Chapter 6

Materials Around Us

> उपादानं भवेत्तस्या (मूषाया:) मृत्तिका लोहमेव च।
>
> (रसरत्नसमुच्चय–१०.३)
>
> The materials used to make the crucible
> (a vessel used to melt substances) are clay and iron.
>
> (*Rasaratnasamuchchaya*–10.3)

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6.1 Observing Objects Around Us

Ghulan and Sheeta are thrilled to go to their new class after the summer break. They enter their classroom and start talking. "What have you brought to school today?" asks Sheeta.

After some time, Madam Vidya, their science teacher, enters the class and starts interacting with the students to draw their attention to many things they use in their daily life. She asks, "How are they similar to or different from each other? What are their shapes and colours? How does it feel when you touch them? Are some of them heavier than

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others?" All things are made up of some materials like paper, wood, cloth, glass, metal, plastic, clay, and so on.
Any substance that is used to create an object is referred to as **material**.

Activity 6.1: Let us identify

Make a list of objects you see around and also write the names of the materials they are made up of in Table 6.1.

Table 6.1: Identify materials

I observe	Materials they are made up of

Based on everyday observations, one can conclude that objects are made up of various materials.

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The earliest pottery found in the Indian subcontinent dates back to 7,000 to 8,000 years in the Ganga plains (Lahuradewa) and in Baluchistan (Mehrgarh). About 4000 BCE onwards, Sindhu-Saraswatī developed techniques of wheel-turned pottery production, pigmentation, application of protective or decorative coats (called 'slips') of multiple colours, decorative painting, etc. These techniques became further sophisticated during the Sindhu-Saraswatī (also known as 'Harappan') Civilisation (2600–1900 BCE), with a bright red surface painted with black-coloured designs displaying geometric patterns, and aquatic and terrestrial animals. The clay used for making pots, dishes, bowls and other items was carefully selected and cleaned, sieved, kneaded, turned over a wheel and finally baked in kilns (baked clay is called 'terracotta'). Pots were used for various purposes, from cooking to storage of food grains, oil, ghee, and so on. Some very large storage jars and other pottery items are exhibited at the National Museum, New Delhi.

Do you know?

Let us explore materials further.

6.2 How to Group Materials?

Activity 6.2: Let us group

- Group the objects shown in Fig. 6.1 based on any common property, such as shape, colour, hardness, softness, shine, dullness or materials they are made up of.

Fig. 6.1: Objects around us

- Which property did you use to group the objects in Activity 6.2?
- Did your friends group objects based on similar properties?
- What did you learn from this activity?

You must have noticed that an object can be made from different materials and some materials can be used to make more than one object.

The method of arranging the objects into groups is called **classification**. Objects can be classified on the basis of a common property that they have.

Similarly, we can classify materials based on certain properties.

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Activity 6.3: Let us think

Let us think what materials we can use to make a tumbler. Fill in the names of the materials in the spaces provided in Fig. 6.2.

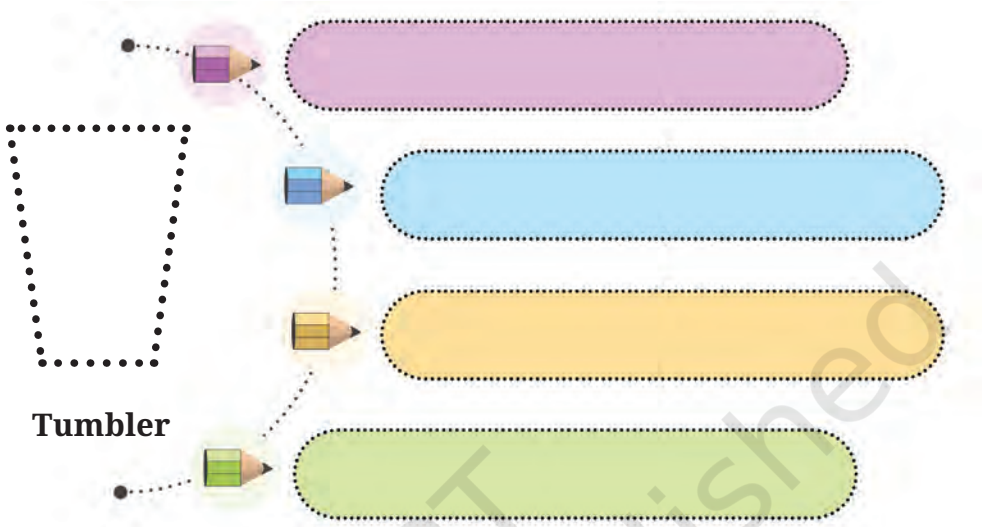

Fig. 6.2: Materials used to make tumbler

Would it be a good idea to use paper-like materials for making cooking utensils?

Why cannot a tumbler made of cloth be used for storing water?

The materials that are required to make a tumbler should be capable of holding water.

What decides which material should be used for making an object? We choose a material to make an object depending on its properties and the purpose for which the object is to be used.

We may use different materials for making different parts of an object. For example, a pen may be made up of different materials like plastic, metal and ink.

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Activity 6.4: Let us explore

Fig. 6.3 illustrates a variety of balls that are of the same size but made up of different materials.

- Take each ball and drop it from a fixed height.
- Note the height to which the ball bounces and **record** it in Table 6.2.
- Identify the ball that achieves the highest bounce.

Tennis ball *Cricket ball* *Hand exercise ball*

Fig. 6.3: Different types of balls used for various purposes

Table 6.2: Bouncing level of the balls

Ball	Bounces (high, medium or low)
Tennis ball	
Cricket ball	
Hand exercise ball	
Any other	

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Discuss in class other properties of sports balls, such as size, colour, texture and how high they bounce and understand why balls are made up of specific materials for specific sports. Observe Fig. 6.4 and group the objects in as many different ways as possible.

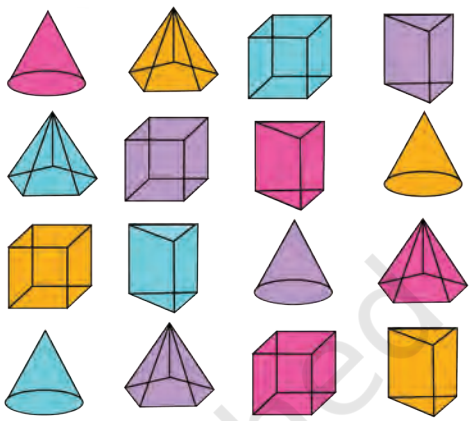

Fig. 6.4: Grouping of objects

You might have grouped these objects according to their shapes or by their colour or materials they are made up of.

We have learnt that materials may be classified on the basis of their properties.

For example, in the kitchen, we usually store things in such a manner that similar utensils are placed together. Similarly, a grocer usually keeps all types of spices in one corner, pulses and grains in another corner and so on. You may also visit any chemist shop and enquire about how medicines are arranged.

6.3 What are the Different Properties of Materials?

Let us learn some more properties of materials.

6.3.1 Observe and identify appearance of materials

Materials often look different from each other. Freshly cut wood, which is unpolished, has a distinct appearance, quite different from that of iron. Similarly, iron looks different from copper or aluminium. However, there might be some similarities among iron, copper and aluminium that make them different from wood.

Let us do a sorting challenge! Collect small pieces of paper, cardboard, wood, chalk, copper wire, aluminium foil and any article made up of brass, bronze, steel, etc. Take a look at the pieces you have collected. Do any of these materials shine when light falls on them? Observe their texture (whether

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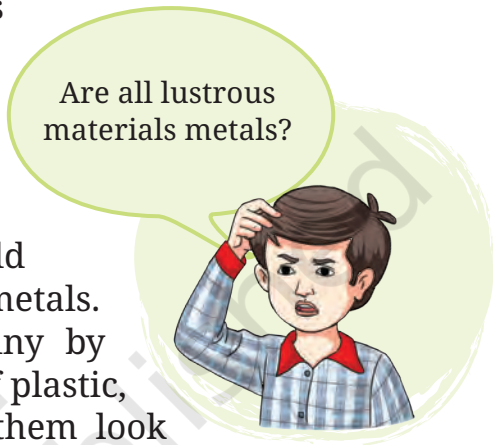
rough or smooth), colour and other noticeable features, and record your observations in the notebook. Group the collected pieces based on their appearance.

Materials that typically have shiny surfaces are said to have a **lustrous** appearance. Such materials with lustre are usually metals. Examples of metals include iron, copper, zinc, aluminium, gold, etc. However, some metals may lose their lustre and start to look dull or non-lustrous due to the effect of air and moisture on them. As a result, we often notice the lustre only on their freshly cut surfaces. **Non-lustrous** materials are those that do not have a shiny surface. Some examples of non-lustrous materials are paper, wood, rubber, jute, etc.



"All that glitters is not gold" goes an old saying! Not all the materials that shine are metals. Surfaces of some materials are made shiny by polishing or coating them with thin layers of plastic, wax or any other material which makes them look shiny. These materials may not be metals.

6.3.2 Which materials are hard?

When you press different objects or materials with your hands, some of them like stones, may be hard to compress, while others, like an eraser, can be easily compressed. Take a metal key and use it to scratch the surface of a piece of wood, aluminium, stone, iron, candle, chalk and any other material or object. Can some materials be scratched more easily than others? Materials which can be compressed or scratched easily are **soft**, while other materials which are difficult to compress or scratch are **hard**. However, these properties are relative in nature. For example, rubber is harder than sponge but softer than iron.

Activity 6.5: Let us observe

- Hold the objects given in Table 6.3 with your hands. Feel whether the objects are hard or soft. Find out the materials they are made up of. Enter your observations in Table 6.3.

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Table 6.3: Hard or soft objects and the materials they are made up of

Object	Hard/Soft	Material(s)
Brick	Hard	Baked clay
Water bottle		
Pillow		
Tumbler		
Table		
Sweater		
Any other		

- Compare your observations with the observations of your friends and discuss.

You have learnt that materials can have different properties, like lustre, hardness, softness and colour. Can you think of any other properties that are shown by materials? Let us explore it further.

6.3.3 Explore materials through which one can see or cannot see

Ghulan, Sheeta and Sara are playing hide and seek with their friends. Ghulan hides behind a wall, Sheeta hides behind a big tree in the garden while Sara hides behind the frosted glass door (which has a hazy surface). Sheeta's younger brother can see all of this happening through a glass window of his house.

The materials, through which things can be seen clearly, are called **transparent**. Glass, water, air, cellophane paper, etc., are some examples of transparent materials.

Why did Ghulan, Sheeta and Sara choose these places to hide?

Do you think it would be possible for Sheeta's brother to see her and her friends through a closed wooden window of the house?

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There are many materials through which you are not able to see at all. These materials are called **opaque**. Wood, cardboard and metals are examples of opaque materials.

The materials through which objects can be seen, but not clearly, are known as **translucent**. Butter paper and frosted glass are examples of translucent materials.

Look at Fig. 6.5. Identify and label the nature of materials used by Ghulan (A), Sheeta (B), Sara (C) and Sheeta's brother (D).

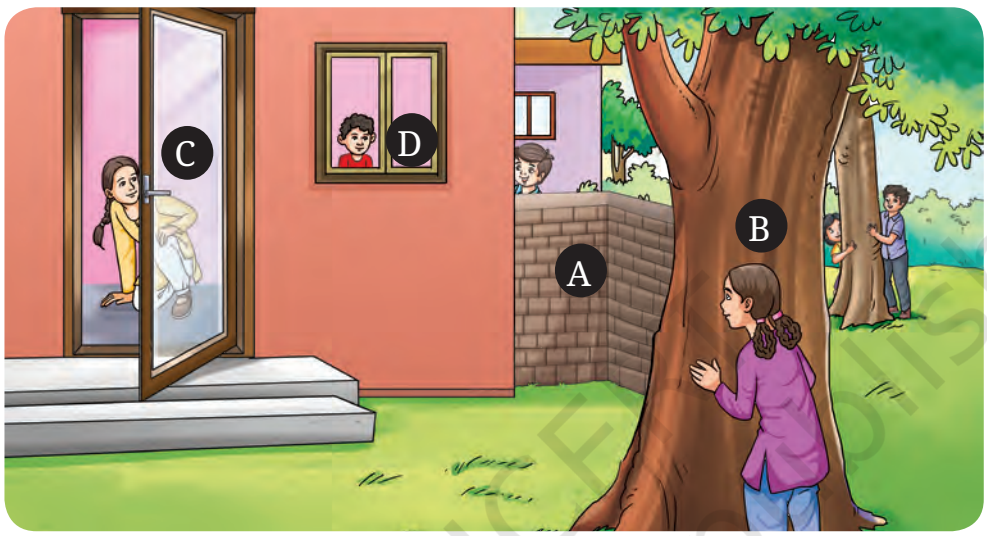


Fig. 6.5: Identify the nature of different materials

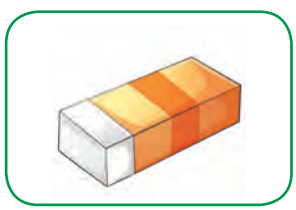
(A) _ _ _ _ _ _ _ _ _ (B) _ _ _ _ _ _ _ _ _ (C) _ _ _ _ _ _ _ _ _ (D) _ _ _ _ _ _ _ _ _ .

Activity 6.6: Let us classify

Classify the following objects as transparent, translucent or opaque in Table 6.4.

Glass tumbler

Butter paper



Eraser

Frosted glass

Wooden board

Window glass

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Is water transparent? Can it be made opaque? ?

Table 6.4: Classification of objects

Transparent	Translucent	Opaque

6.3.4 What is soluble in water; what is not?

Ghulan was sweating when he came home after playing in the evening. He was feeling tired and thirsty. Ghulan's mother mixed a spoonful of sugar, a pinch of salt and some lemon juice in a glass of water and offered him this *shikanji* (lemonade) to drink.

Ghulan noticed that while his mother was mixing sugar and salt in water, the salt and the sugar disappeared after a while.

Let us try a simple activity to explore how different materials behave when we mix them in water!

Activity 6.7: Let us explore

- Collect small amounts of sugar, salt, chalk powder, sand and sawdust.
- Take five glass tumblers and fill them about two-third with water.
- Put a teaspoonful of sugar in the first glass tumbler, salt in the second one, chalk powder in the third, sand in the fourth and sawdust in the fifth glass tumbler.
- On stirring, **predict** what will happen in each case.
- Use a spoon to stir well the contents of each glass tumbler.
- Wait for a few minutes and watch what happens.
- Write down your observations in Table 6.5.

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Table 6.5: Mixing different materials in water

Material	Prediction	Observation
	Will disappear in water/will not disappear in water	Disappears in water/ does not disappear in water
Sugar		
Salt		
Chalk powder		
Sand		
Sawdust		
Any other		

Does everything you put in water disappear?

You might have noticed that some materials completely disappear when mixed in water. We say that these materials dissolve in water or, in other words, they are **soluble** in water (Fig. 6.6a). Some materials do not mix with water and do not disappear even after we stir them for a long time. These materials are **insoluble** in water (Fig. 6.6b). Water plays an important role in the functioning of our body because it can dissolve a large number of materials.

(a) Soluble material in water

(b) Insoluble material in water

Fig. 6.6: What disappears, what does not?

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Make your own ORS!

ORS—Oral Rehydration Solution— is used to treat dehydration due to diarrhoea or other illnesses. These ready-made ORS packets are available in primary health centres and also in the market. Each packet is dissolved in a litre of water before use. If these are not available, ORS can be prepared at home by mixing six teaspoons of sugar and half a teaspoon of common salt in one litre of boiled and cooled water.

Some liquids get completely mixed with water. Some do not mix with water and form a separate layer when left undisturbed for some time. Similarly, some gases are soluble in water whereas others are not. For example, oxygen gas dissolves in water. It is very important for the survival of animals and plants that live in water.

6.3.5 How heavy or light?

Activity 6.8: Let us measure

- Let us take three identical paper cups (or bowls). Fill each cup half with the provided materials.
- Fill one with water and mark it as 'A', second with sand and mark it as 'B', and the third with pebbles and mark it as 'C'.
- Predict which one would be heavier and which one would be lighter?

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- Weigh each cup using a balance (Fig. 6.7) and record the readings in your notebook.
- Compare the data and infer which is heavier or lighter.

From Activity 6.8, we can say that any object which is heavier or lighter can be measured in terms of a property called **mass**.

The one which is heavier has more mass and the one which is lighter has less mass.

Fig. 6.7: Weighing a paper cup containing water

Weight is sometimes used in common language for mass as it is determined by weighing. You will learn more about mass and weight and their relation in higher classes.

6.3.6 Space and volume

Next day, Madam Vidya enters the class. All the students stand up to greet her. She reciprocates and deliberately says, "Please keep your bags on your seats and sit down." Students are not able to sit because bags are kept on their seats. Madam Vidya asks, "Why are you not sitting?" The students reply that there is no place to sit because the bags have occupied that space.

Continuing the conversation, she provides two identical glass tumblers to two students and encourages them to pour the remaining water from their drinking water bottles into the respective glass tumblers. On pouring water in the glass tumblers, the students observe that one glass tumbler gets half-filled with water (Fig. 6.8a) while the other is almost completely filled with water (Fig. 6.8b).

(a) Half-filled *(b) Fully-filled*

Fig. 6.8: Glass tumblers with varying levels of water

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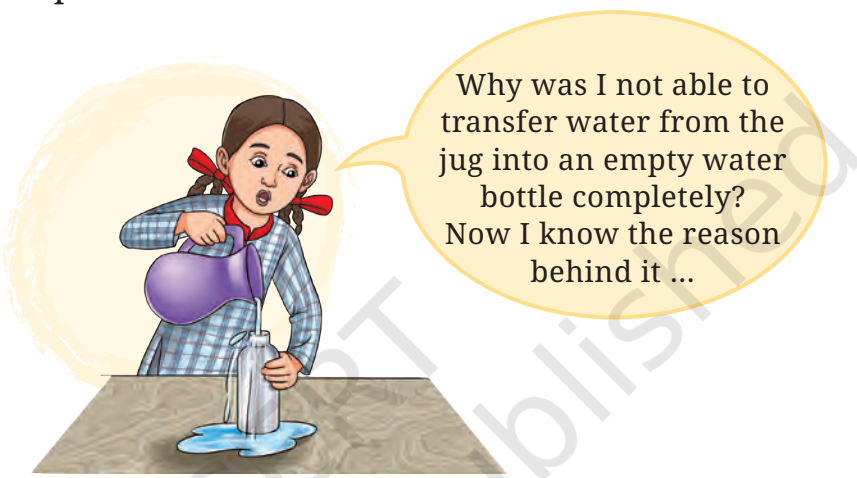
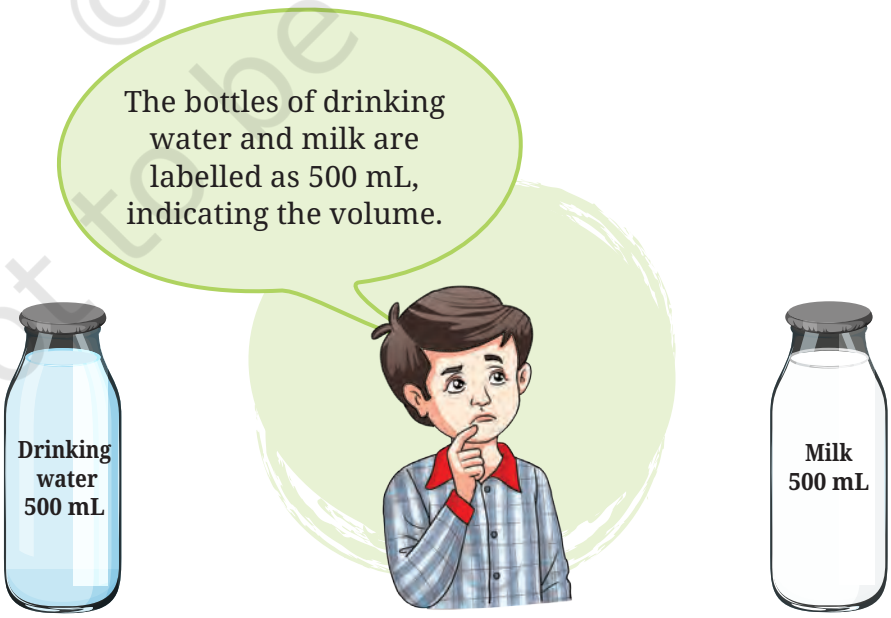
Why is the level of water different in the two tumblers?

Madam Vidya elaborates that both tumblers have the same capacity. The water levels differ in each case, which indicates that the amount of water in each tumbler is different.

The water in the first tumbler occupies less space, indicating that the volume of water in this tumbler is less than the water in the other tumbler. The space occupied by water represents its **volume**.



You may have noticed drinking water bottles of different sizes being sold in the market. Have you noticed 1 L, 500 mL, 200 mL, etc., written as net quantity on the bottles? These indicate the volume of water in the bottles.



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Now you have become familiar with many properties of materials. However, all materials do not possess all these properties.

Are there any properties which can be shown by all materials? If yes, what are those?

6.4 What is Matter?

Mass and volume are the two properties that are possessed by all materials. Can we give a general name to anything that possesses these two properties?

Anything that occupies space and has mass is called **matter**. The mass gives the quantity of matter, and the units to measure it are gram (g) and kilogram (kg). The space occupied by matter is its volume. The units to measure the volume are litre (L) and millilitre (mL).

Kilogram is the unit of mass in the International System of Units (SI). Kilogram is abbreviated in lower case as kg. There is no space between 'k' and 'g' in kg, and no full stop after the symbol, except at the end of a sentence. While writing the mass, always leave a space between the number (numerical value) and the unit. For example, if we have mass of 7 kilograms, it would be written as 7 kg and not as 7 kgs.

Similarly, litre is abbreviated as capital L and millilitre as mL. There is no space between 'm' and 'L' in mL. For example, if you have 500 millilitres of water, it would be written as 500 mL, m will be in lower case and L will be in upper case. The SI unit for volume is cubic metre, abbreviated as m^3. The abbreviation is written with a superscript 3 to denote cubic metre. For example, if you have volume of 2 cubic metres, it would be written as 2 m^3. Always leave a space between number (numerical value) and the unit. 1 m^3 =1000 L.

Do you know?

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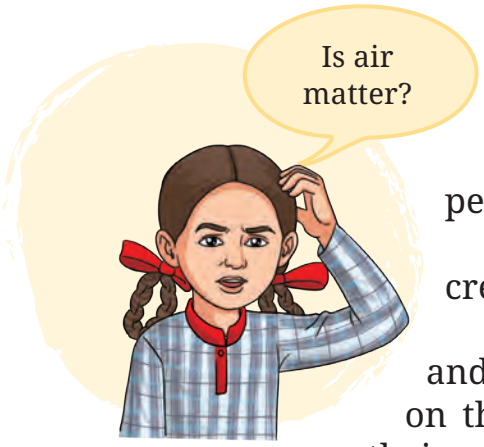


Can all the materials around us be considered as different examples of matter? Discuss with your friends.

For example, water is matter, sand and pebbles are matter and so is the cup.

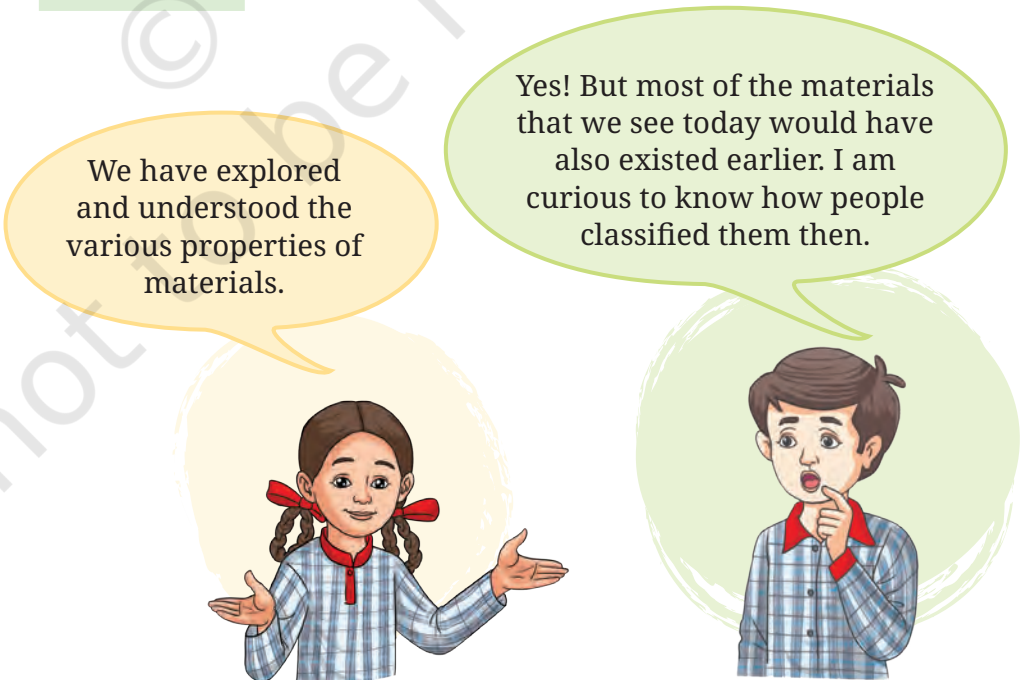
Materials are types of matter used in the creation or making of objects.

We learnt that materials look different and behave differently. We grouped materials on the basis of similarities or differences in their properties.

We find grouping useful as it helps us study and observe patterns in the properties of things. Humans have been classifying not only things, but also rocks, plants and animals. We have learnt about the classification of the living world in the chapter 'Diversity in the Living World'. Just like in the living world, classification of the non-living world is also done on the basis of their properties.

Think it over!

Can you think about what changes the invention of plastic brought to humans? Is it a boon or a bane?



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A similar classification system existed in ancient India. Ayurveda, one of the Indian medical systems, too has a system of grouping things.

गुरु मन्द हिम स्निग्ध श्लक्ष्ण सान्द्र मृदु स्थिराः|
गुणाः ससूक्ष्म विशदा: विंशतिः स विपर्ययाः||

(*Aṣhtanga hṛidaya Sūtra sthāna 1.18*)

The shloka precisely talks about the 20 properties (*guṇa*—ten pairs of opposite properties), which are used to describe all physical matter in Ayurveda. These properties can also be used to describe all living systems (plants, animals and humans), the environment and also food.

These properties are:

(i)	*guru* (heavy)	×	*laghu* (light in weight)
(ii)	*manda* (slow)	×	*tīkṣhṇa* (quick, fast)
(iii)	*hima* (cold)	×	*uṣhṇa* (hot)
(iv)	*snigdha* (unctous)	×	*rukṣha* (dry)
(v)	*śhlakṣhaṇa* (smooth)	×	*khara* (rough)
(vi)	*sāndra* (solid)	×	*drava* (liquid)
(vii)	*mṛidu* (soft)	×	*kaṭhina* (hard)
(viii)	*sthira* (stable)	×	*khāla* (moving, unstable)
(ix)	*sūkṣhma* (subtle, small)	×	*sthūla* (big, gross)
(x)	*viśhada* (non slimy)	×	*picchhila* (slimy)

Do you know?

Keywords

Classification	Non-lustrous	Classify
Hard	Opaque	Explore
Insoluble	Soft	Identify
Lustrous	Soluble	Observe
Mass	Translucent	Predict
Material	Transparent	Record
Matter	Volume	

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Summary

Key Points

- Objects are made from a large variety of materials. An object can be made up of a single material or a combination of different materials.
- We can use different materials to make objects with similar functions.
- The method of arranging objects into groups is called classification.
- Materials possess different properties which determine their use.
- Materials are grouped or classified based on their similarities or differences in their properties.
- Materials can be grouped based on appearance, such as lustrous or non-lustrous and based on the feel, such as hard or soft.
- Materials are grouped as transparent, translucent or opaque depending on how much we can see through them.
- Some materials are soluble in water, while others remain insoluble.
- Anything that occupies space and has mass is called matter.
- The space occupied by matter is its volume.
- Mass quantifies the amount of matter present in an object.

Let us play

1. Find the companion.

   Link the following words by putting arrows between words that have a connection.

Iron

Transparent Copper

Solid Bottle

Plastic Lustrous

Wood Opaque

Glass

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2. Win the 'Word-hub'

The following words from the chapter like lustrous, non-lustrous, soluble, insoluble, hard, soft, matter, mass, transparent, opaque, volume and translucent are picked up.

Grid

- Students should randomly choose nine words from the given list and write them in the grid.
- Then, the facilitator either reads the definition of a word or the word itself (randomly) from the given list.
- The learners have to tick if the particular word is there in the grid.
- Whoever finishes ticking off all nine words first will shout out 'Hurray!'. That person will be the winner if his/her words are marked correctly.

Let us enhance our learning

1. Visit your kitchen and observe how your parents have organised various edibles. Can you suggest a better sorting method? Write it in your notebook.

2. Unscramble the letters (Column I) and match with their properties (Column II).

Column I	Column II
(i) T R E M A T	(a) Objects can be seen clearly through it
(ii) U L S B E L O	(b) Occupies space and has mass
(iii) T N E R P A S N A R T	(c) Shiny surface
(iv) E R U S T L	(d) Mixes completely in water

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3. The containers which are used to store materials in shops and at home are usually transparent. Give your reasons for this.

4. State whether the statements given below are True [T] or False [F]. Correct the False statement(s).

   (i) Wood is translucent while glass is opaque. [ ]

   (ii) Aluminium foil has lustre while an eraser does not. [ ]

   (iii) Sugar dissolves in water whereas sawdust does not. [ ]

   (iv) An apple is a matter because it occupies no space and has mass. [ ]

5. We see chairs made up of various materials, such as wood, iron, plastic, bamboo, cement and stones. Following are some desirable properties of materials which can be used to make chairs. Which materials used to make chairs fulfil these properties the most?

   (i) Hardness (does not bend or shake on sitting even after long use).

   (ii) Lightweight (easy to lift or to take from one place to another).

   (iii) Does not feel very cold when sitting during winters.

   (iv) Can be cleaned regularly and made to look new even after long use.

6. You need to have containers for collection of (i) food waste, (ii) broken glass and (iii) wastepaper. Which materials will you choose for containers of these types of waste? What properties of materials do you need to think of?

7. Air is all around us but does not hinder us from seeing each other. Whereas, if a wooden door comes in between, we cannot see each other. It is because air is ---------- and the wooden door is ---------- . Choose the most appropriate option:

   (i) transparent, opaque

   (ii) translucent, transparent

   (iii) opaque, translucent

   (iv) transparent, translucent

8. Imagine you have two mysterious materials, X and Y. When you try to press material X, it feels rigid and does not change its shape easily. On the other hand, material Y easily changes its shape when you press it. Now, when you mix both materials in water, only material X dissolves completely,

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while material Y remains unchanged. What can materials X and Y be? Can you identify whether material X is hard or soft? What about material Y? Justify your answer.

9. (i) Who am I? Identify me on the basis of the given properties.

   (a) I have lustre. ----------

   (b) I can be easily compressed. ----------

   (c) I am hard and soluble in water. ----------

   (d) You cannot see clearly through me. ----------

   (e) I have mass and volume but you cannot see me. ----------

   (ii) Make your own 'Who am I?'

10. You are provided with the following materials—vinegar, honey, mustard oil, water, glucose and wheat flour.

    Make any two pairs of materials where one material is soluble in the other. Now, make two pairs of materials where one material remains insoluble in the other material.

Learning further

- Gather information on different materials which can be recycled. You can take help from various sources such as newspapers, magazines, talking to elders in your community, and the internet.
- Recyclers buy old objects based on properties of the materials and do not bother even if an object is broken. Conduct a survey with recyclers near you and find out what properties of materials they check before buying objects from households. Which materials do they not buy and why?
- Collect 20–30 objects from your household and classify them based on the properties of the materials they are made up of. Were you able to put them in separate groups? What relationship do you see between the properties of the materials and the use of the objects?
- Create and decorate a useful object of your choice using discarded materials and bring it to the class. Discuss with your friends what they have made and the materials they have used. Additionally, provide constructive feedback on areas for improvement, considering functionality and any other points.

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Notes

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