6 Chapter

Materials around Us

We'll cover the following key points:
- Materials around us
- Grouping Materials According to Their Characteristics
- Characteristics of Frequently Used Materials

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Learning Outcomes

By the end of this chapter, students will be able to:
- Identify and understand the variety of materials present in their surroundings.
- Classify materials based on their characteristics, such as texture, appearance, and usage.
- Analyze the properties of materials frequently used in daily life.
- Explore the connection between the properties of materials and their specific applications.

Guidelines for Teachers

The educator can introduce this topic by explaining the concept of materials and their significance in daily life. They may emphasize the properties that differentiate materials, such as hardness, transparency, or solubility. Hands-on activities, like sorting and grouping common materials, will engage students and make learning interactive. Encouraging discussions about why certain materials are used for specific purposes will enhance critical thinking and understanding. The educator should strive to create an engaging learning environment that encourages curiosity and active participation.

NCF Curricular Goals and Competencies

This chapter aligns with the following curricular goals and competencies:
CG-3 (C 3.1, 3.2, and 3.3) explores the characteristics, classification, and uses of materials in our surroundings, fostering scientific observation and analysis.

Introduction

The world around us is made up of a diverse range of materials, each serving a unique purpose in our daily lives. From natural materials like wood, cotton, and metals to synthetic ones like plastics and glass, these resources are the building blocks of modern civilization. They are essential in constructing our homes, making our clothes, and even in advanced technologies. Understanding the properties and uses of these materials helps us appreciate their role and encourages sustainable practices.

In History...

Early humans relied on naturally available materials like stones, wood, and animal skins for tools and shelter. The discovery of metals, such as copper and bronze, marked the beginning of the Bronze Age, leading to significant advancements in tools and weapons. Later, the Iron Age revolutionized construction and trade with stronger materials. Natural materials like wood, clay, and metals were initially harnessed, followed by the invention of synthetic materials such as plastic in modern times.

Materials around us

Ria and Kabir are in a science exhibit, surrounded by various materials like metals, plastics, and glass.
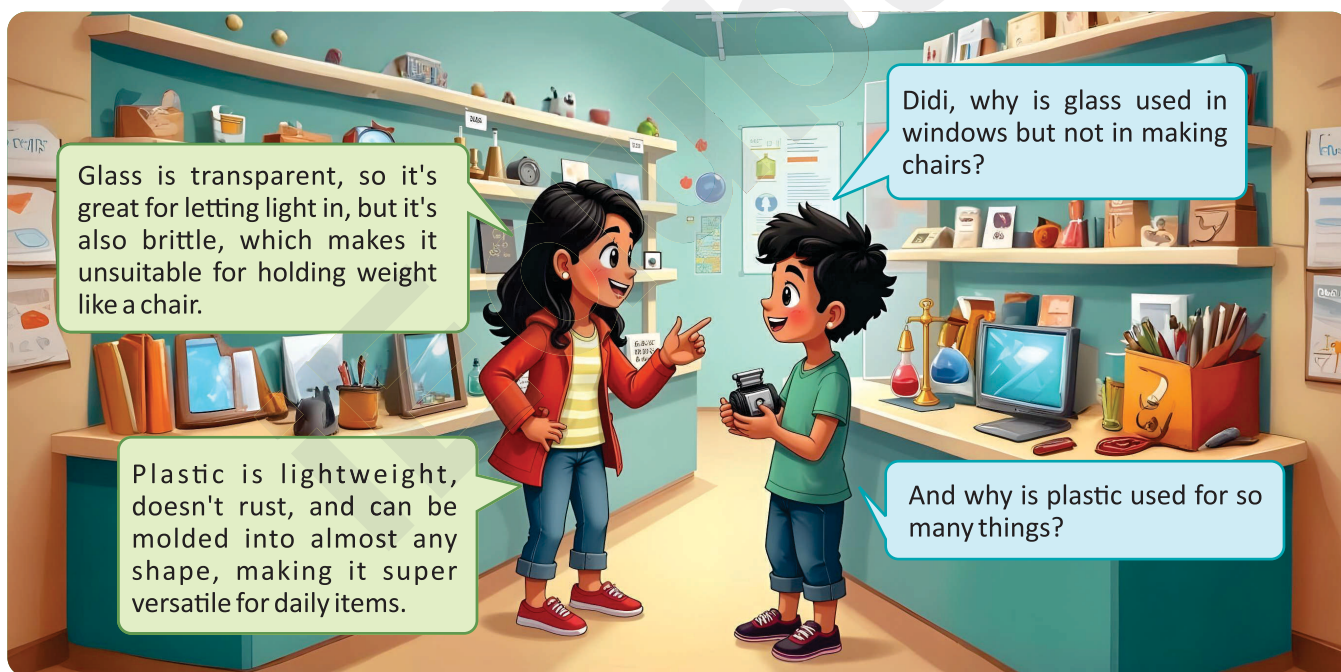
The world is teeming with a fascinating diversity of living and non-living things, each uniquely shaped, colored, and serving a variety of purposes. These entities are crafted from a wide range of materials, including cotton, glass, metal, mud, paper, plastic, and wood.

Materials form the foundation of everything we see around us—they are substances that enable the creation of countless objects. While some things, like trees or buildings, are visible to the naked eye, others, such as air or microscopic organisms, remain hidden from plain sight but are no less vital to our world.

Classification of Materials

Classification refers to the systematic grouping of materials based on their specific properties. These properties help determine the best use for a material in various applications. The major classifications are:

Hardness

- **Hard Materials:** Resist deformation, such as metals and stones.
- **Soft Materials:** Easily **deformed** or compressed, like cotton and sponge.

Lustre

- **Lustrous Materials:** Reflect light and appear shiny, such as gold or glass.
- **Non-lustrous Materials:** Have a **dull appearance**, like wood or clay.

Transparency

- **Transparent Materials:** Allow light to pass through completely (e.g., clear glass).
- **Opaque Materials:** Block all light (e.g., wood, metal).
- **Translucent Materials:** Allow partial light to pass through (e.g., frosted glass).

Hard

Soft

Lustrous

Non-Lustrous

Transparent

Opaque

Translucent

Conductivity

- **Conductors:** Allow electricity or heat to pass through (e.g., copper, aluminum).
- **Insulators:** Prevent the flow of electricity or heat (e.g., plastic, rubber).

Conductors

Insulators

KEYWORDS

Deformed: When something is bent, twisted, or out of its normal shape, we say it is deformed. It does not look like it is supposed to.

Dull Appearance: When something lacks brightness or shine and looks faded or boring, we say it has a dull appearance.

Material Classification

Property	Categories	Examples
Hardness	Hard	Metal, Stone
	Soft	Cotton, Sponge
Lustre	Lustrous	Gold, Glass
	Non-lustrous	Wood, Clay
Transparency	Transparent	Clear Glass
	Opaque	Wood, Metal
	Translucent	Frosted Glass
Conductivity	Conductor	Copper, Aluminum
	Insulator	Plastic, Rubber

Let's recall what we know

Apply Concept in Real-Life Context

Apply

- Explain the difference between transparent, translucent, and opaque materials.
- Why is it important to classify materials before using them in daily life?

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

Examine Further

Analyse

Imagine you are designing a kitchen. You need to arrange items like plates, utensils, cooking ingredients, cleaning supplies, and appliances. How would you classify and organize them for easy access and efficiency?

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

Self-Assessment Questions

Evaluate

- What is the purpose of grouping materials based on their properties?
- If you were tasked with rearranging a cluttered workshop, how would you organize tools and materials like nails, hammers, paints, and screws?

Skills Covered: Critical and logical thinking, Brainstorming, Problem-solving, Organisation
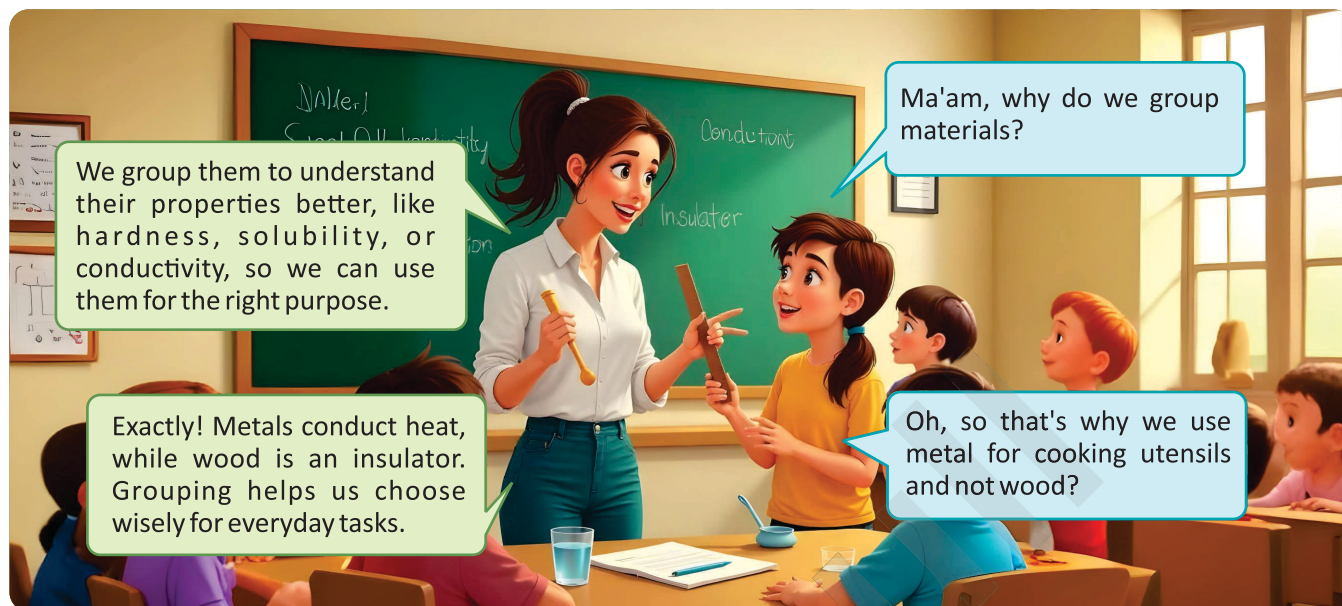
Bloom's Taxonomy

Grouping Materials According to Their Characteristics

A classroom with a teacher holding a wooden ruler and a metal spoon for demonstration.

Properties of Materials

The materials we use every day are selected based on their properties and how well they meet our needs. For instance:

- Cotton clothes are preferred in summer because they are lightweight and absorb sweat, helping to keep the body cool.

- Woollen clothes, on the other hand, are ideal for winter as they trap heat and keep the body warm.

- Materials like glass, plastic, and steel are often used to store liquids due to their specific properties like durability and non-reactivity.

Now, let's explore some key properties of materials that influence their uses:

Solubility: Soluble or Insoluble

Solubility is the ability of a material to dissolve in a solvent, such as water. This property determines how certain substances interact with liquids.

Soluble Materials: These substances dissolve completely in water. Examples include salt and sugar, which disappear into the water upon mixing.

Insoluble Materials: These substances do not dissolve in water. Examples include chalk, sand, and oil, which remain visible and separate even after being added to water.

Some liquids have the ability to completely mix with water, and these are known as miscible liquids. For example, lemon juice mixes fully with water, forming a uniform solution. On the other hand, certain liquids do not mix with water and form a separate layer when left undisturbed; these are called immiscible liquids, such as oil. Similarly, gases also exhibit varying degrees of solubility in water. For instance, oxygen is highly soluble in water, a property that plays a critical role in supporting the survival of aquatic animals and plants. However, not all gases dissolve in water, highlighting the diversity of material properties in our natural environment.


SOLUBLE INSOLUBLE
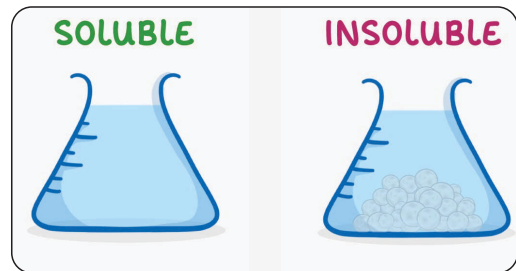
Density

Density is a measure of how much mass a material contains within a given volume. This property plays a critical role in determining whether an object will float or sink in water.

Floating and Sinking:

Less Dense Materials: These materials are lighter relative to water and tend to float. Examples include **plastic balls, cooking oil, feathers, and air-filled balloons.**
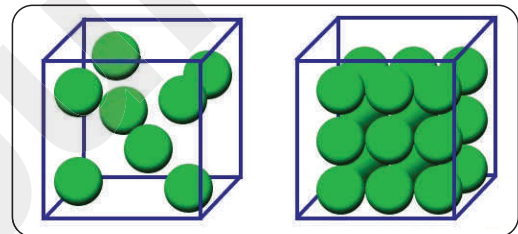
Denser Materials: These materials are heavier relative to water and sink. Examples include **iron nails, stones, and bricks**.

Volume

Volume refers to the amount of space that an object or substance occupies. For liquids, the volume is often measured as the capacity of a container.

Illustrative Example:

When water is poured from a **jar into a glass**, the glass may spill because its capacity is less than the jar's.
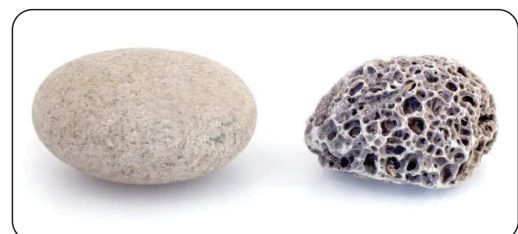
A **cricket ball** has more volume than a **table tennis ball** because it occupies more space.

Texture

The texture of a material refers to how it feels when touched, whether it is rough or smooth. This property is determined by the surface characteristics of the material.

- **Rough Materials:** These have uneven surfaces with

noticeable ridges and bumps. When you run your hand over them, you can feel the irregularities. Examples include the bark of trees and bricks.

- **Smooth Materials:** These have even surfaces without any ridges or bumps, giving them a sleek and polished feel. Examples include paper and glass sheets.

Comprehensive Table of Material Properties

Property	Definition	Types	Examples
Solubility	Ability of a substance to dissolve in water or mix with liquids.	Soluble, Insoluble; Miscible, Immiscible easily.	Soluble: Salt; Insoluble: Oil
Density	Determines whether a material sinks or floats in water.	Less dense (floats), More dense (sinks) and experiments.	Floats: Oil; Sinks: Nails, Stones
Volume	The space occupied by a material or object.	Higher volume occupies more space	Cricket Ball > Table Tennis Ball
Texture	Surface feel of the material.	Smooth, Rough	Smooth: Glass; Rough: Bark

Let's recall what we know

Apply Concept in Real-Life Context

Apply

- What will happen if you add sugar to water and stir it?
- Explain how the density of a material affects its ability to float or sink in water.
- Why do metals feel colder to touch than wood at room temperature?

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

Examine Further

Analyse

- Discuss the significance of hardness in materials used for construction tools.
- Why do gases like oxygen dissolve in water, but materials like sand do not?
- Are all non-shiny materials soft?
- Why is cotton preferred over plastic for making clothes?

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

SCAN TO ACCESS

Take a Task

Watch Remedial

Bloom's Taxonomy

Characteristics of Frequently Used Materials

A classroom with a teacher holding a piece of glass and a cotton cloth for demonstration.
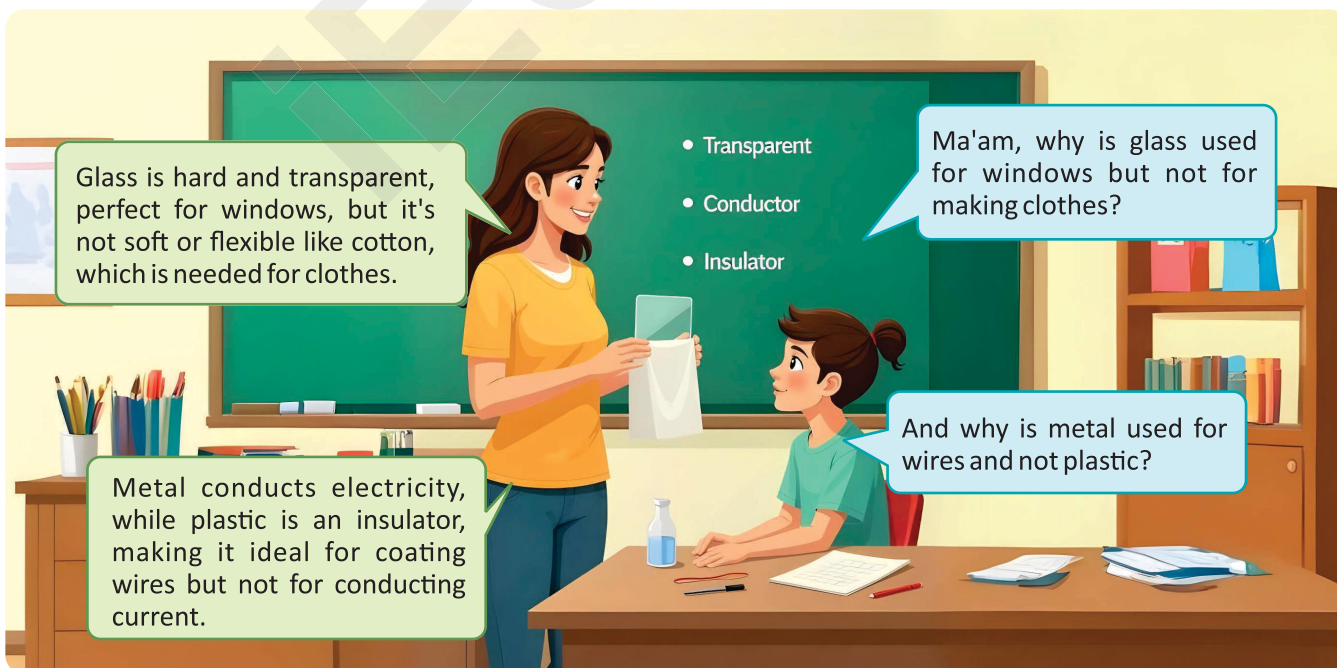
The properties of materials influence their functionality and suitability for different uses. Below is an explanation of the key properties of commonly used materials.

Material	Properties
Wood	• Has a dull appearance. • Hard and rough. • Insoluble in water. • Opaque. • Lower density than water.
Plastic	• Has a dull appearance. • Can be hard or soft. • Insoluble in water. • Smooth. • Can be opaque or translucent. • Lower density than water.
Glass	• Shiny appearance. • Can be hard or soft in molten state. • Insoluble in water. • Smooth. • Can be transparent or translucent. • Higher density than water.
Metal	• Shiny appearance. • Can be hard or soft. • Insoluble in water. • Smooth. • Opaque. • Higher density than water.
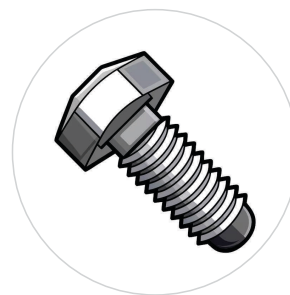
Matter: The Fundamental Building Block

Matter is anything that has mass and occupies space. It makes up everything around us, including living and non-living things.

Properties of Matter:

Mass: The amount of matter in an object, measured in kilograms (kg) or grams (g).

Volume: The space occupied by matter, measured in liters (L) or milliliters (mL).

Examples of Matter:

Living things: Humans, animals, and plants.

Non-living things: Air, water, food items, and other objects.

Significance: Matter exists in various forms throughout the universe, forming the basis of everything we sense and interact with.

Let's recall what we know

Apply Concept in Real-Life Context
Apply

- Explain the property that determines whether a material is hard or soft.
- Name a material that is transparent and used for both practical and decorative purposes.

Skills Covered: Critical and logical thinking, Applicative thinking

Examine Further
Analyse

- Why are metals not used for making pillows?
- What makes glass different from plastic in terms of transparency and durability?

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

Self-Assessment Questions
Evaluate

- Name two materials that are soft but durable.
- Name two materials that dissolve in water and are commonly used in daily life.

Skills Covered : Observation, Analytical thinking

Creative Insight
Create

Task: Design a chart that categorizes materials based on their texture (smooth/rough) and appearance (lustrous/non-lustrous). Present the chart in class and explain the categories briefly.

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

Bloom's Taxonomy

SUMMARY

Materials Around Us

Materials are the foundation of everyday objects, chosen for their specific properties. They can be natural, like wood or metals, or artificial, like plastics. Understanding their characteristics helps us use them effectively in daily and industrial life.

Grouping Materials by Characteristic

Materials are categorized based on their properties to determine their best uses:

- **State of Matter:** Solids (e.g., wood, metals) are used for construction, liquids (e.g., water, oils) for cooling and consumption, and gases (e.g., oxygen, CO_2) for breathing and combustion.

- **Appearance:** Lustrous materials like metals are shiny, while non-lustrous ones like wood are dull.

- **Hardness:** Hard materials (e.g., steel) resist wear, while soft ones (e.g., cotton) are flexible.

- **Transparency:** Materials are transparent (glass), translucent (frosted glass), or opaque (wood).

- Solubility: Some dissolve in water (salt), while others don't (oil).

- **Conduction:** Conductors like metals carry heat/electricity; insulators like rubber do not.

Characteristics of Frequently Used Materials

Materials frequently used in everyday life have unique properties that make them indispensable:

- **Wood :** Lightweight, durable, and aesthetically pleasing, wood is widely used in furniture, construction, and tools. It is also biodegradable and environmentally friendly.

- **Metals :** Known for their strength, malleability, and conductivity, metals are essential in construction, transportation, and electronics. Examples include iron for building frameworks, aluminum for lightweight applications, and copper for electrical wiring.

- **Plastics :** Plastics are lightweight, flexible, and resistant to corrosion, making them ideal for packaging, household items, and medical equipment. However, their non-biodegradable nature poses environmental challenges.

- **Glass:** Transparent and easy to shape when heated, glass is used in windows, containers, and optical devices. Its brittle nature limits its usage in certain applications.

- **Fabrics :** Fabrics, both natural (cotton, wool) and synthetic (polyester, nylon), are flexible and comfortable, making them essential for clothing, upholstery, and industrial use.

EeeBee: Your AI Buddy

Explore! **Materials around Us** with EeeBee AI Buddy.

Hi Friend! Use prompts to ask me questions about the chapter we just finished! eeee, lets go!

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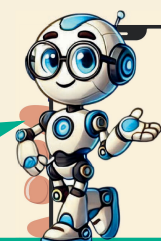
EXERCISE

That turn curiosity into confidence—let's begin!

A. Choose the correct answer.

1. What is the main reason for grouping materials?

   (a) To understand their uses ☐   (b) To make them attractive ☐

   (c) To dispose of them ☐   (d) To increase their weight ☐

2. Which of these is an example of a natural material?

   (a) Plastic ☐   (b) Wood ☐

   (c) Nylon ☐   (d) Glass ☐

3. Why are metals commonly used for making utensils?

   (a) They are flexible ☐   (b) They are poor conductors of heat ☐

   (c) They are shiny and strong ☐   (d) They are light and transparent ☐

4. What is the primary characteristic of glass that makes it useful for windows?

   (a) Transparency ☐   (b) Flexibility ☐

   (c) Conductivity ☐   (d) Opacity ☐

5. Which material is waterproof and used for raincoats?

   (a) Paper ☐   (b) Cotton ☐

   (c) Rubber ☐   (d) Jute ☐

B. Fill in the blanks.

1. Metals like _____ are used in electrical wiring due to their conductivity.

2. Wood is a _____ material and is used for furniture.

3. Rubber is elastic and can regain its _____ after stretching.

4. Plastic materials are often used because they are _____ and long-lasting.

5. Glass is _____ and allows light to pass through.

C. Write True or False.

1. All materials can conduct electricity. _____

2. Plastic is biodegradable and environmentally friendly. _____

3. Wood is an insulator and does not conduct electricity. _____

4. Transparent materials allow light to pass through. _____

5. Metals are brittle and break easily. _____

D. Define the following terms.

1. Material
2. Transparency
3. Conductor
4. Flexibility
5. Waterproof

E. Match the columns.

Column A	Column B
1. Metals	(a) Elastic and stretchy
2. Rubber	(b) Transparent material
3. Wood	(c) Good conductor of heat
4. Plastic	(d) Lightweight and durable
5. Glass	(e) Natural and sturdy

F. Give reasons for the following statements.

1. Metals are used for making electrical wires.
2. Plastic is used for water bottles and containers.
3. Glass is ideal for making windows.
4. Rubber is used for making tires.
5. Wood is commonly used in furniture and construction.

G. Answer in brief.

1. Why is grouping materials important?
2. What are some uses of plastic in everyday life?
3. Why is wood preferred for furniture?
4. Explain the difference between transparent and opaque materials.
5. How does the elasticity of rubber make it useful?

H. Answer in detail.

1. Describe the characteristics of commonly used materials.
2. Explain the importance of grouping materials with examples.
3. How are metals and plastics different in their properties and uses?
4. Discuss why some materials are better suited for specific purposes.
5. Compare the characteristics of natural and synthetic materials.

Custom Learning Path

Scan to Create
Your Own
Learning Path

Choose Your Own Path!

No need to worry about being "stuck" in one career. NEP lets you explore multiple entry and exit points in higher education.
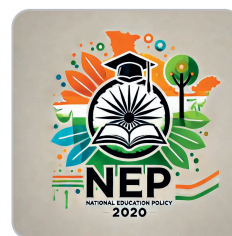
Skill-based Activity

Investigating Material Properties

STEM

Question: Look around your surroundings and identify one material frequently used in a household object (e.g., plastic in a water bottle or metal in a cooking pan).

- Why do you think this material is chosen for this specific purpose?
- What are the key properties that make this material effective in its use?

Activity : Using the scientific method, describe how you would design an experiment to test one or more of its properties, such as durability, conductivity, or water resistance.

Example: For a water bottle, you could test plastic's flexibility and waterproof nature by comparing it with other materials like paper or cloth.

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

Exploring Objects Through

Art

Question: Sketch a commonly used object in your home or school (e.g., a chair, backpack, or mug).

- Break it down into its parts and identify the materials used (e.g., metal for the frame, plastic for the seat, or ceramic for the cup).
- Why were these specific materials chosen for each part of the object?
- How do these materials support the overall function of the object?
  Skills Covered: Creativity, Critical and logical thinking, Applicative thinking

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

Classifying Materials

Group Activity

Question: Work in groups to collect objects from your surroundings (e.g., spoons, containers, pens, shoes).

- How can you group these objects based on the properties of the materials they are made from?
- What categories would you use to classify these materials (e.g., natural vs. man-made, transparent vs. opaque, strong vs. fragile)?
- How do these classifications help us understand the best uses for these materials?

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

Innovative Materials in Action

Case to Investigate

Question: Scientists and engineers are constantly discovering and creating new materials, such as graphene or biodegradable plastics.

- How are these materials different from traditional materials like wood, metal, or glass?
- What are the unique properties of these materials, and how are they solving current global challenges?
- Can these materials replace commonly used ones, and what could be the impact of such changes?

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

Recycling and Sustainability

Aligning with SDGs

Question: Recycling and reusing materials are critical for sustainability. Investigate one program or initiative that focuses on reducing material waste (e.g., a company recycling e-waste or a community reusing plastics).

- What materials are they targeting, and why?
- What challenges are involved in recycling or reusing these materials?
- How do their efforts align with sustainable development goals, such as reducing waste or promoting responsible production?

Aligned with: SDG 12 – Responsible Consumption and Production

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

Mapping Natural Resources

Integrated Learning

Question: Materials like metals, coal, and bamboo are often tied to specific geographical regions due to the availability of natural resources.

- Where in India are these materials commonly found?
- How do the geography and climate of these areas support their production or extraction?
- What role do these materials play in regional industries or economies?

Integrated Learning: Geography

Skills Covered: Critical and logical thinking, Brainstorming, Analytical thinking, Applicative thinking