12 Chapter

Beyond Earth

We'll cover the following key points:

- Stars and Constellations
- Satellites
- The Solar System

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Learning Outcomes

By the end of this chapter, students will be able to:

- Explore the stars, constellations, and the structural and chemical composition of the Sun and celestial objects in the solar system.
- Understand how telescopes are used to observe far-off astronomical bodies.
- Gain knowledge about natural and artificial satellites, along with other objects within the solar system.

Guidelines for Teachers

The teacher can begin the chapter by explaining the importance and vastness of the solar system. They can encourage students to participate in hands-on experiments, visual observations, and projects to make astronomical ideas easier to grasp. The use of digital tools, including animations and presentations of space phenomena, can help clarify complex topics. By linking space exploration to real-world examples and technological progress, teachers can inspire students to value astronomical advancements and discoveries.

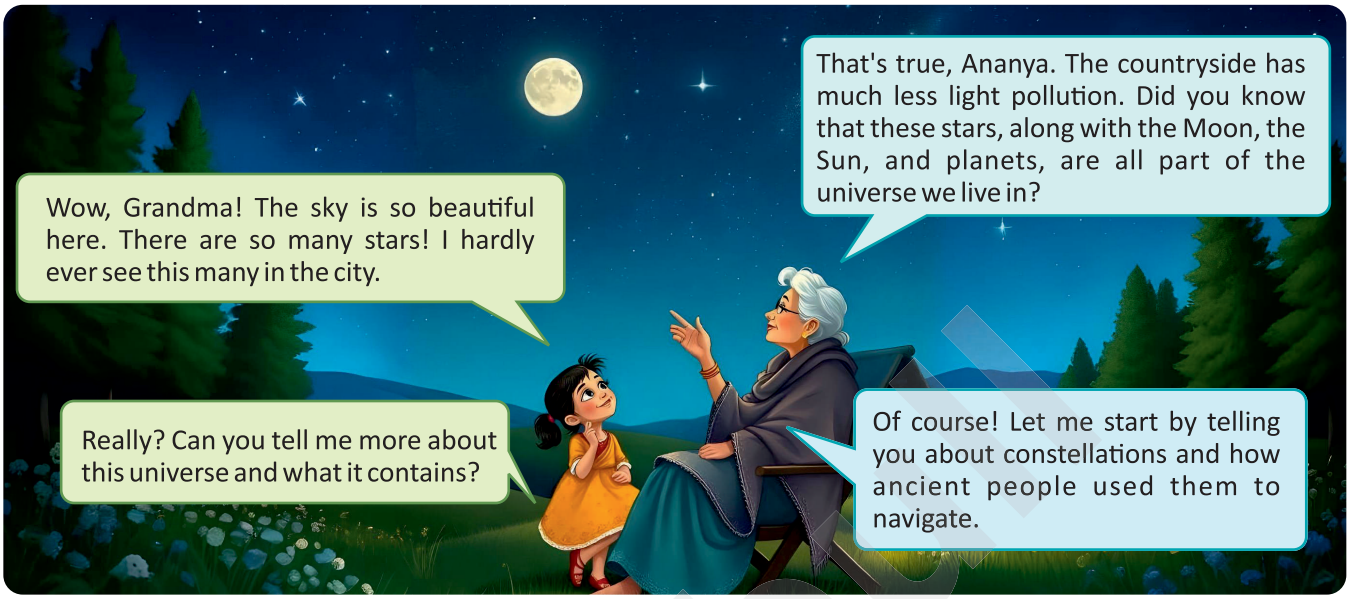
NCF Curricular Goals and Competencies

This chapter addresses the following learning objectives:

- **CG-2 (C 2.5):** Develops an understanding of the physical universe through scientific and mathematical perspectives.
- **CG-5 (C 5.2):** Explores the relationship between scientific advancements and technology.
- **CG-6 (C 6.1 and C 6.2):** Investigates the principles and progression of scientific discoveries while promoting scientific inquiry and innovation.

Stars and Constellations

Ananya visits her grandmother, Meera, in the countryside during her winter holidays. They sit outside on the lawn, gazing at the sparkling night sky.



The vast expanse beyond Earth has captivated human imagination for centuries, inspiring stories, discoveries, and innovations. From the twinkling stars in the night sky to the mysteries of distant galaxies, the universe holds endless possibilities and secrets yet to be unraveled. Exploring what lies beyond our planet has not only deepened our understanding of the cosmos but also redefined humanity's place within it.

At night, the sky becomes a canvas filled with countless stars, some appearing bright while others are faint. Stars are massive spheres of burning gases, primarily hydrogen and helium, that generate their own heat and light through nuclear fusion. These celestial objects have fascinated humanity for millennia, not only for their beauty but also for their significance in navigation, storytelling, and science.

In History...

1. Space Age Beginnings:

- The launch of Sputnik 1 by the Soviet Union on October 4, 1957, was the first artificial satellite to orbit Earth, marking the beginning of the space age.
- Laika, a dog, became the first living creature to orbit Earth aboard Sputnik 2 on November 3, 1957.

2. First Human in Space:

On April 12, 1961, Yuri Gagarin of the Soviet Union became the first human to travel into space aboard Vostok 1, completing one orbit around Earth.

3. First Human on the Moon:

On July 20, 1969, astronauts Neil Armstrong and Buzz Aldrin of the United States became the first humans to walk on the Moon during the Apollo 11 mission. Armstrong's famous words were, "That's one small step for [a] man, one giant leap for mankind."

What Are Constellations?

Constellations are specific arrangements of stars that form recognizable patterns in the sky. These patterns were used by ancient people to organize and map the night sky. Constellations were especially valuable for navigation, as sailors and travelers used them to determine directions during their journeys. For instance, the Pole Star (Dhruva Tara), part of the Ursa Minor constellation, has been a reliable guide for locating the North in the Northern Hemisphere.

In modern times, constellations are defined as specific regions of the sky containing these star patterns. The International Astronomical Union (IAU) officially recognized 88 constellations in the early 20th century to standardize the boundaries and ensure uniformity in astronomical studies.

Cultural and Practical Importance of Constellations

1. Navigation:

Constellations have been crucial for navigation. Sailors and travelers used constellations like Ursa Major to locate the Pole Star and find their way in the absence of compasses.

2. Storytelling and Mythology:

Different cultures have associated constellations with myths and legends. These stories often served as a way to explain natural phenomena and passed on cultural knowledge across generations.

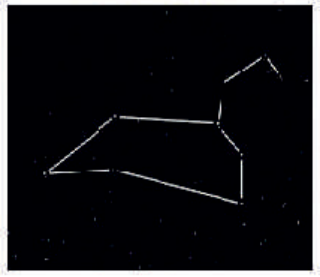
Examples of Constellations

Several constellations stand out due to their historical, cultural, or navigational significance. Here are some key examples:

Constellation Name	Description	Significance
Ursa Major (Vrihat Saptarishi)	Consists of seven bright stars forming a "big spoon" shape, with three stars as the handle and four forming the bowl.	Also known as the Big Dipper or Great Bear. Used to locate the Pole Star by drawing a line through its top two stars. Visible in the northern sky from April to September.
Ursa Minor (Laghu Saptarishi)	Contains seven bright stars, including the Pole Star, and resembles a smaller dipper.	Also called the Little Dipper or Lesser Bear. The Pole Star remains stationary in the northern sky, aiding navigation. Visible throughout the year in the Northern Hemisphere.

Orion (Vyadha or Mriga)	Represented as a hunter with seven bright stars. The middle three stars form the "belt of the hunter," while the remaining stars form a quadrilateral.	Associated with mythology, Orion is said to be followed by Canis Major, his dog, as he battles the bull Taurus.
Cassiopeia (Sharmishtha)	A group of five bright stars forming a W or M shape.	Found near the Pole Star and visible from December to April in the Northern Hemisphere.
Canis Major (Mahaashvaan)	Contains Sirius, the brightest star in the night sky.	Also called the Dog Star or Great Dog. It is prominently visible during winter.

Leo Major



Ursa Major

Orion

Cassiopeia

Role of Telescopes in Observing the Sky

A telescope is an essential instrument that allows us to observe distant celestial objects with clarity. Telescopes have revolutionized astronomy by providing detailed insights into the universe.

Key Features of Telescopes:

- **Magnification:** Telescopes magnify distant objects, making stars, planets, and galaxies visible to the human eye.
- **Scientific Importance:** They are used extensively in research to gather information about celestial phenomena, including the movement of stars and the composition of planets.
- **Types of Telescopes:** Modern telescopes range from small amateur devices to massive research-grade installations.

Notable Telescope:

- The **Keck Telescope**, located in Hawaii, is one of the largest telescopes in the world. It is capable of detecting nearly a million stars and is instrumental in advancing our understanding of the cosmos.

Let's recall what we know

Apply Concept in Context

Apply

- Describe how constellations were historically used to determine the changing seasons.
- How can you identify the Pole Star using the stars in the Big Dipper constellation?

Skills Covered: Critical and logical thinking, Research, Applicative thinking, Observation

Examine Further

Analyse

- Why are stars more visible in rural areas compared to urban areas?
- Research and list some global organizations that promote the use of renewable energy to reduce light pollution. What measures can you suggest for your locality to minimize artificial light at night?

Skills Covered: Analytical thinking ,Research, Problem-solving, Environmental awareness

Self-Assessment Questions

Evaluate

- What is the difference between a constellation and a Nakshatra?
- Name a constellation that is shaped like a "W" or "M."
- What is the significance of the Pole Star in navigation?
- Explain why reducing light pollution is important for studying the night sky.

Skills Covered: Self-reflection, Knowledge recall, Comparative analysis, Logical reasoning

Creative Insight

Create

- Design a plan for a "Stargazing Night" event in your school or neighborhood. Include activities to teach participants about constellations and light pollution.
- Develop a concept for a mobile app that uses augmented reality to help users identify stars, planets, and constellations in real-time. Explain the key features of your app.
- Imagine you are an astronaut viewing the stars from space. Write a short diary entry describing how the constellations appear without light pollution and how this inspires your mission.

Skills Covered: Creativity, Critical and logical thinking, Brainstorming, Communication

Bloom's Taxonomy

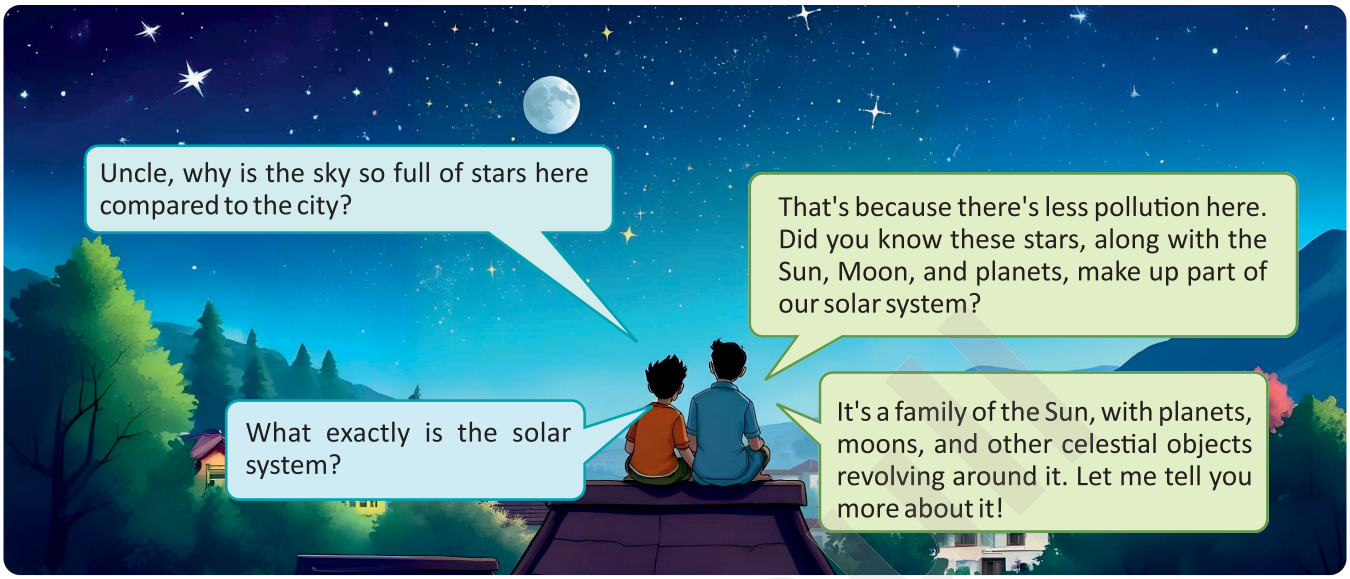
SCAN TO ACCESS

Take a Task

Watch Remedial

The Solar System

Aryan visits his uncle, Ravi, in a small town during his holidays. They sit on the rooftop, enjoying the clear night sky.



The night sky, with its vast expanse of stars and planets, has captivated humanity for centuries, leading us to ponder the origins of the cosmos. The exact beginnings of the universe remain a mystery, but numerous theories attempt to explain its formation. Among the most widely accepted is the Big Bang Theory, which suggests that the universe began approximately 13.8 billion years ago. According to this theory, a singular, infinitely dense point underwent a massive explosion, leading to the expansion of space and the creation of matter.

The study of the universe and its celestial bodies falls under the branch of science known as astronomy. Astronomers, the scientists who specialize in this field, use advanced tools like telescopes, satellites, and space probes to observe and study celestial phenomena.

The Sun: The Central Star of Our Solar System

The Sun is a star and the largest object in our solar system. It is a massive sphere of primarily hydrogen and helium gases, continuously producing heat and light through nuclear fusion. Positioned approximately **150 million kilometers away from Earth**, the Sun's rays take around 8 minutes to reach the planet. Its surface temperature exceeds **6,000°C**, making it the primary source of energy that sustains life on Earth.

The Sun also drives Earth's **climate system**, influencing seasons, weather patterns, and the **water cycle**. By evaporating water from oceans and other water bodies, the Sun powers precipitation and replenishes freshwater supplies, ensuring the continuity of life. In India, the Sun is revered as **Sūrya,** symbolizing energy, power, and life. It holds a prominent place in Indian culture and spirituality, often worshipped for its vital role in sustaining life on Earth.

Planets: Wanderers of the Solar System

The term **"planet"** originates from the Greek word **"planes,"** meaning "wanderer." Planets are celestial bodies that revolve around the Sun in fixed paths called **orbits**. Each planet takes a specific amount of time to complete one full orbit around the Sun, which is referred to as its **period of revolution**. This period increases as the planet's distance from the Sun grows. For instance, Earth completes one revolution in **365.25 days**, while Neptune takes **165 years** due to its greater distance. Alongside their revolution, planets also rotate on their own axes, a motion known as their **period of rotation**.

Planets are categorized into three main types: inner planets, outer planets, and dwarf planets, based on their location, size, and composition.

Types of Planets

1. Inner Planets (Terrestrial Planets):

- These include Mercury, Venus, Earth, and Mars.
- Inner planets are small, rocky, and dense.
- They are located closer to the Sun and lack rings around them.
- They are primarily composed of solid materials and metals.

2. Outer Planets (Gas Giants):

- These include Jupiter, Saturn, Uranus, and Neptune.
- Outer planets are larger, composed mostly of gases, and are farther from the Sun.
- They have ring systems made of dust, ice, and rocks and multiple moons.

3. Dwarf Planets:

- Examples include Pluto, Ceres, Haumea, Makemake, and Eris.
- Dwarf planets are smaller and not considered "full" planets as they fail to clear their orbits of other debris.
- They are significant **celestial bodies** in understanding the solar system's diversity.

KEYWORDS

Celestial bodies: These are natural objects in the sky, such as the Sun, Moon, stars, and planets. They are found in space and are part of the universe.

Details of Planets

Here is a detailed breakdown of the planets, their characteristics, and their distance from the Sun:

Planet	Details	Distance from the Sun	Time for One Revolution
Mercury	Smallest planet, closest to the Sun, extremely hot during the day and cold at night.	58 million km	88 days
Venus	Brightest object after the Sun and Moon, known as the "Morning Star" and "Evening Star," with no moons.	180 million km	225 days
Earth	The "Blue Planet" with life-supporting water and atmosphere, having one natural satellite (Moon).	150 million km	365.25 days
Mars	Known as the “Red Planet" due to its reddish soil, has two small natural satellites (Phobos and Deimos).	228 million km	322 days
Jupiter	Largest planet, features a large red spot (a giant storm) and faint rings, with 95 known moons.	778 million km	11 years
Saturn	Second-largest planet, famous for its prominent ring system, and 146 known moons.	1,427 million km	29 years 167 days
Uranus	Third-largest planet, has a blue-green color due to methane, with 28 moons and faint rings.	2,872 million km	84 years 7 days
Neptune	Farthest planet, has 14 moons, a bluish appearance, and extremely low temperatures.	4,502 million km	165 years

The Sun: The Central Star of Our Solar System

Interesting Facts

Inner vs. Outer Planets:

- Inner planets are rocky and smaller, whereas outer planets are gas giants and larger.
- Outer planets have rings, while inner planets do not.

Planetary Mnemonic:

To remember the order of planets from the Sun, use this mnemonic:

"My Very Educated Mother Just Served Us Noodles"

(Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune).

Let's recall what we know

SCAN TO ACCESS

Take a Task

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Apply Concept in Context

Apply

- List the inner, outer, and dwarf planets of the solar system. Suggest why the inner planets are rocky while the outer planets are gaseous.
- Imagine you are designing a solar system model for a science exhibition. Describe how you would represent the Sun, planets, moons, and their orbits effectively.
- Create a simple diagram to show how the Sun drives the water cycle. Explain the Sun's role in maintaining life on Earth and its connection to weather patterns and seasons.

Skills Covered: Creativity, Applicative thinking, Brainstorming, Critical and logical thinking, Observation

Examine Further

Analyse

- The Big Bang Theory explains the origins of the universe. Discuss its significance and how it differs from cultural beliefs about the universe's formation.
- Compare the periods of revolution and rotation of inner planets with outer planets. How do these differences impact their climates and characteristics?
- Why do gas giants like Jupiter and Saturn have rings, while inner planets like Earth and Mars do not? Analyze how distance from the Sun influences planetary composition.

Skills Covered: Critical and logical thinking, Research, Brainstorming, Applicative thinking, Problem-solving

Bloom's Taxonomy

Self-Assessment Questions

Evaluate

- What is the difference between a terrestrial planet and a gas giant? Provide two examples of each.
- Why is the Sun essential for sustaining life on Earth? List three reasons based on its role in the solar system.
- Using the mnemonic "My Very Educated Mother Just Served Us Noodles," identify the planets in order from the Sun and explain how this order is determined.

Skills Covered: Knowledge recall, Comparative analysis, Logical reasoning, Understanding of concepts

Creative Insight

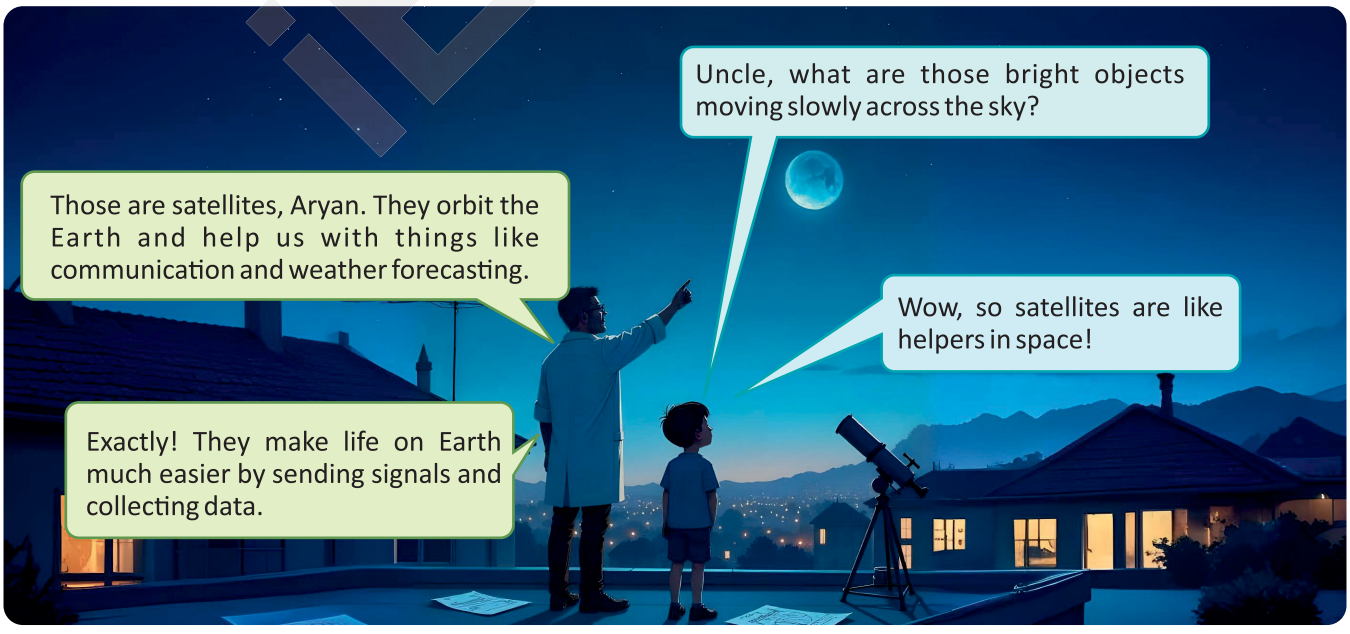
Create

- Imagine you are an astronaut observing the planets from space. Write a short diary entry describing the differences between Earth and the outer planets like Saturn and Neptune.
- Create a chart comparing the key characteristics of all eight planets, including size, composition, distance from the Sun, and period of revolution. Use visuals to enhance understanding.

Skills Covered: Creativity, Critical and logical thinking, Brainstorming, Applicative thinking, Observation

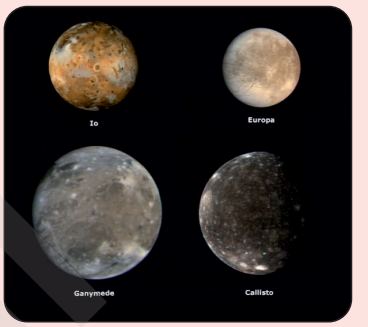
Satellites

Aryan visits his uncle, a space scientist, during the holidays. They stand on the rooftop, looking at the clear night sky.



A **satellite** is a small celestial body that revolves around a planet. The term "satellite" is derived from the Latin word **'satelles,'** meaning a "companion" or "attendant." Satellites play an essential role in both natural celestial systems and human technological advancements. They are classified into two main types: **natural satellites and artificial satellites.**

1. Natural Satellites

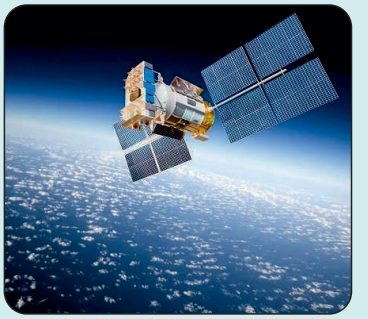


Natural satellites are naturally occurring celestial bodies that orbit planets. They are formed through cosmic processes and are a vital part of planetary systems. The most well-known natural satellite is Earth's Moon, which affects tides, stabilizes the planet's tilt, and influences various natural phenomena.

Key Characteristics of Natural Satellites:

- They are naturally found orbiting planets.
- They vary in size, from small moonlets to massive satellites like Jupiter's Ganymede, which is the largest natural satellite in the solar system.
- Each planet may have one or multiple natural satellites. For instance:
- Earth has one natural satellite, the Moon.
- Jupiter has 95 known moons, including Ganymede, which is larger than the planet Mercury.

2. Artificial Satellites



Artificial satellites are human-made machines launched into space to orbit Earth or other celestial bodies. These satellites are designed for specific purposes, such as communication, navigation, weather forecasting, scientific research, and space exploration.

Key Characteristics of Artificial Satellites:

- They are built and launched by humans using advanced technology.
- Artificial satellites serve various purposes, including:
  - **Communication Satellites** for global connectivity.
  - **Weather Satellites** for tracking climate and predicting natural disasters.
  - **Scientific Satellites** for studying space and celestial phenomena.
- Some notable examples include:
  - **Sputnik 1:** The first artificial satellite launched by the Soviet Union in 1957.
  - **Aryabhata:** The first Indian artificial satellite, launched in 1975.

Asteroids: Minor Planets of the Solar System

Asteroids, or minor planets, are rocky remnants from the early solar system, mainly found in the asteroid belt between Mars and Jupiter.

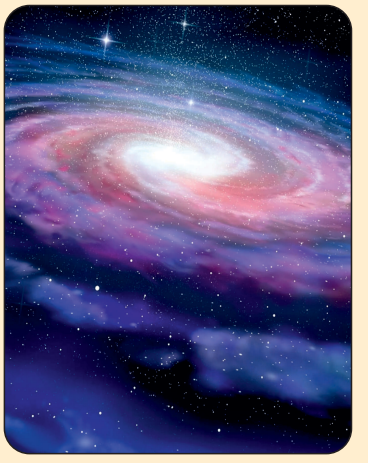
Key Features of Asteroids

1. **Composition and Size:**
   - Asteroids are primarily composed of rock and metal. Their sizes vary significantly, ranging from 10 kilometers to 500 kilometers in diameter.
   - The largest known asteroid is Ceres, which is classified as a **dwarf planet** with a diameter of approximately 975 kilometers.

Comets: The Icy Wanderers of Space

Comets are fascinating celestial objects composed of ice, gas, and dust that orbit the Sun. They are often described as "dirty snowballs" due to their icy cores mixed with dust and other materials. When a comet approaches the Sun, its ice begins to vaporize due to the intense heat, releasing gas and dust in the process. This activity forms a glowing coma (a bright halo around the nucleus) and an elongated tail that always points away from the Sun due to solar wind. This tail is what makes comets one of the most visually striking objects in the night sky.

The Milky Way Galaxy



The Milky Way Galaxy (referred to as Ākāsha Gangā in Indian culture) is a vast spiral-shaped structure that contains the Sun, the solar system, and hundreds of billions of stars. This appearance is caused by the presence of gas, dust, and countless stars densely packed in its spiral arms.

It is estimated to be 13.6 billion years old, making it almost as old as the universe itself. The closest galaxy to the Milky Way is the Andromeda Galaxy, located approximately 4 light years away. Andromeda is also a spiral galaxy and is visible with the help of telescopes.

KEYWORDS

A **dwarf planet** is a small, round object in space that orbits the Sun but is not big enough to clear other objects from its path. Examples of dwarf planets include Pluto and Ceres.

Let's recall what we know

Apply Concept in Context

Apply

- List examples of natural and artificial satellites. Describe how artificial satellites help in communication, weather prediction, and navigation.
- Imagine you are part of a community planning to launch a new artificial satellite. Suggest the steps you would take to ensure the satellite fulfills its purpose effectively and operates sustainably.
- Create a model explaining how a comet's tail forms when it approaches the Sun. Illustrate how solar radiation and wind contribute to the creation of the tail.

Skills Covered: Creativity, Applicative thinking, Brainstorming, Critical and logical thinking, Observation

Examine Further

Analyse

- Discuss how the Moon influences Earth's natural phenomena like tides and climate. What could happen if the Moon were not present?
- Compare natural satellites like Jupiter's Ganymede with artificial satellites like Sputnik 1 in terms of size, purpose, and origin.
- Explain why asteroids located in the asteroid belt are less likely to collide with Earth, while Near-Earth Objects (NEOs) pose a potential threat.

Skills Covered: Critical and logical thinking, Research, Brainstorming, Applicative thinking, Problem-solving

Self-Assessment Questions

Evaluate

- What are the main differences between natural satellites and artificial satellites? Provide examples for each.
- Why are artificial satellites important for modern-day activities like communication, weather forecasting, and space exploration?
- Define the term "meteorite" and describe how it differs from a meteoroid and a meteor.

Creative Insight

Create

- Imagine you are observing the night sky through a telescope. Create a drawing or a model of the Milky Way Galaxy, highlighting its spiral arms and Earth's location. Label key features.
- Develop a plan for a community workshop to educate people about the differences between asteroids, comets, and meteoroids, including their role in space exploration.

SCAN TO ACCESS

Take a Task

Watch Remedial

Bloom's Taxonomy

SUMMARY

Stars and Constellations

Stars are massive spheres of burning gases, primarily hydrogen and helium, that emit heat and light through nuclear fusion. They have been vital for navigation, storytelling, and science throughout history. Constellations are star patterns named by cultures worldwide, with significant cultural and practical uses.

Examples of Constellations

- **Ursa Major:** Guides to the Pole Star.
- **Orion:** Resembles a hunter, linked to mythology.
- **Canis Major:** Contains Sirius, the brightest winter star.

Indian Astronomy

Nakshatras (e.g., Ārdrā, Rohiṇī) hold cultural and astrological importance.

Challenges

- Light pollution and urbanization reduce visibility.
- Telescopes, like the Keck Telescope in Hawaii, help study celestial objects.

The Solar System

The solar system comprises the Sun, eight planets, moons, and celestial objects like comets, asteroids, and meteoroids, formed billions of years ago and governed by gravity.

The Sun

- Central star made of hydrogen and helium.
- Drives climate, seasons, and the water cycle on Earth.

Planets

- **Inner Planets (Mercury, Venus, Earth, Mars):** Small, rocky, dense, and close to the Sun; no rings.
- **Outer Planets (Jupiter, Saturn, Uranus, Neptune):** Large, gaseous, distant; have rings and many moons.
- **Dwarf Planets (Pluto, Ceres, etc.):** Small celestial bodies that do not clear their orbits.

Key Facts

- **Mercury:** Smallest and fastest.
- **Jupiter:** Largest.
- **Venus:** Hottest due to its dense atmosphere.
- **Neptune:** Farthest from the Sun.

Satellites

Satellites are either natural, like Earth's Moon, or artificial, created for purposes such as communication and research. Other celestial objects include asteroids, comets, and meteoroids. All these exist within the Milky Way Galaxy and the vast universe beyond.

Key Points:

1. Satellites

- Natural Satellites: Orbit planets; e.g.,
  - **The Moon:** Influences tides, lacks atmosphere, extreme temperatures.
  - **Ganymede:** Jupiter's moon, largest in the solar system.
- **Artificial Satellites:** Man-made for communication, navigation, and science.

4. The Universe

- A vast expanse of galaxies, stars, and cosmic phenomena.
- ~13.8 billion years old, studied using advanced telescopes like Hubble and James Webb.

Gap Analyzer™
Take a Test

EXERCISE

That turn curiosity into confidence—let's begin!

A. Choose the correct answer.

1. Which of the following is the brightest star in the night sky?
   (a) Polaris ☐ (b) Sirius ☐
   (c) Betelgeuse ☐ (d) Vega ☐
2. What is the primary purpose of artificial satellites?
   (a) To reflect sunlight ☐ (b) To orbit other planets ☐
   (c) To aid in communication, navigation, and research ☐ (d) To create craters on the Moon ☐
3. Which constellation is known as the "Great Bear"?
   (a) Orion ☐ (b) Ursa Major ☐
   (c) Cassiopeia ☐ (d) Canis Major ☐
4. Which celestial object is also referred to as a "dirty snowball"?
   (a) Asteroid ☐ (b) Comet ☐
   (c) Meteoroid ☐ (d) Moon ☐
5. What galaxy is home to the solar system?
   (a) Andromeda Galaxy ☐ (b) Milky Way Galaxy ☐
   (c) Whirlpool Galaxy ☐ (d) Sombrero Galaxy ☐

B. Fill in the blanks.

1. The constellation _____, also known as the "Hunter," has a belt formed by three bright stars.
2. The _____, located approximately 384,400 km from Earth, is its only natural satellite.
3. _____ are icy celestial bodies that develop glowing tails when they approach the Sun.
4. The largest known asteroid in the solar system is _____.

C. Write True or False.

1. Sirius is the brightest star visible in the night sky. _____
2. Artificial satellites can only orbit Earth and no other celestial bodies. _____
3. The Moon has no atmosphere, causing extreme temperature variations. _____
4. Comets remain visible even when they move far away from the Sun. _____
5. The Milky Way Galaxy is older than the universe itself. _____

D. Define the following terms.

1. Constellations
2. Natural Satellites
3. Artificial Satellites
4. Light Pollution
5. Telescope

E. Match the columns.

Column A	Column B
1. Constellations	(a) Form patterns used for navigation and study
2. The Milky Way Galaxy	(b) Spiral galaxy containing the solar system
3. Artificial Satellites	(c) Machines launched for communication and research
4. Comets	(d) Develop glowing tails when near the Sun
5. The Moon	(e) Earth's only natural satellite

F. Give reasons for the following statements.

1. The Pole Star has been a reliable guide for navigation for centuries.
2. Artificial satellites are vital for modern communication and weather forecasting.
3. Light pollution affects the visibility of celestial objects in urban areas.
4. Telescopes have revolutionized astronomy and the study of the universe.
5. The Milky Way Galaxy is important for understanding the structure of the solar system.

G. Answer in brief.

1. What are constellations, and how are they used in navigation?
2. Name two key differences between natural and artificial satellites.
3. Why does the Moon experience extreme temperature variations?
4. What role do telescopes play in observing the night sky?
5. Explain the significance of comets in understanding the solar system.

H. Answer in detail.

1. Compare and contrast the features of natural and artificial satellites, with examples.
2. Discuss the impact of light pollution on stargazing and suggest ways to reduce it.
3. Explain the differences between the inner and outer planets of the solar system.
4. Describe the importance of the Sun in sustaining life on Earth and its role in the solar system.
5. How do astronomers use telescopes to study distant stars and galaxies?

NEP Corner

Know about NEP 2020

Focus on Mental Health!

NEP promotes wellness programs to support emotional and mental well - being.

Skill-based Activity

Constellation Mapping

STEM

Perform an experiment to understand the concept of constellations:

- Use black paper, a flashlight, and small holes punched into the paper to represent stars.
- Shine the flashlight through the paper onto a wall to project a constellation.

Questions:

- How do constellations help sailors and travelers find directions?
- Why do constellations appear to move in the night sky?
- Can the same constellation be seen from all parts of the Earth? Why or why not?

Skills Covered: Creativity, Logical Thinking, Observation, Applicative Thinking

The Solar System

Art

Create a poster illustrating the Sun, planets, and their unique features. Highlight the difference between inner planets, outer planets, and dwarf planets.

Skills Covered: Creativity, Awareness-building, Logical Thinking

Planning a Night Sky Observation

Group Activity

Imagine organizing a stargazing event to observe stars, planets, and constellations. Design a plan for the event.

Questions:

- How would you identify the best time and location for observing constellations?
- What equipment (e.g., telescopes, star maps) would you need, and how would you use them?
- How would you explain light pollution's impact on stargazing to participants?

Skills Covered: Planning, Teamwork, Critical Thinking, Problem-Solving

Investigating the Role of Satellites

Case to Investigate

Research how satellites (natural and artificial) play a crucial role in our lives.

Questions:

- How does Earth's Moon affect tides and stabilize the planet?
- What are the benefits of artificial satellites for communication and weather forecasting?
- Suggest ways to improve the efficiency of artificial satellites for global connectivity.

Skills Covered: Research, Logical Thinking, Analytical Reasoning

Innovative Uses of Telescopes in Astronomy

Aligning with SDGs

Research how telescopes contribute to space exploration and astronomy.

Questions:

- How have telescopes like Hubble and James Webb advanced our understanding of the universe?
- Why are telescopes located in remote areas or space?
- Suggest three innovative features for future telescopes to improve astronomical studies.

Aligned with SDGs:

SDG 4: Quality Education, **SDG 9:** Industry, Innovation, and Infrastructure

Skills Covered: Innovation, Applicative Thinking, Problem-Solving

Role of Astronomy in Understanding the Universe

Integrated Learning

Write a report on how the study of stars, planets, and galaxies has expanded humanity's knowledge of the cosmos.

Questions:

- What is the importance of constellations in ancient and modern astronomy?
- How do studies of asteroids and comets help predict potential threats to Earth?
- Discuss the role of space telescopes in exploring the boundaries of the universe.

Skills Covered: Integrated thinking, Logical reasoning, Research