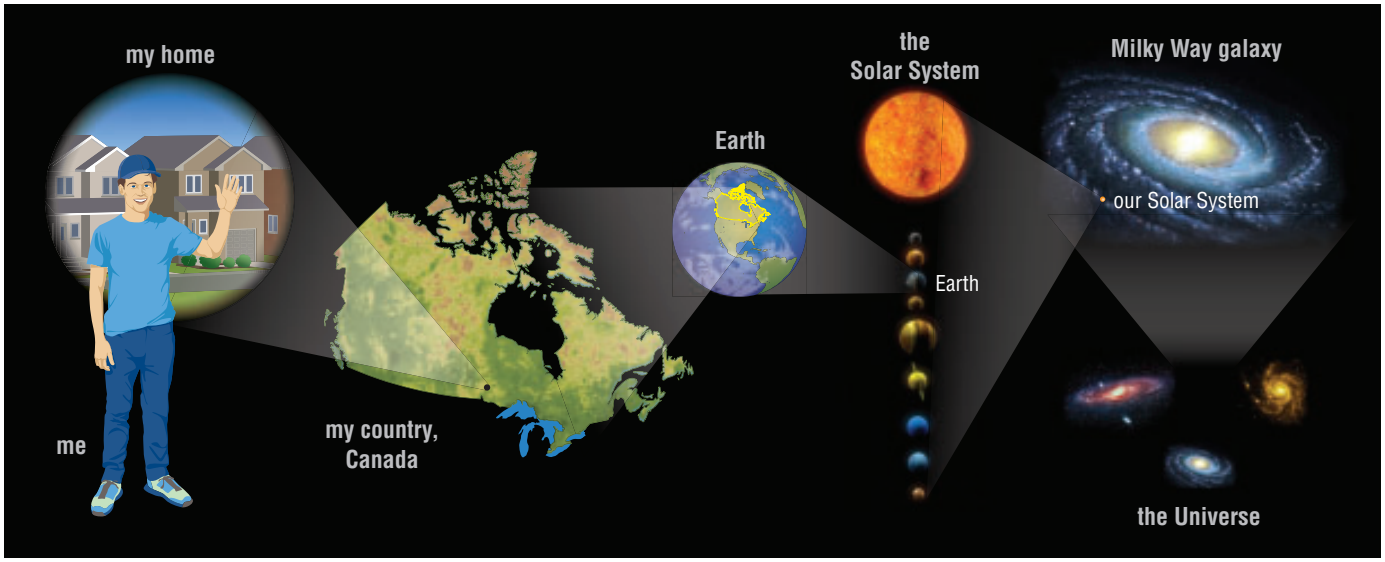

Figure 4 The Universe consists of everything that exists, including galaxies, the Solar System, celestial objects, and even you!

TRY THIS CREATE A HORIZON DIAGRAM

SKILLS: Observing, Analyzing, Communicating

SKILLS HANDBOOK 3.B.

In this activity, you will create a diagram that shows the positions of celestial objects as seen against the horizon.

Equipment and Materials: flashlight; red cellophane; plain paper and clipboard; pencil; ruler

1. With an adult, go to a dark site to observe the night sky. Before you begin making observations, cover the end of the flashlight with the red cellophane. This will minimize the glare produced by the flashlight.
2. Draw a line at the bottom of your paper to represent the horizon in one direction. Sketch any trees or buildings that you observe along the horizon. You will use these objects as landmarks.
3. Carefully sketch the brightest objects you see in the night sky.
4. Record the date and exact time of your observations, a detailed description of the position from which you made your observations, and the cloud conditions for that evening.

A. See if you can identify any of the celestial objects you have drawn. T/I

B. Is the Moon in your drawing? If so, describe its position and appearance. T/I

C. How do the objects you have sketched differ in their brightness? Why do you think this is so? T/I

UNIT TASK Bookmark

How can you apply what you learned about horizon diagrams in this section to the Unit Task described on page 446?

IN SUMMARY

- Astronomy is the scientific study of what exists beyond Earth, including stars, planets, and moons.
- Many celestial objects, such as stars, are visible in the night sky. Stars are luminous, whereas planets and the Moon are visible because they reflect light from the Sun.
- The eight planets in the Solar System travel around the Sun.
- Natural satellites, such as the Moon, orbit some planets in the Solar System.
- Within the Universe there are galaxies, such as the Milky Way. Each galaxy contains billions of stars and other celestial objects.

CHECK YOUR LEARNING

1. What do astronomers study? K/U
2. Write a brief paragraph explaining the term "luminous" to a classmate. K/U C
3. If the Moon does not produce its own light, how are we able to see it? K/U
4. Explain the terms "terrestrial planets" and "gas giants," providing examples of each. K/U
5. How are stars different from planets? How are they similar? K/U
6. According to astronomers, what is a satellite? K/U
7. Use an example to define the term "orbit" in your own words. K/U
8. There are more than 100 billion stars, including the Sun, in our solar neighbourhood (Figure 5). What do astronomers call this collection of stars? K/U

Figure 5

9. Arrange the following objects from biggest to smallest: galaxy, moon, star, planet, Universe. K/U