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Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world.

– Louis Pasteur

The Ever-Evolving World of Science

The Big Question

Have you ever wondered why the sky looks blue, how a tiny seed becomes a towering tree, or what powers the light in your phone?

What if every question you ask is actually the first step into the fascinating and ever-changing world of science—guided by one powerful tool: your curiosity?

Meet EeeBee.AI

Hi explorers! I'm EeeBee, your science buddy! Join me in discovering how science shapes our world—through inventions, nature, and life itself. Let's explore the wonders of change together!

Still curious? Talk to me by scanning the QR code.

Learning Outcomes

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

- **Understand** that science is a process of inquiry, observation, and experimentation—not just facts.
- **Identify** how curiosity and questioning are fundamental to scientific exploration.
- **Recognize** the interconnectedness of different scientific fields in understanding the world.

From Last Year's Notebook

- Science Universe
- Scientific Method

Science Around You

Science is not confined to laboratories! From the weather forecast you check daily, the technology in your smartphones, the medicines that keep us healthy, to understanding climate change and finding sustainable solutions for our planet, science is deeply woven into the fabric of our lives and shapes our future.

NCF Curricular Goals and Competencies

Competency Goal (CG 3.1): Demonstrates the ability to observe, question, hypothesize, experiment, and draw conclusions using scientific methods. **Competency Goal (CG 3.2):** Applies scientific concepts to explain everyday phenomena and solve real-life problems using logical reasoning and creativity.

Mind Map

The Ever-Evolving World of Science

Science Explores the Vast and the Minute

- ❖ **Microscopic World:** Cells, revealed by microscopes.
- ❖ **Properties of Materials:** Features that define how a material looks, feels, or reacts.
  - ✓ **Physical (color, density).**
  - ✓ **Chemical (flammability, acidity).**
  - ✓ **Acids, Bases, Indicators (litmus test).**
  - ✓ **Classification → Metals & non-metals.**

Science Explains Changes Around Us

- ❖ **Heat & Energy:** Heat is energy transferred from a hot object to a cold one.
  - ✓ Conduction, Convection, Radiation.

- ❖ **Water Cycle:** Evaporation → Condensation → Precipitation.

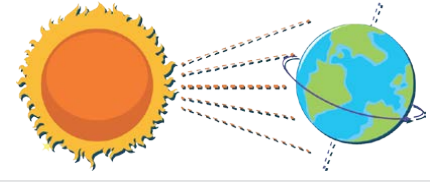
Science Investigates Life and Our Planet

- ❖ **Life Processes:** Nutrition, respiration, growth, movement, reproduction, excretion.
- ❖ **Earth's Systems:** Atmosphere, Hydrosphere, Lithosphere, Biosphere.
- ❖ **Human Impact & Sustainability:** Pollution, deforestation → Need for sustainability.

Science Measures and Understands Our Universe

- ❖ **Measuring Time**: Sundials → Atomic clocks.

- ❖ **Light & Shadows:** Eclipses (Solar & Lunar).
- ❖ **Earth's movements:** Rotation (Day/Night), Revolution **(Seasons).**



In Focus

- Science Explores the Vast and the Minute
- Science Explains Changes Around Us
- Science Investigates Life and Our Planet
- Science Measures and Understands Our Universe

Introduction

Science is more than memorizing facts. It's a dynamic process of inquiry and exploration—a way of thinking and investigating the universe. Derived from the Latin "*scientia*" (knowledge), science is about acquiring and refining understanding of the principles that govern our world.

From History's Pages

The journey of science is as old as humanity itself. Early humans observed patterns in nature – the movement of stars to navigate, the properties of plants for food and medicine. Think of ancient astronomers in Egypt or Mesopotamia charting the skies, or philosophers like Aristotle in Greece trying to explain natural phenomena. The "scientific revolution" (16th-18th centuries) with figures like Copernicus, Galileo, and Newton, emphasized systematic experimentation and mathematical reasoning, transforming how we investigate the world.

Science Explores the Vast and the Minute

Science is a tool to understand the entirety of our universe, from the largest **galaxies** to the smallest **subatomic particles**. It helps us classify and understand the properties of all the "stuff" – or matter – that makes up our world.

Exploring the Microscopic World

Many aspects of our world are too small to be seen with the naked eye. Science provides tools, like microscopes, to explore this hidden realm.

Fig. 1.1 Microscopic World

Keywords

Galaxies: Galaxies are massive collections of stars, planets, gas, dust, and dark matter held together by gravity, forming vast systems in the universe.

Subatomic Particles: Subatomic particles are the extremely small units—like protons, neutrons, and electrons—that make up atoms.

Cells as Building Blocks

All living things, from the smallest **bacterium** to the largest whale (and including plants like a leaf), are made up of tiny units called cells. Cells are the basic structural, functional, and biological units of all known living organisms.

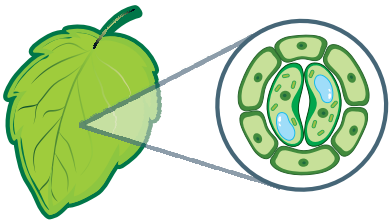


Fig. 1.2 Plant Cell from Leaf

Example: Plant cells (like those in a leaf) have specific structures like a cell wall (for support) and chloroplasts (for photosynthesis – making food). Animal cells have different structures suited to their functions.

Properties of Materials:

Science helps us understand why different materials behave the way they do. This involves studying their physical and chemical properties.

Physical Properties: These can be observed or measured without changing the chemical identity of the substance. Examples include color, odor, density, melting point, boiling point, hardness, and state (solid, liquid, gas).

Example: Water is a clear, odorless liquid at room temperature. Ice is the solid form of water.

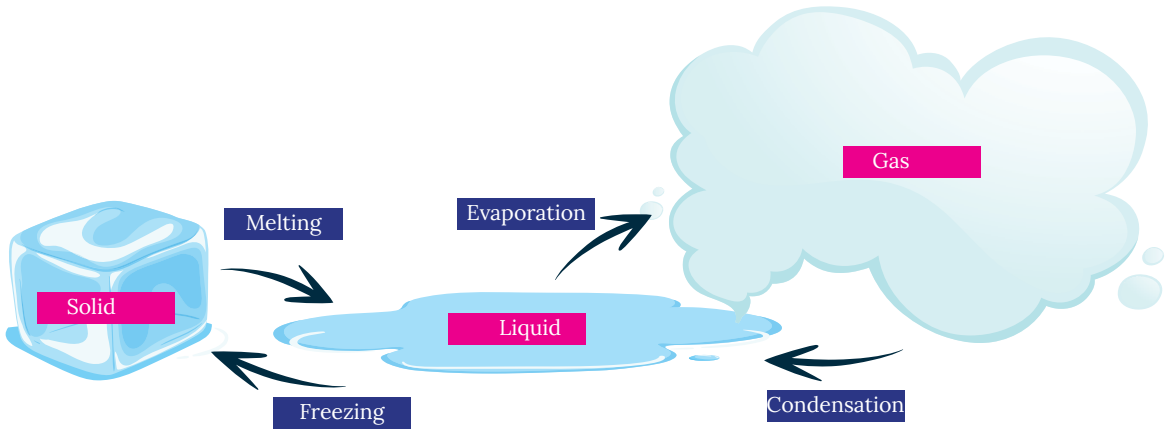


Fig. 1.3 Physical Changes of Water

Chemical Properties: These describe how a substance reacts with other substances or changes from one substance to another.

- The sour taste of fruits like lemons or unripe mangoes is due to the presence of acids. Acids are a class of chemical compounds.
- Turmeric (haldi) contains a natural substance called **curcumin**, which acts as an indicator. An indicator is a substance that changes color in the presence of an acid or a base.
- When a turmeric stain (yellow) comes into contact with soap (which is basic), it turns reddish-brown. This is a chemical reaction indicating the presence of a base. When rinsed with plenty of water, or if an acidic substance like lemon juice is applied, the stain might revert to yellow. This demonstrates a chemical property of turmeric and its interaction with acids and bases.

Fig. 1.4 Turmeric on Cloth

Keywords

Bacterium: A tiny single-celled organism; some cause disease, others are helpful.
Curcumin: A yellow compound in turmeric with anti-inflammatory and antioxidant properties.

Classifying Materials

Materials can be broadly classified based on their properties. One common classification is into metals and non-metals.

Metals

Metals (e.g., iron, copper, silver, gold, aluminum) are typically shiny, good conductors of heat and electricity, malleable (can be beaten into sheets), and ductile (can be drawn into wires)

Fig. 1.5 Silver

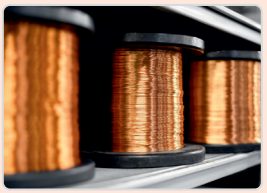


Fig. 1.6 Copper

Fig. 1.7 Aluminum

Fig. 1.8 Iron

Non-metals

Non-metals (e.g., carbon, sulfur, wood, plastic) are generally not shiny, are poor conductors of heat and electricity (insulators), and are often brittle if solid.

Fig. 1.9 Wood

Fig. 1.10 Plastic

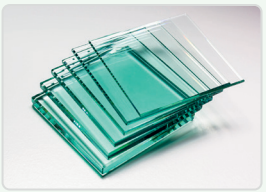


Fig. 1.11 Glass

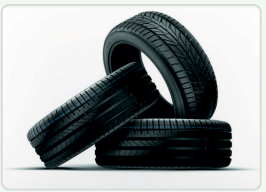


Fig. 1.12 Rubber

This classification is crucial in selecting materials for specific purposes (e.g., copper for electrical wires, wood for furniture handles).

Fact Flash

Your body is made up of an estimated 30-40 trillion cells! And every second, millions of old cells die and are replaced by new ones.

Common Misconceptions

- × **Misconception:** All tiny things are cells.
- ✓ **Correction:** Cells are specific to living organisms. There are many other microscopic things like dust particles, viruses (which are not considered fully alive by all scientists), or tiny crystals that are not cells.
- × **Misconception:** If something changes color, it's always a chemical change.
- ✓ **Correction:** While many color changes indicate chemical reactions (like turmeric with soap), some are physical. For example, painting a wall changes its color, but it's a physical change (covering the surface). Heating a metal might make it glow red, but it returns to its original color when cooled (physical change related to temperature).

Science Around You

Indicators are used in chemistry labs, soil testing (to determine if soil is acidic or alkaline for farming), and even in swimming pools to check water quality.

Activity

Homemade Indicator Test

- **Objective:** To observe how a natural indicator changes color with acidic and basic substances.
- **Materials Required:** Red cabbage (or beetroot or hibiscus flower petals), warm water, a blender (optional, or knife and mortar/pestle), filter paper (or fine cloth), small transparent cups/glasses, lemon juice (acidic), soap solution (basic), vinegar (acidic), baking soda solution (basic), plain water (neutral).

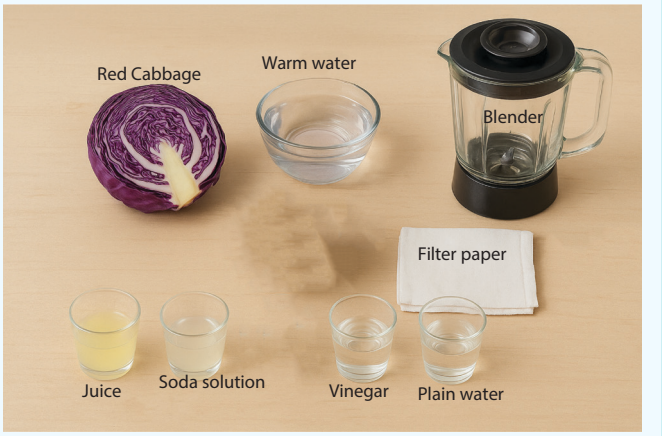


Fig. 1.13 Materials Required

- **Procedure:**
  1. Chop the red cabbage finely. Add a little warm water and crush/blend it to extract the colored juice.
  2. Filter the juice to get your red cabbage indicator solution (it will be purplish).
  3. Pour small, equal amounts of the indicator into several transparent cups.
  4. To one cup, add a few drops of lemon juice. Observe the color change.
  5. To another cup, add a few drops of soap solution. Observe the color change.
  6. Test other substances like vinegar, baking soda solution, and plain water. Record your observations. (Red cabbage juice turns pink/red with acids, and green/blue/yellow with bases).

Knowledge Checkpoint

Gap Analyzer™ Homework | Watch Remedial

Remembering

Multiple Choice Questions:

1. Which of these is a physical property of a substance?
   a) Flammability ☐ b) Reaction with acid ☐ c) Melting point ☐ d) Ability to rust ☐
2. Which of the following is generally a good conductor of electricity?
   a) Wood ☐ b) Plastic ☐ c) Copper ☐ d) Glass ☐

Understanding

3. Turmeric stain turns reddish-brown when soap is applied because soap is:
   a) Acidic ☐ b) Basic ☐
   c) Neutral ☐ d) An indicator itself ☐

Short Answer Question:

Applying

4. What are cells? Why is it important to study them?
5. Give two examples of metals and two examples of non-metals, and list one key property that distinguishes them.

Long Answer Question:

Analyzing

6. Explain the difference between physical and chemical properties of materials using at least two examples for each. How does understanding these properties help us in everyday life?

Science Explains Changes Around Us

The world is in a constant state of flux. Things grow, decay, move, and transform. Science helps us understand these changes, classify them, and even predict or control them. A key aspect of understanding change involves energy.

Heat and Its Role in Changes

Heat is a form of energy that can cause or speed up many physical and chemical changes.

Heat Flow (Transfer): Heat energy always flows from a hotter object/region to a cooler object/region. This can happen in three main ways:

Conduction

Transfer of heat through direct contact, mainly in solids. (e.g., a metal spoon getting hot when placed in hot soup).

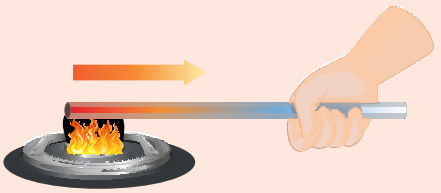


Fig. 1.14 Heat Conduction in Metals

Convection

Transfer of heat through the movement of fluids (liquids or gases). (e.g., boiling water, warm air rising).

Fig. 1.15 Convection in Boiling Water

Radiation

Transfer of heat through **electromagnetic waves**, which can travel through empty space. (e.g., heat from the Sun reaching Earth, heat you feel from a bonfire).

Fig. 1.16 Radiation in Flame

Effects of Heat

- **Change in Temperature:** Adding heat generally increases the temperature of a substance.
- **Change in State:** Heat can cause substances to change state (e.g., ice melting to water, water boiling to steam).
- **Expansion:** Most substances expand when heated and contract when cooled.
- **Speeding up Chemical Reactions:** Heat often provides the energy needed for chemical reactions to occur or makes them happen faster (e.g., cooking food).

The Water Cycle – A Grand Display of Change:

1. **Evaporation:** The Sun's heat causes water from oceans, lakes, and rivers to turn into **water vapor** (a gas) and rise into the atmosphere.
2. **Transpiration:** Plants also release water vapor into the atmosphere from their leaves.
3. **Condensation:** As the water vapor rises, it cools and changes back into tiny liquid water droplets or ice crystals, forming clouds.

Keywords

Electromagnetic Waves: Waves of electric and magnetic fields that travel through space carrying energy without needing a medium.
Water Vapor: Water in its gaseous state present in the air, formed by evaporation or boiling.

4. **Precipitation:** When these droplets/crystals become too heavy, they fall back to Earth as rain, snow, sleet, or hail.
5. **Collection:** The water collects in rivers, lakes, oceans, or seeps into the ground (groundwater), and the cycle begins again.

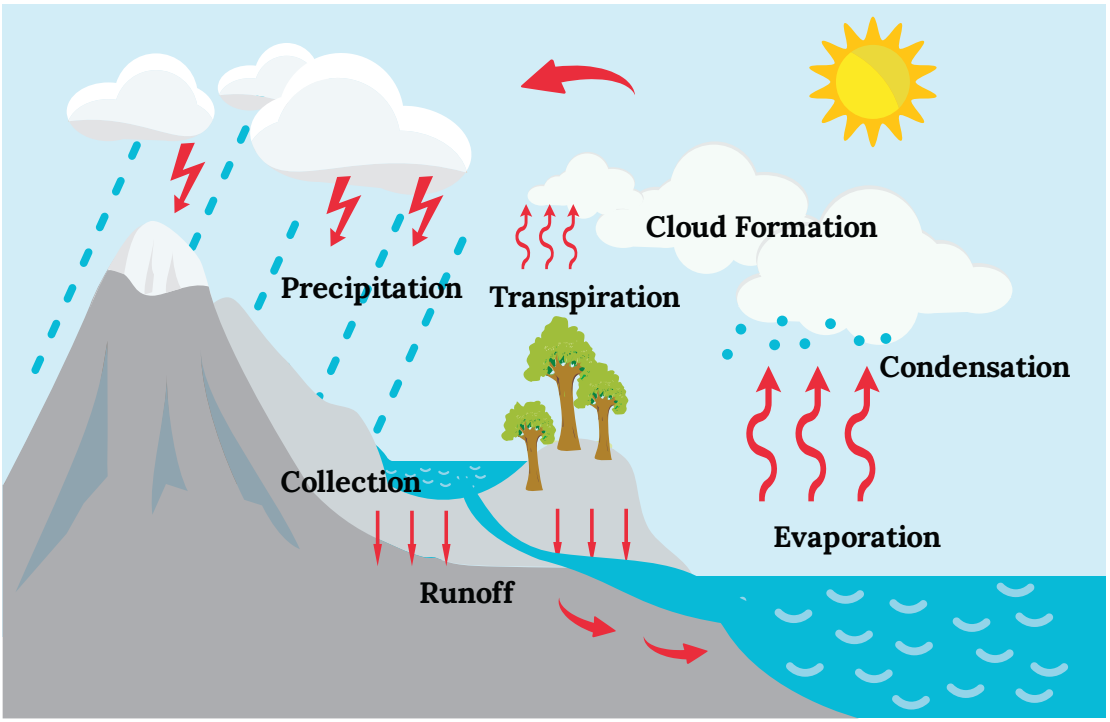


Fig. 1.17 Water Cycle

This continuous movement of water is vital for life on Earth.

Fact Flash

The water you drink today might have been part of a dinosaur's drinking water millions of years ago! The Earth's water is constantly recycled through the water cycle.

Common Misconceptions

- × **Misconception:** When water boils and turns to steam, the water disappears or is destroyed.
- ✓ **Correction:** Water changes its state from liquid to gas (steam/water vapor), but it is still water (H_2O). This is a physical change, and the steam can condense back into liquid water. Mass is conserved.
- × **Misconception:** Dissolving something (like sugar in water) is a chemical change because the sugar disappears.
- ✓ **Correction:** Dissolving is usually a physical change. The sugar particles spread out in the water, but they are still sugar. If you evaporate the water, you can get the sugar back.

Science Around You

Touching a metal spoon in hot soup shows conduction as heat moves particle to particle. Boiling water swirls because convection currents carry heat through the liquid. Sunlight warms your face through radiation, needing no air or contact to travel.

Activity

Reversible or Irreversible?

- **Objective:** To observe and classify changes as reversible or irreversible.
- **Materials Required:** A piece of paper, a candle, matchbox, an ice cube in a dish, a small amount of sugar, a spoon, water in a glass, a raw egg.

Fig. 1.18 Materials Required

Procedure:

1. **Paper:**
   a. Fold the paper. Is this change reversible? (Try to unfold it).
   b. Carefully (with adult supervision if using a candle), burn a small corner of the paper. Is this change reversible? (Can you get the original paper back from ash?).
2. **Ice Cube:** Observe the ice cube melting. Is this reversible? (Think about how you could get ice back).
3. **Sugar & Water:** Dissolve a small amount of sugar in water. Taste it (optional, if clean). Is this change easily reversible in the classroom? (Think about evaporation).
4. **Egg (Observation/Discussion):** Think about a raw egg. If you fry it, is the change reversible?

- **Record:** For each action, note down your observation and classify the change as physical or chemical, and reversible or irreversible.

Knowledge Checkpoint

Gap Analyzer™ Homework | Watch Remedial

Understanding | Remembering | Analyzing | Applying | Create

Multiple Choice Questions:

1. Which of the following is an example of a chemical change?
   a) Melting of wax ☐ b) Baking a cake ☐
   c) Dissolving salt in water ☐ d) Tearing a piece of cloth ☐
2. Heat transfer from the Sun to the Earth primarily occurs through:
   a) Conduction ☐ b) Convection ☐ c) Radiation ☐ d) Evaporation ☐
3. The change of water vapor into liquid water on cooling is called:
   a) Evaporation ☐ b) Condensation ☐ c) Precipitation ☐ d) Melting ☐

Short Answer Question:

4. Give two differences between a physical change and a chemical change.
5. Describe the three ways heat can be transferred, with one example for each.

Long Answer Question:

6. Explain the water cycle with a neat, labeled diagram. Why is this cycle important for life on Earth? Mention the types of physical changes involved.

Science Investigates Life and Our Planet

Science is not just about non-living things; it's also crucial for understanding life itself and the complex interactions on our planet. Biology (the study of life) and Earth science (the study of the Earth) are vast fields that show how interconnected everything is.

Essential Life Processes

All living organisms, from the simplest bacteria to complex animals and plants, carry out certain basic processes to stay alive, grow, and reproduce.

1. **Nutrition:** All living things need food to get energy and materials for growth and repair.
   - **Animals:** Get food by eating plants or other animals. (e.g., humans eat fruits, vegetables, grains, meat).
   - **Plants:** Make their own food through a process called photosynthesis, using sunlight, water, and carbon dioxide from the air.
2. **Respiration:** This is the process by which living organisms release energy from food. It usually involves taking in oxygen and releasing carbon dioxide.
3. **Growth and Development:** Living things grow and change throughout their lives.
4. **Movement:** Most animals can move from place to place. Plants also show movement, like turning towards sunlight or roots growing downwards.
5. **Reproduction:** Living things produce offspring of their own kind to continue their species.
6. **Excretion:** Getting rid of waste products from the body.
7. **Circulation (in many animals):** Transporting substances like nutrients, oxygen, and waste products around the body (e.g., blood circulation in humans).

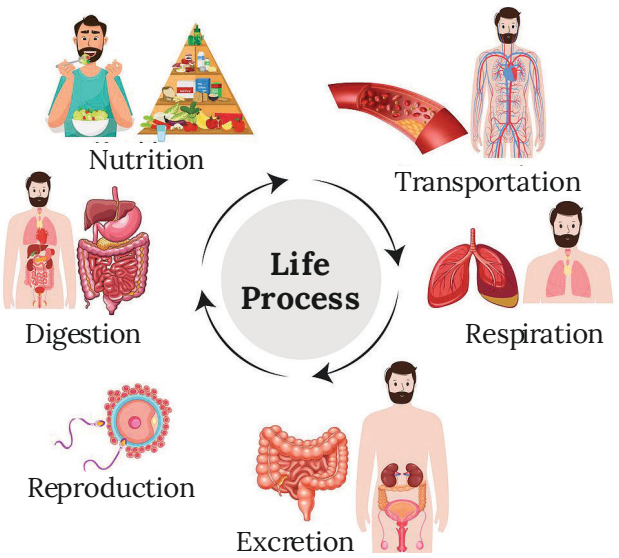


Fig. 1.19 Life Process

Earth's Dynamic Systems

Our planet Earth is not static. It has several interconnected systems that influence life.

- **Atmosphere:** The blanket of gases surrounding the Earth, providing air to breathe and regulating temperature.
- **Hydrosphere:** All the water on Earth (oceans, lakes, rivers, groundwater, ice caps).
- **Lithosphere/Geosphere:** The solid Earth (rocks, soil, landforms).
- **Biosphere:** All living organisms on Earth and the environments where they live.

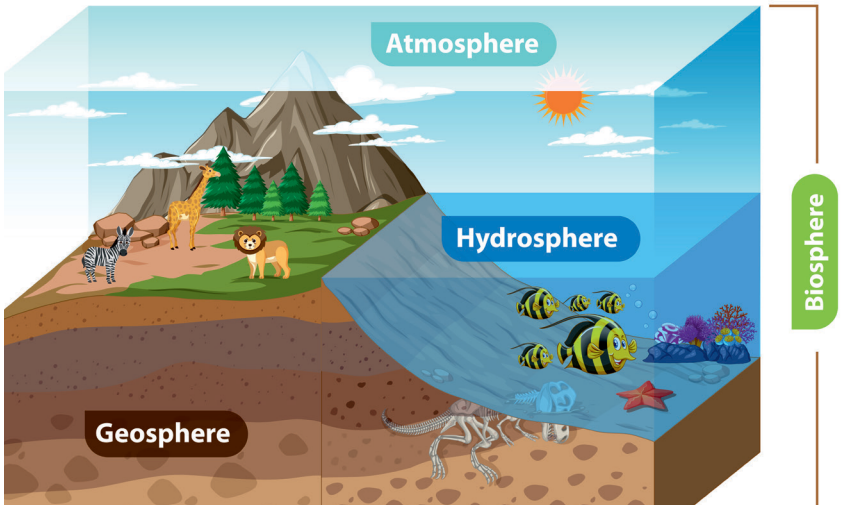


Fig. 1.20 Earth Systems

These systems constantly interact. For example, the water cycle (hydrosphere) interacts with the atmosphere and lithosphere, and is essential for the biosphere.

Common Misconceptions

× **Misconception:** Plants only perform photosynthesis and do not respire.

✓ **Correction:** Plants respire 24 hours a day, just like animals, to get energy from the food they produce. Photosynthesis only occurs in the presence of light.

× **Misconception:** Only large-scale industrial pollution harms the environment; small individual actions don't matter.

✓ **Correction:** While industrial pollution is a major concern, the cumulative effect of individual actions (like littering, wasting water or electricity) also significantly impacts the environment. Every positive action helps, change related to temperature.

Science Around You

Understanding ecosystems helps us appreciate the balance of nature and the importance of conserving biodiversity, whether in a large forest or a small pot.

Knowledge Checkpoint

Gap Analyzer™ Homework | Watch Remedial

Remembering

Multiple Choice Questions:

1. The process by which plants make their own food is called:

   a) Respiration ☐ b) Photosynthesis ☐ c) Transpiration ☐ d) Pollination ☐

2. Which of the following is an abiotic component of an ecosystem?

   a) A tree ☐ b) A deer ☐ c) Sunlight ☐ d) A fungus ☐

Understanding

3. Sustainability primarily means:

   a) Using all resources as quickly as possible. ☐

   b) Meeting present needs without compromising future generations' needs. ☐

   c) Stopping all human development. ☐

   d) Focusing only on economic growth. ☐

Short Answer Question:

Applying

4. List three essential life processes common to most living organisms.
5. Explain how human activities can impact the environment, giving one example.

Long Answer Question:

Analyzing

6. What is an ecosystem? Describe the interdependence between plants, herbivores, and carnivores in a simple food chain. Why is this interdependence important?

Science Measures and Understands Our Universe

Science strives to understand the fundamental forces and phenomena that shape our universe, including concepts like time, light, and the motion of celestial bodies. Measurement is a key tool in this endeavor.

Measuring Time

Time is a fundamental concept, and its measurement has evolved significantly.

Early Methods:

Long before the age of electric clocks and digital watches, early humans observed the shadows of objects in the Sun and used the position of the shadows to tell the time.

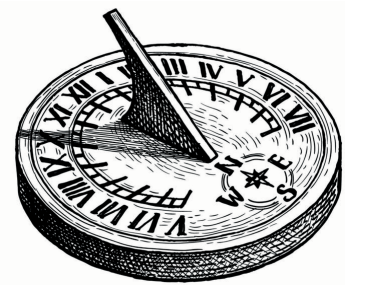


Fig. 1.21 Sundial

- **Sundials:** Used the changing position and length of a shadow cast by a gnomon (a fixed object) as the Sun moved across the sky.
- **Water Clocks (Clepsydra):** Measured time by the regulated flow of water into or out of a vessel.
- **Hourglasses:** Used the flow of sand from one bulb to another.

Modern Methods:

- **Mechanical Clocks:** Use oscillating systems like pendulums or balance wheels, with gears to mark time.
- **Electric and Digital Clocks:** Use electronic oscillators (e.g., quartz crystals) for very precise timekeeping.
- **Atomic Clocks:** The most accurate timekeeping devices, based on the vibrations of atoms. They are used to define the standard second.
- **Units of Time:** Second, minute, hour, day, week, month, year.

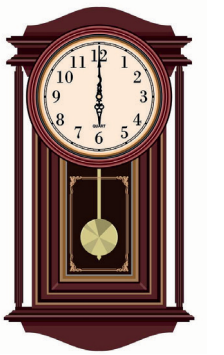


Fig. 1.22 Mechanical Clock

Light and Shadows

Light is a form of energy that allows us to see the world.

- **Rectilinear Propagation of Light:** Light travels in straight lines. This property is responsible for the formation of shadows.
- **Shadow Formation:** A shadow is an area where light from a source is blocked by an opaque object. The shape of the shadow often resembles the shape of the object.
- The size of the shadow depends on the distance between the light source, the object, and the screen/surface where the shadow is formed.
- **Eclipses – Celestial Shadows:** Even the Earth and the Moon can cast shadows, leading to the fascinating phenomena of eclipses.

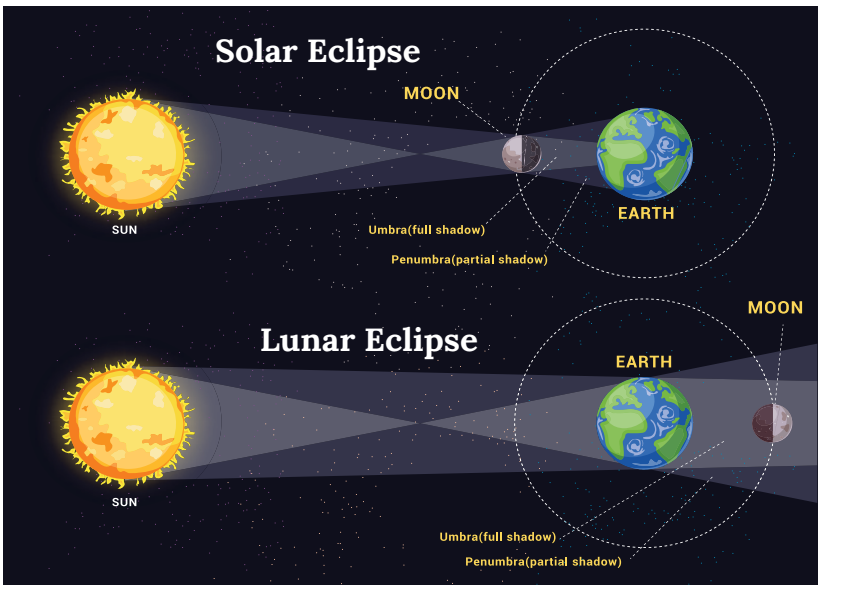


Fig. 1.23 Solar and Lunar Eclipses

- **Solar Eclipse:** Occurs when the Moon passes between the Sun and Earth, and the Moon's shadow falls on Earth. The Sun appears to be partially or totally covered.
- **Lunar Eclipse:** Occurs when the Earth passes between the Sun and Moon, and the Earth's shadow falls on the Moon. The Moon appears dim or reddish.

Earth's Movements and Their Consequences

Our planet is constantly in motion, and these movements have **profound effects**.

Rotation:

- The Earth spins on its axis (an imaginary line passing through the North and South poles).
- One complete rotation takes approximately 24 hours.
- **Consequence:** Causes day and night. The side of the Earth facing the Sun experiences day, while the side facing away experiences night.

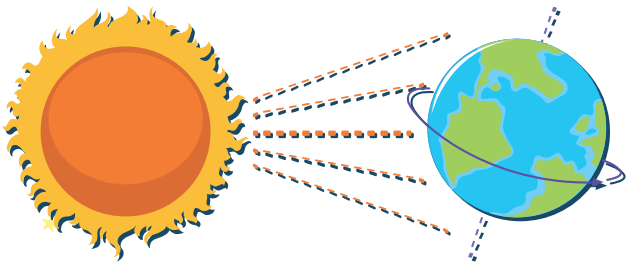


Fig. 1.24 Rotation of Earth

Revolution:

- The Earth travels in a fixed elliptical path (orbit) around the Sun.
- One complete revolution takes approximately 365.25 days (which is why we have a leap year every four years).
- **Consequence:** Combined with the tilt of Earth's axis (23.5 degrees), revolution causes the seasons (summer, winter, autumn, spring). Different parts of the Earth receive more direct sunlight at different times of the year.

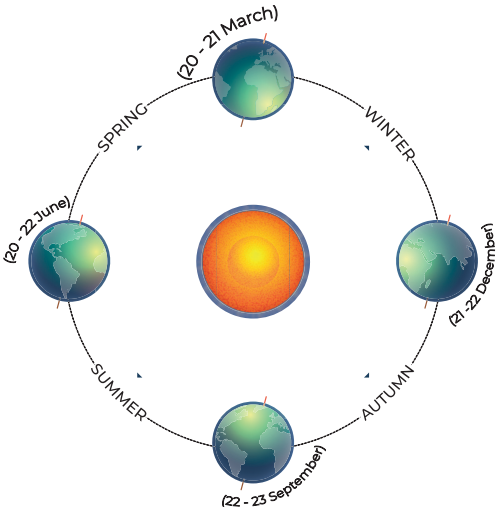


Fig. 1.25 Revolution of Earth

Fact Flash

It takes about 8 minutes and 20 seconds for light from the Sun to reach Earth! So, when you look at the Sun (don't look directly!), you are seeing it as it was over 8 minutes ago.

Common Misconceptions

× **Misconception:** Seasons are caused by the Earth being closer to or farther from the Sun during its orbit.

✓ **Correction:** While Earth's orbit is slightly elliptical, the primary cause of seasons is the tilt of Earth's axis. When a hemisphere is tilted towards the Sun, it receives more direct sunlight and experiences summer; when tilted away, it experiences winter.

Science Around You

Science uses tools and numbers to explore stars, planets, and space. From measuring Earth's gravity to the distance between galaxies, it reveals vast truths. Telescopes catch starlight from billions of years ago, helping us see the past.

Keywords

Profound Effects: It refers to significant impact caused by Earth's rotation and revolution, such as day-night cycles, seasons, tides, and climatic patterns.

Activity

Making a Simple Sundial

- **Objective:** To understand how shadows can be used to indicate time.
- **Materials Required:** A paper plate, a pencil or straight stick (gnomon), modeling clay or tape, a compass.
- **Procedure:**
  1. Find a flat, sunny spot outdoors where the sundial can remain undisturbed for several hours.
  2. Push the pencil/stick through the center of the paper plate so it stands upright. Use modeling clay or tape to secure it firmly at a slight angle (if you know your latitude, tilting it to that angle towards North, if in the Northern Hemisphere, is ideal, but even vertical can work for a simple demonstration).
  3. Place the sundial on the ground.
  4. Starting in the morning (e.g., 9 AM), mark the position of the tip of the pencil's shadow on the plate. Write the time next to the mark.
  5. Repeat this every hour (e.g., 10 AM, 11 AM, 12 PM, 1 PM, 2 PM) for as long as possible.
- **Observe:** How does the shadow change its length and direction throughout the day?

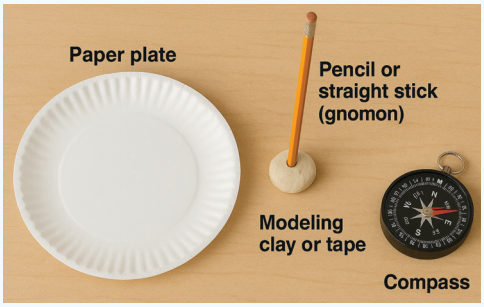


Fig. 1.26 Materials Required

Knowledge Checkpoint

Gap Analyzer™ Homework | Watch Remedial

Remembering

Multiple Choice Questions:

1. Day and night on Earth are caused by:
   a) Earth's revolution around the Sun. ☐
   b) Earth's rotation on its axis. ☐
   c) The Moon's revolution around Earth. ☐
   d) Changing distance between Earth & Sun. ☐

Understanding

2. Which of these early devices used the flow of water to measure time?
   a) Sundial ☐ b) Hourglass ☐ c) Clepsydra ☐ d) Pendulum clock ☐
3. A solar eclipse occurs when:
   a) The Earth is between the Sun and Moon. ☐ b) The Sun is between the Earth and Moon. ☐
   c) The Moon is between the Sun and Earth. ☐ d) The Earth's shadow falls on the Sun. ☐

Short Answer Question:

Applying

4. Explain why shadows are formed. How does the property of light relate to this?
5. What are the two main movements of the Earth, and what is one major consequence of each movement?

Long Answer Question:

Analyzing

6. Describe how early humans might have measured time before the invention of mechanical clocks. Explain the principle behind one such method. Why is accurate time measurement important in modern society?

SUMMARY

1. Science Explores the Vast and the Minute:

Science investigates all matter, from microscopic cells to large-scale structures, by studying its properties.

- **Microscopic World:** Tools like microscopes reveal hidden structures such as cells, the basic units of life. Plant cells (e.g., in a leaf) and animal cells have distinct structures related to their functions.

Properties of Materials:

- **Physical Properties:** Observable without changing chemical identity (e.g., color, density, melting point).
- **Chemical Properties:** Describe reactivity and how substances change chemically (e.g., acidity, flammability).
- **Acids and Bases:** Acids (e.g., in sour fruits) and bases are chemical categories. Indicators (like turmeric) change color in their presence. Turmeric turns reddish-brown with basic soap.
- **Classification:** Materials are classified based on properties (e.g., metals – shiny, conductive; non-metals – dull, insulators). This helps in practical application.

2. Science Explains Changes Around Us:

Science helps understand and classify changes in matter, often involving energy transformations.

- **Heat and Energy:** Heat is energy flowing from hot to cold (via conduction, convection, radiation). It causes temperature change, state change (melting glaciers), expansion, and faster reactions.
- **Water Cycle:** A global system of physical changes (evaporation, condensation, precipitation) driven by solar energy, crucial for water distribution.

3. Science Investigates Life and Our Planet:

Science explores living organisms, their processes, and Earth's systems, emphasizing sustainability.

- **Life Processes:** Include nutrition (plants via photosynthesis, animals by consumption), respiration, growth, movement, reproduction, and excretion.
- **Earth's Systems:** Atmosphere (gases), hydrosphere (water), lithosphere (land), and biosphere (life) interact constantly.
- **Human Impact & Sustainability:** Human activities (pollution, deforestation) affect these systems. Science supports sustainable solutions to meet present needs without harming future generations.

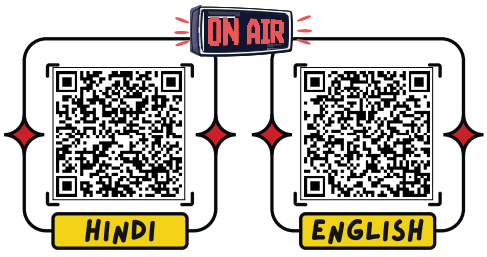
4. Science Measures and Understands Our Universe:

Science uses measurement and observation to understand time, light, and celestial motion.

- **Measuring Time:** From sundials and water clocks to precise atomic clocks.
- **Light and Shadows:** Light travels straight, forming shadows. This explains solar (Moon's shadow on Earth) and lunar (Earth's shadow on Moon) eclipses.

  Earth's Movements:

  - **Rotation:** Causes day and night (24 hours).
  - **Revolution:** Around the Sun (365.25 days) and tilt cause seasons.



Example Based Questions

Multiple Choice Questions

1. Which tool is used to study the microscopic world, such as cells?

(a) Telescope (b) Microscope

(c) Barometer (d) Periscope

Answer: (b) Microscope

Explanation: A microscope magnifies tiny objects invisible to the naked eye. It is used to study plant and animal cells, which are the basic units of life. Telescopes, in contrast, are used to study large celestial objects.

2. Turmeric changes colour to reddish-brown when soap solution falls on it. This shows that soap is:

(a) Acidic (b) Neutral

(c) Basic (d) Neither acid nor base

Answer: (c) Basic

Explanation: Turmeric acts as a natural indicator. It remains yellow in acids but turns reddish-brown in bases. Soap is a base, so it changes the colour.

Short Answer Questions

3. Differentiate between physical and chemical properties of matter with one example each.

Answer:

- Physical properties can be observed without changing a substance's identity. Example: Melting point of ice (0°C).
- Chemical properties describe how a substance reacts to form new substances. Example: Flammability of paper, which burns to form ash and gases.

Thus, physical properties help in identification, while chemical properties explain reactivity.

4. How does heat play a role in the water cycle?

Answer:

Heat from the Sun drives the water cycle:

- It causes evaporation of water from oceans and lakes.
- Vapour rises and condenses into clouds.
- Clouds lead to precipitation (rainfall/snow).

This continuous cycle redistributes water on Earth, supporting life and ecosystems.

5. What are Earth's four major systems, and how do they interact?

Answer:

- Atmosphere: Air and gases.
- Hydrosphere: All water bodies.
- Lithosphere: Land and rocks.
- Biosphere: Living organisms.

These systems are interconnected. For example, rainfall (hydrosphere) nourishes crops (biosphere) that grow on soil (lithosphere) and depend on air (atmosphere) for photosynthesis.

Long Answer Questions

6. Explain the differences between Earth's rotation and revolution. How do these movements affect our lives?

Answer:

- **Rotation:**
  - Earth spins on its axis once in 24 hours.
  - Causes day and night.
  - Influences local time zones and daily temperature cycles.
- **Revolution:**
  - Earth orbits around the Sun once in 365.25 days.
  - Combined with Earth's tilt, causes seasons (summer, winter, etc.).
  - Affects agriculture, animal behaviour, and climate patterns.

Conclusion: Rotation and revolution are essential in maintaining life rhythms, weather systems, and biodiversity on Earth. Without them, life as we know it would not exist.

EXERCISE

Gap Analyzer™
Complete Chapter Test

A. Choose the correct answer.

1. Which of the following is a physical property of matter?
   (a) Flammability ☐ (b) Reactivity ☐
   (c) Density ☐ (d) Combustion ☐
2. The water cycle is primarily driven by:
   (a) Moonlight ☐ (b) Wind energy ☐
   (c) Solar energy ☐ (d) Geothermal heat ☐
3. Microscopes are primarily used to observe:
   (a) Stars ☐ (b) Cells ☐
   (c) Rocks ☐ (d) Planets ☐
4. What causes seasons on Earth?
   (a) Earth's shape ☐ (b) Earth's tilt and revolution ☐
   (c) Earth's magnetic field ☐ (d) Earth's core heat ☐
5. Which of the following is a chemical change?
   (a) Freezing water ☐ (b) Cutting paper ☐
   (c) Burning wood ☐ (d) Melting wax ☐

B. Fill in the blanks.

1. _____ is the process through which living beings obtain and utilize food.
2. The _____ layer of Earth includes air and gases essential for life.
3. _____ clocks are the most accurate timekeeping devices developed so far.
4. _____ changes involve formation of new substances.
5. Acids and bases can be detected using _____.

C. Write True or False.

1. Chemical properties can be observed without changing the substance. _____
2. The tilt of the Earth does not affect the occurrence of seasons. _____
3. Plant and animal cells have structures suited to their functions. _____
4. Science involves only observation and no experimentation. _____
5. Conservation of mass states that matter is neither created nor destroyed. _____

D. Define the following terms.

1. Radiation
2. Physical Change
3. Ecosystem
4. Indicator
5. Electromagnetic Energy

E. Match the columns.

	Column A		Column B
1.	Microscopes	(a)	Interdependent living systems
2.	Light	(b)	Observe cells
3.	Biosphere	(c)	Travels in straight lines
4.	Conduction	(d)	Chemical change
5.	Burning	(e)	Method of Heat Transfer

F. Assertion and Reason

Instructions: For each question, two statements are given: Assertion (A) and Reason (R). Choose the correct option:

a) Both A and R are true, and R is the correct explanation of A.

b) Both A and R are true, but R is not the correct explanation of A.

c) A is true, but R is false.

d) A is false, but R is true.

1. **Assertion:** Science is a self-correcting process.

Reason: Scientific knowledge changes with new evidence.

2. **Assertion:** Bases change the color of turmeric.

Reason: Turmeric is a chemical indicator.

3. **Assertion:** Metals are good conductors of electricity.

Reason: They have free electrons that help in conduction.

G. Give reasons for the following statements.

1. Ice melts into water without forming a new substance.
2. Science is considered a dynamic and evolving process.
3. Turmeric changes color when exposed to a base.
4. Burning is an example of a chemical change.
5. Light causes shadows and eclipses.

H. Answer in brief.

1. What are the different types of Earth movements?
2. Describe two physical properties and two chemical properties of substances.
3. How do plant and animal cells differ in structure and function?
4. What are the main components of Earth's systems?
5. How does Earth's revolution around the sun affect seasons?

I. Answer in detail.

1. Explain the types involved in the heat transfer and explain one example from each.
2. Describe the water cycle in detail and explain how solar energy powers it.
3. Compare and contrast physical and chemical changes with examples.
4. How do human activities disrupt ecosystems, and how can science help?
5. Discuss how our understanding of time and light has evolved through scientific discoveries.

SKILL-BASED PRACTICE

Activity Time

STEM

Exploring Physical and Chemical Changes at Home

Materials Needed: Sugar (2–3 teaspoons), Candle and matchbox/lighter, Vinegar (½ cup), Baking soda (2 teaspoons), Metal spoon, Small bowl or glass.

Materials Required

Activity Steps

1. **Heating Sugar**
   - Place a small amount of sugar in a metal spoon.
   - Heat it gently using a candle flame.
   - Observe the colour and smell as the sugar changes.
2. **Candle Wax**
   - Light the candle.
   - Watch carefully as the solid wax melts near the flame.
   - Notice also how the liquid wax burns to give light and smoke.
3. **Vinegar and Baking Soda Reaction**
   - Take a bowl and pour some vinegar into it.
   - Add a teaspoon of baking soda and watch the fizzing and bubbling.
   - Observe the gas formation.

Questions:

1. Which of the changes you observed were physical and which were chemical?
2. What signs (colour change, smell, gas bubbles, smoke) helped you identify whether a new substance was formed?
3. Which of the changes were reversible? Which were irreversible? Why?
4. How does this activity show that science, technology, and math are connected in everyday life?

Skills Covered: Observation, Scientific Reasoning, Critical Thinking, Classification skills

Creativity

Art

Earth's Movements and Their Consequences

Materials Required: Chart paper or drawing sheet, Coloured pencils/markers/sketch pens, Compass or round objects (for drawing circles), Glue, scissors (optional).

Materials Required

Activity Steps

1. **Draw the Earth and Sun**
   - On your chart, draw the Sun at the center and Earth in two different positions:
   - Rotation (Earth spinning on its axis → day and night).
   - Revolution (Earth revolving around the Sun → seasons).
2. **Show the Consequences**
   - Use arrows to indicate rotation and label it as causing day and night.
   - Draw Earth in at least four positions around the Sun (spring, summer, autumn, winter) to show how revolution leads to seasons.
3. **Add Creativity**
   - Colour the Sun, Earth, and seasons brightly.
   - Add small drawings (e.g., a sunrise/sunset for day & night, trees with snow/leaves for seasons).

Questions:

1. Which two main movements of the Earth did you show in your poster?
2. How does rotation cause day and night on Earth?
3. How does revolution cause changes in seasons?
4. Which part of your drawing was most creative or fun to make?

Skills Covered: Scientific Reasoning, Presentation skills, Critical Thinking, Fine Motor skills

Matter All Around

Group Activity

Work in a group and collect samples of different materials from home or school (e.g., plastic cup, metal spoon, wooden stick, cotton fabric).

Classify the materials based on their physical and chemical properties such as:

Appearance (shiny/dull), hardness, flexibility, Ability to conduct heat/electricity, Reaction to vinegar or turmeric

Questions:

1. How did your group test and classify the materials?
2. What physical and chemical properties helped you in classification?
3. Which materials were best suited for specific uses and why?

Skills Covered: Classification, Analysis, Teamwork, Communication, Scientific Investigation

The Curious Case of the Classroom Plant

Case Study

Read the given passage below and answer the question:

Rohan's Grade 7 class has a small potted plant kept on the windowsill. For the first few weeks of term, it seemed healthy and green. Recently, Rohan noticed that the leaves on the side of the plant facing away from the window are starting to look a bit yellow and droopy, while the leaves facing the window still look quite green. He remembers the teacher watering it regularly. He wonders what might be happening.

Questions:

1. What specific changes did Rohan observe about the plant? (Focus on what he saw).
2. What questions might Rohan ask about the plant based on his observations? List at least three.
3. How might sunlight or its direction be affecting the plant? What science ideas connect to this?
4. If Rohan wanted to be a "young science explorer" as the chapter suggests, what simple thing could he do next to investigate his questions further (even without special equipment)?

Skills Covered: Observation, Scientific Investigation, Critical Thinking, Experimental Thinking

National Geographic & NASA Climate Education

Source Based Question

"Science investigates the universe at every scale—from the microscopic cells that form living beings to the immense systems that regulate our planet. Microscopes reveal the tiny structures of plant and animal cells, each with special features that allow them to function. At the other extreme, satellites in space help scientists study Earth's climate, water cycle, and energy flows. Matter has both physical properties, such as color and melting point, and chemical properties, such as acidity or flammability. These properties help classify substances as metals, non-metals, acids, or bases. For example, natural indicators like turmeric change color in contact with soap because soap is basic. Science also explains changes around us: heat energy flows from hot to cold, driving phenomena like melting glaciers, boiling water, and global circulation. Understanding both the smallest cells and the largest planetary systems shows how science connects every scale of life and matter."

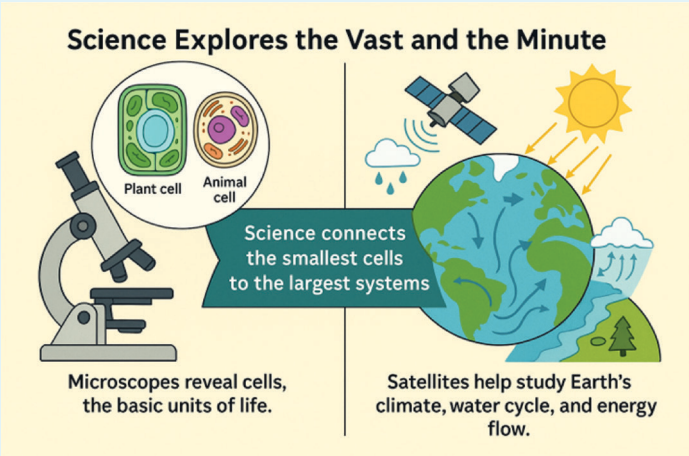


Image Credit: NASA Climate Education

Questions:

1. **Microscopic World**
   - What tool allows scientists to study cells in detail?
   - How are plant cells and animal cells different in their structures and functions?
2. **Properties of Materials**
   - Give one example of a physical property and one example of a chemical property mentioned in the passage.
   - Why do scientists use indicators like turmeric when studying substances?
3. **Energy and Change**
   - According to the passage, how does heat energy flow, and what changes can it cause in matter?
   - How is the melting of glaciers an example of energy-driven change?
4. **Connecting the Vast and the Minute (Critical Thinking)**
   - Why is it important that science studies both very small things (like cells) and very large systems (like climate)?
   - Imagine you are a scientist: how could learning about cell functions help you understand bigger systems like human health or the environment?

Skills Covered: Observation and analysis, Scientific reasoning, Classification and comparison