



# Unit

## 3

### Matter Around Us



#### Learning Objectives

At the end of the lesson you will be able to

- Define matter and develop an understanding of the particulate nature of matter
- Sort the objects on the basis of certain properties
- Differentiate between solids, liquids and gases based on the arrangement of their particles.
- Differentiate between pure substances and mixtures
- Identify the need for separation of mixtures
- Suggest suitable methods for separating given samples of mixture
- Acquire an awareness on food adulteration and its harmful effects



## Introduction

Matter is all around us. The air you are breathing is also a matter. Matter is defined as anything that has mass and takes up space. Matter is found in three major states; solid, liquid and gas. So what is matter made of? All 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 atoms thick. Science has come up with a technology to identify structure of atoms Scanning Electron Microscope (SEM) and Tunnelling Electron Microscope (TEM) which uses electricity to map atoms. There is more about atoms in the later, but first let's learn about the three states of matter.

Silicon atoms on a surface via Scanning Tunneling Microscopy, (STM).

### Activity - 1

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

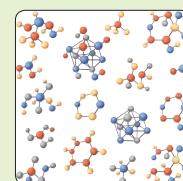
A	B	C	D	E	F

Which of the shapes given above resembles a sugar crystal?

A      B      C      D      E      F

Now place a few sugar crystals in a teaspoon full of water.

What happens to the sugar crystals?



Like everything else 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 the water. This makes the water taste sweet. The sugar molecules are extremely small, that is why we are not able to see them. A small amount of any matter will have many million molecules. (1 million = 1000000)



Besides solids, Liquid and gases there are two more states plasma and Bose – Einstein condensates.

Plasma is not a common state of matter on Earth, but may be the most common state of matter in the universe. For example, stars including sun are covered in plasma.

Bose – Einstein condensate is a gas – like state of matter that exists at extremely cold temperatures. It was predicted around 1925 and confirmed in 1995, This is used in the field of cryogenics.



## Physical Nature of Matter

Matter occupies space and has mass. But what is its nature? Ancient philosophers pondered over such questions. In India a philosopher named Kanada and in Greece a philosopher named Democritus came to somewhat similar idea.

Imagine you have a piece of thread. You cut it into two with the same piece. Take again one of the piece and cut it again into two. Repeat the above process for many times. At some point piece of the thread will be so small to see, or we may not have sharp enough knife to cut further. But this is imaginary 'thought experiment'. Therefore these are not possible practically.

Imagine if you can cut as fine as possible and are able to see even the very small things. Can we cut the rope into two without an end?

Kanada and Democritus said, No; we cannot go on endlessly. There will be a point at which we will not be able to cut the thread further. That is the point when we will reach molecules or atoms.

We will read more about molecules and atoms later. Suffice to say that all matter is made up of very small particles. Gold is made up of tiny gold particles and

water is made up of tiny water particles. These tiny particles present in all matter are called as atoms or molecules.

The particles in matter are extremely small and cannot be seen even with a powerful microscope. What we can see is only group of particles.



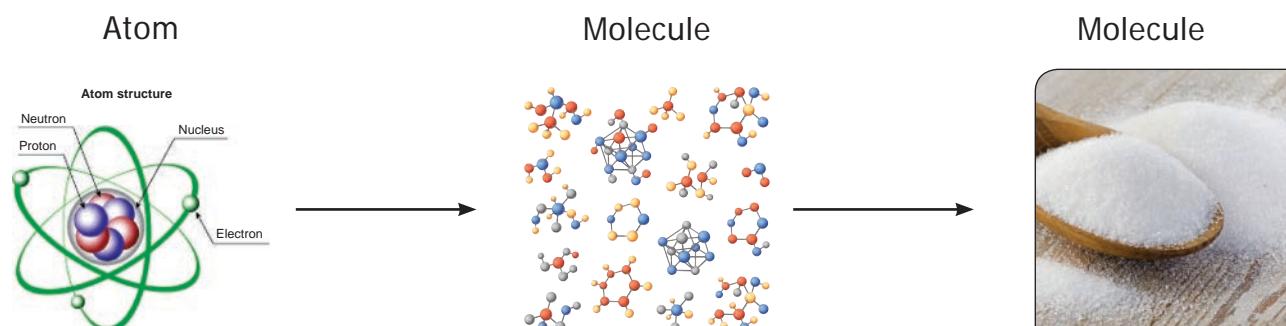
Do you know? that a drop of water contains about  $10^{21}$  water particles? One dot that you make with your pen has more than two lakh molecules.

### Characteristics of the particles of matter

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.

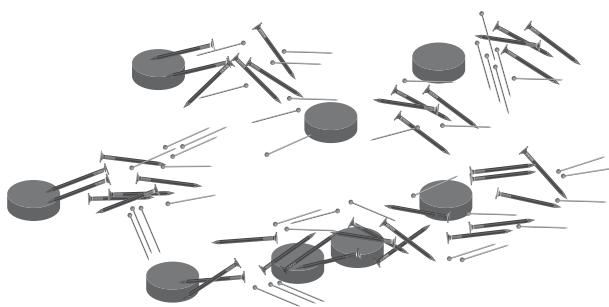
Stir well. Sugar disappears completely. Where has it gone? Will the glass of water be now sweet?





1. Water particles have space between them and sugar particles are now occupying those spaces.

2. *Particles of matter attract each other.* It is this 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

You already know what grouping is all about.

Matter can be grouped into Solids, Liquids and Gases based on the above characteristics. These are called the physical states of matter.

### 3.1 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
- If you move the stone from the ground to a table or place it on the shelf does its shape change? Yes / No

- A solid does not need a container; it stays where it is because its particles are tightly packed into a definite shape that, ordinarily, does not change. If you take the stone from the ground 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 following objects. All these are familiar to you. Are they all the same or different? Can you pick out a few which you think are similar and group them? On what basis did you group them? Is there only one way of doing it or more ways? Discuss with your group members and note it down. You can group them according to their uses, the materials with which they are made of or some other properties and also as living and non-living things.

For example, 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 the glass of water and the spectacles but not through the apple or iron box. The cow and the bird are living things while the rest are not. Water in the glass is a liquid but air in the balloon is a 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. Thus we can see similarities and differences between things and group them and sort them in many different ways.

#### Try to fill in the following table

	Things that float	Things that sink
1.		
2.		
3.		

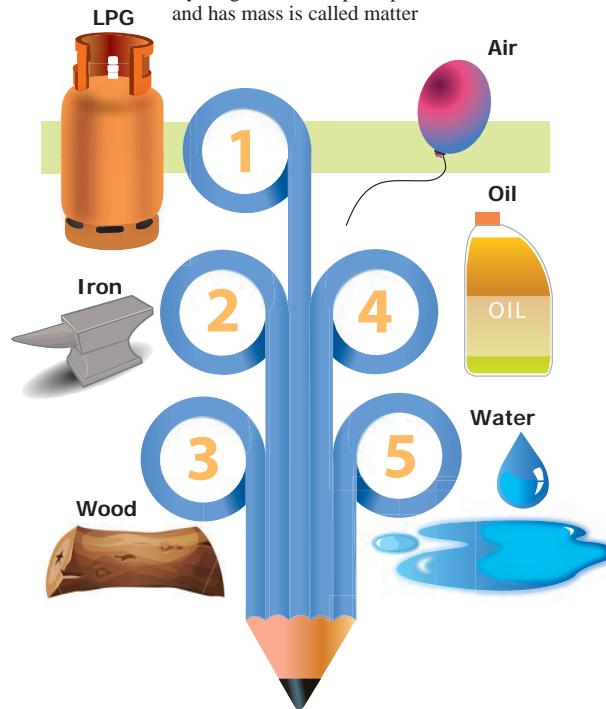
Try to make more such tables based on the properties discussed above.

How many tables could you make?

But one thing is common to all the above. They are all MATTER.

#### MATTER AROUND US

Anything which occupies space and has mass is called matter





### Activity 3

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

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

How did you classify the items of the above list as solids , liquids and gases? You should have done it based on some properties- items like brick and door which are hard comes under solids, things that flow comes under liquids and others which are very light and can flow more freely comes under gases. Well, you are right. Take a look at the figure given below. What do you observe?

### 3.2.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 just a drop of ink carefully at the centre. Do not shake or stir.

Now light an incense stick and keep 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 and that among gases more easily. We call this movement as **diffusion**. **Diffusion** is the tendency of particles to spread out in order to occupy the available space.

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 in solids Eg. water	The particles in the gases are arranged far apart. They move freely. Eg. Air



## Fact file

1. Liquid atoms are packed more loosely which allows things to be able to pass through it
2. Liquid is effected by gravity more than anything
3. Liquids are always moving due to gravity around it



1. A gas atoms are spread out so far, you can walk through it without any restriction
2. Gas is not affected by gravity
3. The gas's atoms never stop moving and it never stays in place



Movement of particles is restricted in solids and they do not diffuse like liquids or gases. In fluids the particles are under motion and hence can push ink or smoke particles here and there.

### Activity 4

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

So we can say that air is also matter though we cannot see.

Let us try to know more about matter.

We saw that matter can have different properties.

### Test Yourself

Name an object which is brittle and transparent.

Name an object which can be stretched.

Name two objects which can be bent.





### Activity 5

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 also change?  
Yes / No

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

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

A liquid needs a container and takes the shape of a container because the particles slide past one another and keep moving. The amount of juice is the same in both glasses. The volume of a liquid remains the same whether it is kept in a large container or a small one but its shape changes.

Try to draw the shape of the liquid containers alone in your note book. What do you observe?

### Think to learn

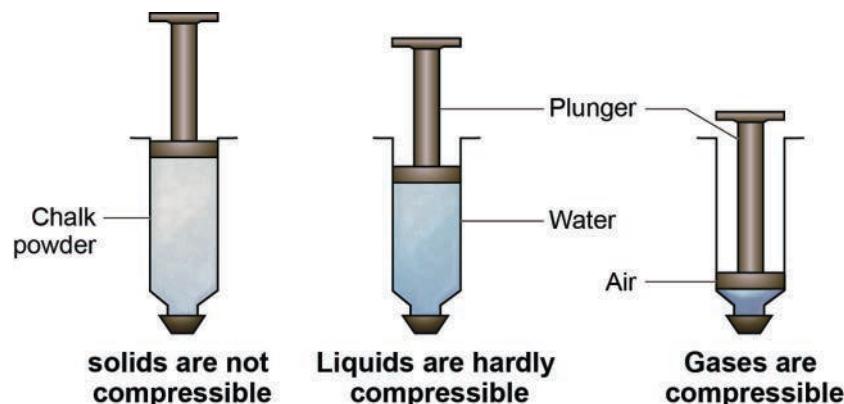
**Solid → Liquid → Gas**

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

### 3.3. Compressible as compared to liquids and solids



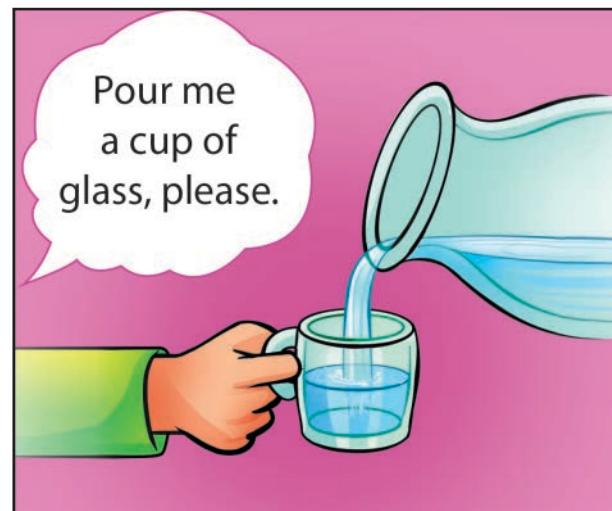
- Let us take three identical syringes. Close the nozzles tightly with a cork.
- After removing the plunger first let us fill it with fine chalk powder. Now put the plunger back and try to press it down. What do you observe?





- Now let us fill the second one with water. Try pressing 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 we 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 when air was present and in the case of water and chalk powder it was difficult to press and the piston hardly moved.

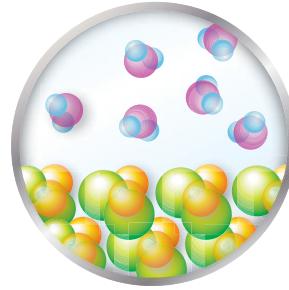
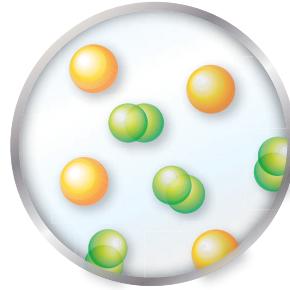
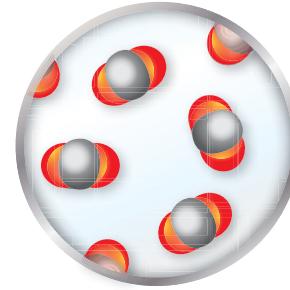
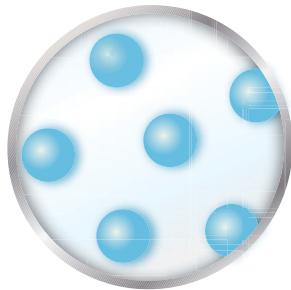
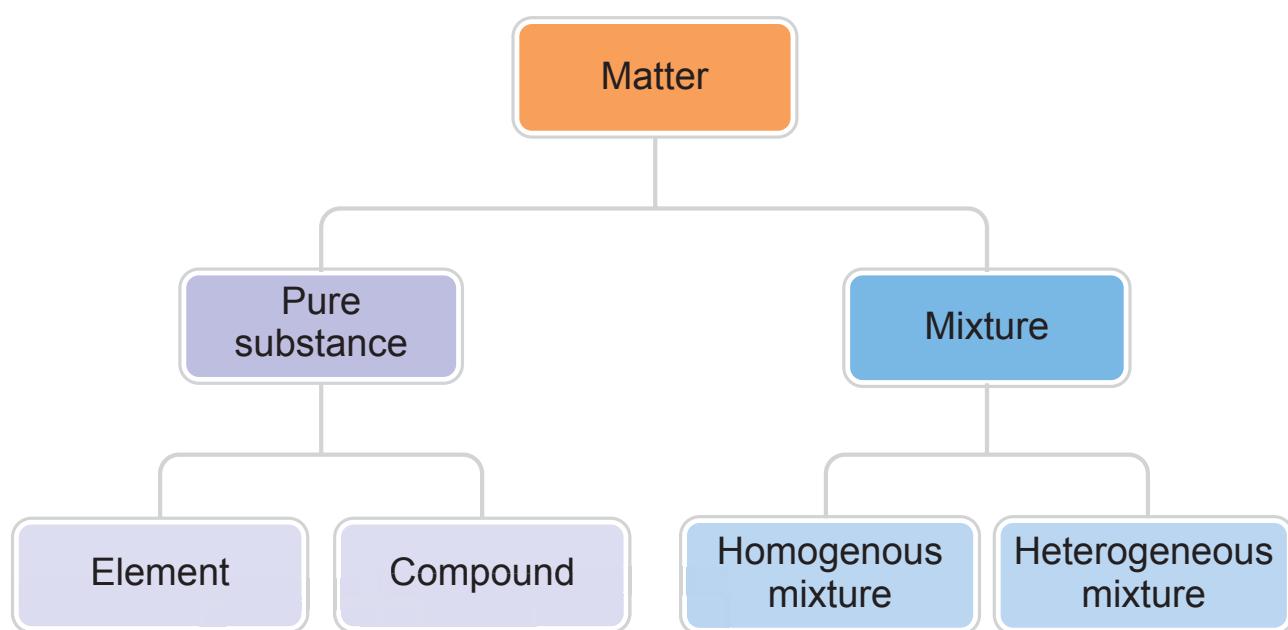
We conclude that gases are highly compressible as compared to liquids and solids.



Strictly speaking, Glass is not a solid. It is actually a very slowmoving liquid. In church windows that are hunderds of year old. The glass at the bottom is thicker than that at the top- proof that glass flows like a liquid if given enough time.

### To sum up...

S.no.	Solid State	Liquid state	Gaseous state
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 the particles of solid	These particles have a greater space between them.	The space between gas particles is the greatest.
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.



### 3.4.Pure Substances And Mixtures

In shops, we find products which are sold as 100% pure! For common people pure means unadulterated- that which does not

contain any cheap or harmful additives. Are these really pure substances as they claim to be?

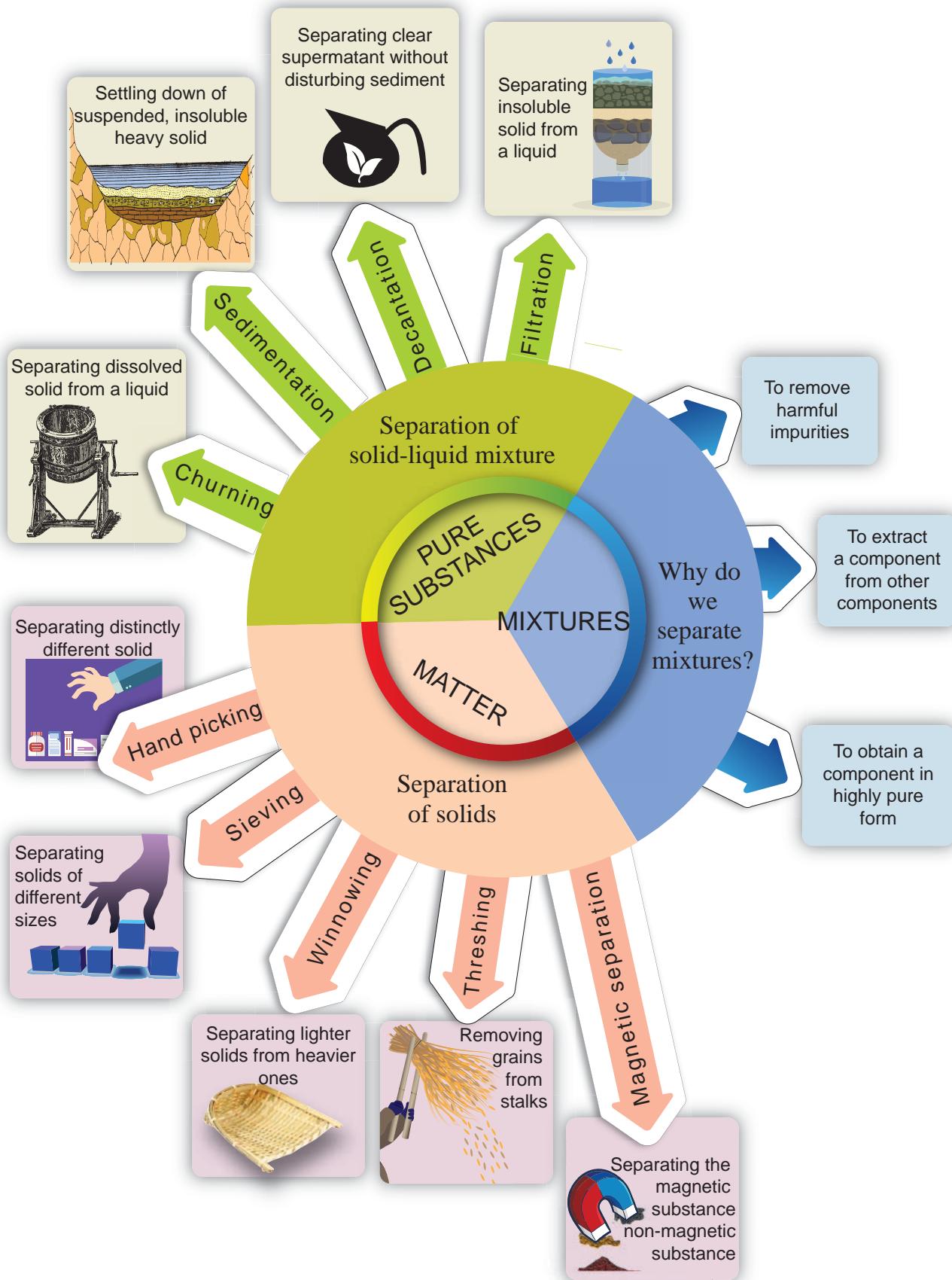
For a Chemist the word 'pure' means something else!

- A pure substance is made up of only one kind of particles.
- Pure substances may be elements or compounds.
- An atom is the smallest particle that an element is made up of same kind of atoms. Molecule is the combination of two or more atom. Compound in the substance formed by the chemical combination of two or more element.



# Is matter around us pure?

## Fast facts





Purity of gold is expressed in terms of 'carat'. 24 carat gold is considered to be gold in its purest form.

Let us consider the following examples:



We have had the snack. Can you identify and mention a few things that are present in snacks like - 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 a mixture.

Why do we call these as mixtures- because they are made up of more 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 see the two pictures given below:

Fig:1



Fig:2



In fig: we can see and physically separate the components of vegetable salad, where as in fig: we can neither see nor physically separate the components of an aerated drink- soda water.

**Try it yourself:** Try to identify from the list what you think may be classified as mixture. Write yes if it is a mixture, then write 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 etc.

Milk is also a mixture of water, fat, protein etc.

Lemon juice is a mixture. Some of us like it less sweet i.e. with less sugar; while some others like it very sweet so they prefer to add 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 lemons 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.

When elements chemically combine they form compounds; whereas a mixture can be a physical combination of

a) two or more elements. Example: 22 carat gold which is composed of gold and copper / gold and cadmium,

b) two or more compounds. Example: aerated drink which is composed of

carbon-di-oxide, water, sweetening and colouring agents,

c) an element and compound.  
Example : Tincture of iodine which is composed of Iodine in alcohol.

### 3.5. Separation Of Mixtures

Are all mixtures used as they are? or is there a need for separating 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 in these cases. 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.

So 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 get the original properties and uses of 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 fields collecting paddy after harvesting. Selvi is helping her mother in preparing to cook rice and is separating stones from the rice. Selvi's little brother Balu is fascinated by a piece of magnet that he 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 is engaged in?

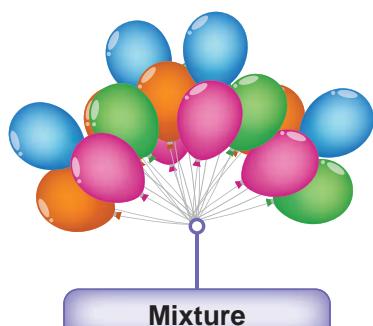
Let us explore the different separating methods involved in the above activities and also learn about a few other methods.

The choice of 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 – they may be solids, liquids or gases.

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**.

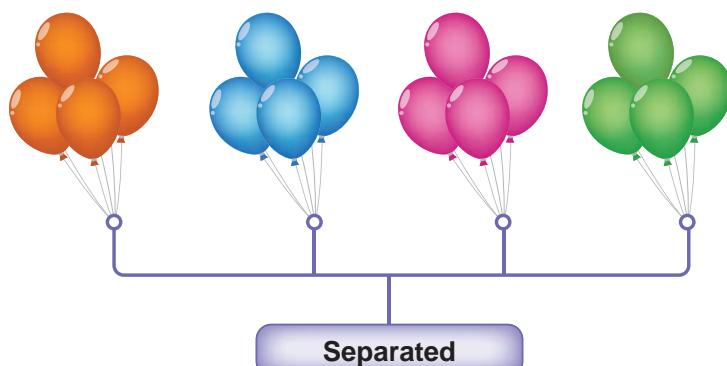
Will you discard the tea leaves after straining? Can you suggest a good way of using them?

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.



#### Activity 6

Think and find out!: Is it a good idea to separate bran from flour? Write your answer in your notebook





**Wire mesh as a strainer sieve is used to separate gravel from sand at a construction site.**

When very fine insoluble solids have to be separated from a liquid as in butter from curds, **Churning** is performed. The mixture is churned vigorously when solid butter will be collected on the sides of the vessel. Both butter and buttermilk are obtained after churning are useful and can be consumed.



In washing machines this principle is used to squeeze out dirt from clothes and the method is called **centrifugation**.



### Threshing

We pluck flowers from a plant? 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 which also grow on plant stalks? That would not be possible because the grains are small in size and also the quantity is very large. Farmers separate grains from their stalks by beating them so hard that the grains are separated from their stalks. This is called **Threshing**.



### Activity-7

Have you seen how some farmers spread the dried grain stalks in the middle of the road? Heavy vehicles pass on them and the grains get separated from the stalks. Write down two merits and demerits of this practice.

### Winnowing

Rice, wheat and other food grains are covered in husk which cannot be eaten by us. Husk is very light and gets easily blown away by a breeze or wind. This property



is made use of in **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.



Winnowing



Rice **husks** are the hard protecting coverings of grains of rice. In addition to protecting rice during the growing season, husks can be used as building material, fertilizer, insulation material and fuel

If the rice that we cook has stones in it we have to pick the stones out.

### Handpicking

How do we identify a stone from a grain of rice? If the stones are visibly very different from the grain, they can be easily picked and separated by hand. This is **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. 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? The 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 away leaving clean rice at the bottom. This is called **decantation**.



## SEPARATING MUD FROM MUDDY WATER: (can be demonstrated by the teacher)

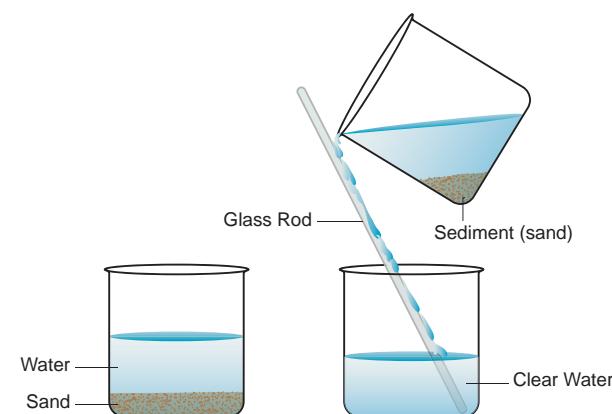
Muddy water is a mixture of very fine particles of soil in water. What will happen to a beaker of muddy water if it is left undisturbed for some time? Mud being heavy will settle down at the bottom of the beaker and will form the sediment. Water will form the top layer and is called the supernatant liquid.

The settling down of heavier component 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 has settled down is called sediment. The water that is obtained after decantation is called the decantate.

The process of removal of water 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? By the process of filtration. Do you think a strainer or a cloth can filter these very fine particles? Do it and see for yourself.



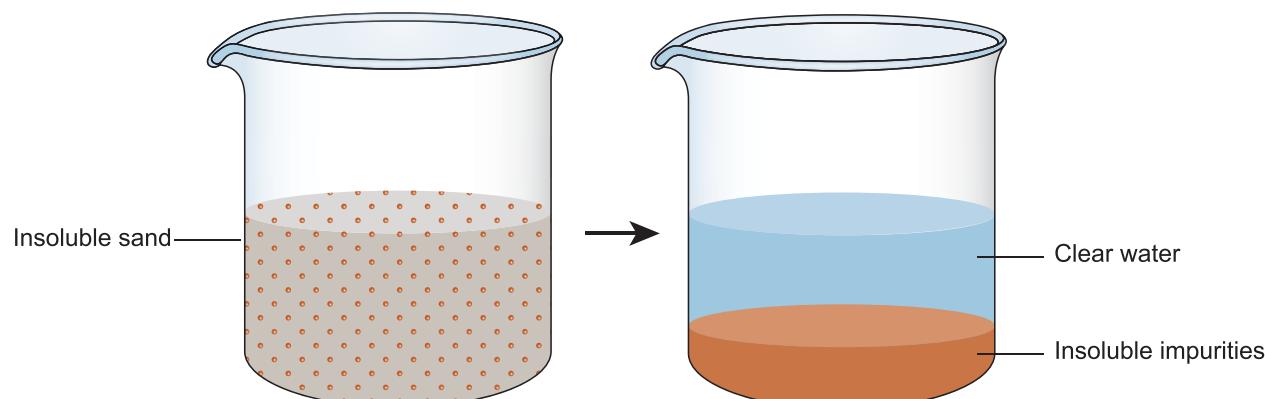
## Filtration

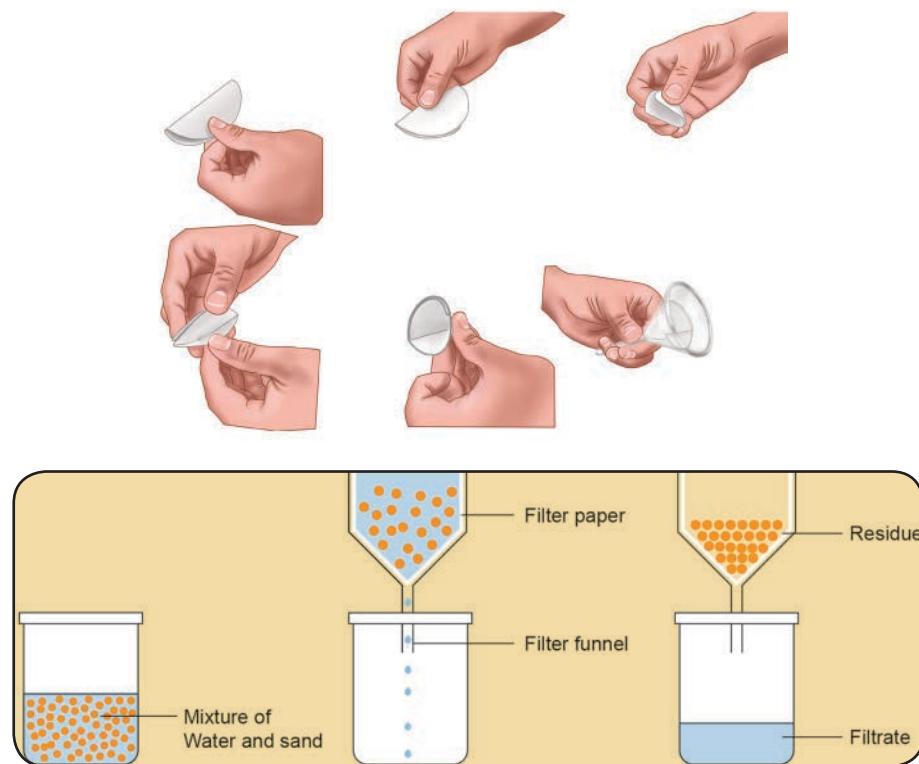
We will use filter papers to remove the finer impurities. A filter paper has very fine pores much smaller than soil particles. Let us see how to use the filter paper.

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

## Sedimentation





(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 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 steps will be involved: Sedimentation, decantation, filtration, evaporation and condensation.

#### Activity 8

Group Activity – Students are divided into 4 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 form 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. This process is called adulteration.



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.

RO – a process of removing impurities from water to make it potable.

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.

Consumption of any adulterated food 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 our health.

#### Activity 9

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](https://www.youtube.com/watch?v=_XLi_WunnudY)

#### KEYWORDS

Matter	Particles
Volume	Mass
Compressibility	Diffusion
Fluids	Mixture
Handpicking	Threshing
Winnowing	Sieving
Magnetic separation	Sedimentation
Decantation	Filtration
Adulteration	

#### FAST FACTS

- Matter is anything that has mass and occupies space.
- All matter is made up of extremely small particles.
- 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 is 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 component
  - 3) to obtain a substance in a highly pure form
- Separation method to be adopted depends on the properties of the components.
- Handpicking – For smaller quantities containing particles reasonably large in size to be recognised can be picked by hand
- Winnowing – Adopted to separate lighter solids from heavier ones
- Magnetic separation – Used to separate magnetic substance from non-magnetic substance
- 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 – make impure by the addition of a foreign or inferior substance.



## ICT CORNER

### Types of matter

Lets play with  
Science kids



Can you drag each thing from the menu into the right category of solids, liquids or gases?

Solids	Liquids	Gases

Ice

#### Steps:

- 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**.
- 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.

**Try this**

Can you drag each thing from the menu into the right category of solids, liquids or gases?

OK

Step1

Can you drag each thing from the menu into the right category of solids, liquids or gases?

Solids	Liquids	Gases
Sand	Milk	Steam
Ice	Rain	Air

Helium

Step2

Cool down the gas by pressing the blue button. What happens? Why does liquid appear in both beakers?

Remove lids      Reset      Help

Step3

#### URL:

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



**Pictures are indicative only**

**Evaluation****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 400ml capacity. The volume of water now will be
  - a. 400 ml
  - b. 600 ml
  - c. 200ml
  - d. 800ml
3. Seeds from water-melon can be removed by \_\_\_\_\_ method.
  - 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. \_\_\_\_\_ of 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. From the following \_\_\_\_\_ is not a mixture
  - a. Coffee with milk
  - b. lemon juice
  - c. water
  - d. ice cream embedded with nuts.

**II. State whether the following statements are True or False. If false give the correct statement**

- a. Air is not compressible.
- b. Liquids have no fixed volume but have fixed shape.
- c. Particles in solids are free to move.
- d. When pulses are washed with water before cooking, the water is separated from them by the process of filtration
- e. Strainer is a kind of sieve which is used to separate a liquid from solid
- f. Grain and husk can be separated by winnowing
- g. Air is a pure substance
- h. Butter from curds is separated by sedimentation.

**III. a) Match the following**

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	Separating of heavier and lighter components	sand and water	Decantation
iii	Separation of insoluble impurities	iron impurities	Filtration
iv	Separation of magnetic component from non-magnetic components	rice and stone	Hand-picking
v	Separation of solids from liquids	husk and paddy	Winnowing

**IV) 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. Among the following items: safety pins, pencil and rubber band, \_\_\_\_\_ will get attracted to a magnet.
7. Water obtained from tube wells is usually \_\_\_\_\_ water

**V. Complete the given analogy**

1. Solid: rigidity:: gas: \_\_\_\_\_
2. Large Inter-particle space: gas:: \_\_\_\_\_:solid
3. Fluidity: Fixed volume:: \_\_\_\_\_ : \_\_\_\_\_.
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

**VI. Very Short answer**

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. Short answer**

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 mixture of 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 curds. What can she do to get buttermilk? Explain

### VIII. Answer in detail

1. Distinguish between properties of Solid, liquid, gas. Draw 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.

### IX. Life Skills-Debate

Debate on "Food adulteration and detection"

### X. Field Trip

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

OR

**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:

Write the sequence of steps you would use for making tea.

Use the words : mixture, dissolve, filtrate and residue.

### XII. Topic enrichment –Project

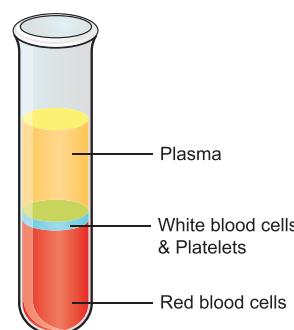
Make a fruit or vegetable salad. Give reasons why you think it is a mixture.

### Connect with Environment

We learnt about different objects and their properties. Can you tell why it is better to use plates made of paper or dry leaves better than the ones made of plastics? Discuss in small groups and share with the class.

### Connect with Biology

Blood constitutes about 7-8% of human body weight. Blood has the important function of transporting oxygen and nutrients to our cells and getting rid of carbon dioxide, ammonia, and other waste products, in immunity and also in regulating our body temperature. Blood is composed of more than 4,000 different kinds of components. Four of the most important ones are red cells, white cells, platelets, and





plasma. Plasma is the liquid in which the red cells, white cells and platelets are present.

Blood is not a pure substance but a mixture.

Find out details of separating its components.

### 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. The basis of how the balloon works is that, hot air is lighter than cool air. which makes balloon rise up Find out more about Hot Air balloons.



### HOTS

1. 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.
2. 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?
3. Justify your answer.

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

- a) Which state is represented by fig. I?
- b) In which will be the inter particle attraction maximum?
- c) Which one of them cannot be contained in an open vessel?
- d) Which one can take the shape of its container?

FIG 1	FIG 2	FIG 3



# Unit

# 5

## Living World of Animals



### Learning Objectives

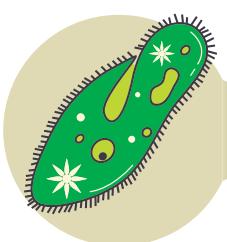
- To know there are many kinds of animals.
- Diversity is seen both in animals and plants.
- Living organisms may be unicellular and multicellular.
- Based on the habitat where they live there are variations in forms.
- Based on the habitat animals exhibit adaptations.
- Life form depends on each other.



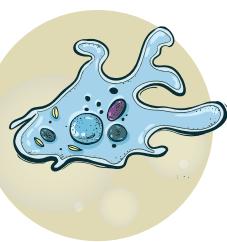


## Animals Bio Diversity

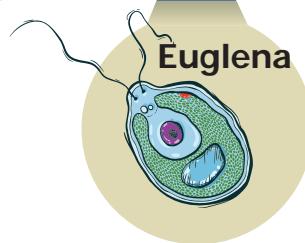
Paramecium



Amoeba



Uni  
Cellular

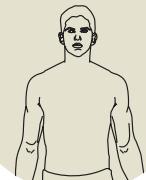


Multi  
Cellular

Tiger



Man



Monkey



Eartworm  
and Snail



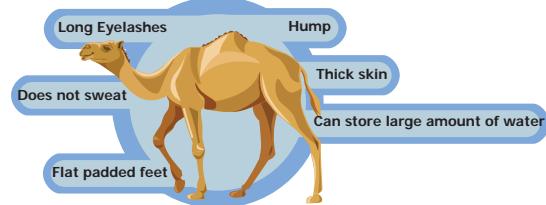
Frog



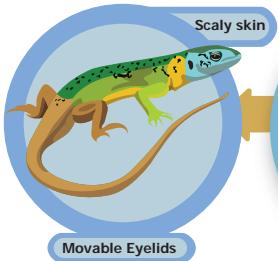
Fish and  
pigeon



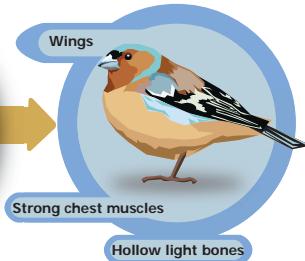
CAMEL



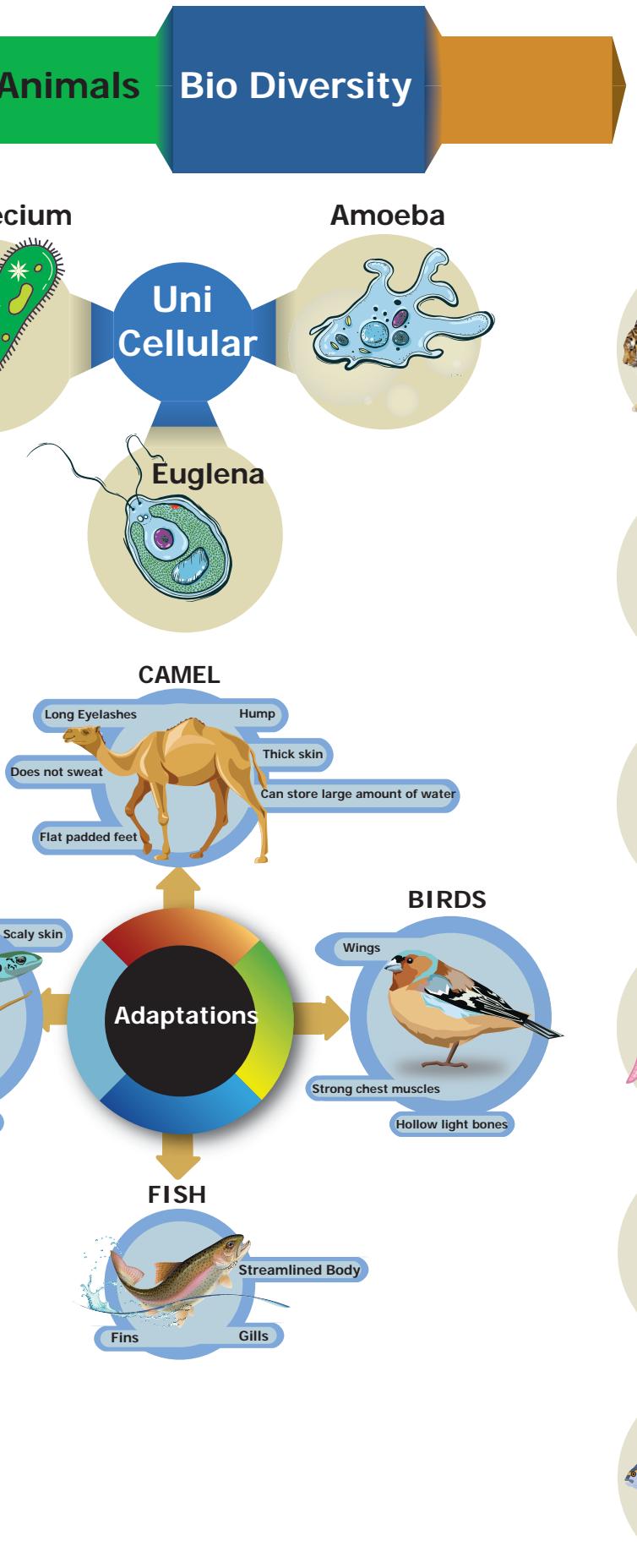
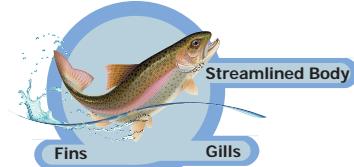
LIZARD



BIRDS



FISH





## Introduction

The National School, Nallur, organised a field trip to a nearby village called Anaikkadu. The Students were so happy to see a village with ponds, streams, green fields and coconut trees. With the help of the teacher students were allowed to go around. One of them saw two birds building a nest. Where do the birds build a nest and why?

Children saw a number of butterflies fluttering near the flowers. The air was so fresh, so calm, so quiet and so relaxing. They came across a pond in the distance. It had some water. Floating on the water were dark green lotus leaves. A green frog was leaping from one lotus leaf to another making a croaking sound. A girl spotted a rabbit with a short tail. Can you make a list of the animals seen by the children? Were they all similar? In what way they were similar?

## 5.1 Biodiversity

In the living world, a lot of diversity is seen both in animals and plants. Every plant and animal is unique. The term biodiversity refers to the totality of species, populations, communities and ecosystems, both wild and domestic. It may also be defined as the variety and variability among living organisms and the habitats in which they live.

Biodiversity includes a variety of ecosystems such as those that occur in deserts, forests, mountains, lakes, rivers and agricultural fields. In each ecosystem,

living creatures, including humans, form a community interacting with one another and with other animals, plants, air, water and soil around them. The living things form biotic community and non-living things form abiotic community.

### 5.1.1 Habitat

Fishes and crabs grow only in water while many animals like elephants, tigers and camels live on land. The geographical features and environmental conditions on earth differ from one place to another. Though camel can live anywhere it is able

#### Activity 1

Collect the pictures of various ecosystems like lake, pond, forest, desert, mountains, and Polar regions and prepare a chart of animals in these places.

to live in deserts more comfortably. Polar Bear and Penguins dwell in cold regions. Living in such harsh conditions requires special features in these animals which help these organisms to live, breed and excel well in that particular place. Living or dwelling place of an organism is known as **habitat**.





### Activity 2

Look at the below picture and prepare a chart for the following interpretation.

- How does the climate differ in these habitats?
- Name some animals that exist in these habitats.
- Can an animal survive if it is shifted from one habitat to another contrasting habitat?



In Jurong Birds Park, Singapore, Penguins are kept in a big glass case with ice bergs and temperature is maintained at 0° C and below.



Penguin

Some organisms are made up of a single cell and these are called **unicellular organisms**, whereas, the organisms that are made of many cells are called **multicellular organisms**.

Amoeba, Paramecium and Euglena are unicellular while, fish, frog, lizard, bird and man are multicellular.

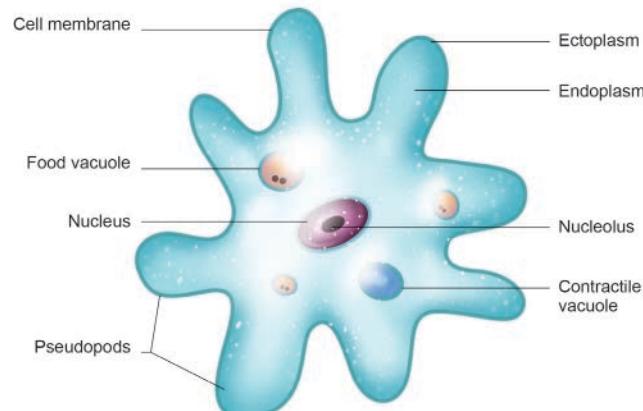
### Unicellular organism

Unicellular organisms are small, usually microscopic, cannot be seen with naked eye. They are aquatic, simplest and most primitive of all animals. They perform all their physiological activities by the special structures present inside the body called organelles.

We know Amoeba is an unicellular organism It does all the activities like digestion, locomotion, respiration and reproduction.

It swallows food from the water and the food is digested in the food vacuole. Contractile vacuoles help in excretion. Respiration is by simple diffusion through the body surface. They have finger-like structures called Pseudopodia, (false foot) which help in movement or locomotion.

### Amoeba



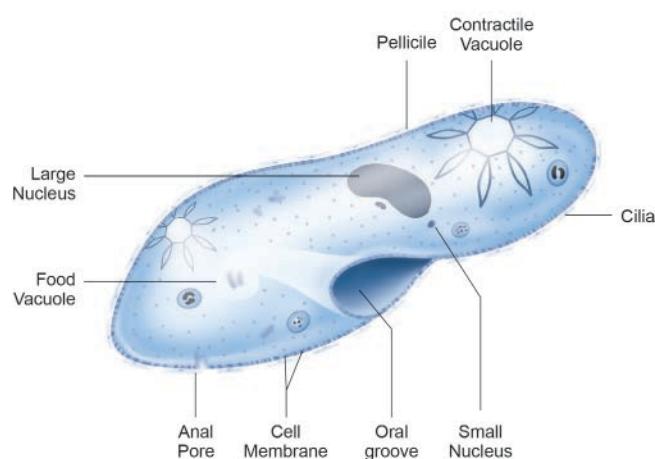
## 5.2 Unicellular and Multicellular Organisms

Living things are made of small units called cells. All the functions and processes in the body of living things are brought about with the help of these microscopic cells.



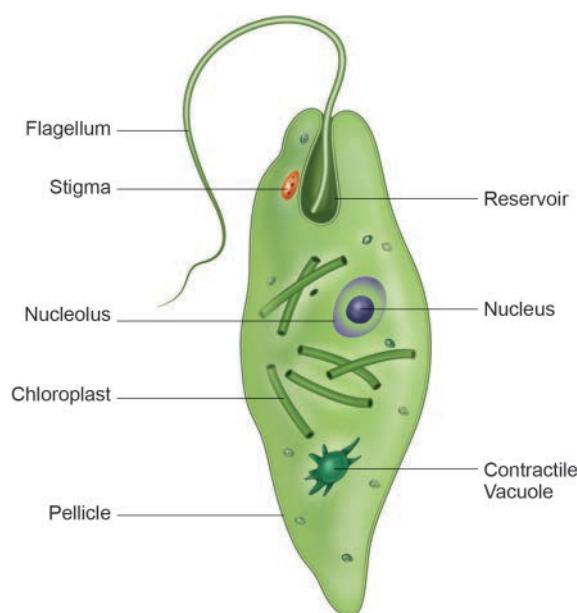
Paramecium is also a unicellular organism which lives in water and move with the help of cilia.

### Paramecium



Euglena is an unicellular animal which moves with a flagellum.

### Euglena



### Multicellular organisms:

Majority of organisms we see around us, including animals are multicellular. In such organisms, different functions are



**Table 2.2 The Differences between Unicellular and Multicellular Organisms.**

Unicellular Organisms	Multicellular Organisms
<ul style="list-style-type: none"><li>They are made up of single cell.</li><li>The single cell of the organism can perform all the functions of life.</li><li>These organisms are generally very small (microscopic) in size.</li><li>They lack tissues, organs and organ systems.</li><li>Growth occurs by an increase in the size of the cell. eg. Amoeba, Paramecium and Euglena.</li></ul>	<ul style="list-style-type: none"><li>They are organisms are made up of many cells.</li><li>Division of labour exists among cells. Different cells are specialized to perform different functions.</li><li>They are mostly large in size.</li><li>They are composed of tissues, organs and organ systems.</li><li>Growth occurs by an increase in the number of cells by cell division. eg. Earthworms, Fish, Frogs, Lizard and human beings.</li></ul>

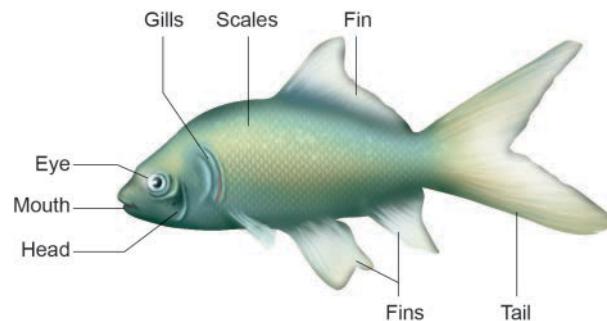


carried out by different groups of cells or organs in their body. E.g. Jelly fish, Earth worm, snails, fish, frog, snakes, pigeon, tiger, monkey and man.



## Fish

1. The head, trunk and tail of a fish merge to form a streamlined shape. The streamlined body shape helps the fish to move through the water easily.
2. The fish has special organs called "Gills" which is a respiratory organ helps to absorb oxygen dissolved in water for breathing. It is adapted to breathe in water.
3. Most of the fishes have slippery scales all over the body which protect the body.
4. The fish has fins for swimming.
5. The fish has strong tail which acts as rudder to change direction and keep its body balance in water.



## 5.3 Adatptation in Animals

### Animals vary in size, shape and behaviour

A Living thing can survive in a particular habitat if its body is adapted to the conditions of that habitat. Plants and animals develop special characteristics or features in their body in order to survive in their habitat (the surroundings). The presence of specific body features for certain habits which enable a plant or an animal to live in a particular habitat is called adaptation.

The fish lives in either freshwater or marine water. Let us analyse the adaptations seen in a fish for its aquatic life.

## Lizard

1. Lizards are scaly-skinned reptiles that are usually distinguished from snakes by the possession of legs, movable eyelids, and external ear openings.
2. They mostly inhabit warm regions. Most lizards are quadripedal (walk with four legs) and have a powerful limb.
3. Some lizards have the capacity to rotate the head around the head joint.
4. They breathe through lungs. Some lizards are able to run bipedally with two legs. In this the tail is held out



- backward and upward and acts as a counterweight.
- 5 Most lizards eat a variety of insects like mosquitoes and Cockroaches with sharp, tricuspid, teeth adapted for grabbing and holding
  - 6 Some lizards (Dinosaurs) have web in the toes, and few lizards are able to glide or parachute the air and make soft landings.



### Birds

1. They have streamlined body covered with feathers.
- 2 This body shape provides minimum resistance to air.
- 3 They have beak instead of mouth.
4. They breathe through lungs. They have a pair of wings that are modified forelimbs.
5. They have hollow and light bones.
6. Usually we see birds fly, however they can also hop, move, run, etc., on the ground and they perch well on the branches of tree with the help of a pair of clawed feet.
7. The tail of the bird helps it to control the direction of the movements.

8. They have strong chest muscles which help them withstand the pressure of the air while flapping their wings during flight.
9. At a time, birds can see one object with one eye and another object with the other eye. (Binocular vision)



When an animal moves its location as the season changes it is said to be **Migration**.

In Tamil Nadu Bird Sanctuaries are



located at Vedanthangal, Kodyakkarai and Koondhankulam. There are many birds from foreign countries like Siberia and Russia migrate to our Vedanthangal. Likewise during summer and drought conditions birds from our country migrate to foreign countries. These birds are called **Migratory Birds**.



### Adaptation in Camel:

Camel lives in hot desert where water is scarce. The body structure of a camel helps it to survive in desert because of its following special features which are listed below:

1. The camel has long legs which help it to keep its body away from the hot sand in the desert.
2. A camel can drink large amount of water (when it is available) and store it in the body.
3. A camel's body is adapted to save water in the dry desert as follows:  
A Camel passes small amount of urine; its dung is dry and it does not sweat. Since a camel loses very little water from its body, it can live for many days without drinking water.
4. A camel's hump has fat stored in it. In case of emergency a camel



can break down stored fat for nourishment.

5. A camel has large and flat padded feet which help it to walk easily on soft sand. Thus it is called "The ship of the desert".
6. Camel has long eye lashes and hairs to protect its eyes and ears from the blowing dust.
7. It can keep its nostrils closed to avoid dust.

### Info Bits

- ☞ Spending winters in a dormant condition is called **Hibernation**. eg. Turtle
- ☞ On the other hand, spending the hot and dry period in an inactive state is known as **Aestivation**. eg. Snail





Kangaroo rat does not drink water at all. Whatever food it eats and oxygen it gets from air combine together to form water inside the body.



**Table: 2 Adaptive Features of Animals from different Habitats**

Sl.No.	Name of the Animal	Habitat	Adaptive features
1.	Polar Bear	Polar region	Thick skin for protection, white fur
2.	Penguin	Polar region	Paddle to swim, walk with two legs
3.	Mountain Goat	Mountains	Strong hooves for running, long hair to protect from cold
4.	Lion	Forest	Strong and fast runner has sharp claws to catch prey.

**Polar Bear**



**Mountain Goat**



**Lion**



**Penguins**



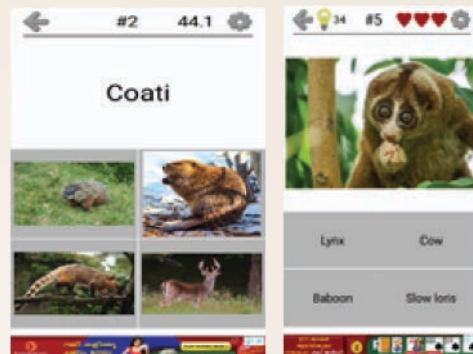
The mountain goat namely Nilgiri Tahr can find small spaces on rock to climb with ease and keep its balance as it feeds.



## ICT CORNER

### Bio diversity

Lets play animal quiz



#### Steps:

- Go to Google / browser and type “animal quiz” to know more about the types of animals and their habitation.
- When you get the app, press install button for installing. Then click open and start your game.
- Many options will be displayed on the screen. From that, you select the option of your choice.
- When the choice is selected and the game is started for each animal four options will come. When the correct answer is given it will automatically go to next animal. When the whole episode is over you can go to the starting phase and start the next play.



#### URL:

<https://play.google.com/store/apps/details?id=com.asmolgam.animals>



**Pictures are indicative only**



## Evaluation

### I Choose the correct answers

1. The study of living things or organisms is called

- a. Psychology
- b. Biology
- c. Zoology
- d. Botany



2. Which of the following are characteristics of living beings?

- (i) Respiration
- (ii) Reproduction
- (iii) Adaptation
- (iv) Excretion

Choose the correct sequence

- a. (i), (ii), and iv only
- b. (i), (ii) only
- c. (ii) and (iv)only
- d. (i), (ii), (iii) and (iv)

3. Lizards breathe through their

- a. Skin
- b. Gills
- c. Lungs
- d. Trachea

4. All animals need

- a. Food and water only
- b. Water only
- c. Air, food and water
- d. Food only

5. Which animal has the special organs of breathing called gills

- a. Earthworm
- b. Fox
- c. Fish
- d. frog

6. Choose the set that represents only biotic components of a habitat

- a. Tiger, Deer, Grass, Soil
- b. Rocks, Soil, Plants, Air
- c. Sand, Turtle, Crab, Rocks
- d. Aquatic plant, Fish, Frog, Insects

7. Which of the following cannot be called as a habitat?

- a. A desert with camels
- b. A pond with fish and snails
- c. Cultivated land with grazing cattle
- d. A jungle with wild animals

8. Birds fly in the air with the help of

- a. heavy and strong Bones
- b. Soft and thick Bones
- c. Hollow and light Bones
- d. Flat and thick Bones

9. Paramecium moves from one place to other with the help of

- a. Pseudopodia
- b. Flagella
- c. Foot
- d. Cilia

10. Kangaroo rat lives in

- a. Aquatic habitat
- b. Desert habitat
- c. Grass land habitat
- d. Mountain habitat

### II. Multiple choice questions

Complete the following with appropriate word(s).

1. Aquatic, deserts, mountains are called \_\_\_\_\_.



2. Based on the number of cells present animals are classified into \_\_\_\_\_ and \_\_\_\_\_.
3. Tail of a bird acts as a rudder which helps to \_\_\_\_\_.
4. Amoeba moves with the help of \_\_\_\_\_.

### III. True or False, If False give the correct answer.

1. Habitat is a living or dwelling place of organism.
2. The geographical features and environmental conditions on earth remain same from one place to other.
3. Amoeba is a unicellular organism and moves with pseudopodia.
4. Birds can see only one object at a time.
5. Paramecium is a multicellular organism.

### IV. Complete the following

1. Tropical rain forests, grasslands and deserts are known as \_\_\_\_\_.
2. Some living things are made of a single cell, they are called \_\_\_\_\_ organism.
3. The breathing organ of a fish is known as \_\_\_\_\_.
4. The lizard \_\_\_\_\_ on the ground with its claw on its feet.
5. Camel stores \_\_\_\_\_ in its hump.

### V. Very short answer questions.

1. How do the birds catch their prey?

2. Where can we see Camels in India?
3. Name the locomotory organ of an Amoeba.
4. What are the body parts of a snake?
5. Which structure helps the bird to change its direction while flying in air?

### VI. Short answer type questions.

1. Differentiate between Unicellular and Multicellular organisms.
2. Write the adaptive features of Polar bear and Penguin.
3. Mention the feature that help a bird to fly in the air?
4. What are the different types of invertebrates?

### VII. Answer in detail

1. Describe the various features which help Camel dwell well in the desert.



# 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





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/ seasonally), Seasons changes 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 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 observe some changes and write about it?

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



- ❖ Is there change in size?  
 Yes  No

- ❖ Is there change in shape?  
 Yes  No

- ❖ Is there any other change?
- 

### 3.1 Classification of Changes

There are different types of changes observed in nature that occurs 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.



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

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



### 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

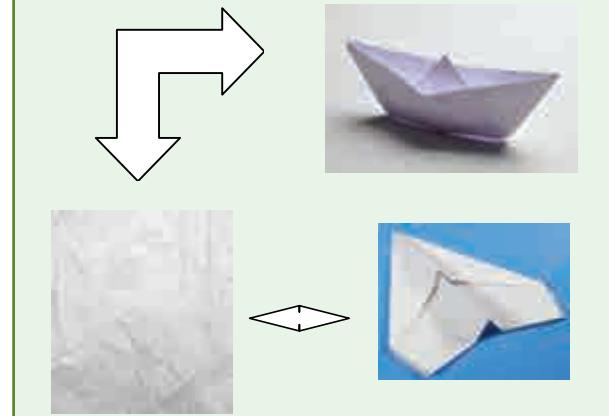
Changes which can be reversed (to get back the original state) are known as reversible changes.

**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.



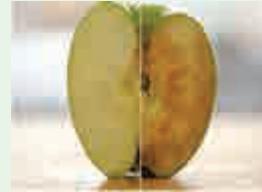
**Examples :** Change of milk into curd, digestion of food, making idly from batter.



### 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**.

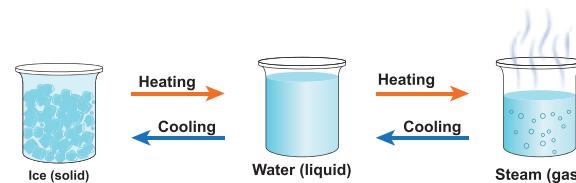
Leave the other half on the table for some time. You can see brown patches formed on the cut surface because of the reaction between some substances in the apple and the air around it. This is a **Chemical change**.

#### Physical changes

Physical changes are the temporary changes in which there is change in the physical appearance 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**.

$$\text{Solute} + \text{Solvent} \longrightarrow \text{Solution}$$



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 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 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



### 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.



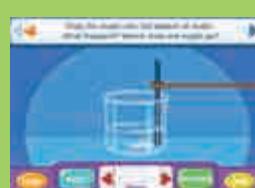
- Step 1:** Use the given URL in the browser. 'Reversible and irreversible changes's page will open. Use the arrow marks on both sides of the substance to choose another substance to test.
- Step 2:** Click and drag the substance into the beaker, observe whether it dissolves or not. Click the Dissolving / 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](http://www.bbc.co.uk/schools/scienceclips/ages/10_11/rev_irrev_changes_fs.shtml)

\*Pictures are indicative only



B443 SCI 6 T2 EM



## Evaluation



### I. Choose the appropriate answer

1. When ice melts to form water, change occurs in its
  - a. position
  - b. colour
  - c. 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. Dissolving 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

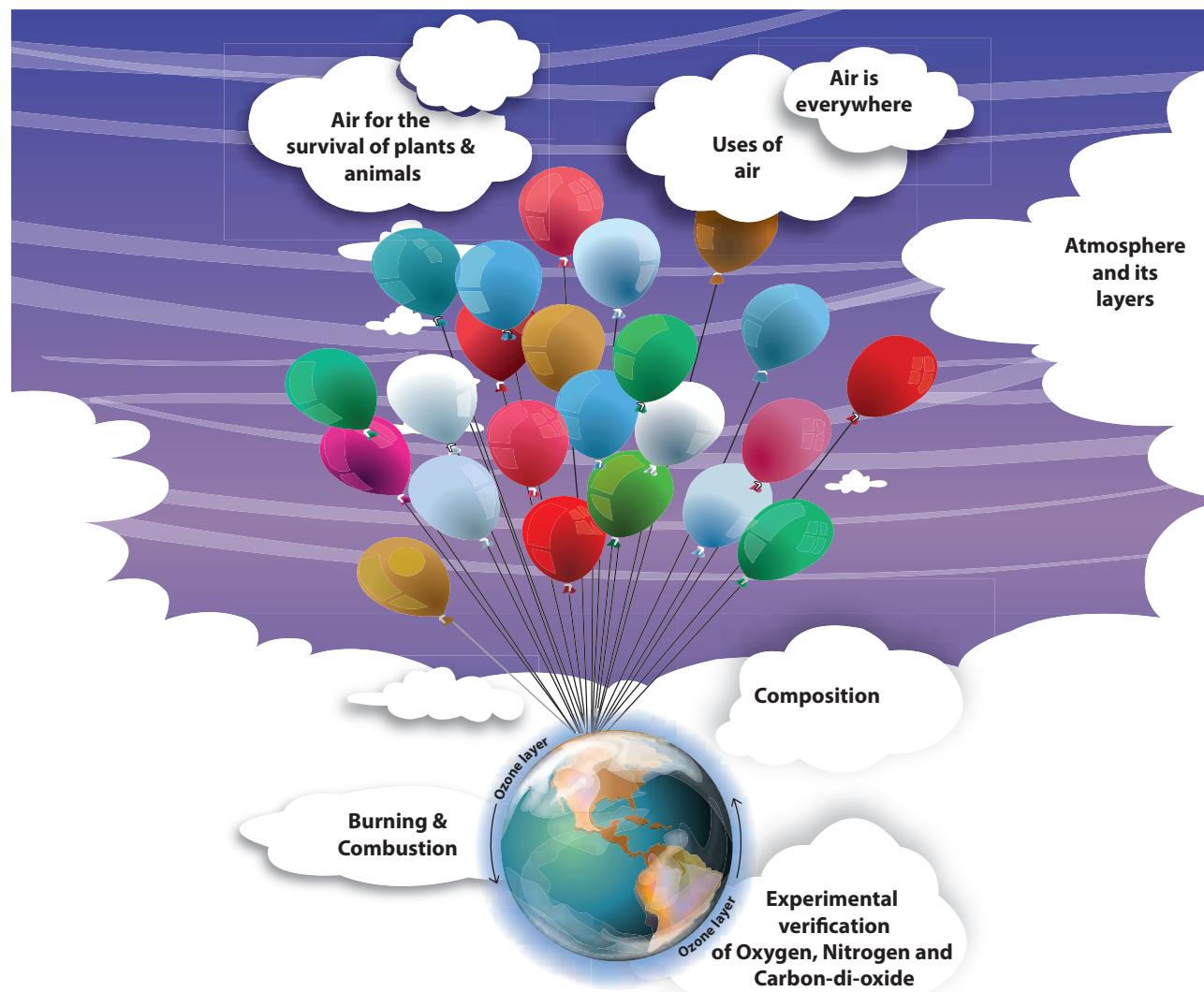
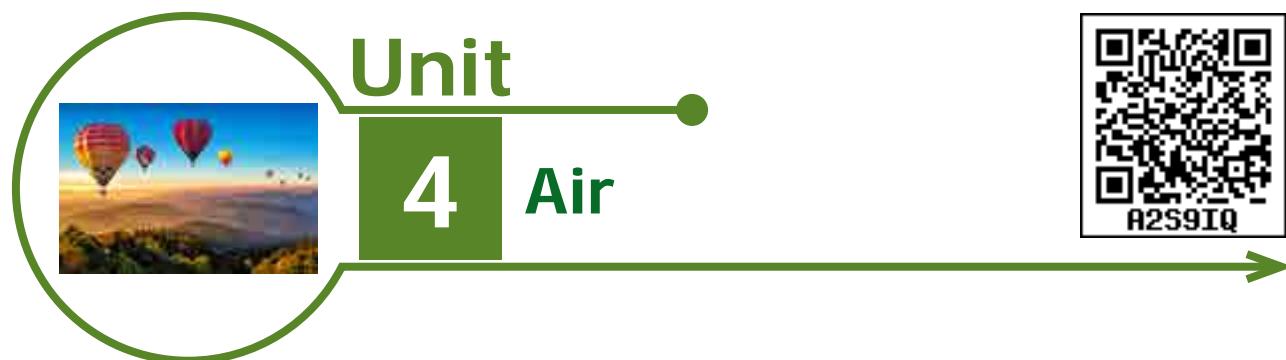
1. What happen when paper is burnt? Explain.
2. Can deforestation be considered a desirable change? Explain.
3. What type of changes is associated with germination of a seed? Explain

#### VIII. Answer in detail

1. Give one example in 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.



### 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

Fig 1



Fig 2



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.

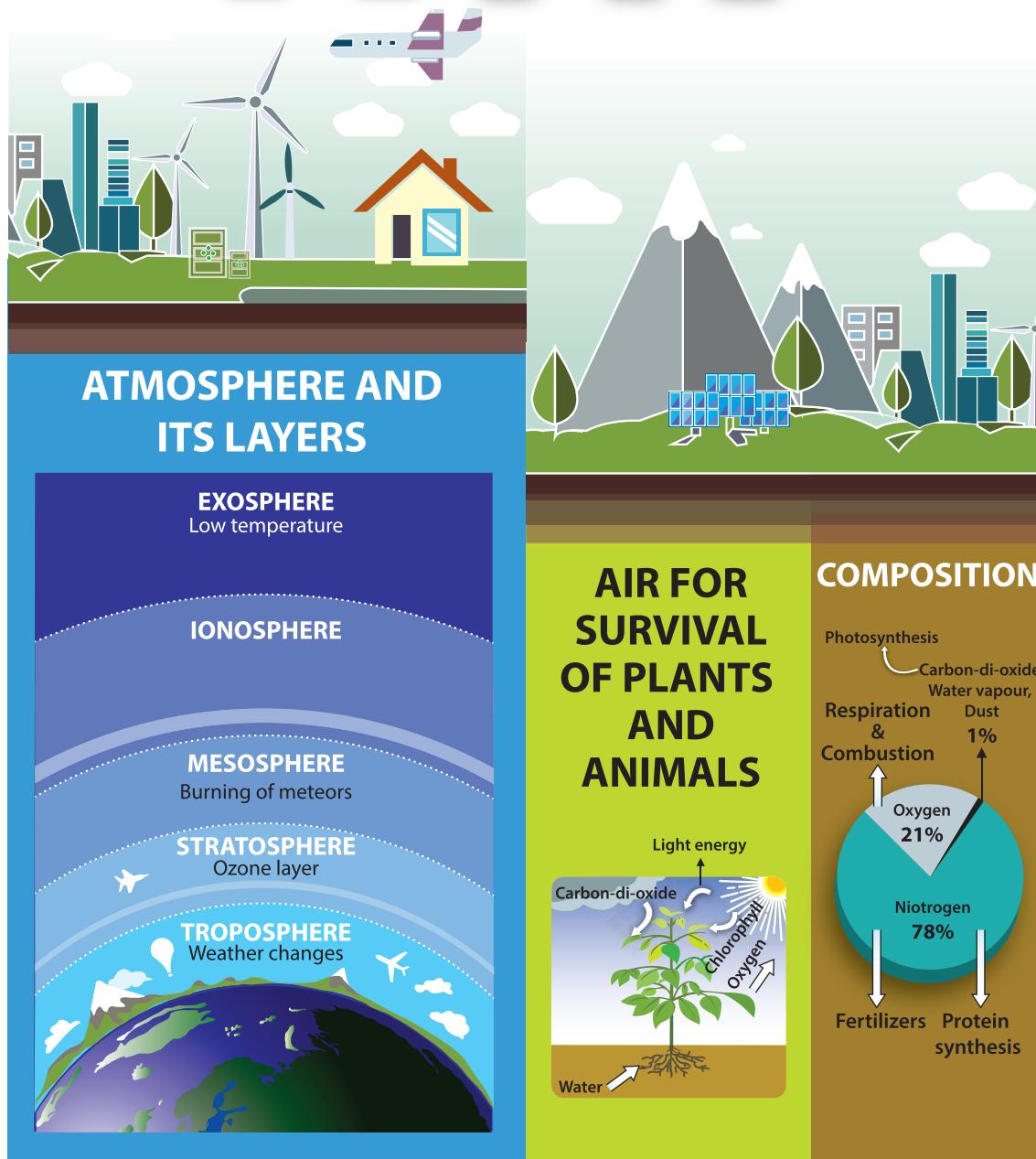
The bottle was not empty at all. In fact, it was filled completely with air even when you turned it upside down. That is why we notice that water does not enter the bottle when it is pushed in an inverted position, as there was no space for air to escape.

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



## USES OF AIR

Breathing



Burning



Cycle tube



Patient



Mountaineer

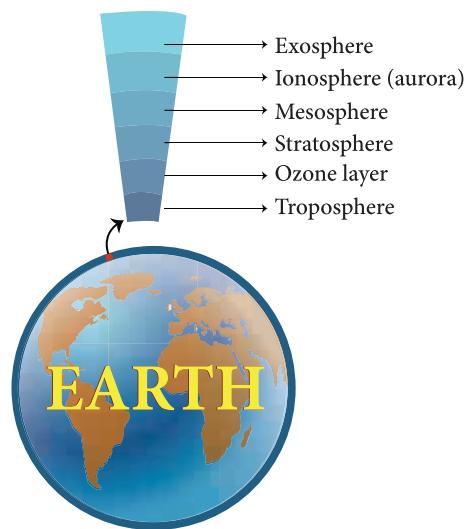




## 4.1 Atmosphere

**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-dioxide 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 survives with a mint plant inside.



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



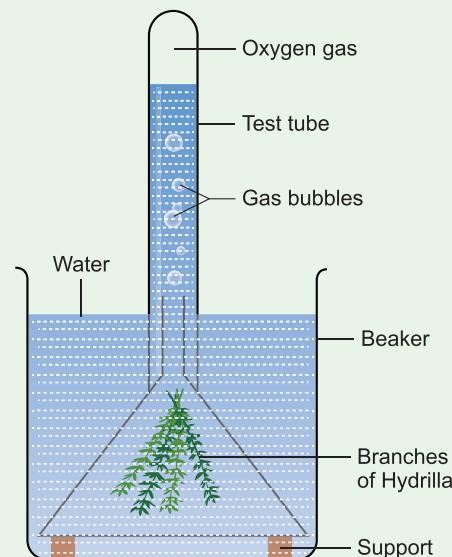
and a mouse into this jar. Both the plant and the mouse survived (**Fig-7**). He found that plants and animals have a synergy. Animals consume oxygen and release carbon-di-oxide and plants take up carbon dioxide and release oxygen.

During 1730 – 1799, Jan Ingenhousz showed that sunlight is essential to the plant 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” was 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.

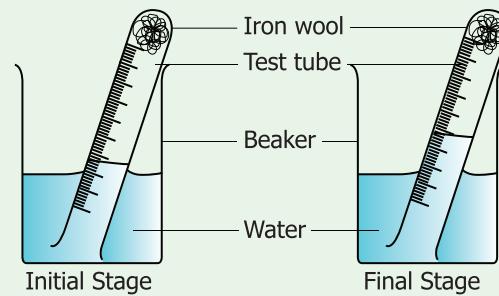


Leave the beaker in sunlight for some time. You will notice some bubbles rising in the test tube. The bubbles contain oxygen released by the plant during photosynthesis. If we show a glowing splinter to the collected air, it burns brightly. **This shows that the collected gas is oxygen.**

#### 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 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



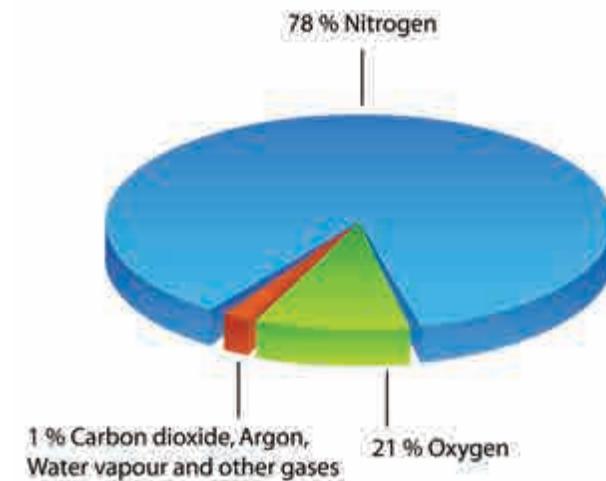
lime water. After a few minutes, look at the lime water carefully. The lime water will produce a white precipitate and that the lime water will eventually turn to a milky white solution. **This shows the presence of carbon-di-oxide in air.**

### 4.3 Composition of Air

From Priestley's experiment which was followed by Ingenhouz 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

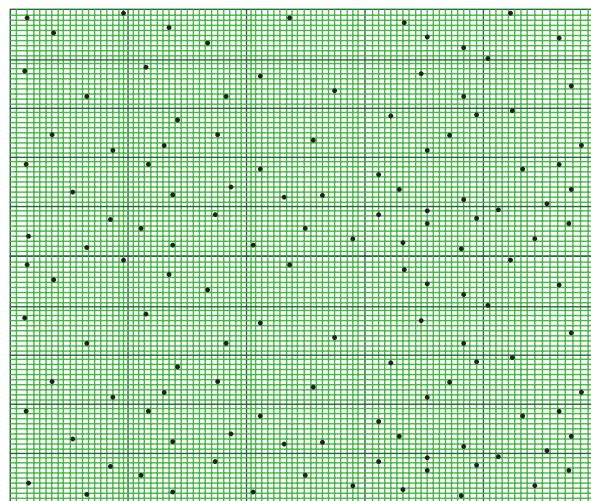
You might have seen the sunlight entering into a dark room through a narrow slit and making shiny dust particles dancing merrily on the path of sunlight. Actually, the air in a room always contains some dust particles, but they are so small that normally they are not visible to us. When a beam of sunlight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

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

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

$$\text{Range} = \text{Maximum value} - \text{minimum value}$$

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

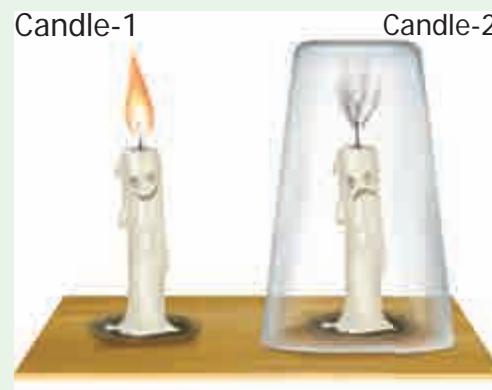
When we burn a candle, paper, kerosene, coal, wood or cooking gas (LPG), oxygen is needed. The oxygen needed for the burning of candle, paper, kerosene, coal, wood and cooking gas comes from the air around us. Thus, for burning a substance continuously so as to make fire, a continuous supply of fresh 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

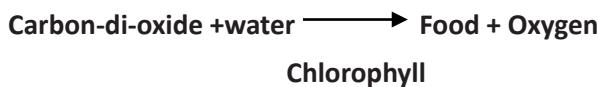
### Respiration in plants

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.

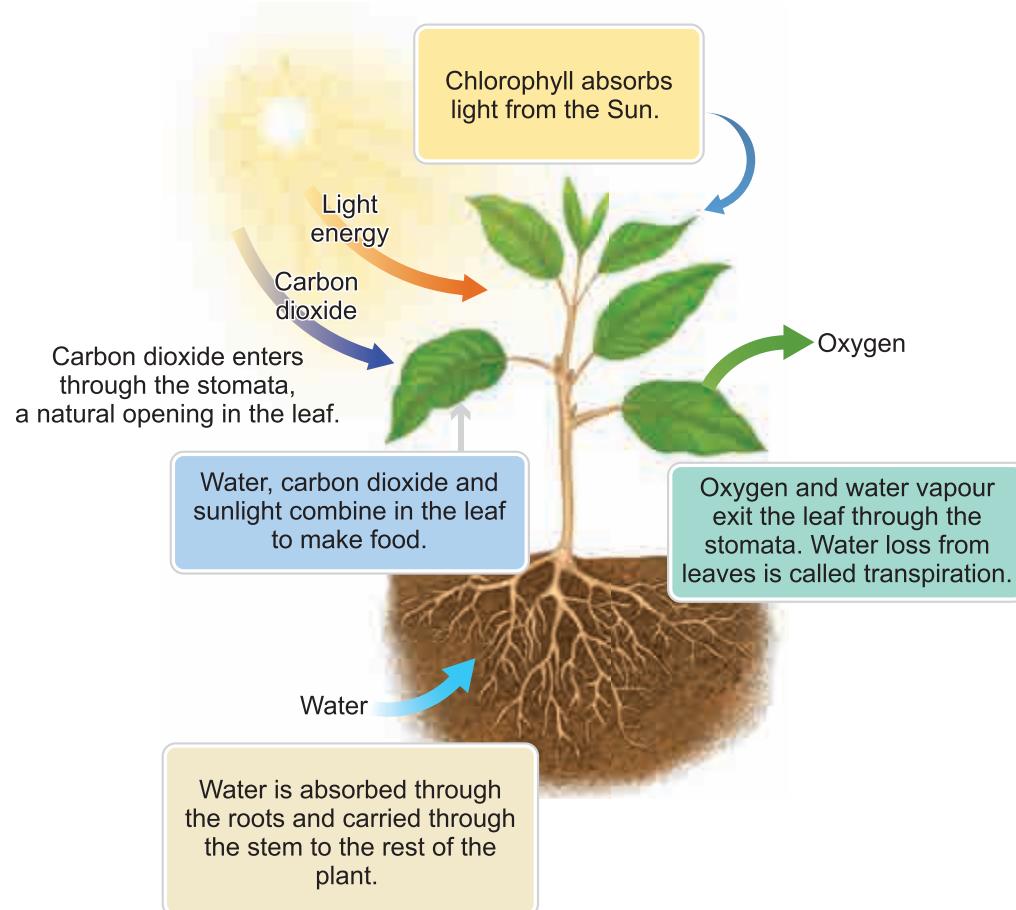
**Sunlight**



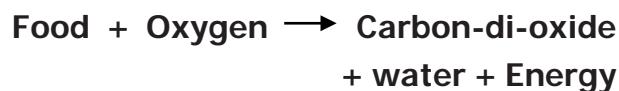
Plants release oxygen during photosynthesis which is much more than the oxygen consumed by the plants, during respiration.

### 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 :-



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  $-57^{\circ}\text{C}$ , 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,

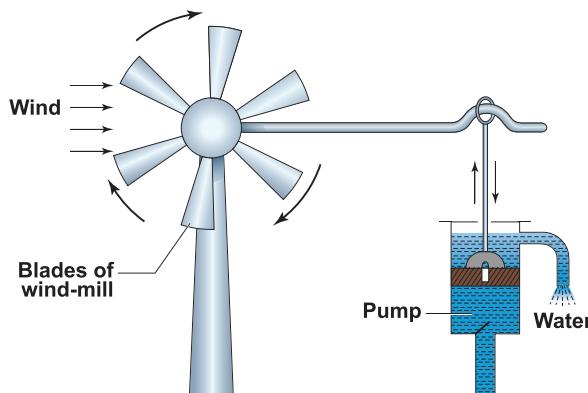


- c. a diver going deep into the sea—oxygen gas cylinders are used for breathing purposes.





- ❖ 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

- ❖ 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](http://www.bbc.co.uk/schools/scienceclips/ages/10_11/rev_irrev_changes_fs.shtml)

\*Pictures are indicative only



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## Evaluation



### 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?

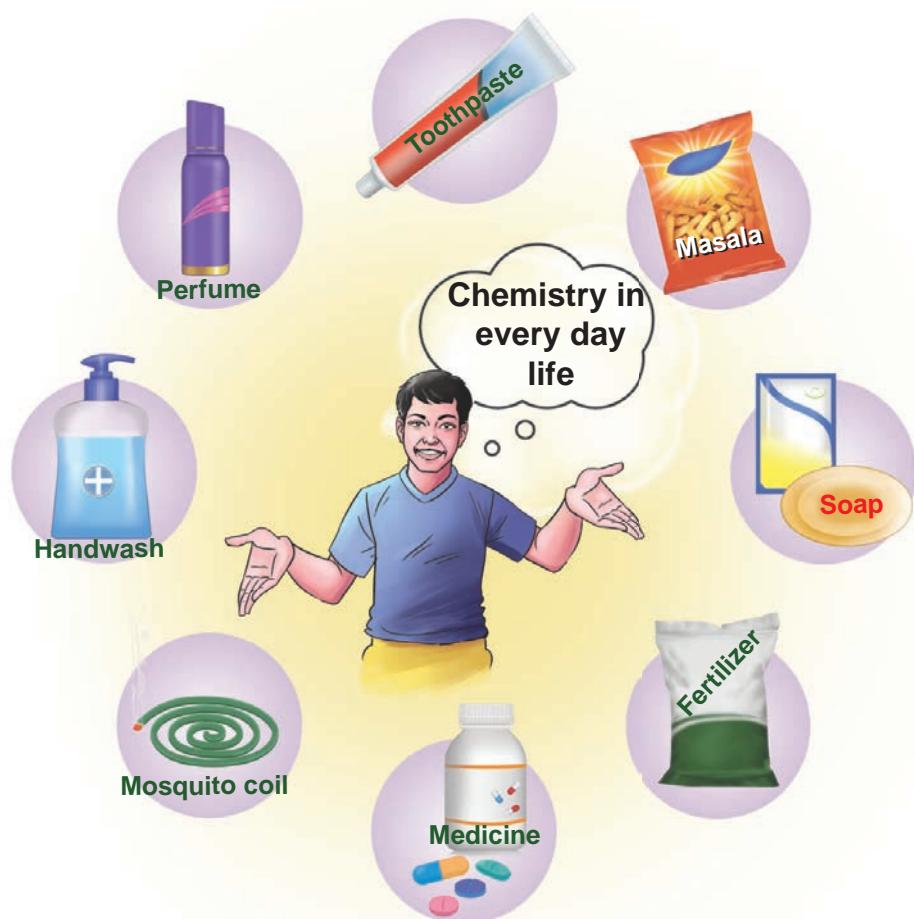
#### XI. Question based on Higher Order Thinking Skills

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



# 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





## 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 of 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 is mixed with the air.

**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.



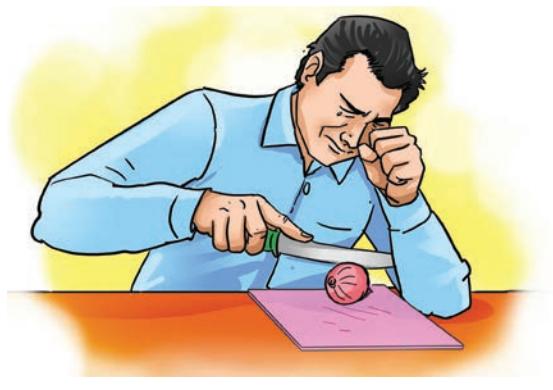
We use chemical changes in various forms in our daily life. **Chemistry** is the branch of science which deals with the study of particles around us. The beauty of chemistry is that, it explains the properties of the basic components of particles such as atoms and molecules and the effects of their combination.

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



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.



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.

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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





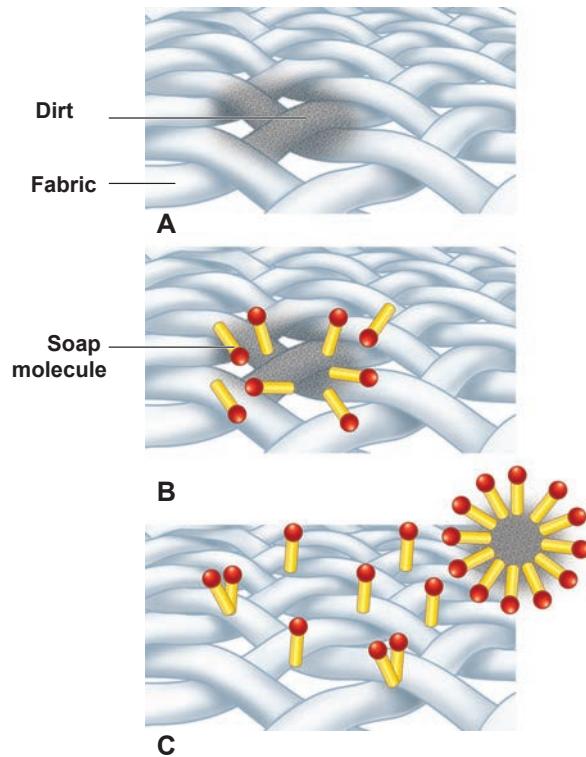
using wash powder to remove strong stains on the clothes.



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



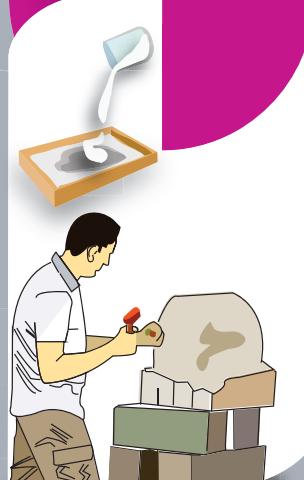
Helps the materials fixing it up together

### 04 Cement



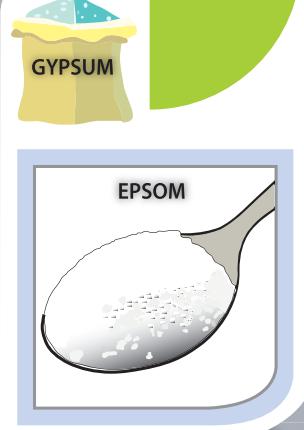
Important material in construction industry

### 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) (Approximate)	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) **Vermicompost, 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.

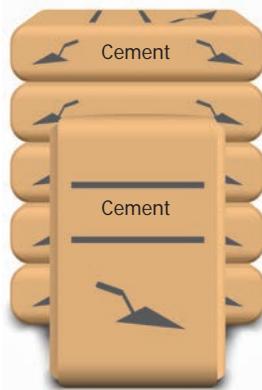
S. No.	Name of the Crop	Name of the Fertilizer
1.		
2.		
3.		

### 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

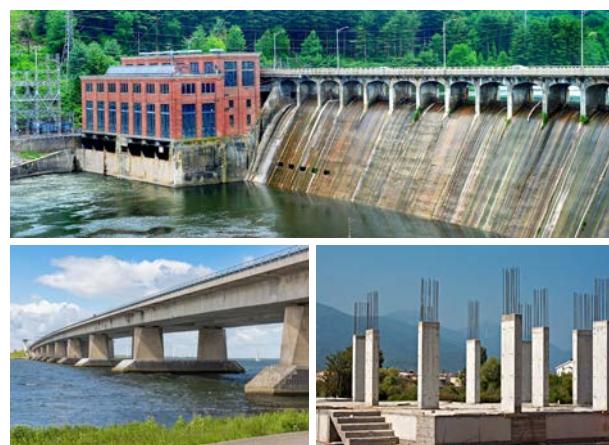
Mortar is a paste of cement and sand mixed with water. In houses, mortar is used to bind building blocks for constructing walls, to apply coating over them and to lay floor.

#### 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  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ .

#### 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  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ . 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  $\text{CaSO}_4 \cdot 1/2\text{H}_2\text{O}$ . 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  $\text{C}_6\text{H}_5\text{OH}$ , 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

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 4



#### Nutrients for life URL:

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

\*Pictures are indicative only



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## Evaluation



### 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. Potassium 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 <sub>6</sub> H <sub>5</sub> OH     |
| 2. Cement      | - | CaSO <sub>4</sub> .2H <sub>2</sub> O |
| 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

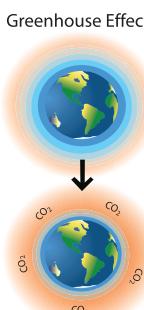
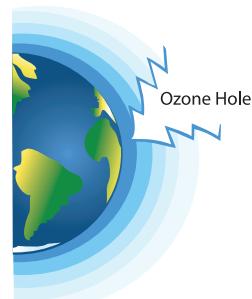
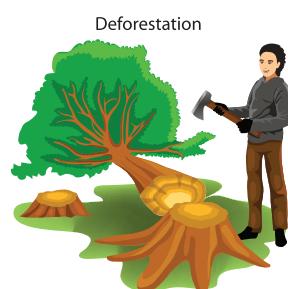
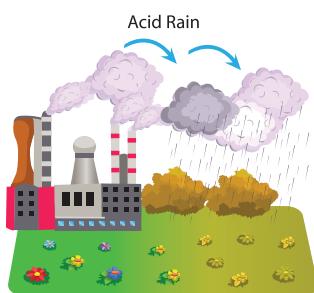
1. Ravi is a farmer; he rears many cattle in his farm. His field has many bio wastes. Advise Ravi how to change this bio waste to compost by using vermi-composting techniques. Explain the benefits of vermi castings.

## 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.



# Unit 4 Our Environment



## Learning Objectives

- ❖ To acquire knowledge about ecosystems and their components
- ❖ To understand food chains and their role in ecosystems
- ❖ To learn about waste, its management and recycling
- ❖ To find out the difference between biodegradable and non-biodegradable waste
- ❖ To study different types of pollution and their impact on environment





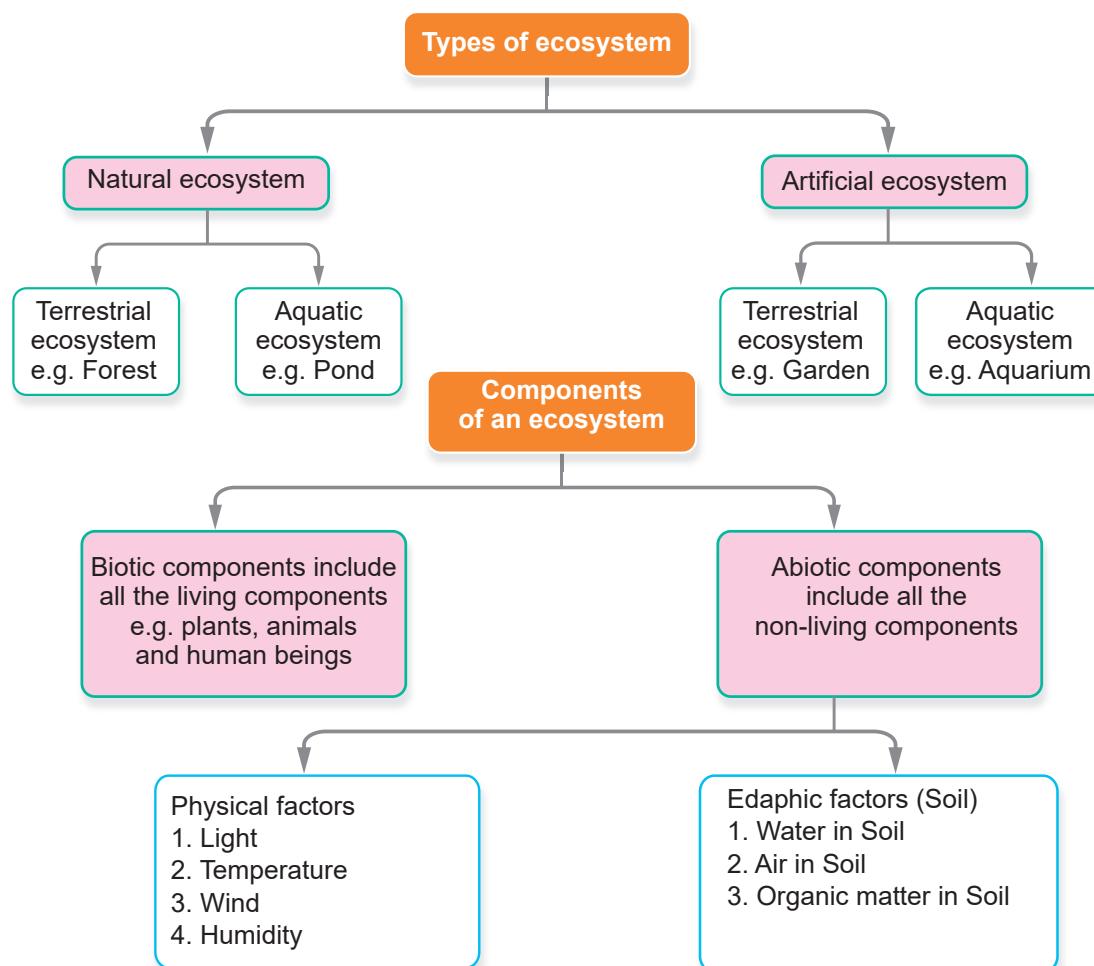
## Introduction

The surroundings or space in which a person, animal, or plant lives, is known as our **environment**. Environment is everything that surrounds us. It can have both living (biotic) and non-living things (abiotic). **Abiotic factors** are non-living parts such as sunlight, air, water and minerals in soil. **Biotic factors** are living things of our environment such as plants, animals, bacteria and more. Organisms live, constantly interact with one another and adapt themselves to conditions to their environment.

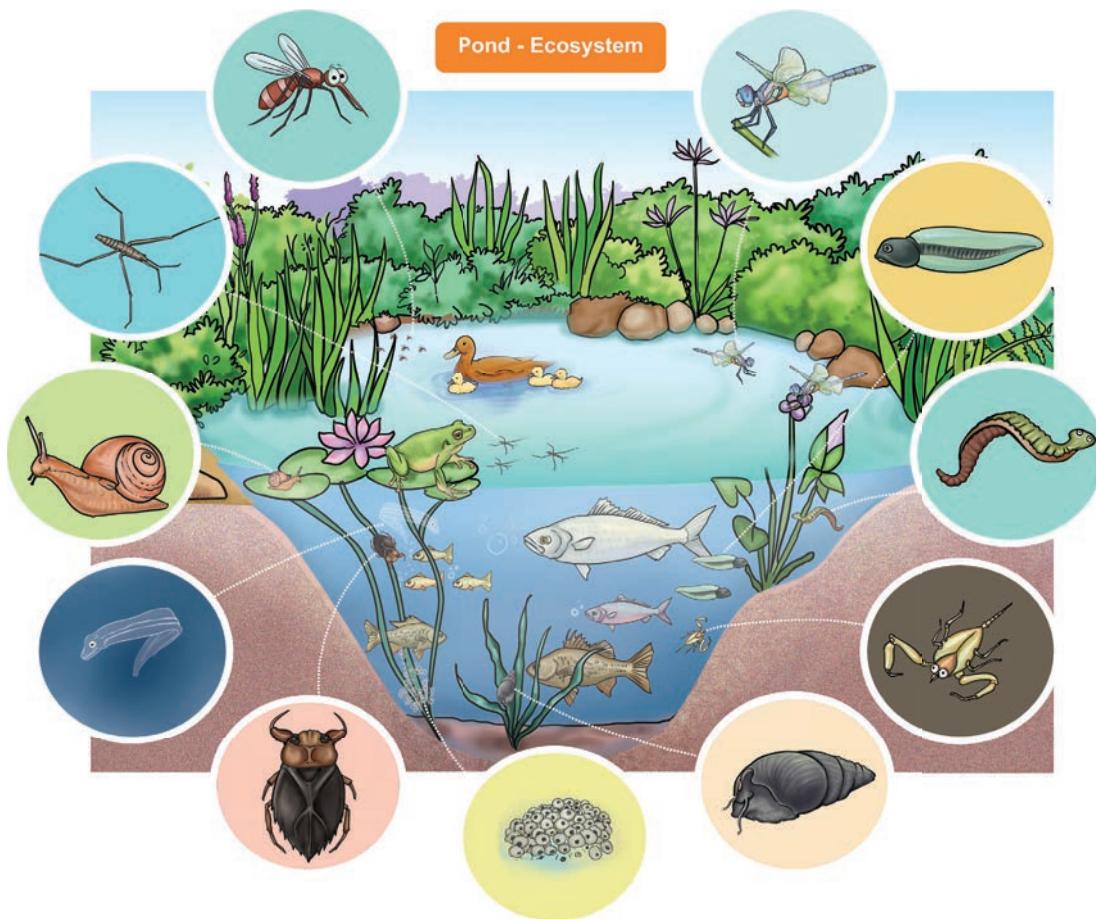
### 4.1 The Ecosystem

Ecosystem is a community of living and non-living things that work together. Each part of an ecosystem has a role to play. Any changes in the environment such as increased temperature or heavy rains, can have a big impact on an ecosystem.

Ecosystems can be either natural or artificial.



**Activity 1:** Think of the objects in your home. Just keep in mind, the books, toys, furniture, food materials and even pets of your home. These living and non-living things together make your home. Look at the following picture and list out the living and non-living things.



### Natural ecosystem

Ecosystem originated without human intervention is called a **natural ecosystem**. This can be an aquatic ecosystem or a terrestrial ecosystem.

The ecosystem in water is called **aquatic ecosystem**. Sea, river, lake, pond and puddle are some examples of natural aquatic ecosystem.

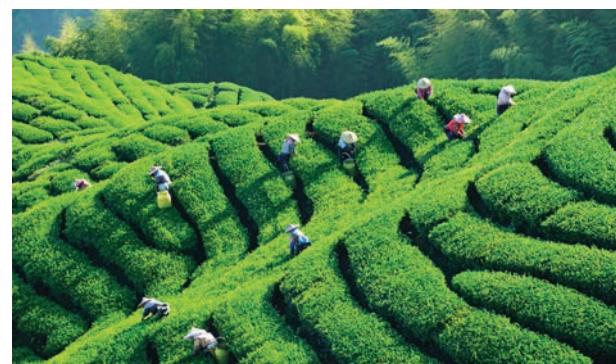
Ecosystems outside the water body and on land are called **terrestrial ecosystems**.

Forests, Mountain regions, deserts etc., are examples of natural terrestrial ecosystems.

### Artificial ecosystem

Artificial ecosystems are created and maintained by human. They have some of the characteristics of natural ecosystems. They are much simpler than the natural ecosystems.

These can be the terrestrial ecosystems such as paddy fields, gardens etc. or the aquatic ecosystem such as fish tank.





### Aquarium:

Aquarium is a place in which fish and other water creatures and plants are maintained. An aquarium can be a small tank, or a large building with one or more large tanks.



### Terrarium:

Terrarium is a place in which live terrestrial animals and plants are kept. Plants and animals are kept in a terrarium with controlled conditions that copy their natural environment.



Aquariums and Terrariums are used to observe animals and plants more closely. They are also used for decorations.

## 4.2 Food Chain and Food Web

Living organisms need food to perform their life processes. Some organisms can produce their own food, such as plants, while other organisms cannot do this and need to feed on other organisms to obtain their energy.



We can therefore identify different feeding types in an ecosystem, based on how the organism obtain (gets) its food. They are **producers and consumers**.

### Producers

**Producers** are organisms that are able to produce their own organic food. They do not need to eat other organisms to do this. Producers are also called **autotrophs**. Can you name an organism that prepares its own food?

Plants are producers because they make their own food by photosynthesis.

What do plants need in order to photosynthesise?

---

### Consumers

Organisms which cannot produce their own food, need to eat other organisms as food. These organisms are called **consumers**. All animals are consumers as they cannot produce their own food. Consumers are also called **heterotrophs**.



There are many types of consumers and we can classify them into specific groups depending on the food that they consume. These are:

❖ **herbivores**

Animals which eat plants or plant products e.g: cattle, deer, goat and rat.

❖ **carnivores**

Animals that eat other animals e.g: Lion, tiger, frog and owl.

❖ **omnivores**

Animals that eat both plants and animals e.g: Humans, dog and crow

❖ **decomposers**

Micro-organisms that obtain energy from the chemical breakdown of dead organisms (both plants and animals). They break complex organic substances into simple organic substances that goes into the soil and are used by plants. (e.g) Bacterium, Fungi

### Food chain

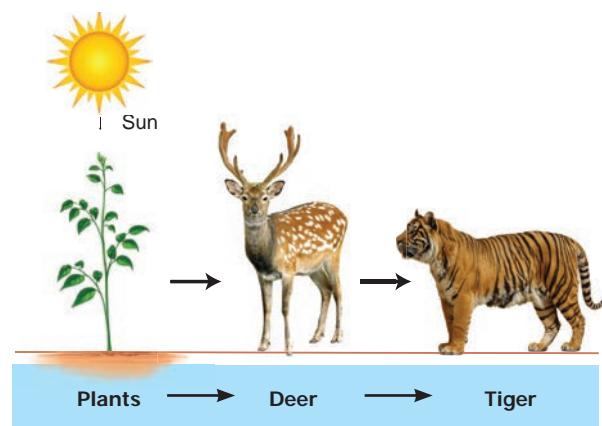
In a forest, deer eats grass; and in turn we know tiger eats deers. In any ecosystem there is a chain like relationship between the organisms that live there.

**This sequence of who eats whom in an ecosystem is called as food chain.**

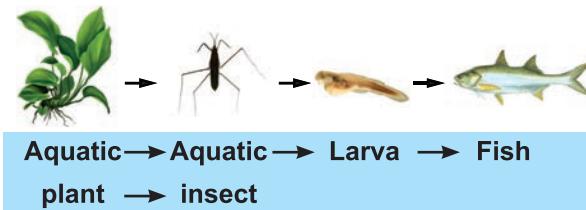
It describes how organisms get energy and nutrients by eating other organisms.

A food chain shows the relationship between producers (e.g. grass) and consumers (e.g. deer, goats, cows and tiger).

### E.g. Food chain in a terrestrial (grassland) ecosystem

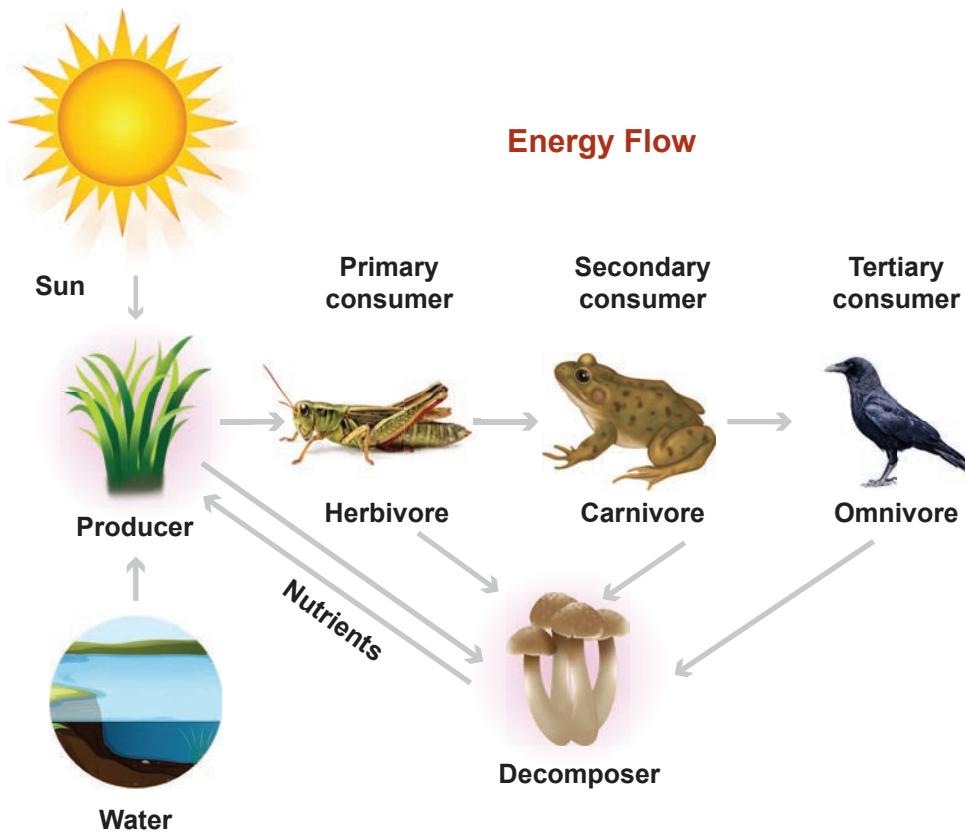


### E.g. Food chain in an aquatic (lake) ecosystem



### Energy flow

The food chain begins with the energy given by the Sun. Sunlight triggers photosynthesis in plants. The energy from the Sun is stored in the plant parts. When the grasshopper eats the grass, the energy flows from grass to grasshopper. Frog gets energy by eating grasshopper. This energy is transferred to a crow, when the frog is eaten by a crow. Thus we conclude the primary energy production in the world of living things is made by plants; that is by photosynthesis.



The micro organism reduce the excreta and the dead bodies of animals into primary simple components and puts them back into soil. It is this material that help the plants to grow. Thus we can see that there is a cycle of materials from primary producers to highest level predators, then back to soil.

### Trophic levels

We see that the energy is passed along from the producer to the consumers. But, there are three different consumers in any food chain. How can we distinguish different consumers?

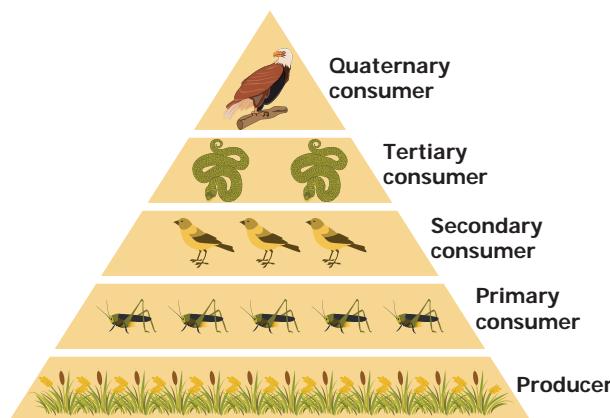
Animals that eat plants are **primary consumers**.

Animals that eat primary consumers are called **secondary consumers**.

Animals that eat the secondary consumers (mostly predators) are the **tertiary consumers**.

There may even be large predators that eat tertiary consumers. They are called as **quaternary consumers**.

Each of these levels in the food chain is called a **trophic level**.



Organism uses up to 90% of its food energy for its life processes. Only about



10% of energy goes into new body cells and will be available to the next animal when it gets eaten. This loss of energy at each trophic level can be shown by an **energy pyramid**.

A rat eats grains; and in turn we know snake eats rat. Now snake is a prey for peacock and in turn peacocks are easy prey for tigers and leopards. Now think? Do tigers have any natural predators?

In all food chain there is a top level predator that has no natural predators. In an aquatic ecosystem there are no natural predator for alligator; in a forest there are no natural predators for tigers.

### Importance of food chain

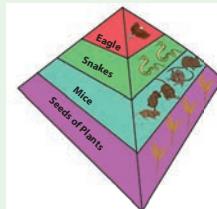
1. Learning food chain help us to understand the feeding relationship and interaction between organisms in any ecosystem.
2. Understanding the food chain also helps us to appreciate the energy flow and nutrient circulation in an ecosystem. This is important because pollution impacts the ecosystem. The food chain can be used to understand the movement of toxic substances and their impacts.

### Food web

Consumers have different sources of food in an ecosystem and do not rely on only one species for their food. If we put all the food chains within an ecosystem together, then we end up with many interconnected food chains. This is called a food web.

A food web is very useful to show the many different feeding relationships between different species within an ecosystem.

#### Activity 2: Take a square paper. Fold its diagonals. Draw three lines in three triangles as shown in the picture.

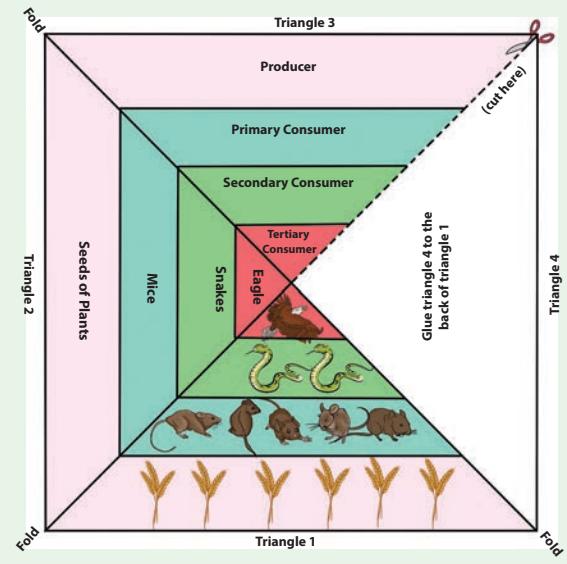


Cut from the edge of the diagonal to the center as shown in the picture.

If you fold this triangle and paste behind the third triangle you get a pyramidal shape.

In one of the triangles, draw images of each of the organisms in the different levels.

In another triangle write the names of the organisms. In the last triangle, write the energy level of the organism. Have a look at the following example. You must come up with different organisms!.



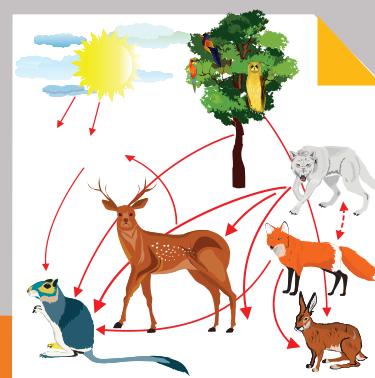


### POLLUTION

When something harmful or poisonous is added to the environment.



### FOOD CHAIN AND FOOD WEB



The flow of energy and nutrients.

**OUR ENVIRONMENT**  
is everything around us.

**AN ECOSYSTEM**  
is a community made up of living organisms and non-living components.

### 3R PRINCIPLE

Idea of shifting from a mass consumption society

Reduce Reuse Recycle

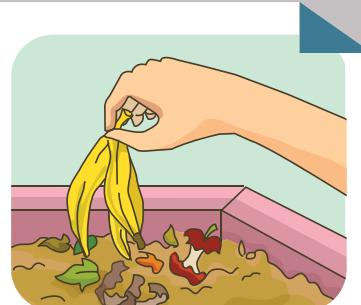


### NON-BIODEGRADABLE

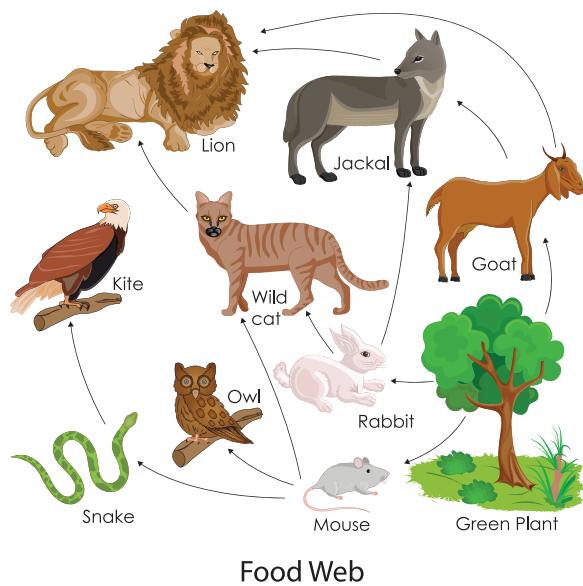
Materials that cannot be broken down by the action of living organisms.



### BIODEGRADABLE



Materials which can be broken down by bacteria, fungi and earthworms.



### 4.3 Waste Management and Recycling

To protect our environment, it is very important to reduce waste, manage it properly and maximise recycling. Waste is any substance or material that has been used but is not wanted anymore. This is either because it is worn out, broken or no longer has any purpose. Everyone produces waste and our waste has an impact on all ecosystems. However, most of us do not know where our garbage goes. There are many types of waste. There is liquid waste (in our drains), there are gases hiding in the air (like pollutants from factories), and there is solid waste (garbage) we put in our waste bins.

### 4.4 Biodegradable and Non-biodegradable Waste

Solid waste we generate can be classified into two major types:

#### 1. Biodegradable waste



#### 2. Non-biodegradable waste

#### Activity 3:

Take two mud pots or glass jars and fill them up with garden soil. In the first pot, mix wastes such as banana peel, some vegetable peels and a few tree leaves into the soil. In the second pot, mix a piece of plastic carry bag, sweet wrapper and metal foil into the soil.

What happen to the waste materials placed in both pots? Do you notice a difference between first and second pot? Observe the changes over two weeks and discuss with your classmates.

#### Biodegradable waste

The term '**Biodegradable**' is used for those things that can be easily



decomposed by natural agents like water, oxygen, ultraviolet rays of the sun, micro-organisms, etc.

One can notice that when a dead leaf or a banana peel is thrown outside,



it is acted upon by several micro-organisms like bacteria, fungi or small insects in a time period. Biodegradable waste includes vegetable and fruit peels, leftover food and garden wastes (grass, leaves, weeds and twigs).

Natural elements like oxygen, water, moisture, and heat facilitate the decomposition thereby breaking complex organic forms to simpler units. Decomposed matter eventually mixes or returns back to the soil and thus the soil is once again nourished with various nutrients and minerals.

### Non-biodegradable waste

Those materials which cannot be broken down or decomposed into the soil by micro-organisms and natural agents are labeled as **non-biodegradable**. These substances consist of plastic materials, metal scraps, aluminum cans and bottles, etc.



These things are practically immune to the natural processes and thus cannot be fed upon or broken down even after thousands of years.

**Give some examples for Biodegradable and Non-biodegradable waste.**

S. No.	Biodegradable waste	Non-bio-degradable waste
1.	Food Waste	Plastic Bottles
2.		
3.		
4.		
5.		

**Discuss with your teacher and friends.**

1. Are animal bones biodegradable?



2. Are all types of clothes biodegradable?



### Rani and her garbage

Rani gets home from school. She is hungry. She eats a banana and a packet of chips. She puts the banana peel and plastic chips packet into the waste bin. In the waste bin, the waste mixes together and the banana peel makes the plastic chips packet dirty. The waste bin starts to smell and Rani's mother puts the waste outside on the street. The municipality collects the waste from outside Rani's house and many other houses in a tractor. The tractor drives to a big open dump and leaves all mixed wastes there.





Sometimes, there are fires in the open dump. When waste like Rani's chips packet burns, unhealthy chemicals pollute the ecosystem. These chemicals are present in the air we breathe. The leftover ash from burning waste pollutes the soil.

When it rains, some of the dangerous chemicals goes into the ground. Some of the rain never reaches the ground as it collects in the plastic garbage at the dump. Little pools of water let mosquitoes to breed and they can spread unwanted diseases like dengue and malaria. Cows and dogs go into the open dump looking for food. As the waste is mixed, many things that are not good to eat such as plastics, smell like food. The animals get confused and eat some plastics by accident. This makes them sick.

Rani is a student like you. She does not want to make animals sick. She does not want to pollute beautiful Town. She does not like mosquitoes and wishes that no one ever gets sick from them. So Rani takes this decision "I plant trees and reduce all type of pollution".

Do you want the same as Rani does? Become a detective. Learn about the 3R's and how you can start to solve these problems.

## 4.5 Solid Waste Management

It is our duty to reduce creating waste and protect environment. 3R's are important in protecting environment. The first R is reduce and the second R is reuse and the last R is recycle.

The waste hierarchy or pyramid shows the best ways to manage solid waste.



3R-Cycle

### 1. Avoid

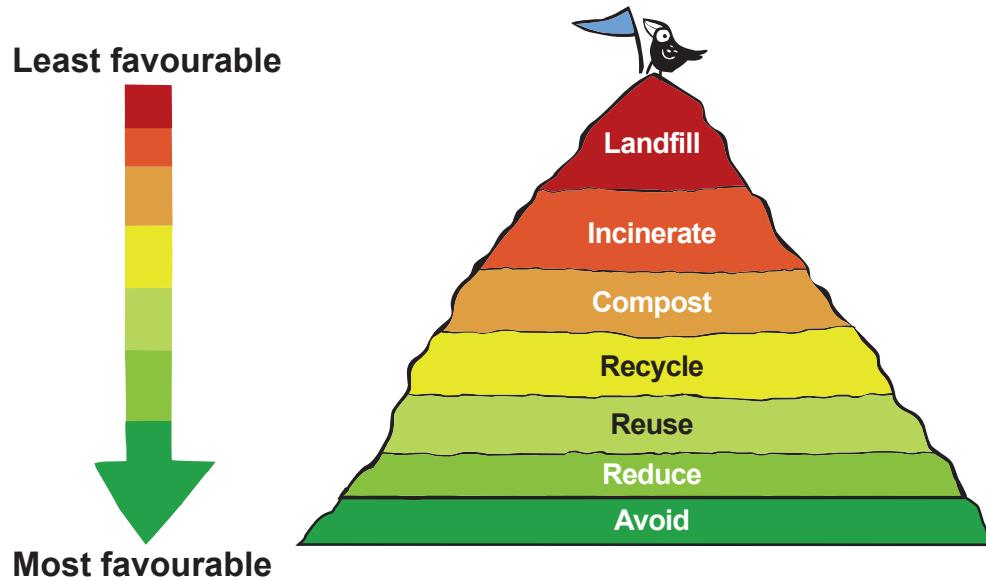
Avoid the usage of unwanted materials which create more debris. Before you buy anything, think that "Do I really need it?" (e.g) Avoid buying packaged foods. Refuse to buy use and throw plastic products.

### 2. Reduce

We can reduce the waste by using durable goods that last longer instead of things that are used once and thrown away. (e.g) Write on both sides of papers. Instead of unnecessary printing, use electronic facilities. Share newspapers, magazines and other things with others.

### 3. Reuse

Reusing means using a thing again and again, rather than using and throwing after a single use. (e.g) Instead of using plastic bags, use and throw pens and batteries, use cloth bags, fountain pens and rechargeable batteries. Reuse glass bottles for other purposes. Repair foot wears and use them.



#### Creative reuse

**DO YOU KNOW?**

Creative reuse or Upcycling is the process of converting waste materials or useless products into new materials or products of better quality or for better environmental value. When you upcycle, you are giving an item a new purpose. (e.g) Used tyres into chairs. Used PET bottle into penstand.



#### 4. Recycle

The process by which waste materials are used to make new products is called recycling. (e.g) Using old clothes to make paper and melting some plastics to make floor mats, plastic boards and hose pipes.

#### 5. Compost

The process of degradation of organic wastes into manure by the action of microorganism is called **composting**. The manure thus obtained becomes natural fertilizer for the plants as well as increases the soil fertility.





## 6. Incinerate

The burning of solid waste in incinerator is called incineration. Human anatomical wastes (discarded medicines, toxic drugs, blood, pus) are disposed by means of incineration. During incineration, the enormous heat kills all contagious disease-causing germs. We can also produce electricity with the help of this heat.



## 7. Landfill

Landfilling is a method in which wastes are dumped into naturally occurring or man-made pits and covered with soil. Garbage buried inside landfills remain here for a long time as they decompose very slowly and become manure. These places can be converted into parks, gardens, etc.,



Earlier in the chapter, you learn about Rani and how she did not want to cause

pollution. Simple steps in your daily life can make big differences. There are two steps you should remember.

1. The first step should always be to reduce waste. Think of the 3R's and the waste pyramid and remember the order of the levels.
2. The second step is to keep waste separate. This way the waste will remain clean and can be easily reused or recycled. Mixing different types of waste together (e.g. biodegradable and non-biodegradable) makes waste dirty. Dirty waste gets sent to a landfill or open dump.

### Waste separation exercise

The Solid Waste Management (SWM) rules, 2016 say that,

1. Every Household should segregate and store the waste generated by them in **three separate streams** – namely **bio-degradable, non bio-degradable and domestic hazardous waste** in suitable bins and handover segregated wastes to authorised waste pickers or waste collector as per the direction or notification by the local authorities from time to time.
2. No body shall throw, burn, or bury the solid waste on streets, open public spaces outside his premises or in the drain or water bodies.

**Domestic hazardous waste** means discarded paint drums, pesticide cans, CFL bulbs, tube lights, expired medicines,



broken mercury thermometers, used batteries, used needles and syringes and contaminated gauge, etc., generated at the household level.

Learn how to separate waste correctly into 3 waste bins so you can keep Tamilnadu clean and beautiful!

**DO YOU KNOW?**

### How much waste does each person make around the world every day?

The average person in India produces 0.45kg of waste every day. It may be small amount of waste. But, India has a large population and imagine you collected all the waste today and put it into tractors. You would fill so many tractors that you could create a traffic jam approximately 2,800 kilometres long. Imagine, a road all the way from Kanyakumari to New Delhi completely blocked with tractors carrying garbage and no space to walk in between. This is how much waste we create in India each day! If we reduce the waste, we reduce the pollution. India produces 532 million kilos of solid waste every day.

Kenya 0.30 kg  
India 0.45 kg  
China 0.63 kg  
Germany 1.69 kg  
USA 2.58 kg

Country	Waste produced per day (kg)
Kenya	0.30
India	0.45
China	0.63
Germany	1.69
USA	2.58

#### Activity 4: Preparation of vermi compost

Dig a pit for about one feet depth in the backyard or garden of your home or school. Fill the pit by bio wastes, paper and food wastes, place few earth worms in it, sprinkle water and close the place with jute or cardboard and ensure moisture all the time.

After 45 days the vermi casting layer formed just above the pit. These castings will be applied to the plant. This contains water soluble nutrients. This type of compost helps in plant growth as well as sustain the land is fertility.





## 4.5 Pollution

**Pollution** occurs when the environment gets contaminated by waste, chemicals and harmful substances.



Pollution is the damage caused to the environment mainly because of human activities. Any substance that causes pollution is known as a **pollutant**. Pollution is an unwanted change in the physical, chemical and biological characteristics of our land, air and water.

## 4.6 Types of Pollution

There are four major kinds of pollution:

1. Air pollution
2. Water pollution
3. Land (soil) pollution
4. Noise pollution

### 4.6.1 Air pollution



Most air pollution is caused by the burning of fossil fuels (e.g. oil, petrol, coal and natural gas). These fossil fuels are used in factories (industries), power plants and motor vehicles. Burning these fossil

fuels release toxic gases and fine particles (such as ash and soot) into the air causing air pollution. Air pollution is also caused by burning solid waste (especially some plastics), gases or chemicals released from factories and fumes from aerosols (like deodorant spray cans) or paints.

Certain toxic gases produced by industries mix with raindrops high in the atmosphere and make rain unusually acidic. This is called acid rain. It damages plants, washes the nutrients out of soils and kills fish. Air pollution is harmful to all living organisms including humans. Polluted air affects skin, eyes and respiratory system.

### How can we reduce air pollution?

1. Cycle or walk short distances instead of using a motor vehicle.
2. Travel by public transport (bus or train)
3. Do not burn solid waste.
4. Avoid fireworks.

### 4.6.2 Water pollution



Water pollution occurs when wastes from factories, houses and farms mixes with the water in rivers, lakes, ponds, the ocean or even groundwater. Contaminated or polluted water can spread diseases and chemicals which are not good for our health.



## The most significant sources of water pollutants are

1. Sewage (water we use at home for bathing, cleaning, cooking).
2. Industrial effluents (liquid wastes from factories).
3. Agricultural pollutants (chemical pesticides and fertilisers that get washed from farms).
4. Solid waste (when waste gets dumped into water bodies).

## How can we reduce water pollution?

1. Do not pour leftover oil, old medicines or waste down the drain or into the toilet.
2. Reduce the use of chemical pesticides and fertilizers to grow crops.
3. Use waste water for garden in home.
4. Do not litter or dump waste – always use a waste bin.

## 4.6.3 Land (soil) pollution



In the same way as water and air get polluted, land or soil pollution happens when toxic chemicals change the natural balance in soil. Land pollution comes from farming (Excess use of chemical pesticides and fertilisers), mining (digging up metals

and other materials), factories (industrial waste) and the solid waste from our own homes like plastics and broken electronics. Soil pollution affects animals, humans and even plants because soil or land acts like a sponge. When it rains, pollutant sinkss into the soil. If we grow plants to eat in polluted soils, these dangerous chemicals can get into our food.

## How can we reduce land pollution?

1. First try to reduce waste, then recycle the rest.
2. Always use a waste bin and never litter.
3. Do not burn waste, the ash mixes easily with soil.

## 4.6.4 Noise pollution



Noise pollution affects the environment. We all like a quiet and peaceful place since unpleasant or loud sounds disturb us. Loud music, the sounds of motor vehicles, fire works and machines cause noise pollution. Continuous noise disturbs our sleep and does not let us to study. Noise pollution has been directly linked to stress and health impacts such as high blood pressure and hearing loss. Loud noise or even loud music can damage our ears. Noise pollution also



disturb animals. Birds have to communicate (talk) louder so that, they can hear each other in noisy areas. Even underwater noise pollution from ships, can make whales lose their way as they use sounds to navigate.

### How do we reduce noise pollution?

1. Turn off your electronics when you do not use them.
2. Lower the volume when you watch TV or listen to music.
3. Remind drivers not to use the horn too much.
4. Avoid fireworks.
5. Speak, do not shout (try to set an example).

### Classroom Exercise

Identify who am I?

1. I am the type of pollution caused by burning of fossil fuels like petrol or coal and the smoke of burning garbage. I float around and cause breathing problems. I am \_\_\_\_\_ pollution.
2. I am the type of pollution caused by loud sounds and I can cause serious damage to your ears and also affect sleep. In India, I am mainly caused by loudspeakers and honking of air horns of cars. I am \_\_\_\_\_ pollution.
3. I flow from homes and farms into rivers and lakes. I kill fish and make water unfit for drinking. I am \_\_\_\_\_ pollution.
4. I am the type of pollution caused by using too much chemical fertilizers

and pesticides by farmers. I lower the quality of soil and even move chemicals into plant parts which are eaten by people. I am \_\_\_\_\_ pollution.

### Points to remember

- ❖ Living (biotic) and non-living (abiotic) components interact with one another.
- ❖ There are two types of ecosystems terrestrial (on land) and aquatic (in water).
- ❖ The feeding relationship in an ecosystem is called a food chain.
- ❖ Biodegradable and non-biodegradable waste should be kept separate
- ❖ The 3R's are in a certain order: First reduce, then reuse and finally recycle.
- ❖ Waste should never be burned as it causes air and soil pollution.
- ❖ Pollution occurs when the environment gets contaminated by waste, chemicals and harmful substances.
- ❖ Major types of pollution are four: air pollution, water pollution, land pollution, and noise pollution.
- ❖ There are many small habits, any student can practice to reduce pollution, manage waste correctly and protect the environment.



## ICT Corner

### Eco System

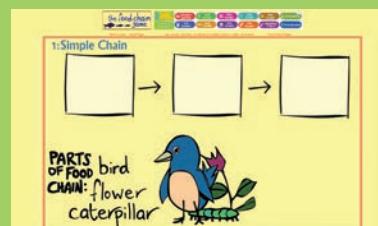


Through this activity you will be able to understand the atomic level of the process that plants use to convert solar energy into chemical energy.

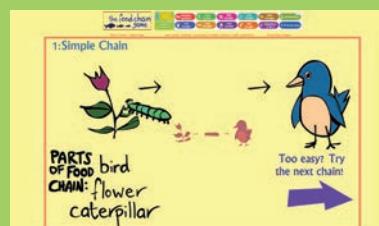


- Step 1:** Type the URL given or scan the QR code to launch the activity. Food chain page will open.
- Step 2:** With the use of mouse drag the parts of the food chain - the animals or plants given to their correct place - in the empty boxes.
- Step 3:** When the chain is complete you can watch the food chain in action.
- Step 4:** Continue the activity by click on the next icon. Play and observe the various complex levels of food chain.

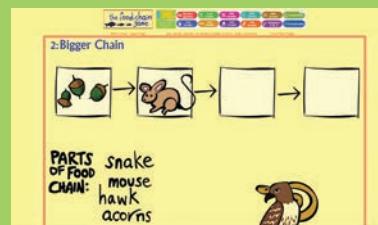
Step 1



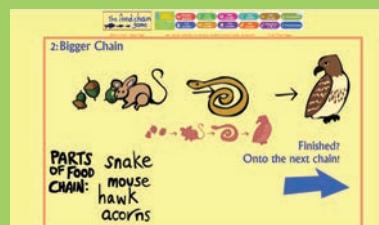
Step 2



Step 3



Step 4



#### Eco System URL:

<http://www.sheppardsoftware.com/content/animals/kidscorner/games/foodchaingame.htm>

\*Pictures are indicative only



B543\_6\_SCI\_EM\_T3



## Evaluation



### I. Choose the appropriate answer

1. Identify the fresh water ecosystem.
  - a. Pond
  - b. Lake
  - c. River
  - d. All of them
2. Producers are \_\_\_\_\_
  - a. Animals
  - b. Birds
  - c. Plants
  - d. Snakes
3. It is a biodegradable waste.
  - a. Plastic
  - b. Coconut Shell
  - c. Glass
  - d. Aluminium
4. It is an undesirable change that occurs in air and water.
  - a. Recycling
  - b. Reuse
  - c. Pollution
  - d. Reduce
5. Usage of chemical pesticides and fertilisers causes \_\_\_\_\_ pollution.
  - a. Air pollution
  - b. Water pollution
  - c. Noise pollution
  - d. None of the above

### II. Fill in the blanks

1. Primary consumers that eat plants are called \_\_\_\_\_.
2. Temperature, light and wind are \_\_\_\_\_ factors.

3. \_\_\_\_\_ is the process of converting waste materials into new materials.
4. Water pollution can spread \_\_\_\_\_ and chemicals.
5. The 3R's are Reduce, \_\_\_\_\_ and Recycle.

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

1. The Pacific ocean is an example of an aquatic ecosystem.
2. Bacteria and fungi are called decomposers.
3. Human and animal wastes are examples of non-biodegradable waste.
4. Excessive use of pesticides leads to air pollution.
5. In schools, waste management rules say that we should separate waste in two categories.

### IV. Match the following

- |                  |                         |
|------------------|-------------------------|
| 1. Biotic factor | - Terrestrial Ecosystem |
| 2. Sewage        | - Land pollution        |
| 3. Fertilizers   | - Air pollution         |
| 4. Desert        | - Water Pollution       |
| 5. Smoke         | - Animals               |

### V. Arrange the following in a correct sequence and form a food chain

1. Rabbit → Carrot → Eagle → Snake
2. Human → Insect → Algae → Fish



## VI. Give very short answer

1. Define ecosystem.
2. What are the two types of ecosystems?
3. Write any two things that can be recycled.
4. What are the types of pollution.
5. Give one example of a food chain in an aquatic ecosystem?
6. Name some pollutants.
7. What are the pollutions caused by the objects given below?
  - a. Loud Speaker b. Plastic

## VII. Give short answer

1. What is biodegradable waste?
2. How can we reduce water pollution?
3. Write the importance of the food chain.

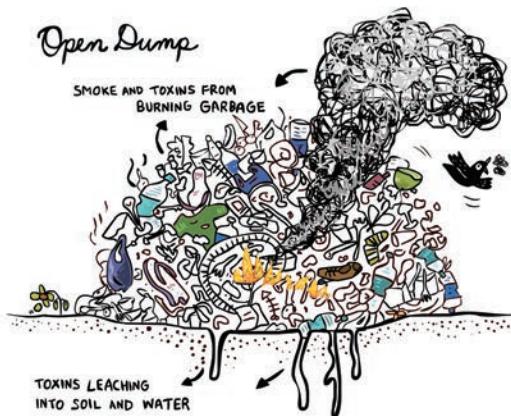
## VIII. Answer in detail

1. Give two examples of how you can avoid or reduce waste?
2. Write a short note on noise pollution.

## IX. Question based on Higher Order Thinking Skills

1. What would happen if an organism is removed from the food chain?
2. Explain the link between waste and dangerous diseases like dengue and malaria?

## X. See the diagram and answer the following questions



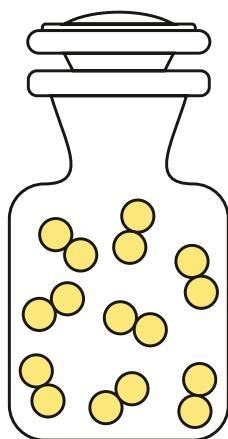
1. Explain what is happening in the picture?
2. What types of pollution are caused by open dumps?



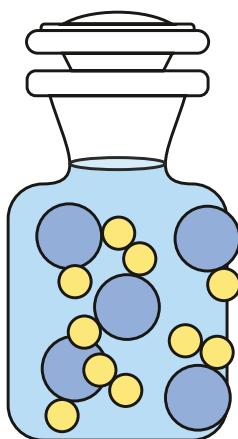
# Unit 3

## Matter Around Us

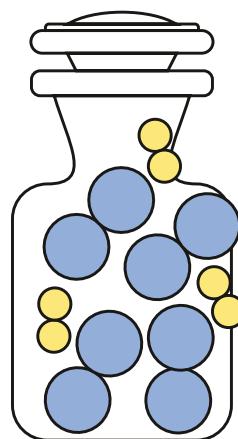
### Elements, Compounds and Mixtures



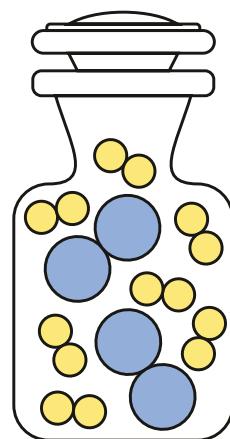
An Elements  
(Hydrogen)



A Compound  
(Water)



A Mixture  
(Hydrogen & Oxygen)



A Mixture  
(Hydrogen & Oxygen)

### Learning Objectives

- ❖ To understand molecules of elements and compounds
- ❖ To recognize the symbols of common elements
- ❖ Able to calculate atomicity of commonly used elements
- ❖ To recognize the occurrences of elements and compounds in nature and human body / air
- ❖ To understand the effects of temperature on solid, liquid and gas



BUB 3D 7



## Recap



We knew that everything we see around, that occupy space and have mass, is called matter. Heat, light and sound occupies space, but does not have mass. Hence these are not matter. Do you know what is matter is composed of? We studied earlier that matter is composed of tiny little particles, which cannot be seen with naked eye. Let us understand what these particles are?

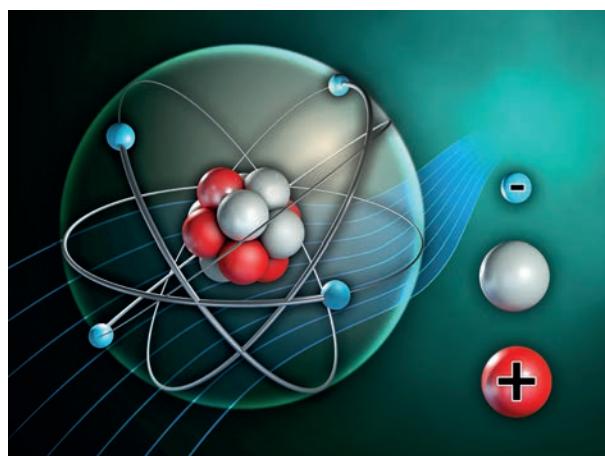
### 3.1 Atoms

The graphite refill used in pencil is made up of element called Carbon. We can break the graphite into smaller and smaller pieces. In fact, if we have an even finer knife, we can break it even smaller. If keep cutting the minuscule graphite into smaller and smaller particle, we will reach a point where we reach smallest constituent of graphite- carbon atom. If we break that carbon atom apart, then it will no longer exhibit the properties of carbon.

The smallest unit of an element that exhibits the properties of the element is called as ‘atom’. All the matter is composed of tiny particles

called atom. Water , rice , in short everything we see around is made up of atoms.

#### An atom is the basic unit of a matter.



*Structure of an atom*

Even with the best of optical microscope we cannot see atoms. However there are advanced instruments that help us to image the atoms on the surface of a material.

For example the following figure shows an image of the surface of silicon.



An image of the surface of Silicon

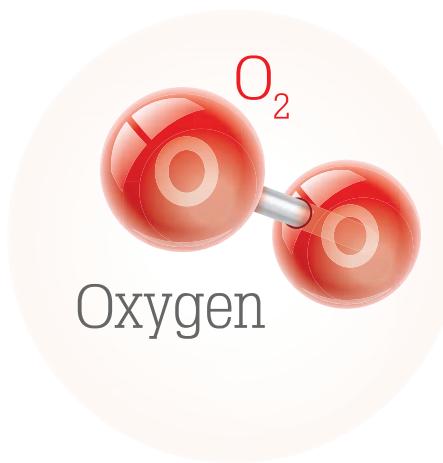


The most abundant type of atom in the universe is the hydrogen atom. Nearly 74% of the atoms in the universe are hydrogen atoms. However on Earth the three most abundant atom are iron, oxygen, and silicon.

### 3.2 Molecules

When an atom combines with another atom (or atoms) and forms a compound it is called as molecule. A *molecule is made up of two or more atoms chemically combined*.

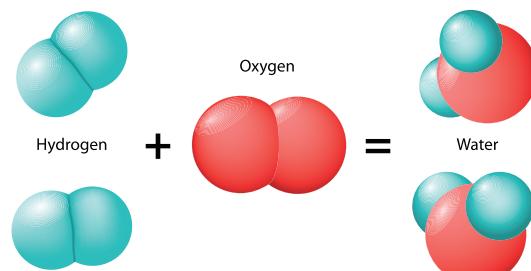
- Oxygen gas in the air that we breathe is made up of two oxygen atoms chemically combined.



- Ozone is a substance that is made up of three oxygen atoms chemically combined.



An atom of oxygen (O) and two atoms of hydrogen (H<sub>2</sub>) combine to form a molecule of water (H<sub>2</sub>O).



$2\text{H}_2 + \text{O}_2 = 2\text{H}_2\text{O}$   
Formation of water molecule

Molecules also exhibit properties of matter and have individual existence. A molecule can be formed by the same or different kinds of atoms.

#### Molecules can be classified as follow :

- A molecule which contains only one atom is called monatomic molecule (inert gases)
- A molecule which contains two atoms is called diatomic molecule (oxygen, nitric oxide, hydrogen, etc.)
- A molecule containing three atoms is called a triatomic molecule (ozone, sulphur dioxide, carbon dioxide, etc.)
- A molecule containing more than 3 atoms are known as polyatomic molecule (phosphate, sulphur, etc.)

#### Molecules of Elements

A molecule of an element consists of a fixed number of one types of atom chemically combined.



The table below shows gases that are made up of two atoms of the same type of element.

### Molecules of Compounds

Molecule of a compound consists of a fixed number of different types of atoms chemically combined.

Molecule	Chlorine Gas	Oxygen Gas	Nitrogen Gas
Molecule Diagram			
Molecule Model (Ball-and-Stick)	 Chlorine Molecule	 Oxygen Molecule	 Nitrogen Molecule

For example, let us look at the model of a water molecule below:



Model of molecular water

Each molecule of water consists of one oxygen atom and two hydrogen atoms. This ratio of oxygen and hydrogen atom remains fixed whether water is in liquid, solid or gaseous state. This principle applies to the molecules of all compounds.

**DO YOU KNOW?**

**Bismuth in diarrhea medicine**

Bismuth is an element that occurs naturally. It is combined with other elements to make medicine for treating diarrhea.

### Molecules of some compounds

Molecule	Carbon-di-oxide	Ammonia	Hydrogen Chloride
Molecule Diagram			
Molecule Model (Ball-and-Stick)	 Carbon-di-Oxide Molecule	 Ammonia Molecule	 Hydrogen Chloride