SCIENCE (Term - I)

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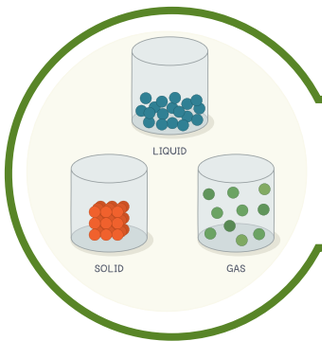

Unit 3 Matter Around Us

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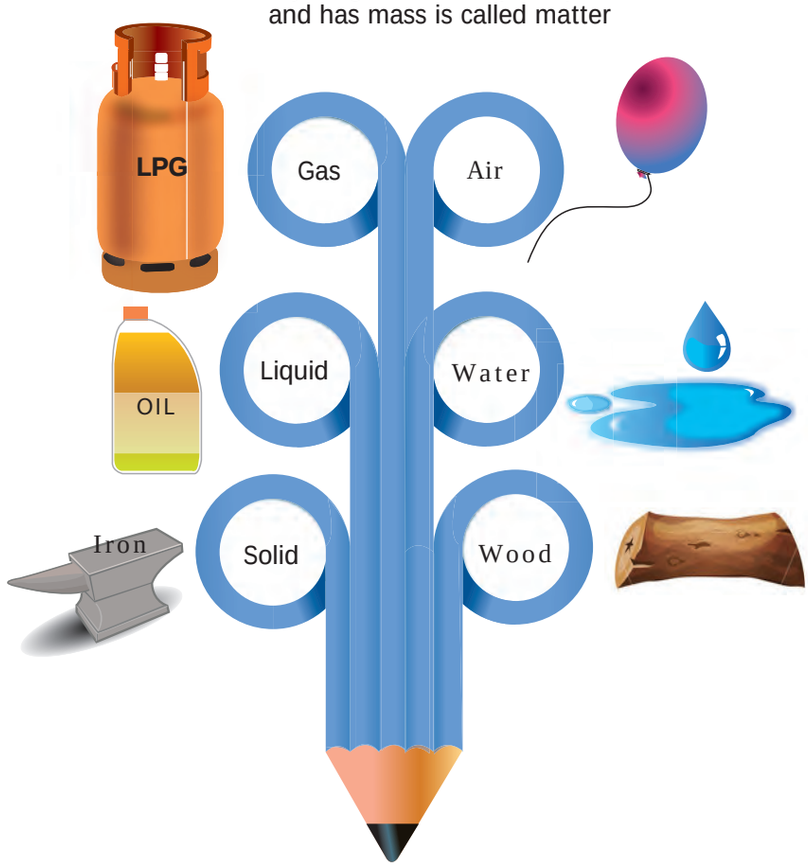
Anything which occupies space and has mass is called matter



Learning Objectives

- To define matter and develop an understanding on the particle nature of matter.
- To sort the objects on the basis of certain properties.
- To differentiate solids, liquids and gases based on the arrangement of their particles.
- To differentiate pure substances from mixtures.
- To identify the need for separation of mixtures.
- To suggest suitable methods for separating given samples of mixtures.
- To acquire an awareness on food adulteration and its harmful effects.

Introduction

Matter is everywhere around us. The air we breath, water we drink and the material we use are made up of matter. Matter is defined as anything that occupies space and has mass. Matter is found in three major states: solid, liquid and gas. Do you know what is matter made of?

Matter is made of atoms. Atoms are the smallest particle of matter. They are so small that you cannot see them with your eyes or even with a standard microscope. A standard sheet of paper is about millions of atoms thick. Science has come up with a technology to identify the structure of atoms by using Atomic resolution Microscope (ARM) and Tunnelling Electron Microscope (TEM) which use electricity to map atoms. There is more about atoms in the later classes. But first let's learn about the three states of matter.

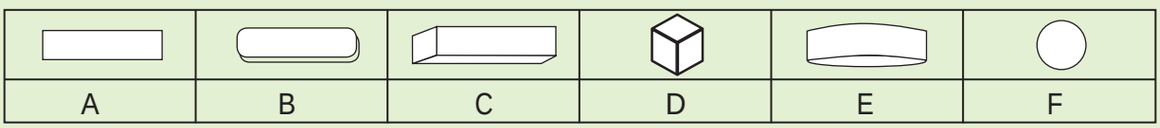
3.1 Physical Nature of Matter

Matter occupies space and has mass. What is its nature? Many philosophers pondered over this question and came out with ideas. It is known that Indian Philosopher **Kanada** and Greek philosopher **Democritus** had their ideas similar. The Indian philosopher Kanada called it as **paramanu** and Democritus called it as **atomos**.

Imagine that a piece of thread is cut endlessly using knife. At one point it would be like a small piece that it cannot be further cut by a knife. That small particle may contain millions of molecules and these molecules are made of atoms. Matter is made of such smallest particles 'atoms'. These atoms are extremely small even to see under a powerful microscope.

Activity - 1

Take a few crystals of sugar. Observe them carefully with the help of a magnifying lens.

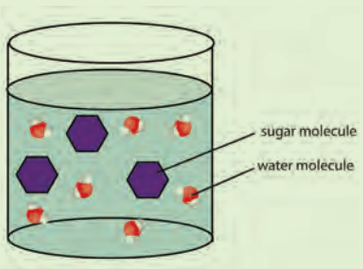


Which of the shapes given above resemble a sugar crystal?

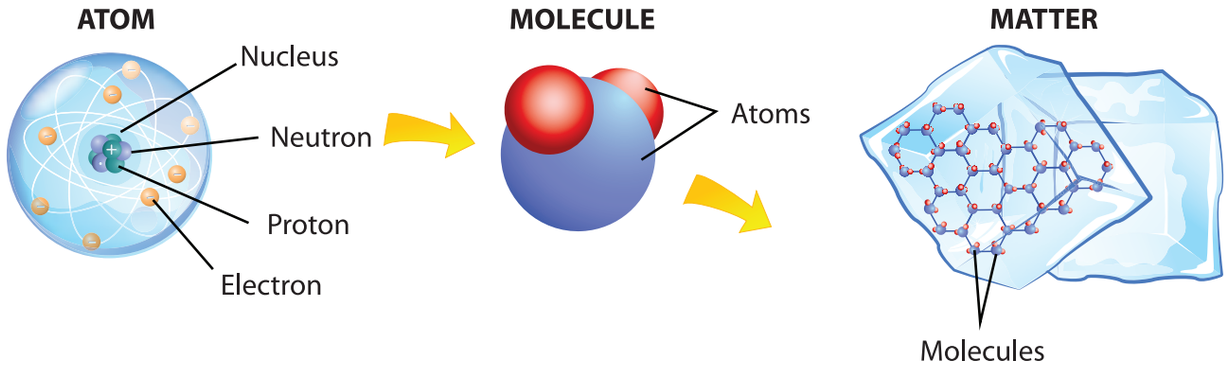
A B C D E F

Now place a few sugar crystals into water.

What happens to the sugar crystals?



A sugar crystal is also made up of molecules. When sugar dissolves in water, the sugar crystals break down and the molecules of sugar get distributed in water. This makes water sweet in taste. The sugar molecules are extremely small; that is why we are not able to see them. Small amount of matter has many millions of molecules in it (1 million = 10 lakhs).



Characteristics of the particles of matter

1. Particles of matter have a lot of space in between them. In different forms of matter this spacing will be different.

Let us add a spoon full of sugar to a glass of water. Stir well. Sugar disappears completely. Where has it gone? Will the glass of water be now sweet? Water particles have space between them and sugar particles are now occupying those spaces.

2. Particles of matter attract each other.

It is the force of attraction which keeps the particles together. This attractive force will be different for different forms of matter.

Grouping of Matter on the basis of Physical states

These are the three physical states of matter. Matter can be grouped into solids, liquids and gases based on the above characteristics.

3.2 Mass, Shape and Volume of Solids, Liquids and Gases

Let us first take any solid say a stone: Answer the following questions.

- Do you need a container to know the shape of a stone ? Yes / No

A solid does not need a container. It stays as it is because its particles are tightly packed and has a definite shape.

- If you move the stone from the ground to a table or place it on the shelf does it's shape change? Yes / No

If you take a stone from the ground and place it on the table or shelf its shape and volume do not change.

Activity 2

Sit together in groups of three. Look at the objects given below. Are they familiar to you? Are they same or different? On what basis you can group them? Is there only one way of doing it or more ways? Discuss with your group members and note down your points.

Pencil and books are used for studying. The bucket and the comb are made of plastic while the table and ladle




















are made of wood. The scrub brush and broom are rough but the toy bear is soft. Light can pass through a glass of water and the spectacles but not through apple or iron box. The cow and the bird are living things while the rest are not. Water in the glass is liquid but air in the balloon is gas and the rest are solids. The feather and the paper cup can float but not the apple or the piece of stone. The rubber band can be stretched but not the comb. Though they have different properties, they are matter.

Try to fill in the following table

You can group them according to their uses, the materials with which they are made of or some other properties.

S.No	Things that float	Things that sink
1.		
2.		
3.		

Try to make more such tables based on the properties discussed above. How many tables could you make?

How did you classify the items in the above list as solids, liquids and gases?

You should have done it based on some properties. Brick and door which are hard come under solids, things that flow come under liquids and others which are very light and can flow more freely come under gases.

Activity 3

Malar was asked to group some items based on their physical states. The table she made is given below. Do you agree with her? Correct the table if you do not agree and submit it to your teacher. (Work in a group of two.)

Chalk piece	Wind	Steam
Water	Rain	Lemon
Air in a balloon	Stone	Lemon juice
River	Air	Smoke
Brick	Table	Door

3.3 Diffusion

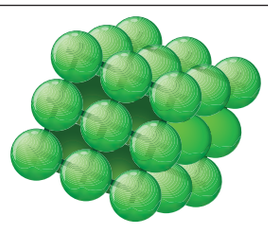
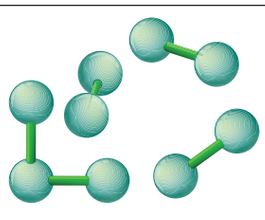
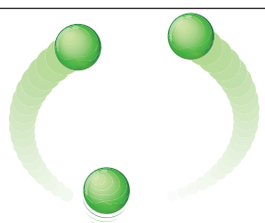
Let us place a book on a table. Let it not be disturbed. Observe for five minutes. Now take a glass of water and add a drop of ink carefully at the centre. Do not shake or stir.

Now light an incense stick and keep it in one corner of the room.

Let us answer the following questions.

- Did the book move?
- Did the ink particles move and spread itself in the water? How long did it take for complete mixing?
- Did you get the smell of the incense stick from where you are standing?
- How fast did you get the smell? How did the smell reach you?

We may conclude that the particles of gases and liquids can move easily and quickly. This tendency of particles to spread out in order to occupy the available space is called diffusion. Solids are tightly packed and they do not diffuse like liquids or gases. Hence ink and smoke spread easily while book stays on the table.

Particles in a Solid	Particles in a Liquid	Particles in a Gas
		
In solid, the particles are tightly packed with very little space between them. Eg. Stone	Particles in liquids are arranged in a random or irregular way and the space between the particles is greater than that is in solids. Eg. Water	The particles in the gases are arranged far apart. They move freely. Eg. Air

Activity 4

Let us take two sachets of juice. In both the sachets, it is written 100ml. Let us empty two sachets and pour the juice into the following glasses.

- Does its shape change? Yes / No

  A liquid needs a container and it takes the shape of a container because the particles slide over one another and keep moving.

- Does its volume change when it is poured into a big glass as well as a small one? Yes / No

  The amount of juice is the same in both glasses.

- How will you find out whether the volume has changed or not?

  The volume of a liquid remains the same whether it is kept in a large container or a small one but its shape changes.

Activity 5

Lift an uninflated cycle tube. Inflate it and now lift it again. Is there a change in the weight? Can we say that air has mass?

We can say that air is also a matter. Though we cannot see it, it occupies space and also has mass. Let us try to know more about matter.

Test Yourself

1 Name an object which is brittle and transparent. _____

2. Name an object which can be stretched. _____

3. Name two objects which can be bent. _____

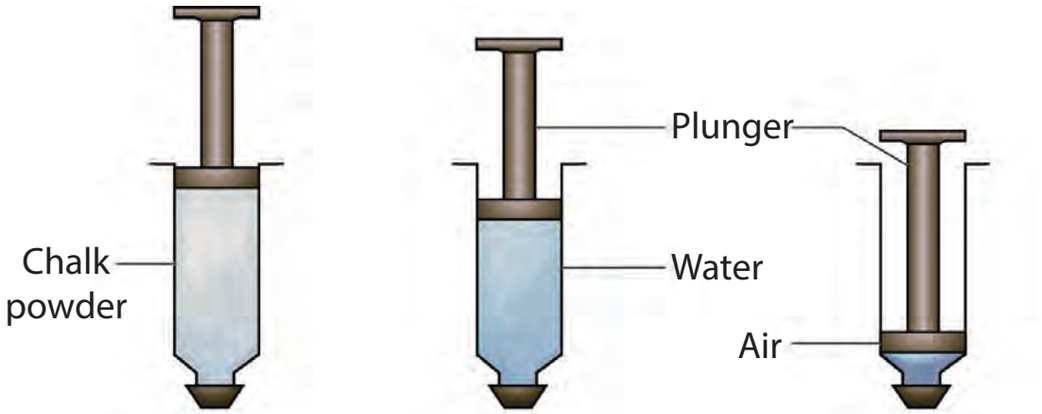
3.4 Compressibility of gases compared to liquids and solids

Let us take three identical syringes. Close the nozzles tightly with a cork. After removing the plunger first let us fill it with fine chalk powder. Try to press plunger down. What do you observe?

B3B4CP

Now let us fill the second one with water. Press the plunger down. What do you observe? Let us now draw the piston back to suck air into the third one. Press the plunger down. What do you observe? Is it easy or hard to press? Record your observations and share among the group members.

You would have observed that the plunger moved freely in syringe with air than in water. It was difficult to press the liquids and the piston hardly moved in chalk powder. Thus, we can conclude that gases are highly compressible as compared to liquids and solids.



Solids are not compressible | **Liquids are hardly compressible** | **Gases are compressible**

Think to learn

Solid ⟶ Liquid ⟶ Gas

'Liquefaction of gases' is the process by which substances in their gaseous state are converted to the liquid state. When the pressure on a gas is increased, its molecules come closer together, and the temperature is reduced. This removes enough energy to make it change from the gaseous state to the liquid state.

Lets summarize

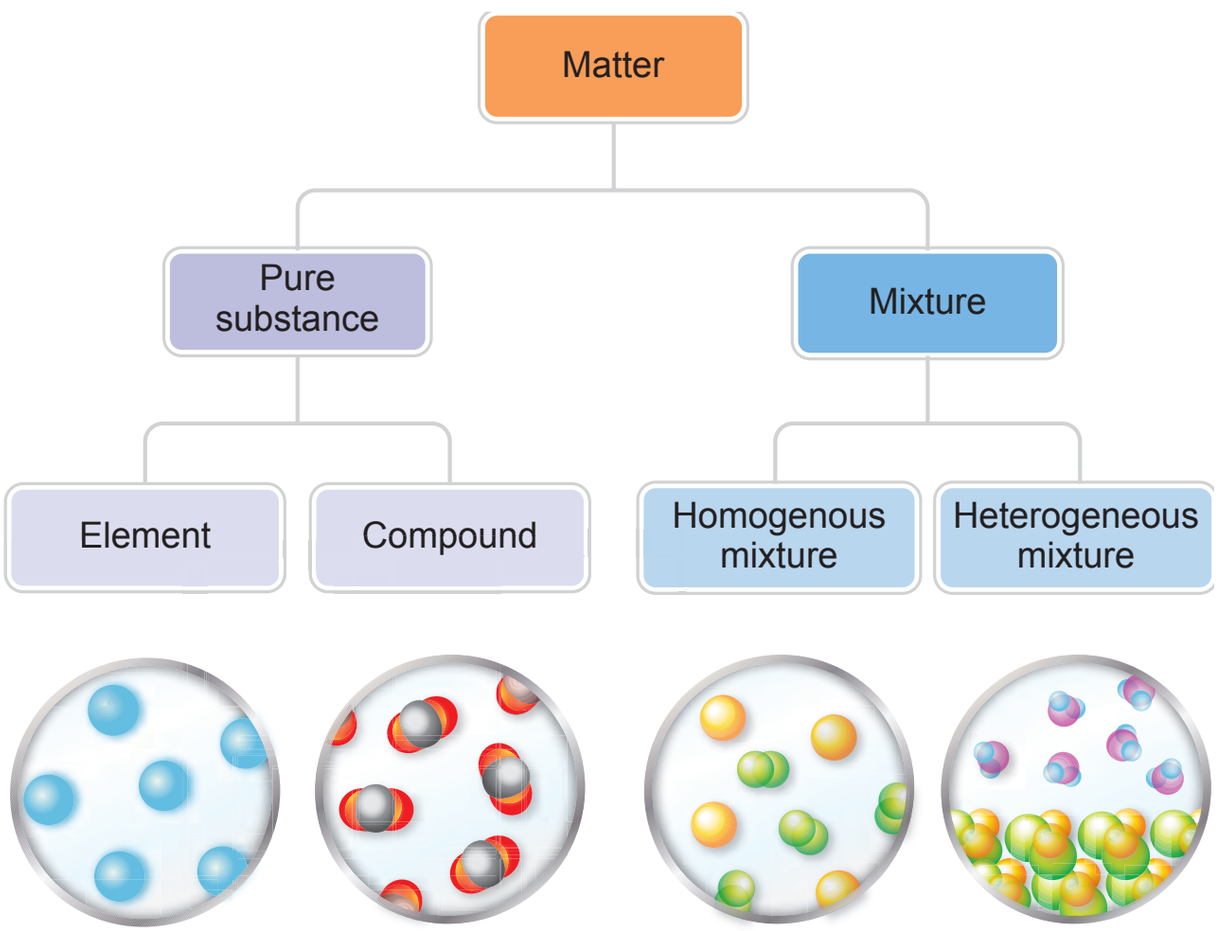
S.no.	Solids	Liquids	Gases
1.	Definite shape and volume	No definite shape. Liquids attain the shape of the vessel in which they are kept.	Gases have neither a definite shape nor a definite volume.
2.	Incompressible	Compressible to a small extent.	Highly compressible
3.	There is little space between solid particles. Particles are tightly packed or arranged.	These particles have a greater space between them. Particles are not tightly packed or arranged. They are free to move.	The space between gas particles is the greatest. Particles are very loosely packed or arranged.
4.	These particles attract each other very strongly.	The force of attraction between liquid particles is less than solid particles.	The force of attraction is least between gaseous particles.
5.	Particles of solid cannot move freely.	These particles move freely.	Gaseous particles are in a continuous, random motion.

3.5 Pure Substances and Mixtures

In shops, we find products which are sold with label 100% pure! For common people pure means unadulterated, does not contain any cheap or harmful additives. Are they really pure substances as they claim to be?

For a Chemist the word 'pure' means something else!

- A pure substance is made up of only one kind of particles.
- Pure substances may be elements or compounds.
- An element is made up of same kind of atoms.
- A molecule consists of two or more atoms.
- Compound is the substance formed by the chemical combination of two or more elements.
- Mixture is a physical combination of two are more substances.



Let us consider the following examples. We all eat snacks. Can you identify and mention a few things that are present in a mixture or fruit mixture? You are able to identify the ingredients in them from their colours, appearance or taste.

We mix rice, dal, salt, chillies, pepper, ghee and other ingredients to make pongal. Pongal is also an example for mixture.

Why do we call these as mixtures? Because they are made of two or more ingredients or components that are physically separable.

Explore

Can we always see the different components of the mixture with our naked eyes?

Let us compare the vegetable salad and soda water. In vegetable salad the individual vegetable can be separated physically. In soda water we can neither see nor separate the components physically.

Vegetable salad

Soda water

Try it yourself

Identify the mixture given in the table below. Write 'yes' for a mixture and 'no' if it is not a mixture. You may also write 'I do not know' and later discuss with your teacher.

Mixture	Yes / No
Borewell water	
Copper wire	
Sugar cube	
Salt Solution	

Air is a mixture because it contains oxygen, nitrogen, carbon dioxide, water vapour, noble gases and other gases. Milk is also a mixture. It contains water, fat, protein etc.

Lemon juice is a mixture. Some of us like to have it with less sugar; while others like to have it with more sugar. But either way, it is still lemon juice - prepared from lemon extract, water and sugar and is a mixture though the amount of sugar added is different. Same way even if we add extra

water or lemon extract it will still be a mixture. A mixture need not have a fixed proportion of components.

- A mixture is an impure substance and contains more than one kind of particles.
- In the mixture the components are mixed in any proportion.

A mixture can be a physical combination of two or more elements. Example: 22 carat gold which is composed of gold and copper or gold and cadmium.

It can be a physical combination of two or more compounds. Example: Aerated drink which is composed of carbon dioxide, water, sweetening and colouring agents.

It can be a physical combination of an element and a compound. Example: Tincture of iodine is composed of Iodine in alcohol.

3.6 Separation of Mixtures

Are all mixtures used as they are? Or is there a need for separating the components? Materials we use in our day-to-day life are got from different sources and are very often combined with other substances.

Mixtures like coffee and ice cream are taken as such. There is no need for separation of this substances. Metals occur in the form of ores under the earth's crust. But if we want to use a pure metal, we need to adopt a laborious process of extraction to separate the useful metal from the ore.

What is meant by separation? The process by which the components of mixture are isolated and removed from each other to get pure substance is called separation. To know about the original properties and uses of the individual substance we need separation.

When and why do we need to separate mixtures?

- ❖ When we need to remove impurities or harmful components from the mixtures. Eg. Stones from rice.
- ❖ When the useful component has to be separated from other components. Eg. Petrol from petroleum.
- ❖ When a substance has to be obtained in highly pure form. Eg. Gold from gold mines.

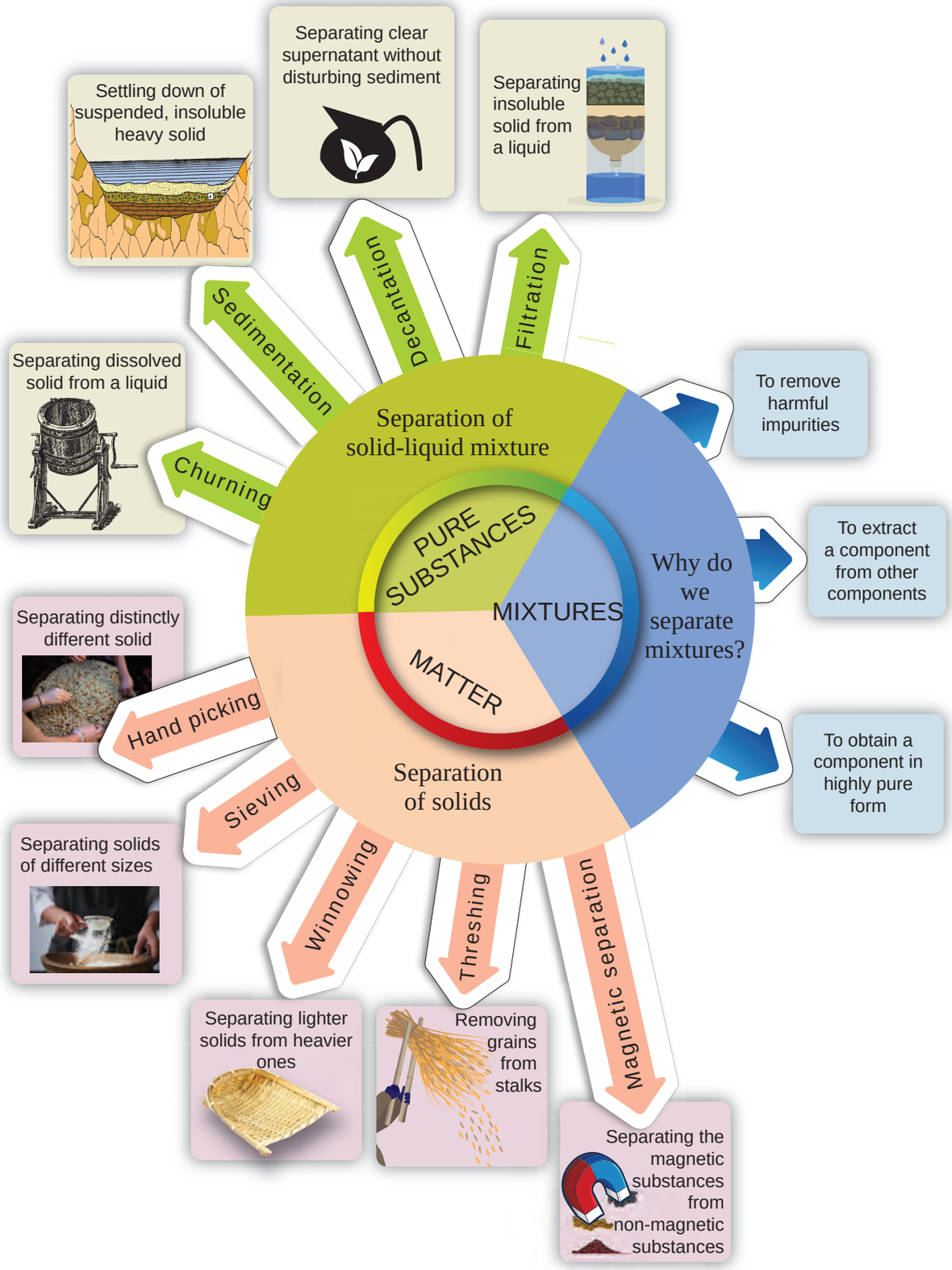
Let us visit Selvi's Family

It is 7 am and Selvi's family is busy. At home, in the kitchen, Selvi's mother is making tea for the family and her grandmother is separating butter from curds. Her father and uncle are out in the field collecting paddy after harvesting. Selvi is helping her mother to cook rice and is separating stones from the rice. Selvi's little brother Balu is fascinated by a piece of magnet that was given by his friend and is playing outside in the sand with it.

Can you list out in your note book, the different activities that Selvi's family members are engaged in?

Let us explore the different separating methods involved in the above activities and also learn about a few other methods.

Separation Techniques



The choice of the method of separation depends upon the properties of the components of the mixture. The separation method may be based on the particle's size, shape or physical state – solids, liquids or gases.

Filtering

Selvi's mother used a strainer to remove the tea leaves to get the clear liquid. Larger sized particles of tea leaves will be retained by the strainer while the clear liquid will pass through. This is called **filtering.**

Will you discard the tea leaves after straining? Can you suggest a good way of using them?

Sieving

A sieve is similar to a strainer. **Sieving** is used when we have to separate solid particles of different sizes. Eg: bran from flour, sand from gravel etc. Wire mesh as a strainer sieve is used to separate gravel from sand at a construction site.

Activity 6

Think and find, is it a good idea to separate bran from flour?

Churning

When very fine insoluble solids have to be separated from a liquid as in butter from curd, **churning** is performed.

The mixture is churned vigorously when solid butter will be collected on the sides of the vessel. Both butter and butter milk obtained after churning are useful and can be consumed.

DO YOU KNOW?

In washing machines water is squeezed out from clothes and they are dried. This method is called centrifugation.

Threshing

When we pluck flowers from plants, we are separating the flowers from their

stalks. Can we do the same for food grains like rice and wheat? It is not possible because the grains are small in size and also the quantity is very large. Farmers separate grains from their stalks by beating them hard. The grains are separated from their stalks. This is called **Threshing.**

Winnowing

Rice, wheat and other food grains are covered with husk which cannot be eaten by us. Husk is very light and gets easily blown away by a breeze or wind. The method used for removing husk from grain is called **winnowing.**

This is done by dropping the mixture slowly from a height in the presence of wind. Lighter solids i.e. husks will be carried by wind and will be collected in a separate heap while heavier solids i.e. grains will fall closer and form a separate heap.

Rice husk also called chaff is the hard coating or protective covering on a seed or grains. It protects the seed during the growing season. Husk can be used as building material, fertilizer, insulation material and fuel.

Handpicking

How do we separate a stone from `rice? If the stones are visible different from the grain, they can be easily picked and separated by hand. This is called **handpicking**. But if the stones look very similar to the rice grains it is difficult to separate.

Magnetic Separation

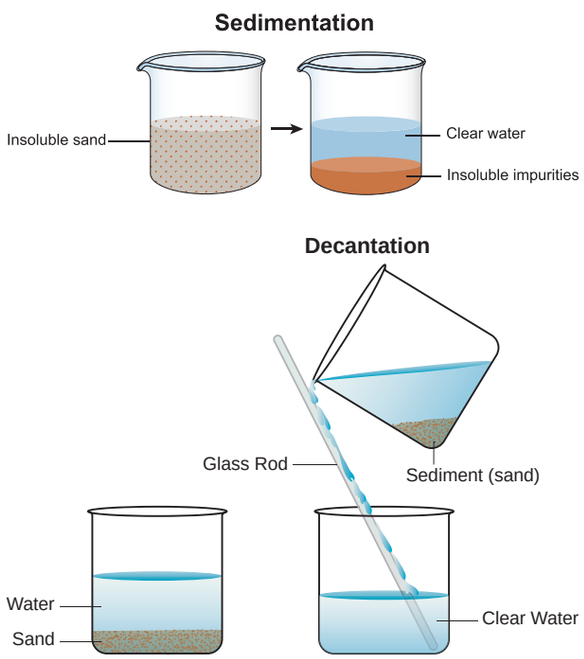
In a mixture containing iron, the magnetic property of iron can be used to separate it from non- magnetic substances by using a magnet. Substances that are attracted to a magnet are called magnetic substances. Separating solids using a magnet is called **magnetic separation.**

Sedimentation

Rice and pulses are often mixed with very fine straw, husk or dust particles which have to be removed before cooking. Are you familiar with the way this is done at home? To remove these particles rice or pulses are washed in water. The lighter impurities float while heavier rice grains sink to the bottom. This is called **sedimentation**. The water with the impurities is carefully poured down leaving clean rice at the bottom. This is called **decantation.**

Separating mud from muddy water

Muddy water is a mixture of very fine particles of soil in water. What will happen if muddy water is left undisturbed for some time? Mud being heavy will settle down at the bottom of the beaker and will form the sediment. Water forms the top layer and is called the supernatant liquid.



The settling down of heavier components of a mixture when allowed to remain undisturbed for some time is called sedimentation.

Decantation

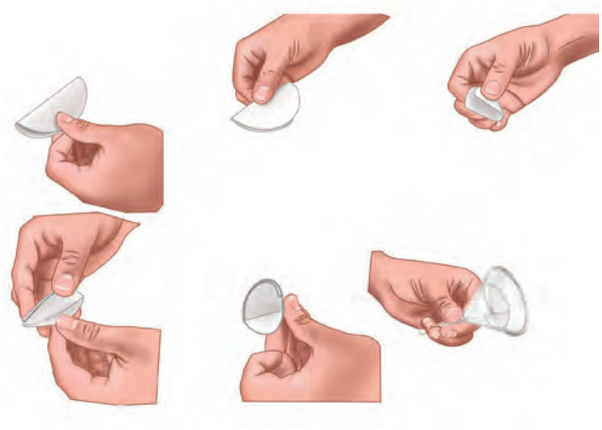
This process is done after sedimentation. The supernatant liquid is slowly poured out from the container without disturbing the sediment. The part that settles down the bottom of the liquid is called sediment. The water that is obtained after decantation is called the decantate. The process of separating liquid above the sediment is called decantation.

But even after decantation the water is not completely free from fine soil particles. How can we remove this? We can do this by filtration. Do you think a strainer or a cloth can filter theses very fine particles? Do it by yourself and find out.

Filtration

We use filter papers to remove the finer impurities. A filter paper has very fine pores much smaller than soil particles. Let us see how to use the filter paper.

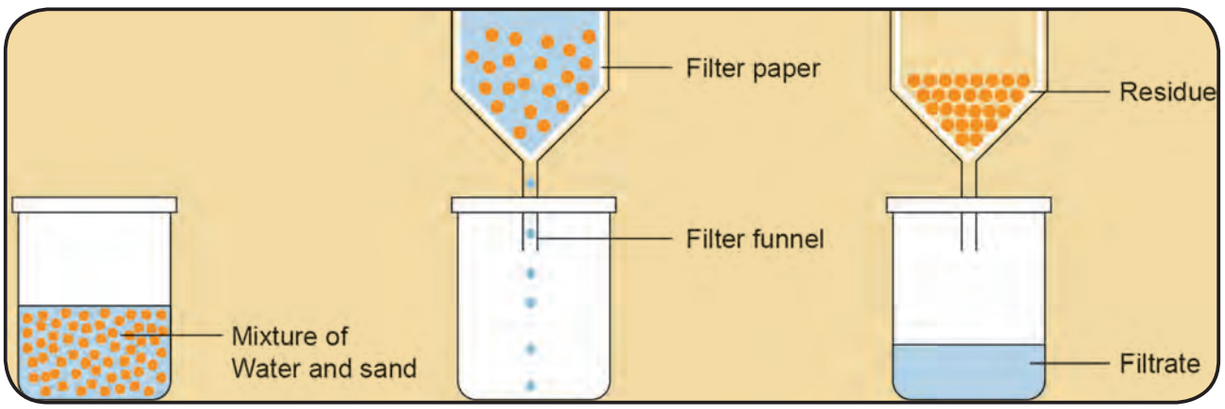
Take a piece of filter paper. Fold it to make a cone (see figure). Slowly pour the muddy water over the filter paper. On filtration clear water (filtrate) flows down the funnel and mud settles as residue on the filter paper. The method of separating insoluble component (sand, mud etc.) from a mixture using a filter paper is called filtration. The liquid which passes through the filter and comes down is called **filtrate** and the insoluble component left behind on the filter paper is called **residue**.



More to know:

Combination of methods are used sometimes for complete separation.

If the mixture of sand and salt in water has to be separated several methods like sedimentation, decantation, filtration, evaporation and condensation are used.



Activity 7

Group Activity – Students are divided into four groups

Each group should suggest a method to separate mixtures and also give reasons why they used a particular method and what property of the components forms the basis for separation. **Examples should be drawn from day-to-day life.** After the group presents its method to the rest of the class, the whole class will discuss and analyse if the suggested method will work and then make a note of it in the table given below.

Separation Method	Example	Basis For Separation

3.7 Food Adulteration

Sometimes, things that we buy in the market are mixed with harmful and unwanted substances. It is called adulteration. Food can also get adulterated due to carelessness or lack of proper handling.

We must be careful about the common adulterants in our consumable goods especially in food. Any adulterated food when consumed will be harmful and can be a health hazard.

An adulterated substance will not indicate the true properties of the original substance. For example, used tea leaves are sometimes used as adulterants in tea. Turmeric powder is adulterated with a bright yellow chemical which is poisonous to us.

In most houses people use commercial water filter to remove not only the impurities but also to kill the harmful germs in water using UV rays.

Reverse Osmosis (RO) is a process of removing impurities from water to make it potable.

Activity 8

Collect and share information on common adulterants and their detection in food stuff in the class. Watch the youtube video: 10 simple tricks to find adulterated food. https://www.youtube.com/watch?v=_XLi WunnudY

Points to Remember

- Matter is anything that has mass and occupies space.
- All matter is made up of extremely small particles called atoms.
- Matter is classified into solids, liquids and gases on the basis of two important factors.
  a. The way the particles are arranged
  b. The way the particles attract each other.
- Difference between the properties of solids, liquids and gases is due to the difference in the arrangement of the particles and the nature of the attractive forces between them.
- A pure substance can be an element or a compound and it can be made up of only one kind of particles.
- A mixture is an impure substance containing two or more components physically mixed in any proportion.
- Separation of mixtures is done
  1. to remove harmful components.
  2. to obtain the useful components.
  3. to obtain a substance in a highly pure form.

- Different separation methods are adopted depending on the properties of the components.
- Handpicking – Particles reasonably large in size to be recognised can be picked by handpicking.
- Winnowing – Adopted to separate lighter solids from heavier ones.
- Magnetic separation – Separating magnetic substances from non-magnetic substances.
- Sedimentation – Settling down of suspended, insoluble and heavy solid particles (used to separate solid – liquid mixtures).
- Decantation - Process of pouring out the clear supernatant liquid without disturbing the sediment.
- Filtration – Process of separating insoluble solid particles (residue) from a liquid (filtrate) by using a filter paper.
- Adulteration – Making things impure by the addition of a foreign or inferior substance.

Evaluation

B3JZEC

I. Choose the correct answer.

1. _____ is not made of matter.
   a. Gold ring b. Iron nail
   c. Light ray d. Oil drop
2. 200 ml of water is poured into a bowl of 400 ml capacity. The volume of water will be _____
   a. 400 ml b. 600 ml
   c. 200 ml d. 800 ml
3. Seeds from water-melon can be removed by _____.
   a. hand-picking
   b. filtration
   c. magnetic separation
   d. decantation
4. Lighter impurities like dust when mixed with rice or pulses can be removed by _____.
   a. filtration b. sedimentation
   c. decantation d. winnowing
5. _____ is essential to perform winnowing activity.
   a. Rain b. Soil
   c. Water d. Air
6. Filtration method is effective in separating_____ mixture.
   a. solid-solid b. solid-liquid
   c. liquid-liquid d. liquid-gas
7. Among the following _____ is not a mixture.
   a. coffee with milk
   b. lemon juice
   c. water
   d. ice cream embedded with nuts

II. Fill in the blanks.

1. Matter is made up of _____
2. In solids, the space between the particles is less than in _____.

3. Grains can be separated from their stalks by _____
4. Chillies are removed from 'Upma' by _____ method.
5. The method employed to separate clay particles from water is _____
6. Water obtained from tube wells is usually _____ water.
7. Which among the following _____ will get attracted to by magnet? (safety pins, pencil and rubber band)

III. State True or False. If false, correct the statement.

1. Air is not compressible.
2. Liquids have no fixed volume but have fixed shape.
3. Particles in solids are free to move.
4. When pulses are washed with water before cooking, water is separated from them by filtration.
5. Strainer is a kind of sieve which is used to separate a liquid from solid.
6. Grain and husk can be separated by winnowing.
7. Air is a pure substance.
8. Butter from curd is separated by sedimentation.

IV. Complete the given analogy.

1. Solid : Rigidity :: Gas : _____.
2. Large Inter-particle space : Gas :: _____ : solid.
3. Solid : Definite shape :: _____ : Shape of the vessel.
4. Husk-Grains : Winnowing :: Sawdust-Chalk piece : _____
5. Murukku from hot oil : _____ :: Coffee powder residue from decoction : _____
6. Iron – sulphur mixture : _____:: Mustard seeds from Urad-dhal : Rolling

V. Match the following.

a)

Property	Example
Breaks easily (Brittle)	Metal pan
Bends readily	Rubber band
Can be stretched easily	Cotton wool
Gets compressed easily	Mud pot
Gets heated readily	Plastic wire

b)

	A	B	C
i	Separation of visible undesirable components	Water mixed with chalk powder	Magnetic Separation
ii	Separation of heavier and lighter components	Sand and water	Decantation
iii	Separation of insoluble impurities	Iron impurities	Filtration
iv	Separation of magnetic components from non- magnetic components	Rice and stone	Hand-picking
v	Separation of solids from liquids	Husk and paddy	Winnowing

VI. Answer very briefly.

1. Define the term matter.
2. How can husk or fine dust particles be separated from rice before cooking?
3. Why do we separate mixtures?
4. Give an example for mixture and justify your answer with reason.
5. Define - Sedimentation.
6. Give the main difference between a pure substance and an impure substance.

VII. Answer briefly.

1. A rubber ball changes its shape on pressing. Can it be called a solid?
2. Why do gases not have fixed shape?
3. What method will you employ to separate cheese (paneer) from milk? Explain.
4. Look at the picture given below and explain the method of separation illustrated.

5. How can you separate a large quantity of tiny bits of paper mixed with pulses / dal?
6. What is meant by food adulteration?
7. Mr. Raghu returns home on a hot summer day and wants to have buttermilk. Mrs. Raghu has only curd. What can she do to get buttermilk? Explain

VIII. Higher Order Thinking Questions.

1. Distinguish the properties of solid, liquid and gas. Draw a suitable diagram.
2. Using suitable apparatus from your laboratory separate the mixture of chalk powder, mustard oil, water and coins. Draw a flow chart to show the separation process.
3. Justify your answer.

Figure 1

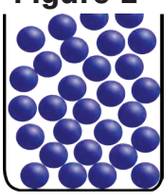


Figure 2

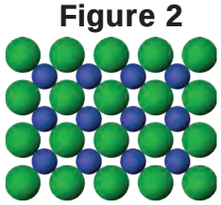
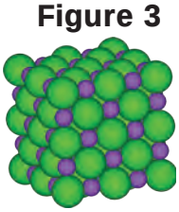


Figure 3



Arrangement of particles in three different phases of matter is shown above.

a) Which state is represented by Fig. 1?

b) In which state will the inter particle attraction be maximum?

c) Which one of them cannot be contained in an open vessel?

d) Which one can take the shape of its container?

4. Malar's mother was preparing to cook dinner. She accidentally mixed ground nuts with urad-dhal. Suggest a suitable method to separate the two substances so that Malar can have ground nuts to eat.

5. In a glass containing some water, tamarind juice and sugar is added and stirred well. Is this a mixture? Can you tell why? Will this solution be sweet or sour or both sweet and sour?

IX. Life Skills - Debate

1. Debate on 'Food adulteration and detection'

X. Field Trip

1. Visit a nearby paddy field and rice mill and note down the different separating techniques used there. Is technology replacing some traditional practices?

Watch you tube video in the given link

https://www.youtube.com/watch?v=9Djc5ZVUyUw

https://www.youtube.com/watch?v=DJGRJ4qL4-A

XI. Sequence Type

1. Write the sequence of steps you would use for making tea. (Use the words : mixture, dissolve, filtrate and residue).

XII. Topic enrichment – Project

1. Make a fruit or vegetable salad. Give reasons why you think it is a mixture.

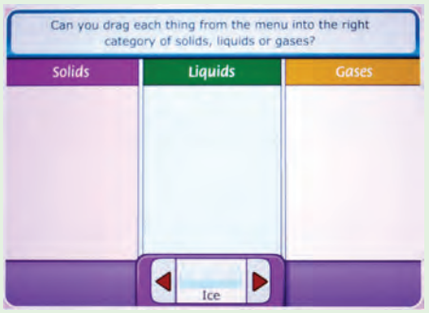
2. Connect with sports

Air is not a pure substance. It helps us in many ways from breathing to playing. Balloon sports are a very popular sport. Hot air is lighter than cool air. So, the balloons filled with hot air rise up. Find out more about hot air balloons.

ICT Corner

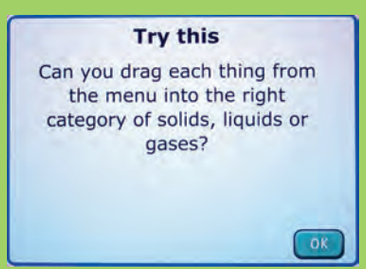
Types of matter

Lets play with
Science kids



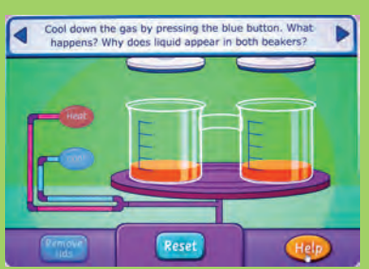
Step 1: To learn more about the matter around us type Science Kids in the Google browser and select games Go inside and select matter. Now the following logo can you drag will appear on the screen. Then click ok.

Step 1: Three divided columns will appear on the screen. The first section is for solid and the second section is for liquid and the third one is for gas. Now when we press this symbol, at the bottom items will appear at the bottom. We have to drag them to their respective column.



Step 1

Step 2



Step 3

Types of matter URL:

http://www.sciencekids.co.nz/gamesactivities/gases.html

*Pictures are indicative only

SCIENCE TERM - II

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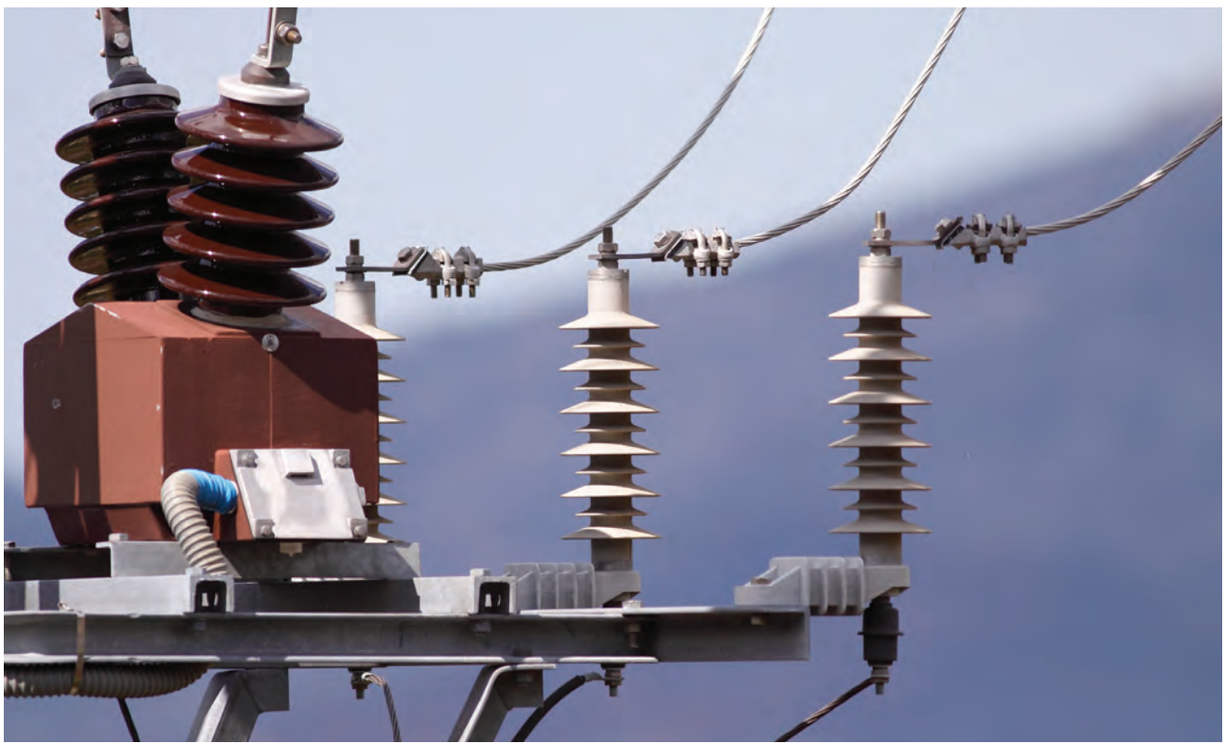


9ZUFIA
E - book

9ZY377
Assessment

B443_SCI_6_T2_EM
DIGI links

Unit 3 Changes Around Us

Learning Objectives

- To recognize and enlist a few changes that happen in our day-to-day life
- To classify the observed changes as,
  - slow / fast, reversible / irreversible
  - physical and chemical changes
  - desirable / undesirable, natural / human made
- To explain the process of dissolution
- To distinguish between a solvent and a solute

A29HFF

Observe the pictures in the previous page and fill in the gaps.

Initial stage	Changing stage
Seed	Sapling
	Night
Rock	
raw fruit	

What is common in all the above pairs?

_____

Introduction

What is a change?

The process in which something becomes different from what it was earlier? It is the observable difference between initial state and the final state of any substance.

Change is the law of nature. In our day - to - day life we see many changes around us. Weather changes periodically (daily/ seasonly), season change periodically. A paper burns readily while it takes a few days for an iron nail to rust. It takes a few hours for milk to turn into curd but vegetables get softened in a few minutes when cooked.

The what happense during a change? said changes are accompanied by change in properties like shape, colour, temperature, position and composition. Some changes can be observed while some are not possible to notice.

Can you list some of the changes that you have observed in your daily life?

Activity 1: What happens when you blow air into a balloon?

- Is there any change in size?
  ☐ Yes ☐ No
- Is there any change in shape?
  ☐ Yes ☐ No
- Is there any other change?

_____

3.1 Classification of Changes

There are different types of changes that occur around us. Some changes take place very quickly while others take hours, days or even years. Some changes are temporary while some others are permanent. Some changes produce new substances while others do not. Some changes are natural while others are made by human beings. Some changes are desirable to us but some changes are not desirable.

A2EQT6

We shall now try to classify changes on the basis of certain similarities and differences.

- **slow and fast changes**
- **reversible and irreversible changes**
- **physical and chemical changes**
- **desirable and undesirable changes**
- **natural and man - made changes**

3.1.1 Slow and Fast changes

Activity 2: Look at the pictures and discuss about the duration for the changes to take place.

Slow changes

Changes which take place over a long period of time (hours / days / months / years) are known as slow changes.

Examples: growth of nail and hair, change of seasons, germination of seed.

Fast Changes

Changes which take place within a short period of time (seconds or minutes) are known as fast changes.

Examples: Bursting of balloon, breaking of glass, bursting of fire crackers, burning of paper.

3.1.2 Reversible and Irreversible changes

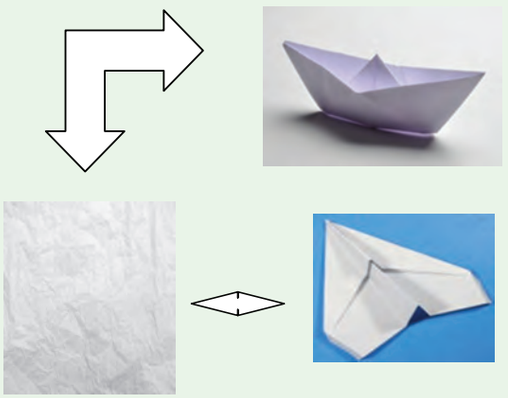
Reversible change

Changes which can be reversed (to get back the original state) are known as reversible changes.

Examples: Touch me not plant (Responding to touch), stretching of rubber band, melting of ice.

Touch me not plant

Activity 3: Try to make a boat and an aeroplane one by one using the same piece of paper. This means the change of shape discussed here is reversible.



Irreversible change

Changes which cannot be reversed or to get back the original state are known as irreversible changes.

Activity 4: What kind of changes are they?

a) Burning of a candle.

_____

b) Piercing a balloon with a pin.

_____

Examples : Change of milk into curd, digestion of food, making idly from batter.

3.1.3 Physical and Chemical Changes

Activity 5: Take an apple and cut it into two halves.

Cut one half into pieces and share it with your friends.

Is there any change in the composition of the apple while cutting?

No, only the shape and size have changed. This can be called a **physical change.**

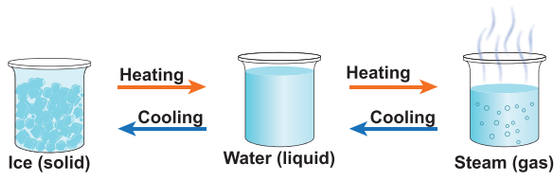
Leave the other half on the table for some time. You can see brown patches formed on the cut surface because of the reaction between some substances in the apple and the air around it. This is a **chemical change.**

Physical changes

Physical changes are the temporary changes in which there is change in the physical appearance or physical state of the substance but not in its chemical composition. Here no new substance is formed.

Example: Melting of ice, the solution of salt or sugar, stretching of rubber band.

Let us now understand **the physical changes that take place in water**. You already know that water exists in three states as solid, liquid and gas. Change of state takes place either by heating or cooling. By heating energy is supplied and by cooling energy is taken away. These are the reasons for the changes.



Let us name a few processes connected with the changes in states of water.

Change	Process
ice into water on heating	melting
water into steam on heating	vapourisation
steam into water on cooling	condensation
water into ice on cooling	freezing

More to Know

The change of state from solid to gas directly is called **sublimation.**

Example : Camphor

Let us understand one more physical change

Dissolution

The spreading of the solid particles (broken into individual molecules) among the liquid molecules is called as dissolution.

- **Solvent** is a substance that dissolves the solute.
- **Solute** is a substance that is dissolved in a solvent to make a solution.
- When solute is dissolved in a solvent it forms a **solution**.

Solute + Solvent ⟶ Solution

Water is known as the universal solvent. It dissolves a wide range of substance.

Activity 6: Take half a cup of water, add one spoon full of sugar and stir well.

a. What do you observe?

_____

b. What happened to the sugar?

_____

c. Where is it gone?

_____

d. The solute in the above solution is _____.

e. The solvent in the above solution is _____.

f. Have you seen a glass of water and a glass of sugar solution looking alike? _____

Chemical changes

Chemical changes are the permanent changes in which there is a change in the chemical composition and new substance is formed.

Examples: Burning of wood, Popping of popcorn, Blackening of silver ornaments, and Rusting of iron.

Physical Change	Chemical Change
No new substance formed	New substance formed
No change in the chemical composition	There a is change in the chemical composition
It is a temporary change	It is a permanent change
It is reversible	It is irreversible

Activity 7: Look at the pictures and write whether they are **physical** or **chemical** changes.

_____

_____

_____

_____

3.1.4 Desirable and Undesirable Changes

Activity 8: Look at the pictures and write whether they are **desirable** or **undesirable** changes.

forest fire

_____

decaying of fruit

_____

egg to chicken

_____

Wind mills

_____

Desirable changes

The changes which are useful, not harmful to our environment and desired by us are known as desirable changes.

Examples: Ripening of fruit, growth of plants, cooking of food, milk changing to curd.

Undesirable changes

The changes which are harmful to our environment and not desired by us are known as undesirable changes.

Examples: Deforestation, decaying of fruit, rusting of iron.

3.1.5 Natural and human made changes

A2IDH3

Activity 9: Identify the type of changes

Natural / Human made

Floods

_____

Carpentry

_____

Planting of seedlings

_____

Land slides

_____

Natural changes

Changes which take place in nature on their own and are beyond the control of human beings are known as Natural changes.

Examples: Rotation of the earth, Changing phases of the Moon, Rain.

Human made or artificial changes

The changes which are brought about by human beings are known as human made or artificial changes. They will not happen on their own.

Examples: Cooking, Deforestation, Cultivating crops, construction of buildings.

Points to remember

- Everything in this world undergoes changes. Changes occur in position, shape, size, state, colour, temperature, composition etc.,

- Fast change – short period of time

  Slow change – long period of time

- Reversible change – can go back to its original state

  Irreversible change – cannot go back to its original state

- Desirable change - changes that are useful and harmless to our environmental

  Undesirable change - changes that are harmful to our environment.

- Natural change - changes that take place in nature on their own

  Human made change - changes that are brought about by human beings

- A solute when dissolved in a solvent makes a solution.

- The process of dissolving the solute in solvent is called dissolution.

ICT Corner

Changes Around Us

Through this activity you will be able to understand reversible & irreversible changes.

Step 1: Use the given URL in the browser. 'Reversible and irreversible changes's page will open. Use the arrow marks on both sides of the substance to choose another substance to test.

Step 2: Click and drag the substance into the beaker, observe whether it dissolves or not. Click the Dissolving / Reversing button to switch between the both activities.

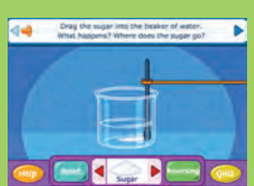
Step 3: In the Reversing activity, with some substances you can choose either to cool or to Heat them. With other substances you can choose either to Heat or to filter them by clicking the respective buttons.

Step 4: Click on the Reset button to clear.

Step 1

Step 2

Step 3



Step 4

Reversible and irreversible changes's URL:

http://www.bbc.co.uk/schools/scienceclips/ages/10_11/rev_irrev_changes_fs.shtml

*Pictures are indicative only

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Evaluation

A2NLUT

I. Choose the appropriate answer

1. When ice melts to form water, change occurs in its

   a. position b. colour

   c. physical state d. composition

2. Drying of wet clothes in air is an example of

   a. Chemical change

   b. Undesirable change

   c. irreversible change

   d. physical change

3. Formation of curd from milk is

   a. a reversible change

   b. a fast change

   c. an irreversible change

   d. an undesirable change

4. Out of the following an example of a desirable change is

   a. rusting b. change of seasons

   c. earthquake d. flooding

5. Air pollution leading to acid rain is a

   a. reversible change

   b. fast change

   c. natural change

   d. human made change

II. Fill in the blanks

1. Magnet attracts iron needle. This is _____ change. (a reversible / an irreversible)

2. Boiling of egg results in _____ change. (a reversible / an irreversible)

3. Changes that are harmful to us are _____. (desirable / undesirable)

4. Plants convert carbon-di-oxide and water into starch. This is an example of _____ change. (natural / human made)

5. Bursting of fire crackers is a _____ change whereas germination of seeds is a _____ change. (slow / fast)

III. True or False. If False, give the correct statement

1. Growing of teeth in an infant is slow change.

2. Burning of match stick is a reversible change.

3. Change of new moon to full moon is human made.

4. Digestion of food is a physical change.

5. In a solution of salt in water, water is the solute

IV. Analogy

1. Curdling of milk : irreversible change :: Formation of clouds : _____change

2. Photosynthesis : _____ change :: burning of coal : Human – made change

3. Dissolution of glucose : reversible change :: Digestion of food: _____ change

4. Cooking of food : desirable change :: decaying of food : _____change

5. Burning of matchstick :_____ change: Rotation of the Earth : Slow change

V. Circle the odd one out. Give reason for your choice

1. Growth of a child, Blinking of eye, Rusting, Germination of a seed

2. Glowing of a bulb, lighting of a Candle, breaking of a coffee mug, curdling of milk

3. Rotting of an egg, condensation of water vapour, trimming of hair, Ripening of fruit

4. Inflating a balloon, popping a balloon, fading of wall paint, burning of kerosene

VI. Give very short answer

1. What kind of a change is associated with decaying of a plants?

2. You are given some candle wax. Can you make a candle doll from it? What kind of change is this?

3. Define a slow change.

4. What happens when cane sugar is strongly heated? Mention any two changes in it.

5. What is a solution?

VII. Give short answer

1. What happen when paper is burnt? Explain.

2. Can deforestation be considered a desirable change? Explain.

3. What type of changes is associated with germination of a seed? Explain

VIII. Answer in detail

1. Give one example for each case that happens around you.

   a. Slow and fast change

   b. Reversible and irreversible change

   c. Physical and chemical change

   d. Natural and man-made change

   e. Desirable and undesirable change

IX. Question based on Higher Order Thinking Skills

1. When a candle is lit the following changes are observed.

   a. Wax melts.

   b. Candle keeps burning.

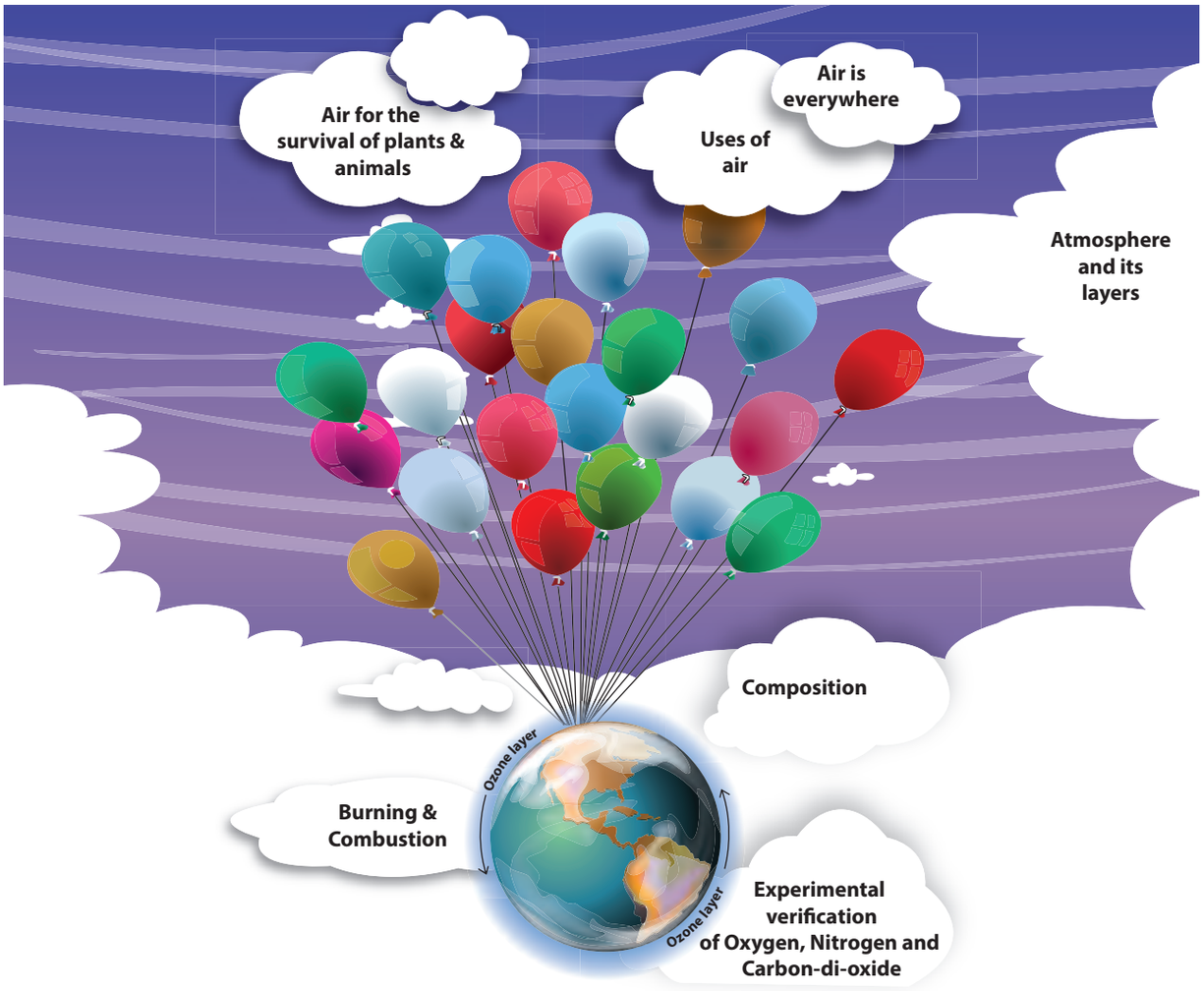
   c. The size of the candle decreases.

   d. The molten wax solidifies

   e. Which of the changes can be reversed? Justify your answer.

Unit 4 Air

A2S9IQ



Learning Objectives

- To identify the components and uses of air
- To develop skills in performing experiments and arriving at conclusions
- To clarify the role of oxygen in the process of burning
- To realize the significance of air for the survival of plants and animals on earth
- To appreciate the need of air in protecting our atmosphere

Introduction

Air is present everywhere around us. We cannot see air. But we can feel its presence in so many ways. For example, we feel air when the trees rustle, clothes hanging on a clothes-line sway, pages of an open book flutters when the fan is switched on, when kites fly in the sky. We cannot see, touch or taste air but we can feel it. It is the air that makes all these movements possible. Thus, we can understand that **air is present all around us.**

Air is necessary for us to live. We can live without food for some days, without water for a few hours, but cannot survive without air for more than a few minutes. So, **air is very important for all living beings to survive.**

When air is moving it is called wind. It is cool and soothing as breeze. When air moves with force it can even uproot trees and blow off the roof tops. Air is necessary for breathing and also for combustion. Shall we do an activity?

Activity 1: Air is everywhere

Let us take an empty glass bottle. Is it really empty or does it have something inside?

Now, shall we turn the glass bottle upside down? Can you agree that there is still something inside the empty glass bottle? Let us do the following activity to find what is there inside an empty glass bottle.

Dip the open mouth of the bottle into

the trough filled with water as shown in Fig 1. Observe the bottle. Does water enter the bottle? _____

Now tilt the bottle slightly. Now again dip the open mouth of the bottle as shown in Fig 2. Do you think that water will enter the bottle? _____

Kindly observe the Fig 2 carefully. You can see bubbles coming out of the bottle.

When you perform the experiment, can you hear the bubbly sound? can you now guess what was inside the bottle?

_____

Yes, you are right. It is **"air"** that was present in the bottle.

The bottle was not empty at all. In fact, it was filled completely with air even when you turned it upside down. That is why we notice that water does not enter the bottle when it is pushed in an inverted position, as there was no space for air to escape.

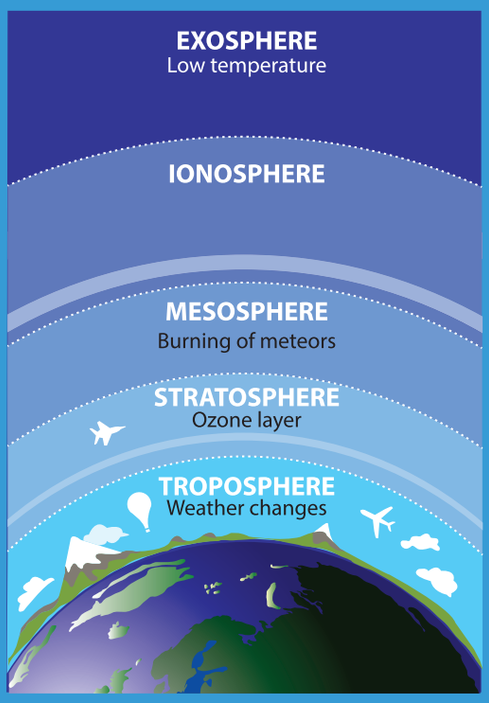
When the bottle was tilted, the air was able to come out in the form of bubbles, and water filled up the empty space that the air has occupied.

Hence **we can see that air fills all the space inside the bottle.**

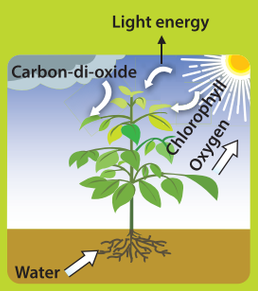
AIR

A2XHWG

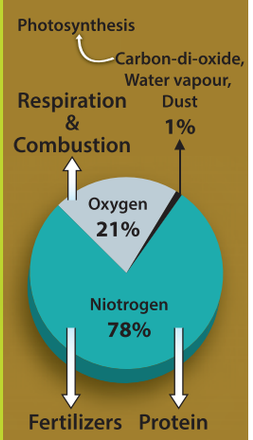
ATMOSPHERE AND ITS LAYERS



AIR FOR SURVIVAL OF PLANTS AND ANIMALS



COMPOSITION

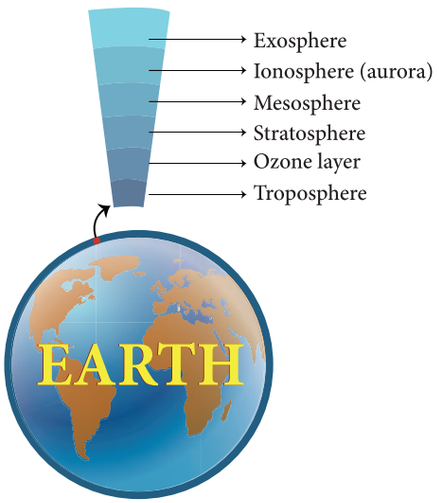


USES OF AIR

4.1 Atmosphere

Our earth is surrounded by a huge envelope of air called the atmosphere. Atmosphere extends to more than 800km above the surface of earth and is held in place by the earth's gravity. The atmosphere protects us from many harmful rays coming from the sun. The air envelope is thicker near the earth's surface and as we go higher the density and the availability of air gradually decreases. This is because, as we go higher, the force of gravity decreases, so it is not able to hold large amount of air.

The atmosphere is made of five different layers – **the troposphere, the stratosphere, the mesosphere, the ionosphere and the exosphere.**



The troposphere is the layer closest to the earth. It is the layer in which we live. It extends upwards for about 16km above the surface of the earth. Movement of wind takes place in this layer. It also contains water vapour, which is responsible for making clouds. This layer is responsible for the weather we experience on earth. Aircrafts usually fly above this layer to avoid strong winds and bad weather.

The stratosphere lies above the troposphere. This layer has the ozone layer in it. The ozone layer protects all life on earth from the harmful ultraviolet rays of the sun.

A weathercock shows the direction in which the air is moving at a particular place. You can also make a wind sock to find the direction of the wind. Can you try it yourself?

4.2 Experimental verification of presence of Oxygen, Carbon-di-oxide and Nitrogen in Air

Is air a thing or a composite mixture?

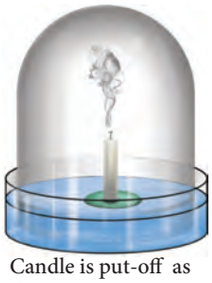
For long time, that is, until eighteenth century, human thought 'air' as a fundamental constituent of matter. However an ingenious experiment conducted by Joseph Priestley in 1774 showed that **"air is not an elementary substance, but a composition,"** or mixture of gases. He was also able to identify a colourless and highly reactive gas which was later named **'oxygen'** by the great French chemist Antoine Lavoisier.

Priestley took a tub of water and made a float and placed a candle on it. He covered

Fig-1

Candle Glows

Fig-2



Candle is put-off as there was no oxygen

Fig-3

Mouse is inserted

Fig-4

Mouse died as there was no oxygen in candle glass jar.

Fig-5

Mint plant is introduced

Fig-6

Candle continued to glow because mint provides oxygen

Fig-7

Candle glows, mouse survies with a mint plant inside.

A325KD

the candle with a glass jar. [As the bottom portion of the jar was filled with water, no air can enter or exit and hence the jar was completely sealed **(Fig-1)**]. As you would have guessed the candle flame was extinguished in a very short time. He used a magnifying glass to focus the sun rays to light the candle. Thus he tried to relight the candle many times without opening the sealed jar **(Fig-2).** The candle could not be relit. What can we make out of it?

It was clear that something in the air was being used for burning and being converted into another substance. Once the substance in the air that was aiding the burning was completely used by the burning flame and converted into another substance, the flame went out.

[Later chemist named the substance necessary for burning as oxygen and during the process of burning oxygen is converted mostly into carbon dioxide.]

Now as the jar was inside the water, Priestley could gently lift the jar and place a live mouse inside it without allowing outside air to enter the jar **(Fig-3).** Without oxygen, as you would have guessed, the mouse died **(Fig-4).** It was clear that oxygen was necessary for the survival of the mouse.

In the next step, he gently lifted the jar and placed a mint plant **(Fig-5).** (**Note**: Look at the Figure- 5; you could see that the plant is inserted into the bell jar when the jar is very much inside the water. This is done to ensure that the outside air is not entering into the bell jar.) Plant being a living thing like mouse, perhaps he thought, would die. Instead, the plant survived. After placing the mint plant, he lit up the candle and it continued to burn **(Fig-6).**

In fourth experiment, he took a jar, burned a candle and converted all oxygen into carbon dioxide. He placed a mint plant

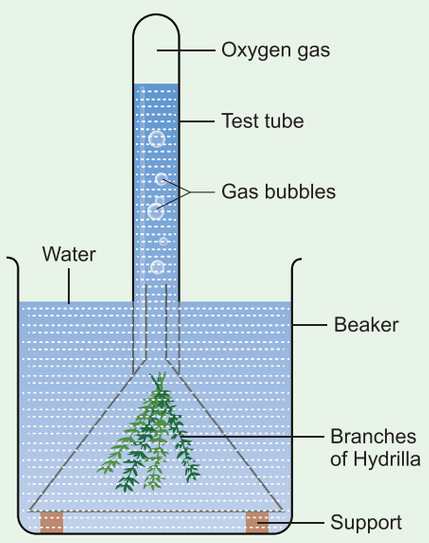
and a mouse into this jar. Both the plant and the mouse survived **(Fig-7).** He found that plants and animals have a synergy. Animals consume oxygen and release carbon-di-oxide and plants take up carbon dioxide and release oxygen.

During 1730 – 1799, Jan Ingenhousz showed that sunlight is essential to plants to carry out photosynthesis and also to purify air that is fouled by breathing animals or by burning candles.

From these experiments **it was clear that "air" is a composite mixture of many gases like oxygen and carbon-di-oxide.**

Proof for release of oxygen in photosynthesis

Activity 2: Take a healthy branch of Hydrilla and place it in a funnel. Invert the funnel in a beaker of water as shown in the figure. Invert a test tube over the stem of the funnel. The stem of the funnel should be kept immersed inside the water.

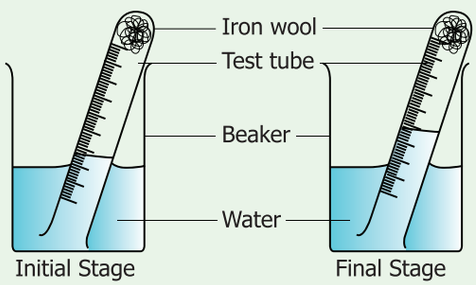


Leave the beaker in sunlight for some time. You will notice some bubbles rising in the test tube. The bubbles contain oxygen released by the plant during photosynthesis. If we show a glowing splinter to the collected air, it burns brightly. **This shows that the collected gas is oxygen.**

Test for the proportion of oxygen and nitrogen in air

Activity 3: We know that iron undergoes rusting with oxygen and forms iron oxide. This process can be used to estimate the percentage of oxygen in air, which has been removed by the rusting reaction.

Take a small portion of iron wool, press it into a 20 ml graduated test tube and wet it with water. Tip away excess of water. Take a 500ml beaker and fill half of the beaker with water. Invert the test tube and place it in air. Leave the arrangement at least for a week without making any disturbance to the test tube.



Observe the changes that had happened in the iron wool and to the level of water inside the test tube. We could

see that the water level has increased inside the test tube. The rise in water is because of oxygen in air which has been removed by the rusting reaction. **This will be about 20% which is approximately the percentage of oxygen in the air.**

More to Know!

Daniel Rutherford, a Scottish chemist, discovered nitrogen. He removed oxygen and converted it into carbon-di-oxide using an inverted bell jar using a burning candle. He passed this air without oxygen through lime water and removed carbon-di-oxide also.

Once the carbon-di-oxide was removed in that air, neither a candle burned nor a plant breathed. Hence he was sure that the remaining air that he had, did not have oxygen and carbon-di-oxide. He was able to produce a gas, which showed the same property of the air without oxygen and carbon-di-oxide. Hence this gas was named **'nitrogen'.**

Test for Carbon-di-oxide in air

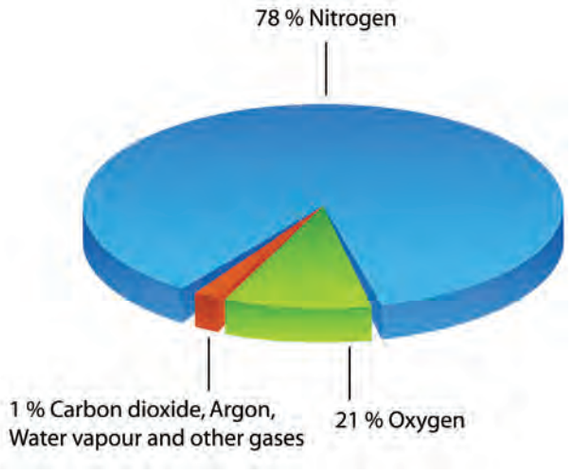
Pour some lime water in a glass tumbler. Bubble some air using a straw through the limewater. After a few minutes, look at the lime water carefully. The lime water will produce a white precipitate and that the lime water will eventually turn to a milky white solution. **This shows the presence of carbon-di-oxide in air.**

4.3 Composition of Air

From Priestley's experiment which was followed by Ingenhousz and Rutherford, we came to know that air was not just one substance. We will now describe what air is made up of. This is called composition of air.

The major component of air is nitrogen. Almost four – fifth of air is nitrogen. The second major component of air is oxygen. About one – fifth of air is oxygen. In addition to nitrogen and oxygen gases, air also contains small amount of carbon–di–oxide, water vapour and some other gases like argon, helium etc. The air may also contain some dust particles.

The composition of air in terms of percentage of its various components can be written as follows:



The composition of air changes slightly from place to place and also from season to season. For example,

- Air over industrial cities usually has a higher amount of carbon-di-oxide in it than the air over open spaces.
- Air in coastal areas may have more water vapour than inland areas.
- Air also contains more water vapour in rainy season.
- The amount of dust in the air is more in windy places than other areas.

Test for the presence of dust particles in air

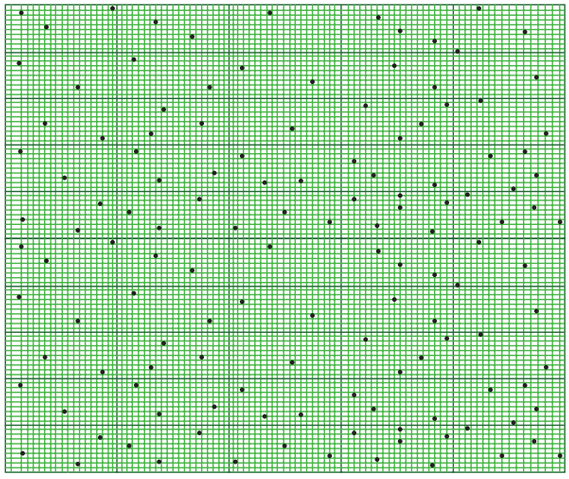
You might have seen the sunlight entering into a dark room through a narrow slit and making shiny dust particles dancing merrily on the path of sunlight. Actually, the air in a room always contains some dust particles, but they are so small that normally they are not visible to us. When a beam of sunlight falls on them, the tiny dust particles become visible.

Shall we do an activity to calculate the amount of dust particles in air from our area?

Take a graph sheet. Using marker pens draw a 5x5 cm square on the graph. Apply a thin film of grease on the graph sheet. This sheet will serve as dust collector. Make four or five graph sheets.

Discuss in the whole class, as where to place the dust collectors, how long to collect dust particles and place the dust collectors in agreed positions.

Ensure that the dust collectors do not get blown away. After the time scheduled for performing this activity is reached, remove the paper and count the number of collected dust particles in the marked area in all the sheets, using a magnifying glass at the dust collector. We can see something similar to the diagram below:-



Then, calculate the mean number of dust particles in the marked area.

$$Mean = \frac{total\ number\ of\ dust\ particles\ on\ collector}{number\ of\ squares\ on\ collector}$$

The range of the dust can also be calculated as given below:-

Range = Maximum value – minimum value

Collect details from all the areas where we have kept the dust collector sheets. Tabulate the recordings in the table given below:-

Location of dust collector	Mean number of dust particles per small square	Range

❖ Which area do you think will have the most dust?

_____

❖ Which area do you think will have the least dust?

_____

Test for water vapour in air

Take a few ice cubes in a glass. Keep it on the table for a few minutes. Observe what happens. You could see tiny droplets of water all over the outer surface of the glass. From where do these droplets come? **The water vapour present in the air condenses on the cold surface of the glass. This shows that air contains water vapour.**

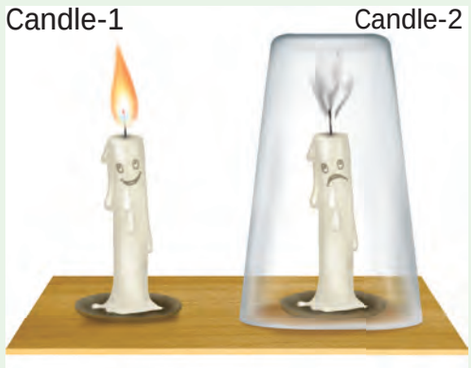
4.4 Burning and Combustion

When we burn a candle, paper, kerosene, coal, wood or cooking gas (LPG), oxygen is needed. The oxygen needed for the burning of candle, paper, kerosene, coal, wood and cooking gas comes from the air around us. Thus, for burning a substance continuously so as to make fire, a continuous supply of fresh air is needed. If we cut off the supply of fresh air to a burning substance, then the burning substance will not get oxygen necessary for burning to continue and hence the substance will stop burning. In rockets, as they go high in the atmosphere, the availability of oxygen is considerably reduced. Therefore in rockets along with the fuel, oxygen is also carried for combustion.

The process of burning of a substance in the presence of oxygen and releasing a large amount of light and heat is called **burning**. If the process does not emit flame then it is called **combustion.**

Activity 4: Oxygen is necessary for burning

Place two candles on a table. Ensure that both the candles are of same size and height. Mark them as candle 1 and candle 2 using a chalkpiece. Light both the candles. Now, cover candle 2 with glass tumbler as shown in the figure Observe the happenings at both the



candles.

What does happen to candle 1?

_____

What does happen to candle 2?

_____

Can you guess why did the covered candle extinguish?

_____

Let us summarize the happenings.

The candle 1 continues to burn, unless it is blown – off by strong moving air or any other external force. This is because fresh air is continuously available to the candle for its burning process.

Candle 2 glows for a while and then gets put – off. When the burning candle is covered with a glass tumbler, the candle can use the oxygen available in the air inside the glass tumbler. Since only a small amount of air is present inside the glass tumbler – only a small portion of oxygen is available for the candle to continue glowing. When all the oxygen of the air inside the gas jar is used up, then the burning candle gets extinguished.

Now, repeat the candle – glowing experiment taking four containers of different sizes. For example, you can take a 250ml conical flask, a 500ml bottle, a one – litre jar, a two – litre jar. Cover the burning candle one by one with these containers and find out how long it takes for the candle to extinguish in each case. Record your observations in the following table.

S. No.	Volume of the container (ml)	Time taken for candle to extinguish (second)

Can you write interpretation based on your observations at the table?

_____

4.5 Importance of air for survival of plants and animals

Respiration in plants

Plants require energy for their growth and hence respiration also occurs in plants. During respiration, plants take in oxygen and release carbon–di–oxide, just as animals do. Gaseous exchange with air in atmosphere takes place in plants with the help of tiny holes called stomata present on their leaves.

Photosynthesis

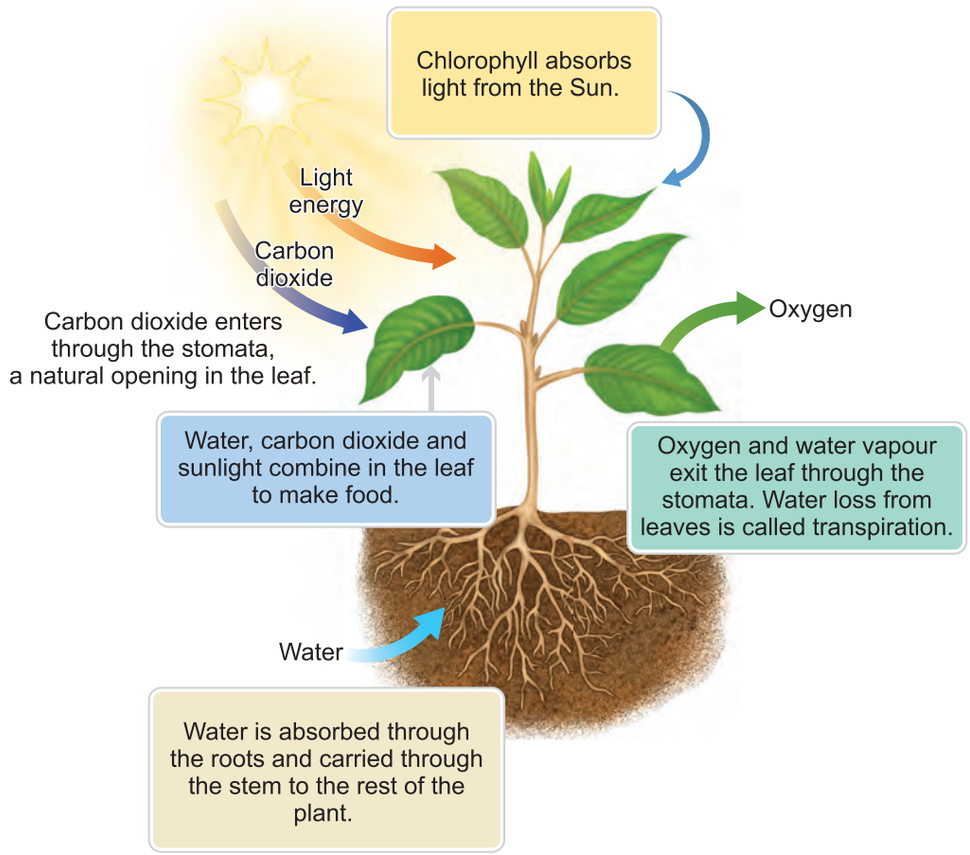
Plants manufacture food by a process called photosynthesis. During photosynthesis, carbon-di-oxide from the air and water from the soil react in the presence of sunlight to produce food. Most plants possess a green pigment called chlorophyll and it is also used-up in the process of photosynthesis. The word equation given below explains the process of photosynthesis.

$$\text{Carbon-di-oxide + water} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Food + Oxygen}$$

Plants release oxygen during photosynthesis which is much more than the oxygen consumed by the plants, during respiration.

Respiration in Animals

When we breathe in air, the oxygen present in the air reacts chemically with digested food within the body to produce carbon-di-oxide gas, water vapour and energy.



This energy is required to carry out many processes in the body such as movement, growth and repair. This process by which oxygen reacts with digested food to form carbon-di-oxide, water vapour and energy is called respiration. The process can be represented by a word equation as given below :-

Food + Oxygen → Carbon-di-oxide + water + Energy

Carbon-di-oxide formed during respiration dissolves in the blood and is exhaled out of the body through the lungs. The inhaled and exhaled air thus contain the same substances but in different proportion, except nitrogen which is present in the same amount. Inhaled air contains more oxygen while the exhaled air contains more carbon-di-oxide.

Let us have a look at the following table to compare the composition of air in inhaled and exhaled air.

Component	Inhaled air	Exhaled air
Nitrogen	78%	78%
Oxygen	21%	16%
Carbon-di -oxide	0.03%	4%
Water vapour	Variable amount	amount increases in exhaled air
Noble gases	0.95%	0.95%
Dust	Variable amount	none
Temperature	Room temperature	Body temperature

Respiration of plants and animals in water

The water of ponds, lakes, rivers and seas have some amount of dissolved air containing oxygen in it. The plants and animals that live in water use the oxygen dissolved in water for breathing. For example, frogs respire through their skin, fish respire using their gills.

When carbon-di-oxide is cooled to -57^0 C, it directly becomes a solid, without changing to its liquid state. It is called **dry ice** and is a good refrigerating agent. Dry ice is used in trucks or freight cars for refrigerating perishable items such as meat and fish while transporting them.

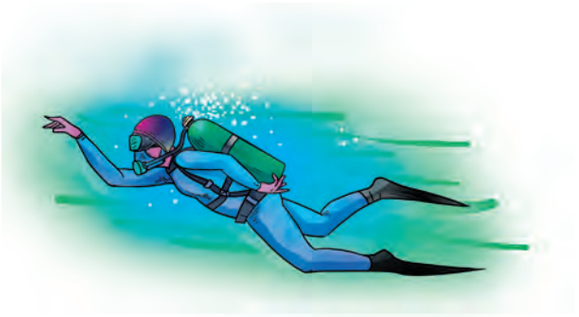
4.6 Uses of Air

- Air is used by plants and animals for breathing.
- Air is used for burning fuels like wood, coal, kerosene, LPG etc.
- Compressed air is used to fill tyres of various kinds of vehicles.
- Air plays an important role in maintaining the water cycle in the nature.
- Ozone layer, present in the atmosphere, helps in preventing harmful radiations of the sun from reaching the earth's surface.
- Under extra – ordinary conditions such as:

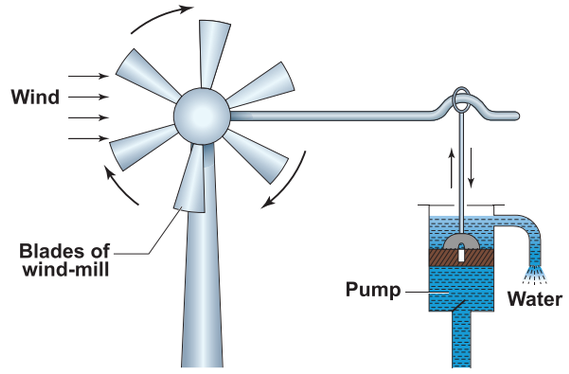
a. a patient having breathing difficulties,

b. a mountaineer climbing a high mountain,

c. a diver going deep into the sea- oxygen gas cylinders are used for breathing purposes.



❖ Blowing air is used to turn the blades of wind mills.



The wind mills are used to draw water by running pumps, run flour mills and to generate electricity.

Points to Remember

❖ Air is every where around us.

❖ Our earth is surrounded by a huge envelope of air called the atmosphere.

❖ The process of burning of a substance in the presence of oxygen and releasing a large amount of light and heat is called combustion.

❖ Priestley helped us in understanding the presence of oxygen in air that is produced by plants during photosynthesis which can be used by animals for respiration.

❖ Ingenhousz experiment helped us to know the role of sunlight in evolving Oxygen during photosynthesis.

❖ Air contains 78% Nitrogen, 21% Oxygen, 1% of carbon-di-oxide, water vapour, Noble gases, and dust particles.

❖ Composition of air changes slightly from place to place and also from season to season.

❖ In plants,

$$\text{Carbon-di-oxide + water} \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} \text{Food + Oxygen}$$

❖ In animals,

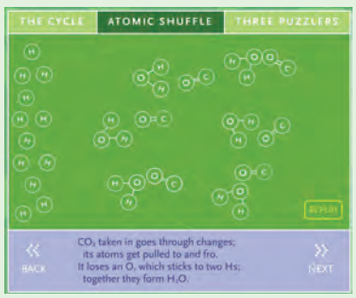
$$\text{Food + Oxygen} \longrightarrow \text{Carbon-di-oxide + water + Energy}$$

❖ Aquatic plants and animals use oxygen dissolved in water for breathing.

❖ Ozone layer, present in the atmosphere helps in preventing harmful radiations hitting the earth directly.

ICT Corner

Air



Through this activity you will be able to understand the atomic level of the process that plants use to convert solar energy into chemical energy.

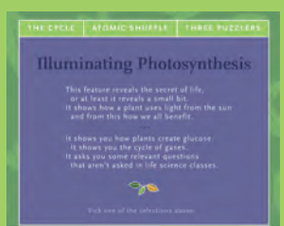
Step 1: Use the given URL in the browser. 'Illuminating Photosynthesis page will open.

Step 2: Three buttons given on the top of the activity window to explore. Click the 'The Cycle' button, in this window you can open the curtain and water the plant by click on the curtain and the watering pot.

Step 3: Explore the atomic level process of the photosynthesis by clicking the 'Atomic Shuffle' button.

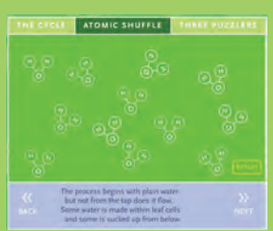
Step 4: Click 'Replay" to view the process again and 'Next' to view the next level of the process.

Step 1



Step 2

Step 3



Step 4

Illuminating Photosynthesis URL:

http://www.bbc.co.uk/schools/scienceclips/ages/10_11/rev_irrev_changes_fs.shtml

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*Pictures are indicative only

Evaluation

A37DY4

I. Choose the appropriate answer

1. _____ is the percentage of nitrogen in air.

   a. 78% b. 21%

   c. 0.03% d. 1%

2. Gas exchange takes place in plants using _____.

   a. Stomata b. Chlorophyll

   c. Leaves d. Flowers

3. The constituent of air that supports combustion is _____.

   a. Nitrogen b. carbon-di-oxide

   c. Oxygen d. water vapour

4. Nitrogen is used in the food packaging industry because it _____.

   a. provides colour to the food

   b. provides oxygen to the food

   c. adds proteins and minerals to the food

   d. keeps the food fresh

5. _____ and _____ are the two gases, which when taken together, make up about 99 percentage of air.

   I.Nitrogen

   II. carbon-di-oxide

   III. Noble gases

   IV. Oxygen

   a. I and II b. I and III

   c. II and IV d. I and IV

II. Fill in the blanks

1. _____ is the active component of air.
2. The gas given out during photosynthesis is _____.
3. _____ gas is given to the patients having breathing problems.
4. _____ can be seen moving in a beam of sunlight in a dark room.
5. _____ gas turns lime water milky.

III. True or False. If False, give the correct statement

1. Inhaled air contains a large amount of carbon-di-oxide.
2. Planting trees help in decreasing global warming.
3. The composition of air is always exactly the same.
4. Whales come up to the water surface to breathe in oxygen.
5. The balance of oxygen in atmosphere is maintained through photosynthesis in animals and respiration in plants.

IV. Match the following

1.	Moving Air	-	Photosynthesis
2.	Layer in which we live	-	Troposphere
3.	Stratosphere	-	Wind
4.	Oxygen	-	Ozone layer
5.	carbon-di-oxide	-	Combustion

V. Arrange the following statements in correct sequence

1. Plants manufacture food by a process called photosynthesis.
2. Plants require energy for their growth.
3. Plants take in oxygen and release carbon-di-oxide just as animals.
4. Plants take carbon-di-oxide from the atmosphere, use chlorophyll in the presence of sunlight and prepare food.
5. Such oxygen is available to animals and human beings for breathing.
6. During this process, oxygen is released by plants.

VI. Analogy

1. Photosynthesis : _____ :: Respiration : Oxygen
2. 78% of air : Does not support combustion :: _____ : Supports combustion

VII. Observe the given figure carefully and answer the questions.

1. What will happen if we remove plants from the aquarium?
2. What will happen if we remove the fish from the aquarium and keep it (with green plants) in a dark place?

VIII. Give very short answer

1. What is atmosphere? Name the five layers of atmosphere.
2. How do the roots of land plants get oxygen for breathing?
3. What should be done if the clothes of a person catch fire accidentally? Why?
4. What will happen if you breathe through mouth?

IX. Give short answer

1. Biscuits kept open on a plate during monsoon days lose its' crispness. Why?
2. Why do traffic assistants wear a mask on duty?

X. Answer in detail

1. How do plants and animals maintain the balance of oxygen and carbon-di-oxide in air?
2. Why is atmosphere essential for life on earth?

XI. Question based on Higher Order Thinking Skills

1. Can you guess why fire extinguishers throw a stream of carbon-di-oxide while putting - off fire?

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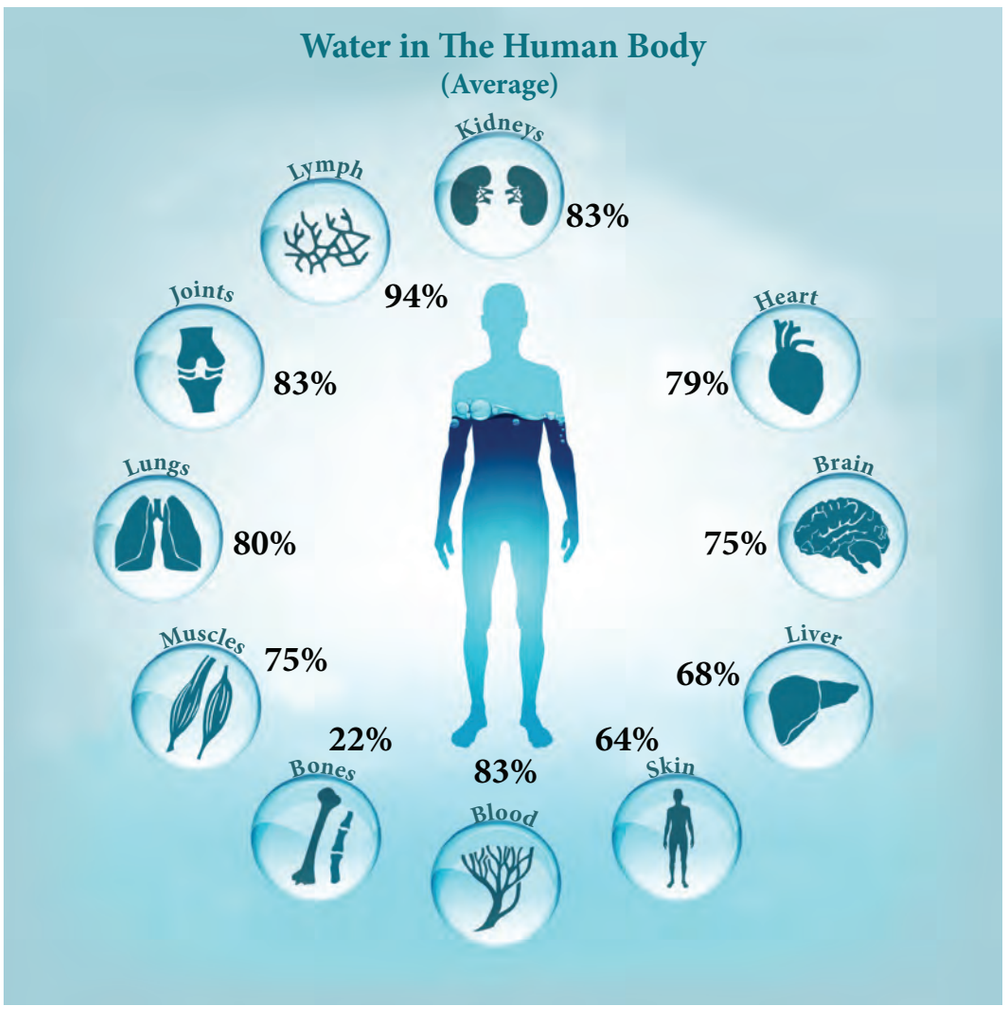
Unit 2 Water

EEA4NV



Learning Objectives

- To recognize the sources and availability of water
- To clarify the composition of water and the process of water cycle
- To develop skills in suggesting ways to conserve water
- To realize the importance of water for life on earth
- To appreciate the efforts made to conserve water

Introduction

Water is one of the basic substance present in the earth. It plays a vital role in the evolution and survival of life. It is impossible to imagine life on the earth without water. Water helps to regulate the temperature of our planet. It also helps to maintain the temperature in organisms.

2.1 Where do we get water from?

We need water to perform several day to day activities like cooking food, washing clothes, cleaning utensils etc.

We get water from different water sources in our surroundings. In villages / towns wells, canals, tanks, ponds, rivers, water tanks, hand pipes are the main sources of water.

List out the sources from where you get water in your village/town.

For example Ramu says he and his family get water from the pipes in washrooms and kitchens. Sankar says he has to use handpump daily both in the morning and evening to collect the water. Raja says his mother used to get up early and walks to pond to get water.

Where do you get water for your household uses?

2.2 Where and how water is found on the earth?

Water is available in nature in three forms – Solid, Liquid , Vapour.

- **Solid form of water - Ice** - It is present in ice bergs and ice caps on top of tall mountains, galaciers and polar regions.
- **Liquid form of water – Water** – It is present in oceans, seas, lakes, rivers and even underground.
- **Gaseous form of water – Vapour** – It is present in the air around us.

EEIZQI

2.3 Availability of water

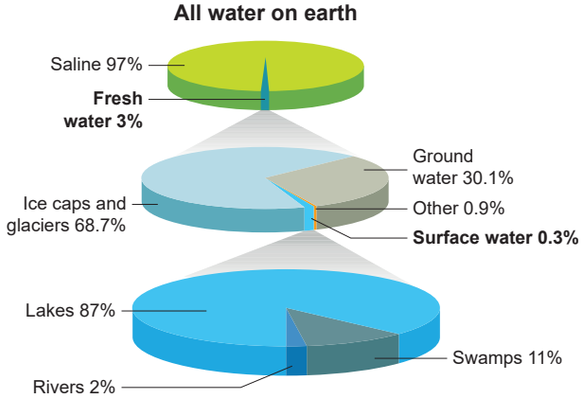
We know that nearly $\frac{3}{4}^{th}$ of the surface of the earth is covered by water. Most of the water, that is 97% of the total amount of water that exits on earth is found in seas and oceans.

Can we drink the water available in the sea?

Sea water is salty. But water used for our daily purposes is not salty. It is known as fresh water. Water obtained from ponds, puddles, river, tube-wells and taps at home is usually fresh water.

If the total water on earth be 100%, let's see what percent would be the availability of fresh water.

Look at the pie chart given below.



From the pie chart, it can also be noted that 97% water is saline water. Only 3% found is the freshwater and that too in polar ice caps and glaciers. So this portion of water is not readily available for drinking.

The distribution of the totally available freshwater is as follows:

Polar ice caps and glaciers	68.7%
Ground water	30.1%
Other sources of water	0.9%
Surface water	0.3 %

The distribution of total surface water is as follows:

Lakes	87%
Rivers	2%
Swamps	11%

Thus the above pie chart explains that we have a very small amount of fresh water available for human usage and so maintaining the water table and the conservation of water is very essential. Isn't it?

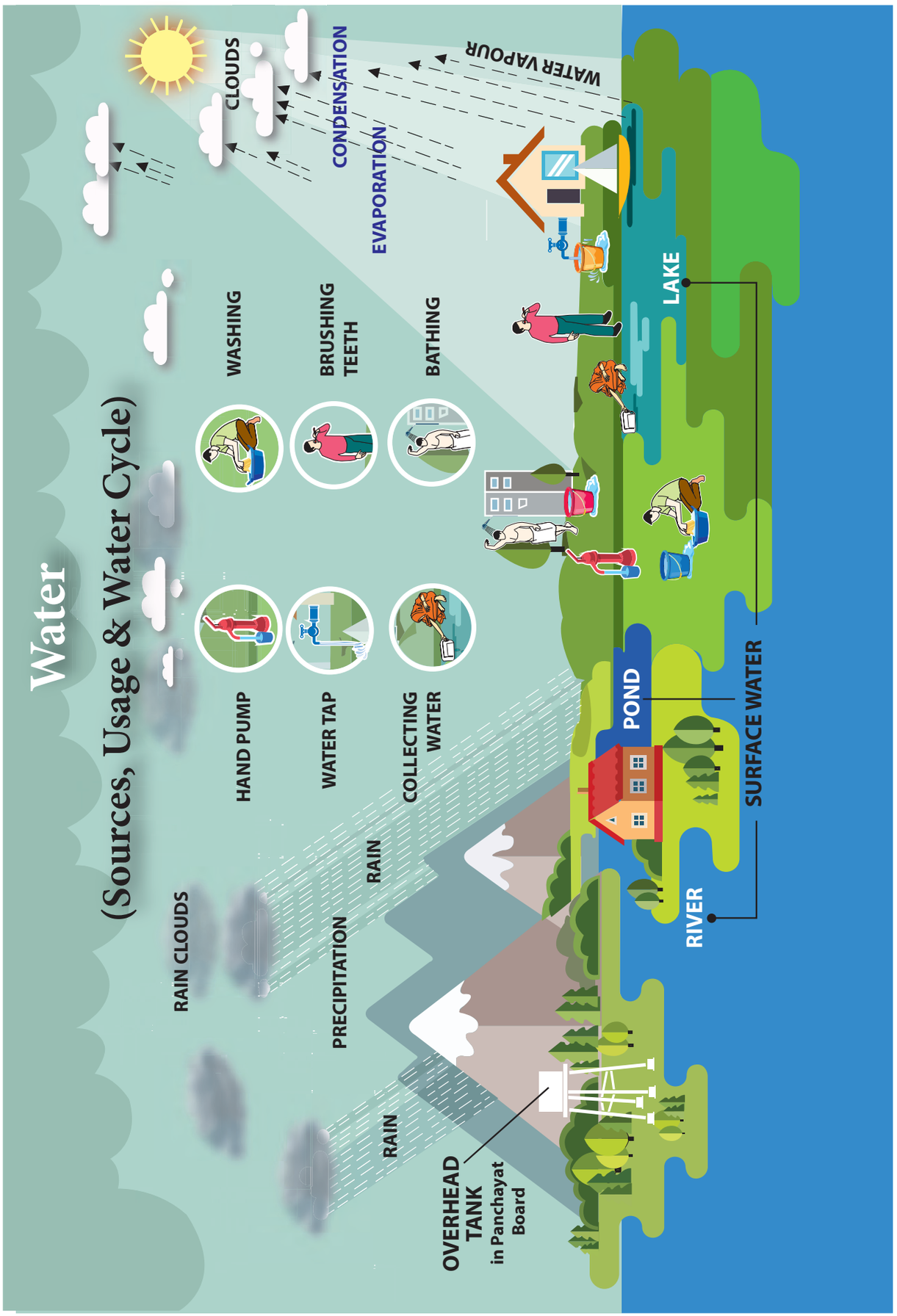
Water while passing through layers of soil dissolves salts and minerals to a maximum extent. These salts and minerals have been deposited in seas and oceans for millions of years and are still being deposited. In addition, the oceanic volcanoes which are present inside, also add salts to the sea. Water with large amounts of dissolved solids is not potable or suitable for drinking. Such water is called saline water.

Activity 1: Relative amount of water at various sources

Take a 20 litre bucket, a 500 ml mug, a 150 ml tumbler and a 1 ml spoon. If the capacity of the bucket is 20 litre, then it represents the total amount of water present on the Earth. Now, transfer a mug of water from the bucket and it is 500 ml and then it represents the total amount of fresh water present in the Earth. The water left in the bucket represents seas and oceans. This water is not fit for human use.

The water present in the mug represents the freshwater which is present in frozen form on snow-covered mountains, glaciers and polar ice caps. This water is also not readily available for human use. Next, transfer 150 ml of water to the tumbler, then it represents the total amount of ground water. Finally, take one-fourth spoonful of water while the capacity of the spoon is 1 ml, then it represents the total amount of surface water (i.e) water seen in all the rivers, lakes and ponds of the world. It can be taken as potable water.

When such a small amount of potable water is available, then we should be more economic in using water. Is it not?



Activity 2: Conduct the activity with common salt,sand, chalk powder, charcoal powder and copper sulphate.

Fill up the following table.

Substance	Dissolves in water	Does not dissolve in water
common salt		
sand		
chalk powder		
charcoal powder		
copper sulphate		

From the above activity we could observe that common salt and copper sulphate dissolve in water and contribute their properties like colour and other properties to water but sand, chalk powder and charcoal powder do not dissolve in water.

2.4 Composition of water

Water is a transparent, tasteless, odourless and nearly colourless chemical substance. It is composed of two atoms of hydrogen combined with one atom of oxygen. The molecular formula of water is H_2O.

However, the physical composition of water changes from place to place. It can be clear or cloudy, oxygenated or not very oxygenated and it can be fresh or salty. The amount of salt in water is termed as salinity. Based on its salinity water is classified into three main categories such as freshwater, brackish water and sea water. Fresh water contains 0.05% to 1% of salt. Brackish water contains upto 3% of salt and seawater contains more than 3% of salt. Ocean water is composed of many substances. The salts include sodium chloride, magnesium chloride and calcium chloride.

Water freeze at 0^o Celsius at normal pressure.

Every year march 22^{nd} is observed as the world water day.

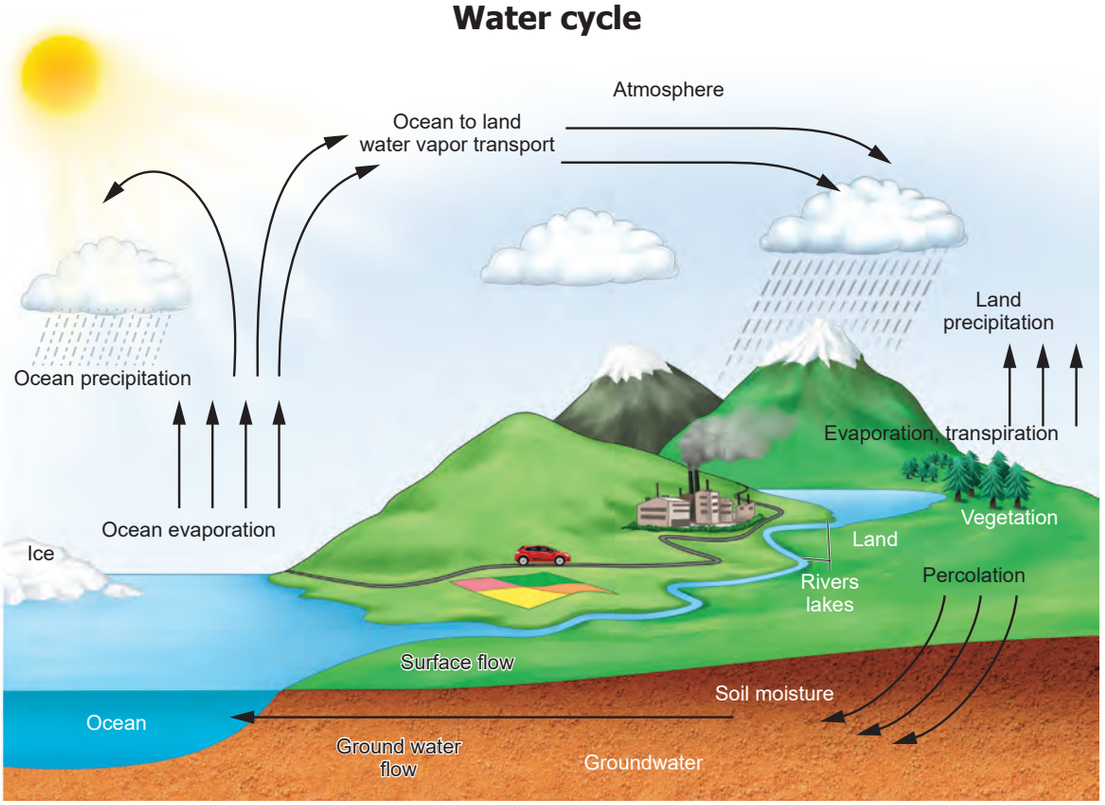
Activity 3: Water contains dissolved salts

Take some tap water in a china dish and heat it. Continue heating till all the water gets dried up. Stop the heating and look at the china dish. What do you observe inside the china dish?

Deposits of some solid particles on the surface of china dish can be observed. The deposit is of salts that are dissolved in water. This shows that water has dissolved salts in it.

Note: Do not use distilled water or water from purifier or R.O. (Reverse Osmosis) unit and the like for this activity.

Water cycle



2.5 Water cycle

EESVS6

The water on the earth evaporates into the atmosphere due to the heat of the sun. The water vapour in the atmosphere forms clouds. From the clouds water falls on the earth in the form of rain or snow. By this natural process, water gets renewed. This is called **water cycle.**

Water cycle is a continuous process. It involves three stages - **evaporation, condensation and precipitation.** It is also called the **hydrological cycle.**

Evaporation : Water from oceans, lakes,ponds and rivers evaporates due to the heat of the sun.

Condensation : Water vapour which enters into the atmosphere by evaporation moves upward with air, gets cooled and changes into tiny water droplets that form clouds in the sky.

Precipitation : The millions of tiny droplets collide with one another to form larger droplets. When the air around the clouds is cool these drops of water fall in the form of snow or rain.

Activity 4: Spread a piece of wet cloth in the sunlight. Observe after some time. Where has the water in the wet cloth gone?

The water evaporates into the atmosphere due to the heat of the sun.

Have you heard of transpiration?

It is the process of loss of water from the aerial parts of a plant in vapour form.

There is a continuous cycling of water and it exists in three forms in nature.

Water evaporating from lakes, rivers and oceans forms the gaseous state. Rain water forms the liquid state. Snow on mountains and polar ice caps forms the solid state.

These three states occur in nature, keep the total amount of water on the earth constant even when the whole world is using it!

How do you know that atmosphere has water vapour?

Let us do the following activity...

Activity 5: Condensation of water vapour.

Take a glass half filled with water. Wipe the outer surface of the glass with a clean piece of cloth. Add some ice into the water. Wait for one or two minutes. Observe the changes that take place on the outer surface of the glass.

From where do water drops appear on the outer side of the glass?

The cold surface of the glass containing icy water cools the air around it and the water vapour of the air condenses on the surface of the glass. This process is also the result of condensation of water vapour.

2.6 Natural Sources of fresh water

Three types of natural sources of fresh water are available on the earth.

Surface water

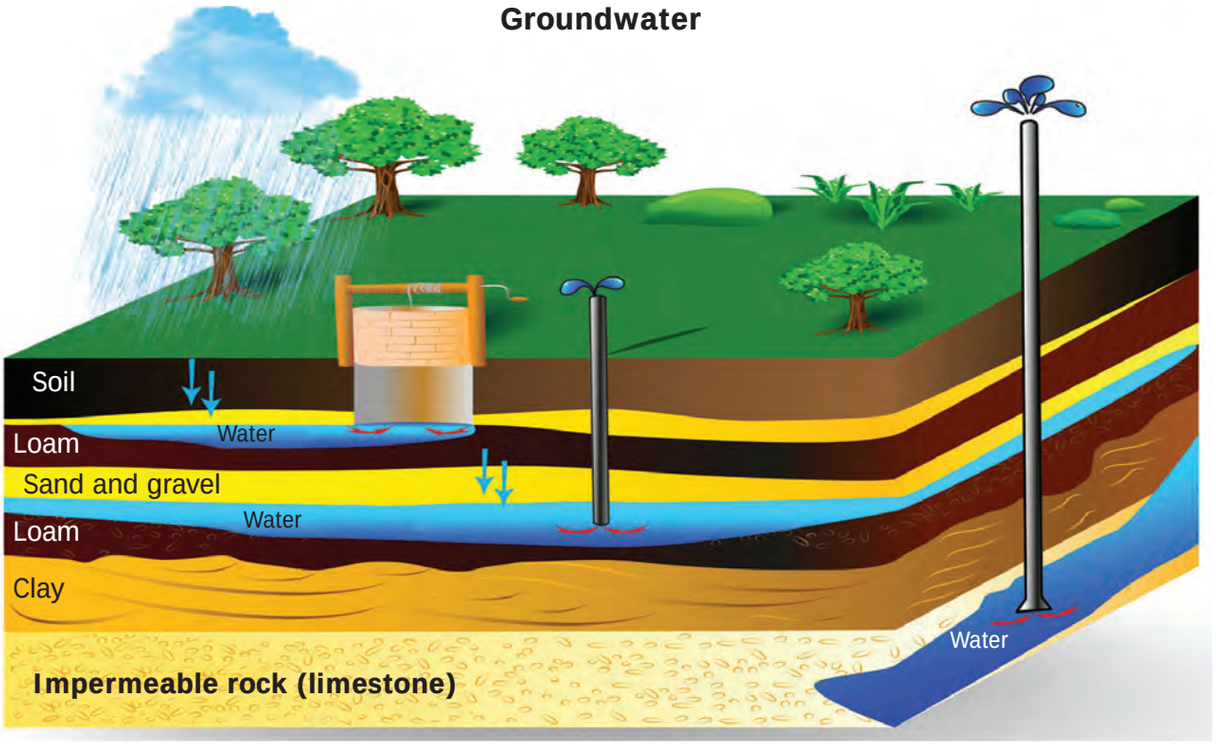
Water present on the surface of the earth such as river,lake,ponds, streams or fresh water wetland is called surface water.

Frozen water

Water that is present in the frozen form as polar ice-caps and glaciers are called frozen water. A larger portion of water is 68.7% of the total available fresh water is in frozen state.

Ground water

Ground water is the water present beneath Earth's surface in soil. This water is



obtained through springs, open wells, tube wells, or hand pumps etc.,

The Himalayas

The Himalayas, contain ice caps, ice bergs and glaciers. Ten of Asia's largest rivers flow from the Himalayas and more than a billion people's livelihoods depend on those rivers.

More to know: Water, is measured in litre and millilitre. Gallon is also a measure of volume of liquids.

1 Gallon = 3.785 litre. Water level in the reserviors is measured in TMC (One thousand million cubic feet). Water released from dams is measured in cusec (cubic feet/sec).

Aquatic animals

During winter, water in lakes and ponds in the cold countries will be frozen and a solid layer of ice is formed on the surface of water. Still aquatic animals living under the ice do not die. This is because the floating layer of ice acts as a protective coat, and doesn't permit heat to escape from water. So as the water at the surface alone turns to ice, it the existence of aquatic animals.

2.7 Conservation of water

There is no change in the total quantity of water available on the earth. It remains the same. But the water useful for plants, animals and man is decreasing day by day. It is called scarcity of water.

What are the reasons for scarcity of water?

The main reasons for water scarcity

1. Population explosion
2. Uneven distribution of rainfall
3. Decline of ground watertable
4. Pollution of water
5. Careless use of water

We should take care to prevent scarcity of water. Otherwise,it is impossible for organisms to live on the earth. The only method of preventing scarcity of water is conservation of water. Saving water for the future generations by using water carefully and in a limited way is conservation of water.

Methods of water conservation:

Mainly, two methods can be followed for the conservation of water.

1. Water management

Water management consists of the following factors:

a. Bringing awareness about the bad effects of throwing wastes into the water bodies

b. Recycling of water by separating pollutants.

c. Minimizing the use of chemical fertilizers in agriculture. It reduces the pollution of underground water.

d. Controlling deforestation

e. Adopting drip irrigation and sprinkler irrigation in agriculture. By this way lesser amount of water can be used for the irrigation

2. Rainwater harvesting

Direct collection and use of rain water is called rainwater harvesting.

There are two types of rainwater harvesting.

a. Collecting water from where it falls.

(e.g): Collecting water from the roof tops of the houses or buildings (Roof water harvesting).

b. Collecting flowing rain water

(e.g): Collecting rainwater by constructing ponds with bund.

Coovam is an estuary!

Estuaries are wetlands where water bodies meet the sea. It is a combination of fresh water from land meeting the salty seawater. **Estuaries** are home to unique plants and animal species.

2.8 Importance of water

Human body: Our body uses water in all its cells, organs and tissues to help regulate its temperature and maintain other bodily functions. On an average, the human body requires 2 – 3 litres of water per day for proper functioning. Water helps in digestion of food and removal of toxins from the body.

Domestic: Apart from drinking, people use water for many other purposes. These include: cooking, bathing, washing clothes, washing utensils, keeping houses and common places clean, watering plants, etc.

Swamps are wetlands that are forested. They occur along large rivers or on the shores of large lakes. The water of a swamp may be freshwater, brackish water or seawater. Swamps are important for providing fresh water and oxygen to all life. Pichavaram Mangroves in Chidambaram, Muthupet mangrove wetland. Pallikkaranai wetland in Chennai, Chembarambakkam in Kancheepuram are a few examples of swamps in Tamilnadu.

Agriculture: Water is also essential for the healthy growth of farm crops and farm stock and is used in the manufacture of many products.

Industry: Industry depends on water at all levels of production. It is used as a material, a solvent and for generating electricity.

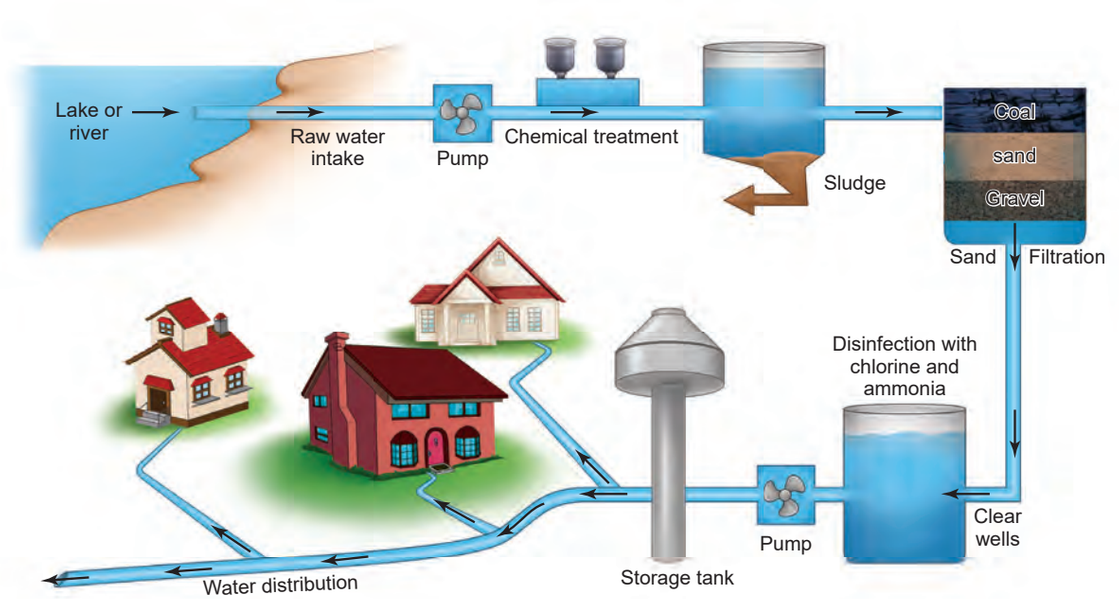
Activity 6: Estimation of water consumed by a family on a day

Activity	Amount of water used (in litres)
Brushing	
Bathing	
Washing clothes	
Toilets	
Cooking	
Washing utensils	
Cleaning floor	
Any other purpose	
Total amount of water used by a family in a day	

2.9 Water distribution and treatment system

We know that water is distributed by local bodies. In some areas which water is obtained from river, lake and ground water is treated and distributed. Model of water distribution and treatment plant is shown in figures.

The Water distribution and water treatment system



Let us avoid wasting water

When you happen to see any leaking tap in your school or home, keep a bucket to collect the water that is leaking and measure the amount of water and the time taken to fill the bucket. After noting the time taken to fill a bucket, you can estimate the amount of water getting wasted on a day.

Can you please think over the amount of water getting wasted all around the world from the leaking taps?

Points to remember

- Water is one of the most important components that all animals including human beings and plants depend on for their livelihood.
- To an extent of 97% of the total water that exists on Earth is found in seas and oceans.
- Only 3% of the freshwater is available in polar ice caps and glaciers.
- Lakes, rivers, swamps constitute only 0.3% of the surface water.
- The moisture in the soil indicates the presence of underground water.
- The continuous circulation of water in nature is called the water cycle. It is effected by evaporation, condensation, precipitation and transpiration.
- Ground water is the water present beneath Earth's surface in soil.

ICT Corner

Water

Through this activity you will be able to know what happens to water when it is taken out of nature, into our house and once it leaves our houses.

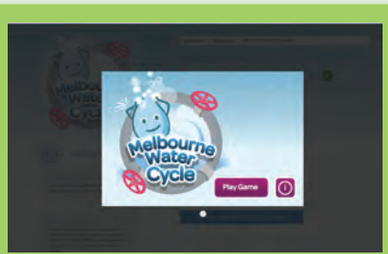
Step 1: Type the URL or scan the QR code to launch the activity.

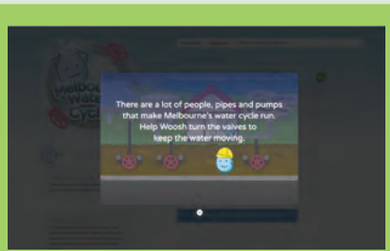
Step 2 : A page of 3 games will open, click on the first game 'Melbourne water cycle', and click the "Play the Melbourne water game" button to start the game.

Step 3: Play the game by following the instructions and using the navigation keys. Observe the steps of water usage and the process of recycling the used water.

Step 4: Play the other two games to know about the Natural water cycle and Sources of water.

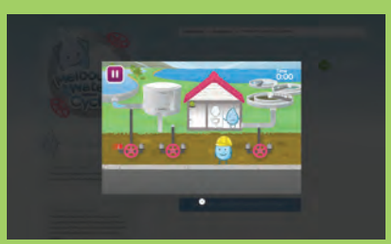
Step 1

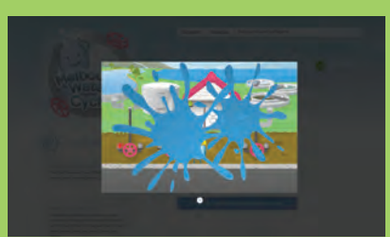




Step 2

Step 3





Step 4

Simple Circuit's URL:

https://www.educationsoutheastwater.com.au/resources?audience=&keywords=&topic=&yearLevel=&type=online-game

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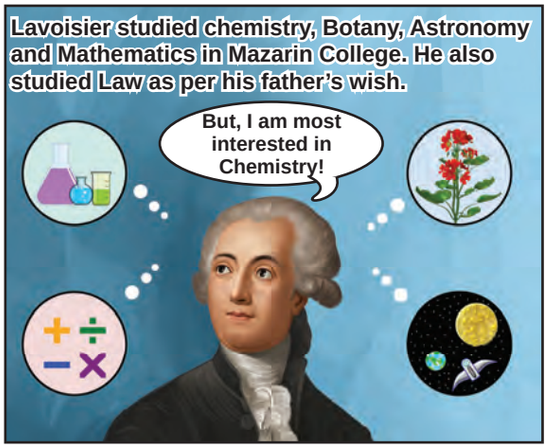
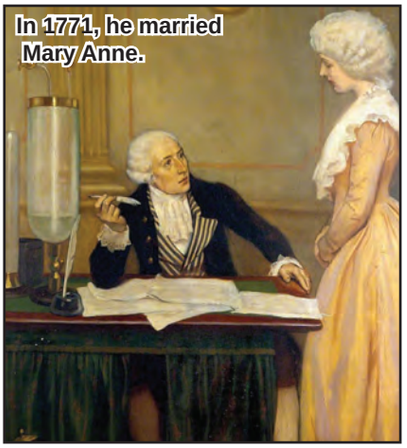
*Pictures are indicative only

The Revolution in Chemistry

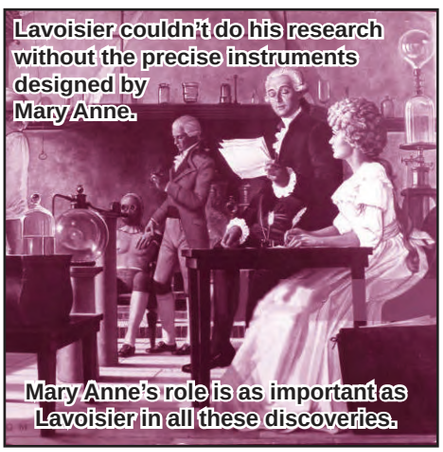
Lavoisier studied chemistry, Botany, Astronomy and Mathematics in Mazarin College. He also studied Law as per his father's wish.



In 1771, he married Mary Anne.

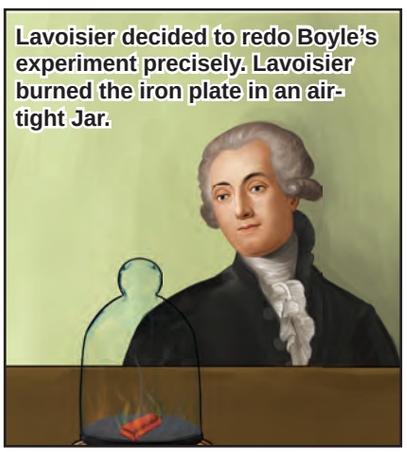


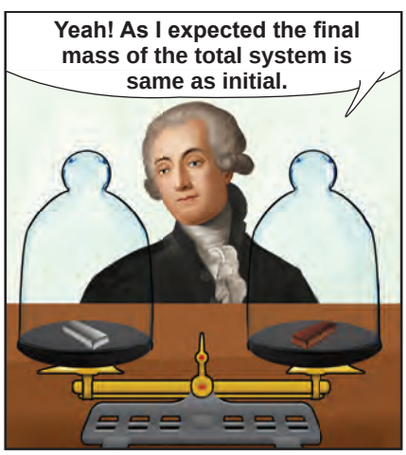
Lavoisier couldn't do his research without the precise instruments designed by Mary Anne.

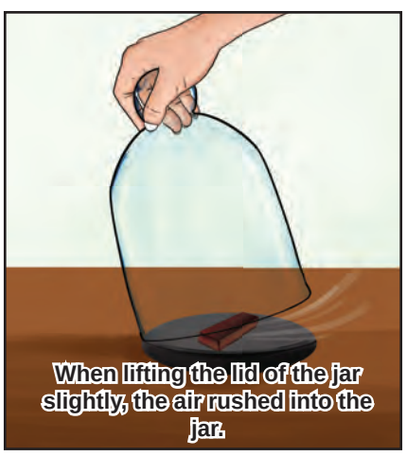


Mary Anne's role is as important as Lavoisier in all these discoveries.

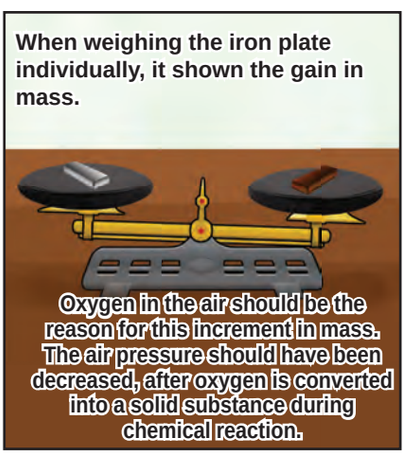
Lavoisier decided to redo Boyle's experiment precisely. Lavoisier burned the iron plate in an air-tight Jar.



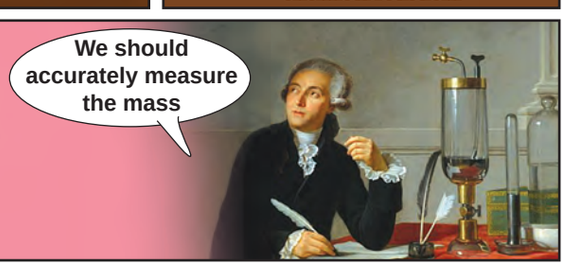


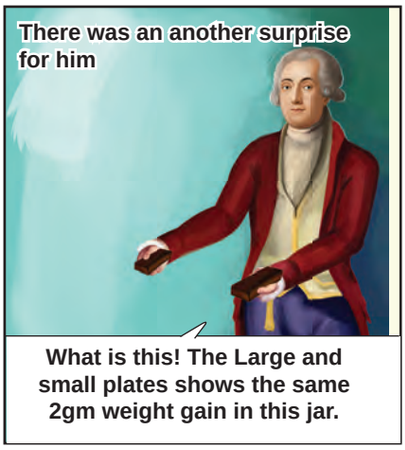


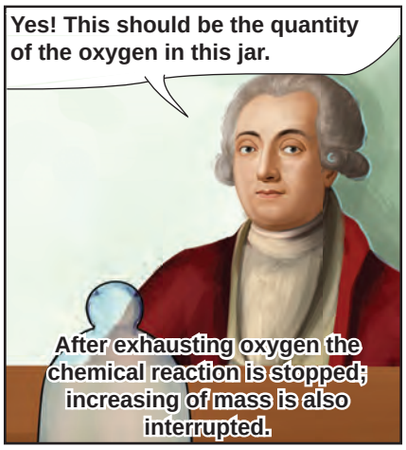
When weighing the iron plate individually, it shown the gain in mass.

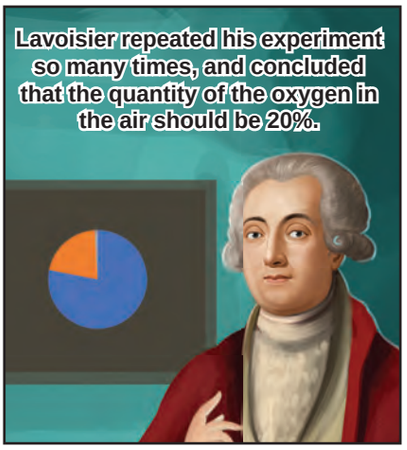


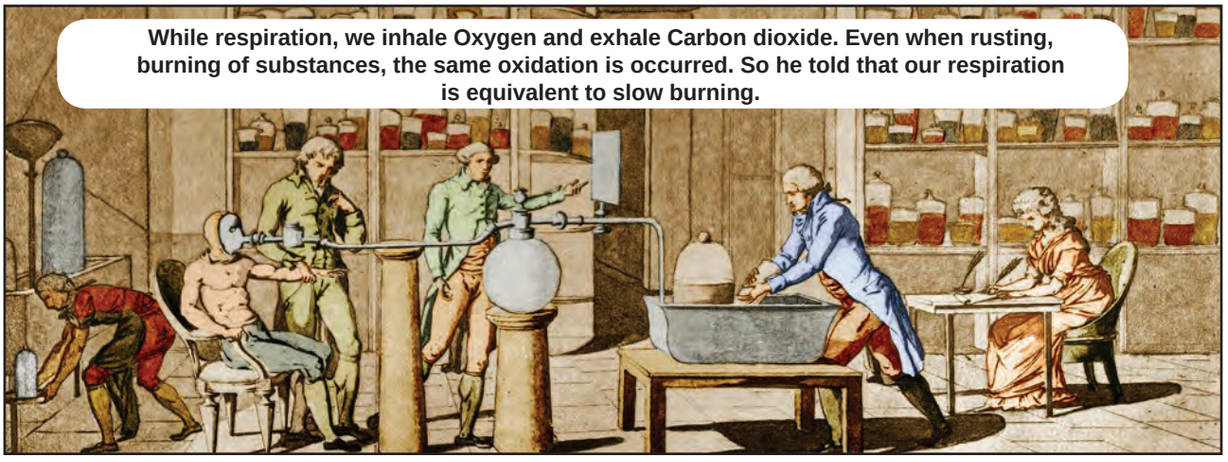
In a chemical reaction, the initial and final mass should be same. so matter can never be created nor destroyed. With a chemical reaction, chemical compound may be changed. We can change the chemical composition of substances by chemical reaction

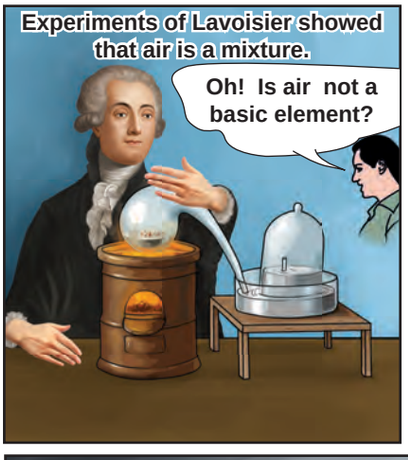


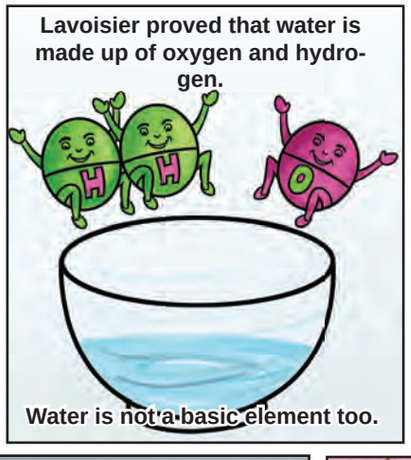


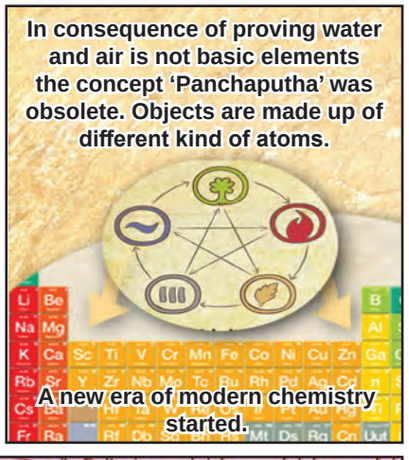


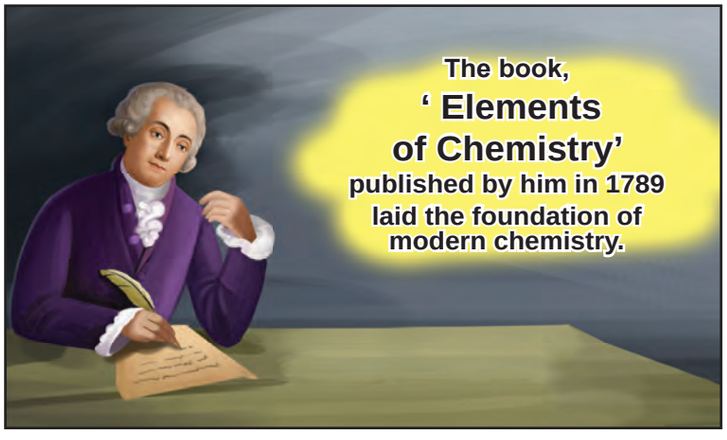


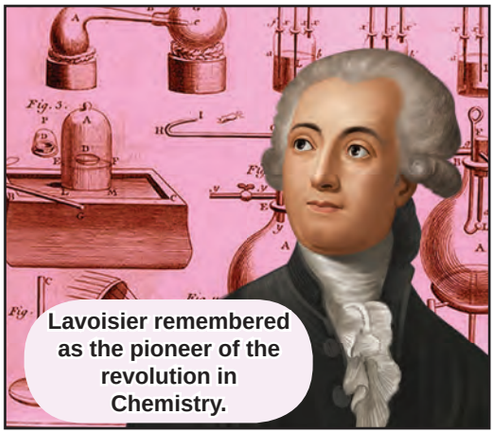












Evaluation

EF2RTT

I. Choose the appropriate answer

1. Around 97% of water available on earth is _____ water.

   a. fresh b. pure

   c. salty d. polluted

2. Which of the following is not a part of water cycle?

   a. evaporation b. condensation

   c. rain d. distillation

3. Which of the following processes add water vapour to the atmosphere?

   i. Transpiration ii. Precipitation

   iii. Condensation iv. Evaporation

   a. ii and iii b. ii and iv

   c. i and iv d. i and ii

4. About 30% of the fresh water is found in?

   a. glaciers
   b. ground water
   c. other sources of water
   d.0.3%

5. Using R.O. (Reverse Osmosis) plant at home eliminates lot of non-potable water. The best way to effectively use the expelled water of R.O. plant is _____.

   a. make the expelled water go and seep near the bore well

   b. use it for watering plants

   c. to drink the expelled water after boiling and cooling

   d. to use for cooking as the water is full of many nutrients

II. Fill in the blanks

1. Only _____ percent of natural water is available for human consumption.
2. The process of changing water into its vapour is called _____.
3. _____ is built on rivers to regulate water flow and distribute water.
4. Water levels in rivers increase greatly during _____.
5. Water cycle is also called as _____ .

III. True or False. If False, give the correct statement

1. Water present in rivers, lakes and ponds is unfit for use by human beings.
2. Seas are formed when the water table meets the land surface.
3 The evaporation of water takes place only in sunlight.
4. Condensation results in the formation of dew on grass.
5. Sea water can be used for irrigation as such.

IV. Match the following

1.	Flood	-	Lake
2.	Surface water	-	Evaporation
3.	Sun light	-	Water vapour
4.	Cloud	-	Pole
5.	Frozen water	-	Increased rain fall

V. Arrange the following statements in correct sequence

1. These vapours condense to form tiny droplets of water.
2. The water droplets come together to form large water droplets.
3. The heat of the sun causes evaporation of water from the surface of the earth, oceans, lakes, rivers and other water bodies.
4. The large water droplets become heavy and the air cannot hold them, therefore, they fall as rains.
5. Water vapour is also continuously added to the atmosphere through transpiration from the surface of the leaves of trees.
6. Warm air carrying clouds rises up.
7. Higher up in the atmosphere, the air is cool.
8. These droplets floating in the air along with the dust particles form clouds.

VI. Analogy

1. Population explosion : Water scarcity :: Recycle : _____
2. Ground water : _____ :: Surface water : lakes

VII. Give very short answer

1. Name four different sources of water
2. How do people in cities and rural areas get water for various purposes?
3. Take out of cooled bottle of water from refrigerator and keep it on a table. After some time you notice a puddle of water around it. Why?
4. We could see clouds almost every day. Why doesn't it rain daily?
5. Name the places where water is found as ice.
6. How do aquatic animals manage to live in Arctic and Antarctic Circle?
7. What are the types of rain water harvesting?

VIII. Give short answer

1. Differentiate between surface water and ground water.
2. Write a few slogans of your own on the topic "Save Water".
3. About 71% of earth's surface is covered with water, then why do we face scarcity of water?
4. Give reason for the following statement – Sewage should not be disposed of in rivers or oceans before treatment.
5. The fresh water available on earth is only 3%. We cannot increase the amount of water. In that case, how can sustain the water level?

IX . Answer in detail

1. What is potable water? List down its characteristics.
2. Who is known as waterman of India? Browse the net and find the details about the award, the waterman received for water management. State the findings by drafting a report.

3. What is rainwater harvesting? Explain in a few sentences how it can be used in houses.

X. Question based on Higher Order Thinking Skills

1. When there is no pond or lake in an area, will there be formation of clouds possible in that area?

2. To clean the spectacles, people often breathe out on glasses to make them wet. Explain why do the glasses become wet.

XI. CROSSWORD

DOWN

1. A method of water conservation.

2. Process of getting water vapour from sea water.

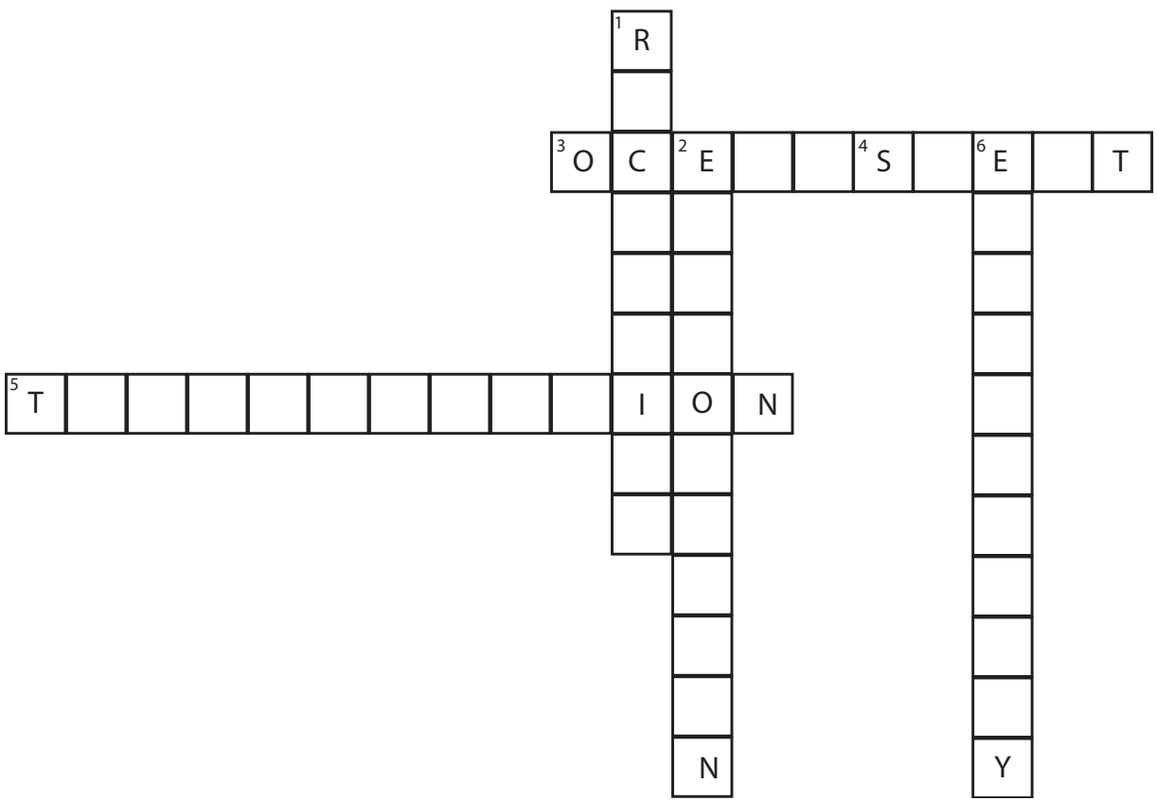
6. Water stored in dams is used for generation of _____.

ACROSS

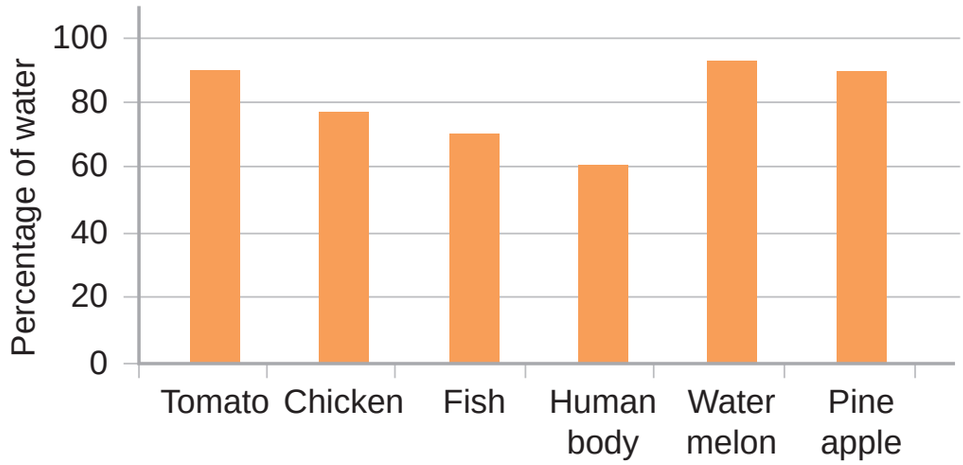
3. _____ is a large body of non-potable water found in nature.

4. In summer, the body loses water as _____.

5. Plants undergo _____ and contribute to water cycle.



XII. (1). Observe the given graph carefully and answer the questions.



a. What percentage of water is seen in fish?

b. Name the food item that has maximum amount of water in its content.

c. Name the food item that has minimum amount of water in its content.

d. Human body consists of about _____ percentage of water.

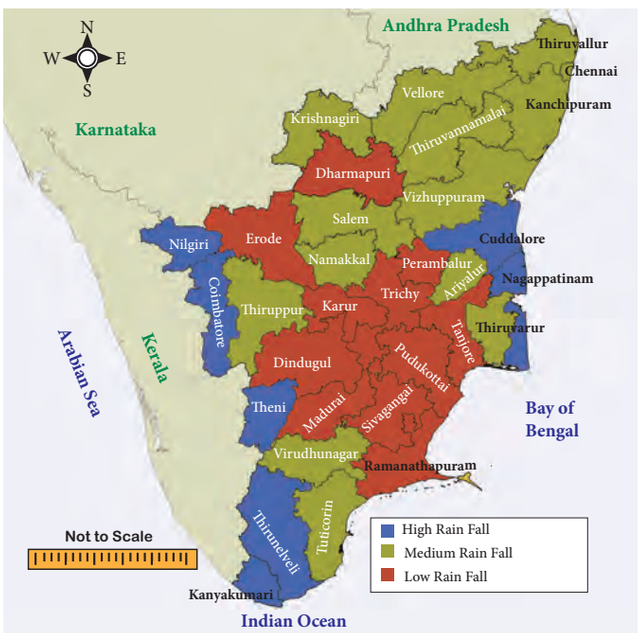
e. Specify the food item that can be consumed by a person when he / she is suffering from dehydration.

(2) Look at the map of Tamilnadu showing annual rainfall and answer the questions given below

a. Identify the districts that get only low annual rainfall in Tamilnadu.

b. Identify the districts that get a medium annual rainfall in Tamilnadu.

c. State the districts that enjoy high annual rainfall in Tamilnadu.



Unit 3 Chemistry in Everyday life

Learning Objectives

- To understand the importance of science in everyday life
- To understand the preparation of soaps and detergents
- To know about kinds of fertilizers and its uses
- To know about uses of cement, gypsum, Epsom, and plaster of paris
- To know about uses of phenols and adhesives in day to day life

EFBMVG

Introduction

We have studied earlier about the physical changes and chemical changes. Can you identify, from the following list which are physical changes and which are chemical changes?

- ❖ breaking of a stick into two pieces
- ❖ burning of a paper
- ❖ tearing paper into small pieces
- ❖ dissolving sugar in water
- ❖ burning of petrol or LPG gas
- ❖ water boiling into water vapour
- ❖ coconut oil becoming solid during winter

Can you see the important difference between the chemical change and physical change? When you cut a paper into two, both are still paper pieces, but once you burn it, there is no longer the paper, only some ash and the smoke are left.

Chemical change results in the change of the substance; In **physical change** only the shape, size or volume changes; the state of the matter may also change, from liquid to gas or from liquid to solid, however the substance remains, chemically as it is.

Let us do the following experiment. Add a pinch of turmeric powder to water; water turns yellow. Take a small quantity of soap water in a beaker and add a pinch of turmeric powder to it. Now, What happens? Is there any change in colour of the solution? Is it also turning to yellow or to some other colour?

Try adding turmeric powder to various household liquids and observe the result. Try it on, say, tamarind extract. Try it on with cleaning liquids in the house. Does it change the colour?

Chemists identify turmeric powder as a **'natural indicator'.** The change in colour indicates that the material is either acid or base medium.

Find answer for the following questions with the help of your teacher. This will help you to understand how chemistry plays vital role in our life.

- ❖ How does milk change into curd?
- ❖ How can you remove stain on the copper vessels?
- ❖ Idli is a little bit hard while we cook by using newly grinded idli dough but it is soft with old dough. Why?
- ❖ How does rusting of iron happen?
- ❖ Why does white sugar change into black when heating?

We can understand the chemical changes that happen around us by knowing the answers for the above questions.

We use chemical changes in various forms in our daily life. **Chemistry** is the branch of science which deals with the study of particles around us. The beauty of chemistry is that, it explains the properties of the basic components of particles such as atoms and molecules and the effects of their combination.

We can consider all the particles around us as chemicals. The water (H_2O) we drink is the combination of hydrogen and oxygen. The salt (NaCl) we use in our kitchen is a combination of the chemicals, sodium and chlorine. Even our body is made up of a lot of chemical particles.

We could prepare soft idly as a result of a chemical change named fermentation takes place in the idly batter. During fermentation the idly batter undergoes a chemical change by bacteria. While cooking, the food products undergo so many chemical changes. As a result there are favourable changes in colour, flavour and taste in the food.

We can use chemical changes to produce certain materials. For example, some of the objects such as soaps, fertilizers, plastics and cement which we use in our daily life can be prepared by making chemical changes in some naturally occurring objects.

Activity 1: Discuss with your group and list out few chemicals which we use in our home and school.

_____

_____

_____

We can study about the manufacturing processes and usages of certain materials we use in our daily life such as **soaps, fertilizers, cement, gypsum, Epsom, plaster of paris, phenol** and adhesives in this lesson.

3.1 Soaps and Detergents

Bathing soap and washing detergents are kinds of soaps which we use in our daily life. In addition to this, we are

EFKIX4

DO YOU KNOW?

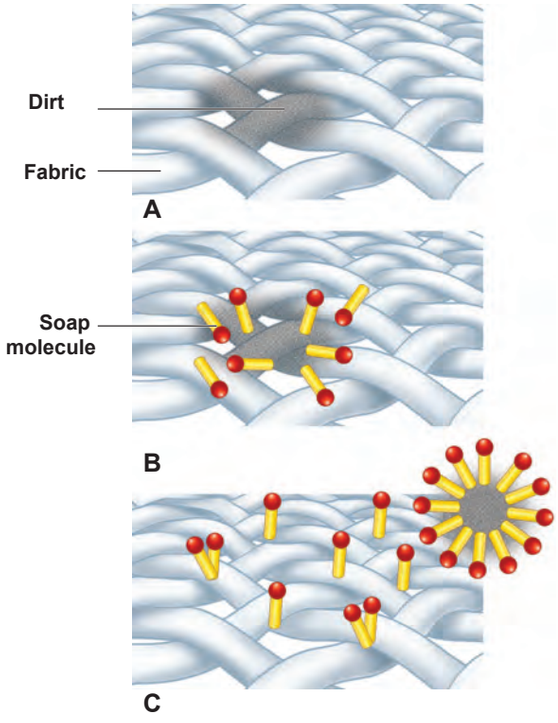
When we cut onion, we get tears in the eyes with irritation, because of the presence of a chemical, propanethial s-oxide in onion. This is easily volatile. When we cut onion some of the cells are damaged and this chemical comes out. It becomes vapour and reach our eyes result in irritation and tears in eyes. When we crush the onion, more cells will be damaged and more chemicals come out.

using washing powder to remove strong stains on the clothes.

The detergent molecules have two sides, one side **water loving**, other **water hating**. Water hating goes and joins with dirt and oil in the cloth while the water loving joins with the water molecules.

When you agitate the cloth the dirt is surrounded by many molecules and is taken away from the cloth. The cloth becomes clean, and the dirt surrounded by the detergent molecules float in the water making it dirty.

How soaps clean clothes?



We can prepare our own soap by the following activity.

Activity 2: Preparation of Soap

Materials Required: 35 ml of water

10 g. of Lye (Sodium hydroxide) 60 ml of coconut oil.

Process : Cover your work area with old newspaper. Take 35 ml of water in a jar. Add 10 gram of concentrated sodium hydroxide and allow it to cool.

Then add 60 ml of coconut oil drop by drop and stir it well. Pour that solution into an empty match box, soap can be obtained after getting dried.

Try this soap to wash your handkerchief.

Different soaps for different purposes are prepared with various raw materials. We can understand this by doing the following activity.

Activity 3: Collect various kinds of soap's wrapper. Complete the following table based on the information provided in the wrapper.

S. No	Name of the Soap	Ingredients
1.	Bathing soap	
2.	Washing soap	
3.	Bathing soap for kids	
4.	Toilet cleaners	
5.	House floor cleaner liquid	

Inference: Nature of the soaps varies according to its constituents.

CHEMISTRY IN EVERY DAY LIFE

01 Soaps and Detergents

Gets clothes cleaner and cleans your body

02 Fertilizers

It helps plants to grow. organic fertilizers restore soil fertility

03 Adhesives

Helps the materials fixing it up together

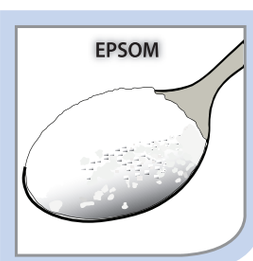
04 Cement

Important material in construction industry

05 Plaster of Paris

Used in surgery for setting fractured bones and used for making casts for statues and toys

06 Gypsum & Epsom



Helpful to humans, animals, plants and environment

3.2 Fertilizers

Apart from water, sunlight and air, certain nutrients are also needed for the growth of plants. We know that the plants get their nutrients from the soil.

Nitrogen (N), Phosphorous (P) and Potassium (K) are the three important nutrients among the various nutrients needed for the growth of plants. These three are called as **Principal Nutrients.**

The table given below depicts the quantity of elements absorbed by certain common plants.

Crop	Yield per hectare (kg) (Approxi-mate)	Nitrogen (kg)	Phosphorous (kg)	Potassium (kg)
Rice	2,240	34	22	67
Corn	2,016	36	20	39
Sugarcane	67,200	90	17	202
Groundnut	1,904	78	22	45

❖ What would happen to the nutrient content of the soil, if the field is farmed continuously?

_____

❖ How could we resend these nutrients back to the soil?

_____

Fertilizers are organic or inorganic materials that we add to the soil to provide one or more nutrients to the soil.

Fertilizers given to plants can be classified into two. They are organic and inorganic fertilizers.

Organic fertilizers

Fertilizers containing only plant or animal-based materials or those synthesized by micro-organisms are called organic fertilizers.

These fertilizers can be prepared easily. This type of fertilizers are economical. **(e.g) Vermi compost, compost.**

Inorganic fertilizers

The fertilizers prepared by using natural elements by making them undergo chemical changes in the factories are called inorganic fertilizers. **(e.g) Urea, Ammonium sulphate and Super phosphate.**

The table given below lists the nutrients in inorganic fertilizers

Name of fertiliser	Nitrogen(%)	Phosphorus(%)	Potassium (%)
Urea	46	0	0
Super phosphate	0	8-9	0
Ammonium sulphate	21	0	0
Potassium nitrate	13	0	44

If we use 50 kg of urea, then according to the table, 23 kg of nitrogen (46 percent) will be added to the soil.

- The percentage of nitrogen in ammonium sulphate is _____
- If 50 kg of potassium nitrate is added to soil, how much potassium would the soil get? _____

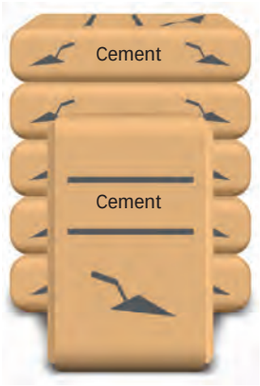
Earthworms take organic wastes as food and produce compost castings. So earthworms are known as **Farmers' friends** because of the multitude of services they provide to improve soil health and consequently plant health.

Activity 4: Make a visit to agriculture field in your area. List out the various crops and type of fertilizers used there.

S. No.	Name of the Crop	Name of the Fertilizer
1.		
2.		
3.		

3.3 Cement

In ancient period, the houses were constructed by using the mixture of lime, sand and wood. At present, the people are widely use the cement for construction of houses, dams and bridges. **The cement is manufactured by crushing of naturally occurring minerals such as lime, clay and gypsum through milling process.**



Cement becomes hardened when it is mixed with water. Gypsum plays a very important role in controlling the rate of hardening of the cement. During the cement manufacturing process, a small amount of gypsum is added at the final grinding process. Gypsum is added to control the "setting of cement".

In 1824, Joseph Aspdin invented Portland cement by burning finely ground chalk and clay in a kiln. It was named "Portland" cement because it resembled the high-quality building stones found in Portland, England.

Uses of cement

Cement is used as **mortar, concrete and reinforced cement concrete.**

Mortar

Mortar is a paste of cement and sand mixed with water. In houses, mortar is used to bind building blocks for constructing walls, to apply coating over them and to lay floor.

Concrete

Concrete is a mixture of cement, sand and gravel. It is used in the construction of buildings, bridges and dams.

Reinforced Cement Concrete

Reinforced cement concrete is a composite material by mixing iron mesh with cement. This is very strong and firm. It is used in the construction of dams, bridges, centering works in houses and construction of pillars. Huge water tanks, water pipes and drainages are built with this.

Activity 5: Take three empty tumblers of same size and name them as A, B and C. Add two tea spoonful of cement in each of the container. Then pour one tea spoonful of water in container A and two spoonful of water in B and three spoonful of water in C.

After an hour, observe which container of the cement set fast? Touch the containers and see if they are warm or cool. From this experiment, we understand that water and cement should be mixed in a certain ratio for fast setting.

3.4 Gypsum

Gypsum is a soft white or grey, naturally available mineral. The chemical name of gypsum is **calcium sulphate dihydrate.**

The molecular formula of gypsum is $CaSO_4 \cdot 2H_2O$.

Uses

- Used as fertilizers.
- Used in the process of making cement.
- In the process of making Plaster of Paris.

3.5 Epsom

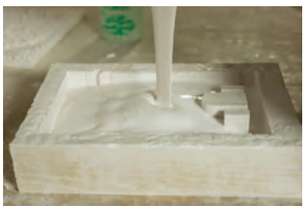
Epsom salt is **magnesium sulphate hydrate.** The molecular formula of Epsom is $MgSO_4 . 7H_2O$. It offers a wide range of uses.

Uses

- Eases stress and relaxes the body
- Helps muscles and nerves function properly
- Medicine for skin problems
- Improving plant growth in agriculture

3.6 Plaster of Paris

Plaster of Paris consists of fine white powder **(calcium sulphate hemihydrate)** The molecular formula of Plaster of Paris is $CaSO_4 . 1/2H_2O$. Known since ancient times, plaster of paris is so called because of its preparation from the abundant gypsum found near Paris, capital of France. Plaster of paris is prepared by heating gypsum, where it gets partially dehydrated.



Uses

- In making black board chalks.
- In surgery for setting fractured bones.
- For making casts for statues and toys etc.
- In construction industry.

3.7 Phenol

Have you ever observed the oily material which is used to clean your house? Do you know what it is? It is a chemical, named as Phenol.

Phenol is a **carbolic acid** of an organic compound. It is a necessary ingredient for preparing variety of phenol products. The molecular formula of phenol is C_6H_5 OH, it is a weak acid. It is a volatile, white crystalline powder.

It is a colorless solution, but changes into red in the presence of dust.

It irritates when exposed on human skin. It is widely used for industrial purposes.

Phenol itself is used (in low concentrations) in mouthwash and as a disinfectant in household cleaners. Phenol used as surgical antiseptic since it kills micro organisms.

3.8 Adhesives

EG4B1E

What will you do when a page of your book is torn accidentally? It can be fixed by using a cello tape. How cello tape works? There is a paste like material in one surface of the cello tape. Have you ever discussed about this material? The paste like substance is called adhesive. It is commonly known as glue, mucilage, or paste. The substances applied to one surface, or both the surfaces of two separate items that binds them together and resists their separation are called **adhesives**.

Adhesives are substances that are used to join two or more components together through attractive forces acting across the interfaces.

A practical experience

Do you notice how puncture of your bicycle is repaired by the shop keeper? He ensures the punctured surfaces are clean, dry and free of dust, and roughens the area around the hole using a metal scraper. He takes an appropriate patch of tyre-tube and applies a suitable adhesive to both the roughened area and to the underside of the patch, apply firm pressure and allows drying completely. Why does he apply pressure? This increases the adhesive capacity at both the surfaces and ensures proper binding.

Types of adhesives

There are two kinds of adhesives, one is natural made from starch and another one is artificial made from chemicals. The one used in puncture shop is an artificial adhesive.

Artificial adhesives may be classified in a variety of ways depending on their utilities. Their forms are paste, liquid, film, pellets, tape.

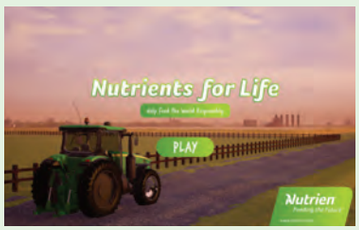
It is used in various conditions such as hot melt, reactive hot melt, thermo setting, pressure sensitive, and contact.

Points to Remember

- Soaps are prepared by heating the mixture of olive oil, animal fat and concentrated sodium hydroxide solutions.
- Fertilizer facilitates growth of plants.
- Vermi compost has high nutrient benefits and it is useful for sustaining the land fertility.
- Cement is manufactured by using lime, clay and gypsum.
- Plaster of Paris is used to fix bone fractures.
- Diluted phenol is used as a cleaner, disinfectant and mouthwash.
- Adhesives are substances that are used to join two or more components together.

ICT Corner

Nutrients for life



Through this activity you will be able to learn about the 4Rs of crop nutrients and their importance.

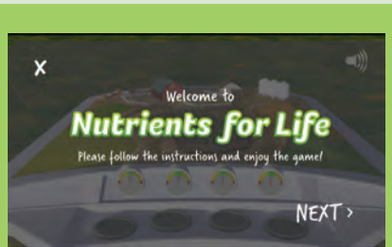
Step 1: Type the following URL in the browser. 'NUTRIENTS FOR LIFE' activity page will open.

Step 2: Click the ' X ' icon on the top left of the activity window to close the welcome note and start the activity or click on 'Next' on the bottom to read the instructions.

Step 3: A corn field , 4 cubes and 4 dials are shown, Using the mouse grab the cubes at the bottom which are labelled WATER , N, P, K and drop them over the crop.

Step 4: Each time you apply water or nutrients on the crop it will rise the dial. Keep all the dials in the green. Repeat the same process till the crop is fully grown.

Step 1



Step 2

Step 3

Step 4

Nutrients for life URL:

http://seedsurvivor.com/agrium-games/Feeding%20the%20Future/

*Pictures are indicative only

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Evaluation

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I. Choose the appropriate answer

1. Soaps were originally made from _____ .

   a. proteins

   b. animal fats and vegetable oils

   c. chemicals extracted from the soil

   d. foam booster

2. The saponification of a fat or oil is done using _____ solution for hot process.

   a. Ammonium hydroxide
   b. Sodium hydroxide
   c. Hydrochloric acid
   d. Sodium chloride

3. Gypsum is added to the cement for _____.

   a. fast setting b. delayed setting

   c. hardening d. making paste

4. Phenol is _____.

   a. carbolic acid b. acetic acid

   c. benzoic acid d. hydrochloric acid

5. Natural adhesives are made from _____.

   a. Protein b. fat

   c. starch d. vitamins

II. Fill in the Blanks

1. _____ gas causes tears in our eyes while cutting onions.
2. Water, coconut oil and _____ are necessary for soap preparation.
3. _____ is called as farmer's best friend.
4. _____ fertilizer is ecofriendly.
5. _____ is an example for natural adhesive.

III. True or False. If False, give the correct statement

1. Concentrated phenol is used as a disinfectant.
2. Gypsum is largely used in medical industries.
3. Plaster of Paris is obtained from heating gypsum.
4. Adhesives are the substances used to separate the components.
5. NPK are the primary nutrients for plants.

IV. Match the following

1.	Soap	-	C_6H_5OH
2.	Cement	-	$CaSO_4.2H_2O$
3.	Fertilizers	-	NaOH
4.	Gypsum	-	RCC
5.	Phenol	-	NPK

V. Arrange the following statements in correct sequence

1. Pour that solution into an empty match box, soap can be obtained after drying.

2. Take necessary quantity of water in a jar.
3. Then add coconut oil drop by drop and stir it well.
4. Add concentrated sodium hydroxide in the jar and allow it to cool.
5. Try this soap to wash your hand kerchief.
6. Cover your work area with old newspaper.

VI. Analogy

1. Urea : Inorganic fertilizer: Vermi compost: _____.
2. _____: Natural adhesives: Cello tape: Artificial adhesives.

VII. Give very short answer

1. What are the three main constituents of soap?
2. What are the two different types of molecules found in the soap?
3. Give an example for inorganic fertilizer.
4. Mention any three physical properties of phenol.
5. Explain the uses of plaster of paris.
6. What are the ingredients of the cement?
7. Why gypsum is used in cement production?

VIII. Give short answer

1. Why earthworm is called as farmer's friend?
2. Explain the process of manufacturing cement.
3. What are uses of Gypsum?

IX. Answer in detail

1. How are detergents manufactured?

X. Questions based on Higher Order Thinking Skills

1. Ravi is a farmer; he rears many cattle in his farm. His field has many bio wastes. Advise Ravi how to change this bio waste to compost by using vermi -composting techniques. Explain the benefits of vermi castings.

XI. Project

- ❖ Take 100 ml of hot water in a glass jar.
- ❖ Add 50 gram of maida in the hot water and stir it well.
- ❖ A paste like substances are formed. Add a small quantity of copper sulphate for a long use.
- ❖ Now you test this paste by binding your damaged book.