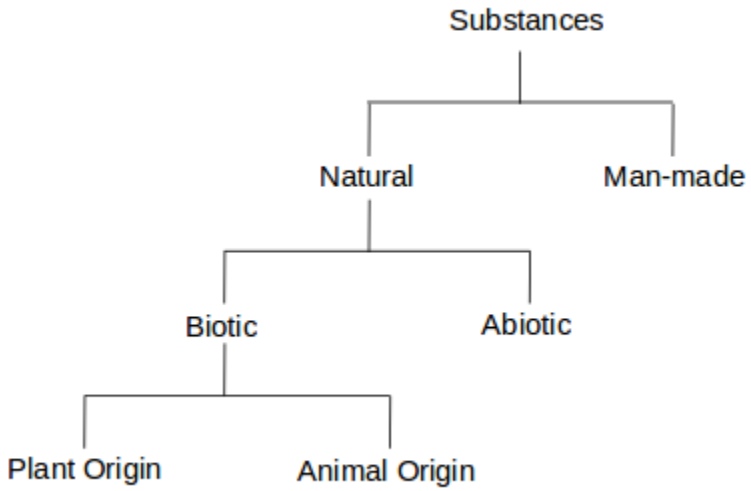
Sorting Materials Into Groups

Materials and Objects

The substances that we use in our day to day life can be categorised into various groups depending upon their source of origin.



The Substances that are present in nature are known as **natural substances** while the one derived from naturally available substances by processing them are known as **man-made substances**.

Type	Substances
Natural	Wood, soil, water, rubber, cotton, silk etc.
Man-made	Raincoat, nylon, umbrella, plastic etc.

Can you classify the above substances as plant origin/animal origin and biotic/abiotic?

The natural substances derived from living things such as plants and animals are called **biotic substances** and those derived from non-living things are called **abiotic substances**. Further, we have **plant origin** substances obtained from plants and **animal origin** substances obtained from animals.

From the above-given substances,

- **Biotic substances**- wood, cotton, silk, rubber
- **Abiotic substances** - soil, water
- **Plant origin substances**- wood, cotton, rubber
- **Animal origin substances**- silk

Objects can be classified into various groups based on the materials from which they are made. The articles or objects that you find in your study room can be grouped as shown.

Material from which objects are made	**Objects in your study room**
Wood	Chair, table, pencil, etc.
Plastic	Pen, wall clock, lunch box, water bottle, etc.
Metal	Windowpanee, geometry box, etc.

These materials, i.e., wood, metal, and plastic are used to produce a variety of articles that are used by us in our daily lives.

Can you think of other objects that are made from these materials?

Try to classify the things that you find in your kitchen into the various groups.

Do You Know:

Copper was the first metal to be used by human beings.

Some objects can be made using more than one material. For example, chairs can be made using both wood and plastic. However, there are certain objects that can only be made using specific materials. We will now discuss some of these objects.

Can metals be used to make the handles of cooking utensils?

You must have noticed that the handles of cooking utensils are usually made up of either wood or plastic. It is done because wood and plastic are bad conductors of heat, i.e., they do not become hot when heated. Therefore, it is easier for a person to remove the utensil from the fire without being burnt. Metals on the other hand become very hot when heated and cause serious burns. For the very same reason, metals are used to make cooking utensils.

Why are tyres made up of rubber?

You must have seen the tyres of cars, scooters, buses, and other vehicles. Have you noticed that irrespective of the vehicle, tyres are always made up of rubber?

Tyres should be made up of such a material that does not become very hot due to the heat generated by the friction of a moving vehicle. It should be strong enough to be driven around in the city and should not wear or tear easily. Rubber fits the bill perfectly and so it is used to make tyres.

Thus, it can be concluded that depending upon the purpose of an object, a material is chosen to make it.

The given table lists a few common objects and the materials from which they are made.

Material	Objects
Copper	Wires, vessels, etc
Iron or steel	Plates, vessels, electric fans, locks and keys, shutters, etc.
Plastic	Bottles, jugs, combs, outer body of most electrical appliances, etc.
Cotton	Clothes, towels, curtains, etc.
Wood	Chairs, tables, doors, etc.
Leather	Belts, purses, bags, shoes, jackets, etc.

Interesting Fact:

Primitive people living during the Ice Age were most likely to have first used the skins of animals to protect their bodies from the rough weather elements.

Classification of Various Materials on the Basis of Their Appearance or Hardness

From the time we get up in the morning until we sleep, we use many objects such as toothbrush, pen, bag, bed sheet, utensils, bottles, etc. Some properties of these substances are the same and some are different. For example, pens and bottles are made up of hard substances, whereas bed sheets and bags are soft.

Make a list of 15 objects that you use in your daily life and try to classify these objects based on properties such as their appearance, hardness, weight, etc.

Materials can also be classified as metals and non-metals. All metals share some common properties such as lustre (shine), hardness, etc. Similarly, non-metals have some properties in common such as softness, the lack of shine, etc. The table given below lists some of the properties of metals and non-metals along with the examples.

Metals	Non-metals
Metals are usually hard, ductile, malleable, and sonorous. They have lustre and can conduct electricity and heat.	Non-metals are not shiny and are usually soft in nature. They are not malleable, ductile, or sonorous.
Few examples of metals are iron, gold, aluminium, copper, silver, etc.	Few examples of non-metals are carbon, iodine, oxygen, etc.
Non-metals are not shiny and are usually soft in nature. They are not malleable, ductile, or sonorous.	

Few examples of metals are iron, gold, aluminium, copper, silver, etc.	Few examples of non-metals are carbon, iodine, oxygen, etc.

Materials can be grouped as hard and soft based on their hardness. Collect some materials such as a candle, a newspaper, a steel glass, a cloth, sponge, an iron rod, a stone, etc. We will now group these materials as hard and soft materials.

Hard materials	**Soft materials**
Steel glass, iron rod, stone	Newspaper, cloth, sponge, candle

Do you know that there are some substances that are hard but can be broken easily?

The hard substances that can be easily broken into pieces on applying force are called **brittle materials**. This property is known as **brittleness.** The materials that do not break easily are called **non-brittle materials**.

Brittle materials	**Non-brittle materials**
Slate, ice, coal	Steel, cast iron,

Materials can also be grouped on their ability to return to their normal shape and size after being stretched or compressed. This property is known as **elasticity.** The materials that regain their original shape are called **elastic**

materials while those that do not regain their original shape are **inelastic materials.**

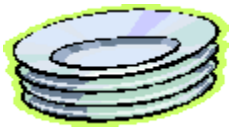
Elastic materials	Inelastic materials
Lycra clothes, spring, bungee cores	Glass, iron, wood

Materials can also be grouped based on their appearance or lustre. Substances having shiny surfaces are said to have a metallic lustre. On the other hand, the substances which have dull surfaces do not possess lustre.

Materials with lustre	Materials without lustre
Copper wire, aluminium sheet, jewellery, steel plate.	Candle, chalk pieces, plastic jug

Can you classify the objects that we had taken above based on their appearance?

Do you know why most dishes are made up of metals?



The dishes that we use for eating are usually made up of metals. Metals are hard and do not wear or tear easily. Hence, hot food can be easily stored in them and they can withstand rough handling. Moreover, metals are hard and malleable. Thus, a variety of shapes can be given to the articles made using them.

Do you know why wires are always covered with a layer of plastic?

Electrical wires, plug tops, switches, and other parts of electrical appliances are covered with plastic. Plastic is a bad conductor of electricity and prevents one from being electrocuted. All non-metals also act as electrical insulators. Metals, on the other hand, are good conductors of electricity.

Classifying Materials as Transparent, Translucent, and Opaque

Take a sheet each of ply board, glass, and butter paper. Try to look through these sheets. Also, keep them in the sunlight and observe the kind of shadows they form.

Do the three substances behave in the same manner?

What can you conclude from the above observations?

Transparent objects	**Translucent objects**	**Opaque objects**
One can clearly see through transparent objects. Or, objects behind a transparent material are seen clearly.	One can see through translucent objects, but not very clearly. Or, objects behind a translucent material have a hazy appearance.	One cannot see through opaque objects. Or, objects behind an opaque material cannot be seen at all.
Few examples of transparent objects are glass, water, air, etc.	Few examples of translucent objects are tracing paper, plastic bags, frosted glass windows, butter paper, oiled paper, etc.	Few examples of opaque objects are wood, clothes, walls, metals, etc.

Take a few substances such as glass, wax paper, book, water, ice cube, dish, shirt, etc. Take each material and try to observe an object through it. Record your observations and list these substances as transparent, translucent, or opaque.

Material	Visibility of the object	Classification
Glass	Fully visible	Transparent
Wax paper	Partially visible	Translucent
Book	Not at all visible	Opaque
Water	Fully visible	Transparent
Ice cube	Partially visible	Translucent
Dish	Not at all visible	Opaque
Shirt	Not at all visible	Opaque

Have you noticed that a grocer keeps biscuits and chocolates in transparent jars?

Grocers keep biscuits, chocolates, etc., in transparent glass jars so that these materials are easily visible to the customers.

Have you noticed that most medicine bottles are dark (brown-coloured) in colour?

Many medicines are sensitive to light. Their composition might be affected if exposed to light. Therefore, syrups are packed in brown-coloured bottles, as a result of which light is not allowed to pass through them.

Have you ever noticed that glass windows are always covered with curtains?

Glass is a transparent material through which everything can be seen. On the other hand, curtains are usually made up of an opaque cloth. As a result, the curtains restrict visibility. Therefore, curtains are always put on glass windows so as to cover or uncover the windows as and when required.

Interaction of Various Substances with Water

You must have observed that some substances dissolve in water, while some do not.

Do you know what the substances that dissolve in water are called?

Substances that dissolve in water are said to be soluble in water, while substances that do not dissolve in water are said to be insoluble in water.

The given table classifies some common solid substances as soluble or insoluble.

Substance	Does the substance dissolve in water?	Soluble or Insoluble
Sugar	Yes	Soluble
Salt	Yes	Soluble
Wooden block	No	Insoluble
Saw dust	No	Insoluble
Chalk powder	No	Insoluble

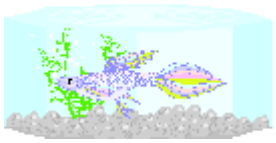
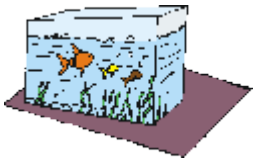
Collect the materials that are given in the table below. Take four glasses and pour some water in each. Add a little amount of each substance in the glasses and stir. Observe whether the substances dissolve in water or not.

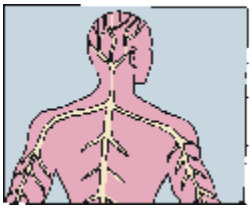
Substance	Does it dissolve in water?	Soluble or Insoluble?
Turmeric powder	Yes	Soluble
Talcum powder	No	Insoluble
Glucose	Yes	Soluble
Coffee powder	Yes	Soluble

Similarly, liquids and gases can also be soluble or insoluble in water. The table given below lists some liquids and gases.

Nature of substance	Substance	Does it dissolve in water?	Soluble or Insoluble?
Liquid	Orange juice	Yes	Soluble
	Milk	Yes	Soluble
	Kerosene	No	Insoluble
	Vinegar	Yes	Soluble
	Mustard oil	No	Insoluble
Gaseous	Oxygen	Yes	Soluble
	Carbon dioxide	Yes	Soluble

Many gases are insoluble in water. However, they can be dissolved in water by applying pressure.

Have you ever wondered how aquatic animals and plants get oxygen? Aquatic animals (fishes, crabs, etc) and plants (algae, sea grass, etc.) cannot use atmospheric oxygen. Atmospheric oxygen dissolves in water under normal conditions. This dissolved oxygen is used by aquatic animals and plants to meet their oxygen requirements.	
	**Aquarium** You must have noticed that bubbles continuously come out of the water in an aquarium. These are air or oxygen bubbles. The oxygen present in the bubbles gets dissolved in water while passing through it. This allows the fishes to survive in the aquarium.



Blood plays an important role by dissolving most bio-molecules.

Blood contains water. A number of bio-molecules such as proteins, vitamins, etc., are dissolved in blood (water). These dissolved materials are then transported throughout the body to provide nutrients to the cells and tissues.

Have you noticed that the taste of water changes when it is boiled?

Few gases such as oxygen, carbon dioxide, etc., are dissolved in water. This gives a particular taste to water. Boiling removes these gases from water. This changes the taste of water.

Substances that are insoluble in water remain as they are when added to water. Depending upon whether they are heavier or lighter than water, they can be classified into two groups. Substances that are insoluble and lighter than water will float on it and those that are insoluble and heavier will sink.

Collect the following objects: a key, a small piece of wood, a pen, a piece of cardboard, a capped empty bottle, a plastic ball, a coin. Fill two-thirds of a vessel with water. Put all the materials one by one into the water. Record your observations.

Object	Does it sink?
Key	Yes
Wood piece	No
Pen	Yes
Cardboard	No
Empty bottle	No
Plastic ball	No
Coin	Yes

How a swimming tube works?

Air trapped inside the tube prevents it from sinking, as air is lighter than water. Hence, swimming tubes float on water. Those who do not know how to swim or are learning are advised to use a swimming tube with the help of which they can float on water.

The interaction of various substances with water is summarized in the given animation.

Have you ever noticed that some liquids flow down easily over a surface while some do not?

There are certain substances that have the ability to flow easily. This property is known as **Fluidity**. Depending upon the tendency of a substance to flow, the degree of fluidity is decided.

Take following substances: water, kerosene, vaseline, tomato ketchup. Take a round plate and put few drops of water on it and tilt it. How fast did the water flow? Repeat this with all the liquids and record your observations.

Liquid	**Flow**
Water	Flows easily
Kerosene	Flows less easily
Tomato Ketchup	Flows heavily
Vaseline	Does not flow