

# BASIC SCIENCE

Part - 2

Standard VI



Government of Kerala  
Department of Education

State Council of Educational Research and Training (SCERT), Kerala  
2016

## The National Anthem

Jana-gana-mana adhinayaka, jaya he  
Bharatha-bhagya-vidhata.  
Punjab-Sindh-Gujarat-Maratha  
Dravida-Utkala-Banga  
Vindhya-Himachala-Yamuna-Ganga  
Uchchala-Jaladhi-taranga  
Tava subha name jage,  
Tava subha asisa mage,  
Gahe tava jaya gatha.  
Jana-gana-mangala-dayaka jaya he  
Bharatha-bhagya-vidhata.  
Jaya he, jaya he, jaya he,  
Jaya jaya jaya, jaya he!

## Pledge

India is my country. All Indians are my brothers and sisters.

I love my country, and I am proud of its rich and varied heritage. I shall always strive to be worthy of it.

I shall give respect to my parents, teachers and all elders and treat everyone with courtesy.

I pledge my devotion to my country and my people. In their well-being and prosperity alone lies my happiness.

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Dear children,

How many are the sights we witness, the sounds we hear, and the experiences we pass through everyday!

In fact, the study of science begins exactly when we think about the 'what' and 'how' of things we have seen, heard and experienced. It is not confined to the four walls of the classroom. You have earlier observed a number of things like plants, animals, water, soil and air. Your observation now has to be at a more micro level.

This textbook provides you with ample scope for such activities and tools. It provides you with suggestions to boost your science club activities and hints at ICT possibilities. There are also suggestions at the end of each lesson for activities that you can do on your own. Try to do all of them with the help of your teachers. We can definitely create a society with scientific temper.

With love and best wishes,

**Dr.J.PRASAD**

Director

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## Certain icons are used in this textbook for convenience



**For further reading**  
(Evaluation not required)



**ICT possibilities for making concepts clear**  
Available in [IT@School, Edubuntu, Applications → School Resources]



**Significant learning outcomes**



**Let us assess**

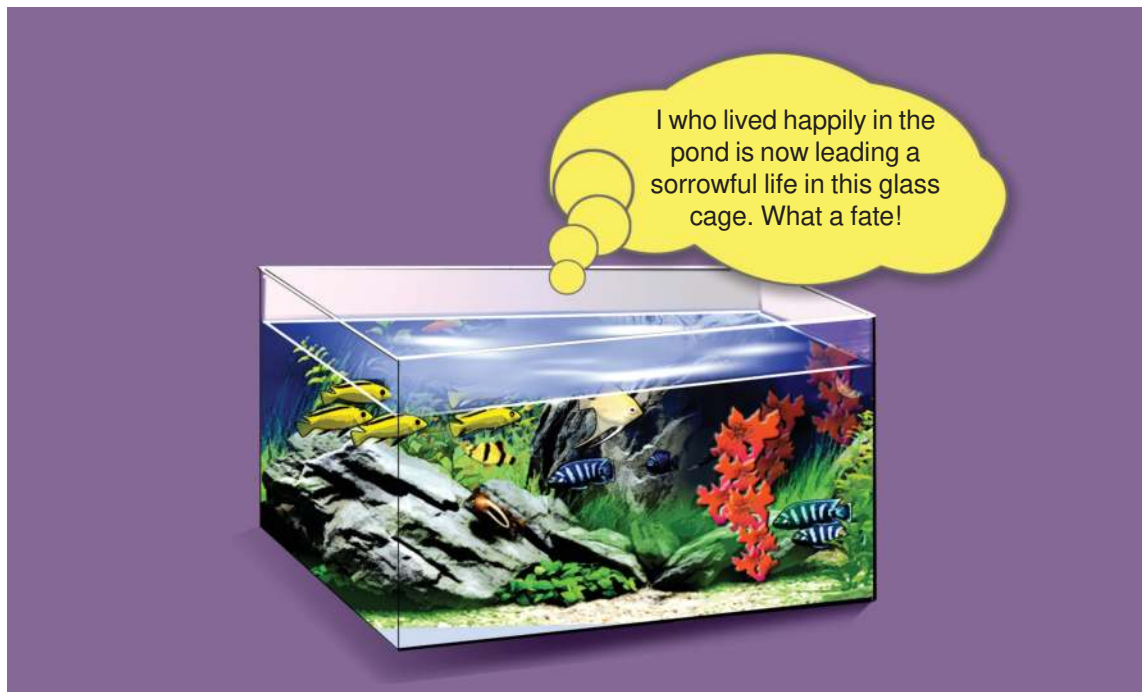


**Extended activities**



## Living in Harmony

6



I who lived happily in the pond is now leading a sorrowful life in this glass cage. What a fate!

Didn't you notice the sorrow of the fish?

What are the factors in ponds which enable the fish to live?

- Aquatic plants
- 
- 
- 

Are there biotic and abiotic factors in your findings? List them.

Biotic factors	Abiotic factors

Which of these factors are missing for the fish in the aquarium?

**In unison**

Notice the picture. How many are the organisms living here together!

Are there only Living beings?

Find out and write them down.

Do all organisms depend on the same biotic and abiotic factors?



- Which are the biotic and abiotic factors that the crane depends on for its existence?

List the biotic and abiotic factors the organisms in your surroundings depend on for their existence.

Organism	Relying factors	
	Biotic	Abiotic
<ul style="list-style-type: none"> <li>● fox</li> <li>● worm</li> <li>●</li> <li>●</li> </ul>		

Every living being depends upon many biotic and abiotic factors for their existence.

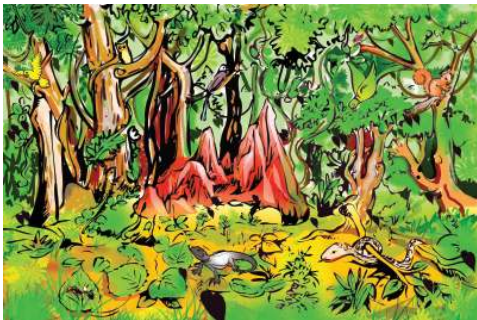
**Ecosystem**

The natural surroundings in which an organism lives is called its habitat. The biotic and abiotic factors in the surroundings and their mutual relationship together form the ecosystem.



Which are the ecosystems in your locality? List them.

- Sacred groves (*Kavu*)
- 
- 



Visit any one of these ecosystems. Don't forget to make use of the Biodiversity Register in your panchayat.

- What all planning must be done?
  - Fix the venue and time
  - Seek help from experts
  -
- How can we record our observation?
  - Tables
  - Illustrations
  -

### From the observation note of Ammu

As it was noon the bottom of the pond could be seen clearly. We watched with interest various kinds of fishes swimming in water. Some fishes were feeding on tiny plants in the water. Suddenly a grasshopper fell into the water. *Tup...* a *varal* fish sprang up from the bottom of the pond and swallowed it. Soon it returned and hid under a stone. From a hole on one side of the pond came out a water snake and it caught a frog. Many of us were scared to see this! It was interesting to watch a school of fish swimming along together. When a big fish came to catch them, they disappeared behind the algae in the corner of the pond. How many such factors are there in the pond! Water, sand, stone, air, algae, water plants, fish, frog and water snake are some of them. When the teacher took us to see the pond, we never thought that the pond had such a variety of things to be seen and understood.

- What should be done after the visit?
- Analysis and modification of the observation note
- Preparation and presentation of the report

### For food

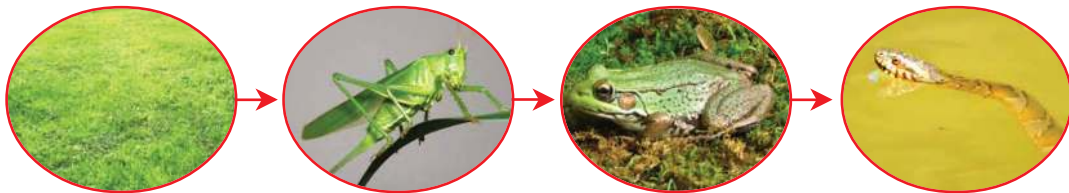
Have you seen water snake capturing a frog?  
Water snake feeds on frogs. What are the things that the frog feeds on?



- Grasshopper
- 
- 

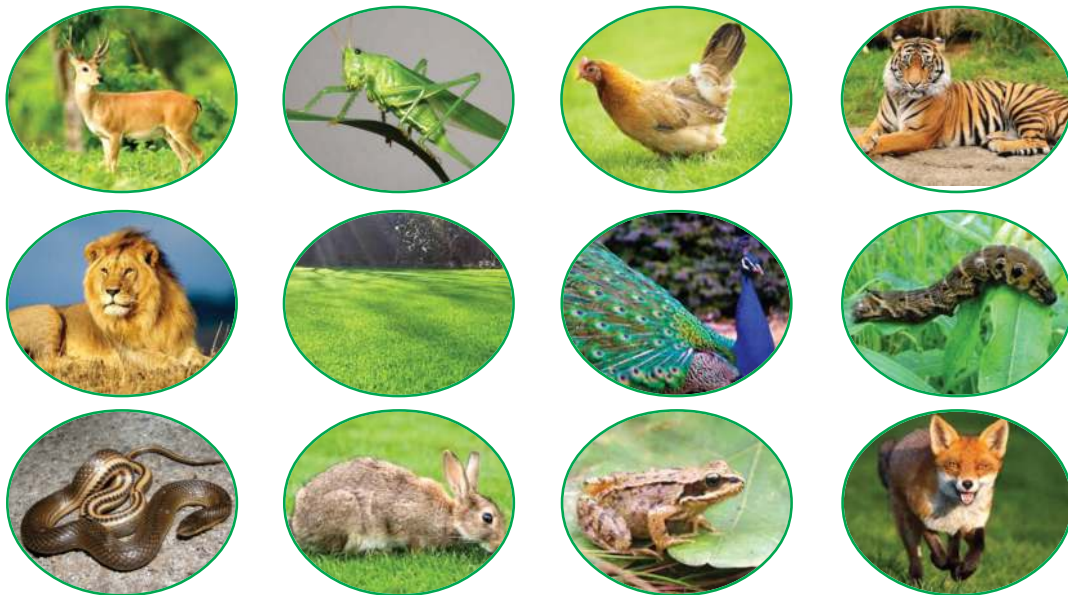
From where does the grasshopper obtain its food?

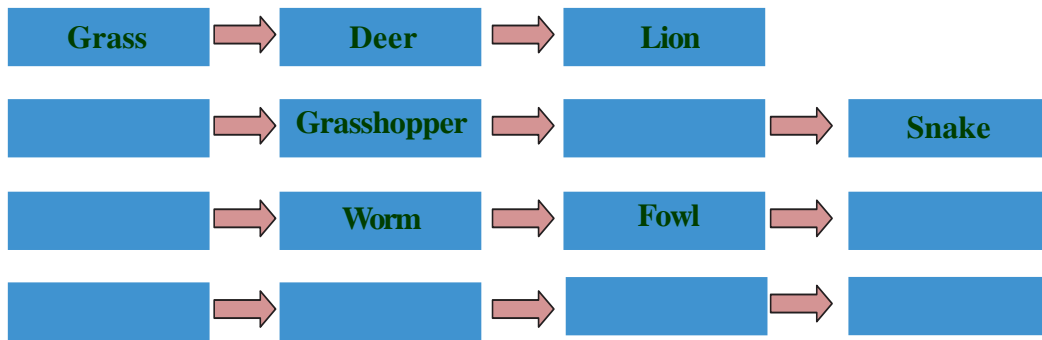
Let us illustrate these on the basis of how each one becomes food for another.



Aren't there organisms that feed on water snakes? Add them in the illustration.

Complete the food relationships using the organisms in the pictures given below.





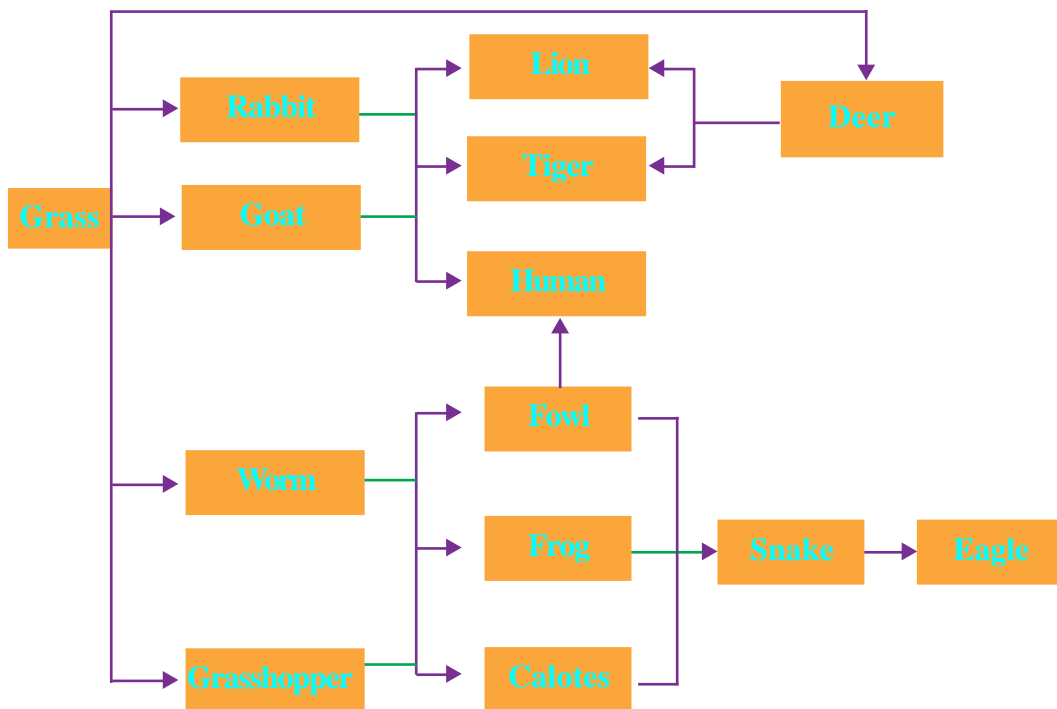
These types of food relations are called food chains. Find out more such food chains and write them down in the science diary.

- Write down the initial levels in the food chains you have found out.
- Which organisms occupy the top level in the food chains?

Green plants always occupy the first level of the food chain. The top level is occupied by the carnivores. Intermediate ones may be herbivores or omnivores.

### How many food relations?

Notice this illustration.



- Is it only the frog that eats the grasshopper?
- Which all organisms are eaten by the lion?

How many food chains can you find out from this?

Write them down in the science diary.

Many food chains join together to form the food web. In nature, we can see many food webs.

Prepare a food web by including organisms you are familiar with.

### Producers and consumers

We have found that the first level of any food chain is always occupied by the green plants. What might be the reason for this? Discuss this matter in connection with the idea of photosynthesis.

Green plants prepare their own food. So they are known as producers. Organisms that depend on other organisms for their food are called consumers.

- Do lion and tiger depend on plants for food?
- Where do the animals preyed upon by the lion and tiger get their food from?

It is now clear that all organisms directly or indirectly depend on green plants for food.

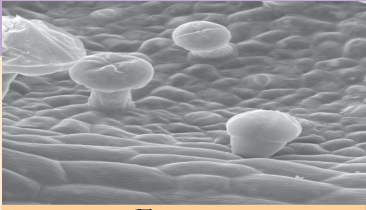

### Mixing with the soil

Green plants need certain nutrients to prepare food and grow. Plants continuously absorb these nutrients from the soil. Still, how do these nutrients remain in the soil always?

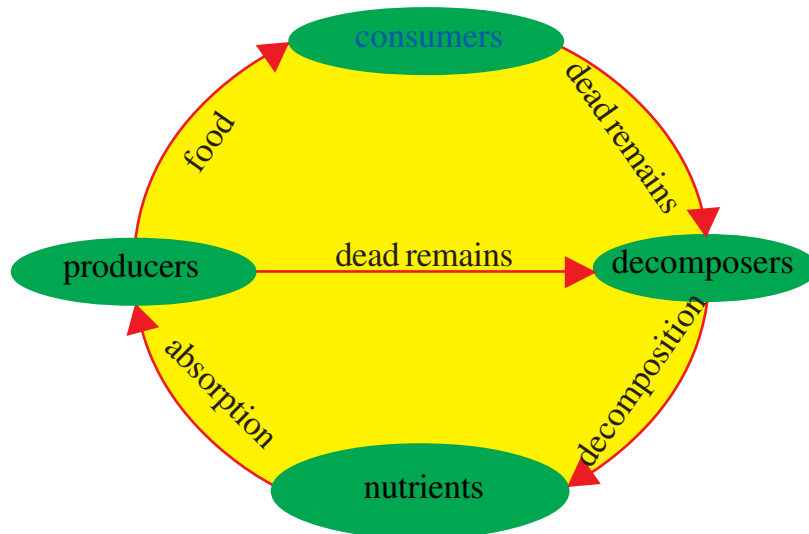
Observe the fallen leaves under a tree and write down the findings.

Leaf observed	Changes in the leaf
<ul style="list-style-type: none"><li>● A leaf which had fallen one or two days ago.</li><li>● A leaf which fell several days ago.</li></ul>	

What happens to the body parts of plants and animals when they die?

<b>Decomposers</b>	
<p>Microorganisms like bacteria and fungi break organic remains and add them to the soil. So they are called decomposers.</p> <p>The nutrients formed as a result of decomposition further become available for the growth of plants.</p>	 <p>Fungus</p>
	 <p>Bacteria</p>

Analyse the illustration given below and explain the relations among producers, consumers and decomposers.



### When we intervene in nature

It must be clear to you by now that producers, consumers, decomposers and abiotic factors are all part of the ecosystem. What change will occur in the ecosystem when any of these factors is altered?

Many activities of human beings cause destruction to the ecosystem. List them.

Observe the situations given below.



Discuss the problems caused by the levelling of land and filling of paddy fields, based on the indicators given below. Write them down in the science diary.

- Which are the ecosystems destroyed by these activities?
- What all organisms lose their habitats?
- Which organisms would face scarcity of food?
- How do these activities affect the availability of abiotic factors necessary for the growth of plants?

So, we have found out that all organisms including producers, consumers and decomposers are interdependent. The importance of keeping and preserving each of them may be presented in a seminar. There are many instances of the adverse effects of human interventions in the ecosystem. Suggest remedial measures for these interventions in your seminar.

*See 'Jaiva Vyvidhyam Innale Innu Nale' in School Resources in IT@School, Edubuntu.*



### Significant learning outcomes

The learner can

- explain ecosystems identifying their peculiarities.
- explain food chains, food webs and illustrate them.

- explain the various factors of an ecosystem like producers, consumers and decomposers and identify their inter-relation.
- engage in the conservation of ecosystems by identifying the adverse effects caused by human intervention.



### Let us assess

1. Find out the maximum number of food chains by including the organisms given below.

Tortoise, fish, aquatic plants, kingfisher, water snake, eagle, frog, crab, *mushi* (Cat fish).

2. Ruby tabulated the various factors in a pond as follows.

<i>Producers</i>	<i>Consumers</i>	<i>Decomposers</i>	<i>Abiotic Factors</i>
<i>Algae</i>	<i>Water snake</i>	<i>Bacteria</i>	<i>Water</i>
<i>Water Lily</i>	<i>Crab</i>	<i>Small fish</i>	<i>Air</i>
<i>Lotus</i>	<i>Frog</i>	<i>Fungi</i>	<i>Sand</i>
<i>Small fish</i>	<i>Varal (Snake head fish)</i>		<i>Stones</i>

- Are there only suitable ones in each group? Which are the unsuitable ones?
  - Explain the interdependence of the various factors in this ecosystem.
3. Explain how different organisms will be affected if a large mango tree is cut down.



### Extended activities

1. Collect newspaper reports on human interventions that brought about destruction of various ecosystems. Prepare a magazine.
2. Write a letter to the local self government officer requesting him/her to take necessary actions to protect the ecosystem under threat in your locality.



# Attraction and Repulsion

7

Whenever there is a strong wind, the front door of Neenu's house usually bangs against the wall. Neenu and her brother managed to get some objects and they fixed them on the portion connecting the wall and the door. Now if the door is opened, it remains close to the wall itself. The door does not bang against the wall when the wind blows. Having noticed this their mother asked,

“What trick have you both done there?”

Yes, what might have they done?

Can you suggest any method using the objects mentioned below?





Set 1- wooden block, gum

Set 2- magnet, iron piece

Set 3- two magnets

Set 4- bricks

### Magnets that attract

Have you heard of magnets? What do you know about them?

Magnets attract certain objects. Which are they?

Let's try this activity.

Bring pins, a blade, safety pins and an iron nail close to a magnet. See what happens.



### Those that attract and those that do not

From the given list, find out those which are attracted by a magnet.

Materials required:

Hinges, different coins, screwdriver, compass, stainless steel utensil, aluminium wire, copper wire, pen, rubber, glass piece, spoon, gem clip, plastic.

Tabulate your findings in the science diary.

Those attracted by magnet	Those not attracted by magnet

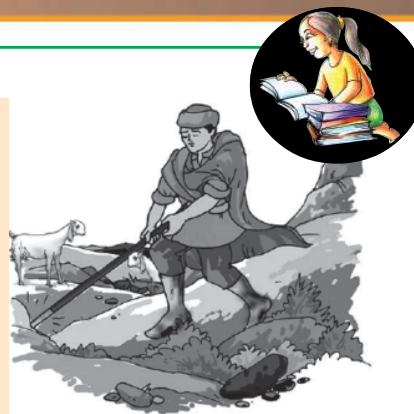
You may expand the table by examining other objects in and around your home too.

There are many objects that are attracted by a magnet. What are they made of?

Substances attracted by magnet are magnetic substances and those not attracted are known as non - magnetic substances. Iron, nickel, cobalt and steel are magnetic substances.

## Story behind the discovery of magnet

A Greek shepherd named Magnus was grazing his sheep on a hilly area holding a stick in his hand. While climbing a rock, he felt that his stick had got stuck to the rock. It was the piece of iron at the tip of the stick that was attracted by the rock. The rock was nothing but lodestone, capable of attracting iron. The Greeks later started calling such rocks as magnetite. These are natural magnets. Later on magnets were made using iron, steel etc. Such magnets are artificial magnets.



## Different types of magnets

Are all magnets of the same size and shape?

Do you have a magnet? What is its shape?

Let's familiarise ourselves with different types of magnets. Examine the figures showing some common magnets in use.



Bar magnet



U magnet



Disc magnet



Ring magnet



Arc magnet



Cylindrical magnet

Which among these have you seen? Examine the magnets in your school lab.

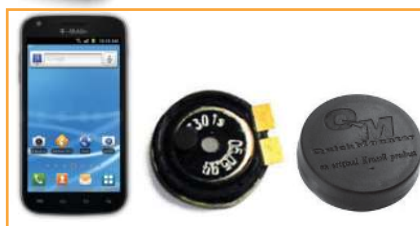
Magnets are made using 'alnico' which is an alloy of aluminium, nickel, cobalt and iron. Substances like neodymium and samarium are also used for making magnets.

## Uses of magnets

What are the different purposes for which magnets are used?

Sound is produced by speakers in TV, radio, mike sets (public address systems) etc. Magnets are used in speakers. There are magnets in mobile phones and head phones too. Find out more devices that make use of magnets and tabulate them.

Observe both the figures.



- What may be the reason for keeping big speakers in sound boxes and small ones in headphones?
- Do both the speakers need sounds of the same loudness?

Reason behind using a large magnet in loud speakers	Reason behind using a small magnet in headphones.

When a person addresses a crowd, which speaker would be ideal?

Why do magnets differ in shapes?

We have learned the shape of magnets used in speakers. Take a look at the figure showing the magnets used in a mini motor. What may be the reason behind the difference in the shape and size of these magnets?



The shape and size of magnets differ according to the device in which they are placed. Arc shaped magnets or ring tube magnets are used in mini motors.

### When magnets attract

Is the attractive power the same on all sides of the magnets?

*Materials required:*

*Iron dust, magnets of different shapes, thin plastic paper / polythene paper, a chart paper of A4 size.*

### To collect iron dust

We can collect iron dust from our surroundings. Wrap a magnet using cloth or paper and drag it along the soil of the courtyard. Don't you see a black powder sticking on to it? Does it not prove that there are substances on the earth that are attracted by magnets? Likewise we can collect iron dust from workshops specialising in iron works.

It is difficult to separate iron powder that is stuck to a magnet. That is why it is advised to wrap the magnet before collecting iron powder.

### Activity

Sprinkle iron dust loosely on the chart paper. Suspend a bar magnet using a thread and bring it near the iron dust.



- Does the iron powder stick evenly to all parts of the magnet?
- In which part is it sticking more?
- In which part is it less?

The end portions of a magnet where magnetic force is strongly felt are the poles of the magnet.

Do all magnets have poles?

Repeat the above activity using magnets of different shapes such as circular magnet, ring magnet and U magnet.

Record your activities and findings in your science diary.



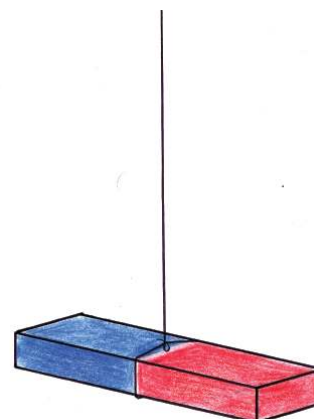
### When a magnet is suspended

Does a freely suspended magnet remain in one particular direction always?

Materials required: four bar magnets, thread, scale.

Take a bar magnet and suspend it horizontally using a thread in such a way that it is balanced. Ensure that there are no magnetic substances nearby. In which direction are the poles when the magnet comes to rest? Suspend the other three magnets like this in different places in your classroom.

Are all the magnets at rest in the same direction? Which is the direction?



Are there markings of S and N on the bar magnets that you have used?

Isn't the end marked S in the south direction and the end marked N in the north direction? On the magnets having no markings, mark N on the end directed to the north and S on the other end. Allow the magnets to rotate. Do all the magnets come to rest in the same direction?



Freely suspended magnets always come to rest in the north - south direction.

When do we make use of this north - south directive property of magnets?

- In ships to find the direction.
- To know the direction inside a forest.
- 



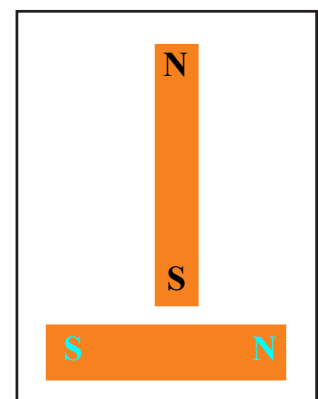
Imagine that you are standing in an unknown place. You can't see the sun due to the rains. Can you find out the directions with the help of a bar magnet? How will you find out the east side?

### When poles come nearer

You now know that magnets can attract certain metals. Does a magnet attract another magnet?

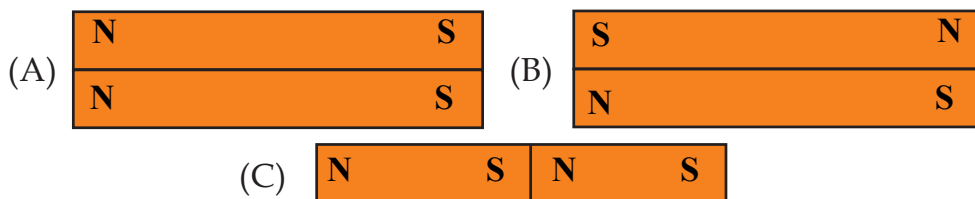
**Activity:** Take two magnets on which N and S are marked. Place one of them on a surface. Bring the pole of the other magnet to the middle of this magnet. What do you observe?

- Is it to the middle part of the first magnet that the second magnet is attracted?
- Place the magnets closer to each other. Which poles stick to each other?

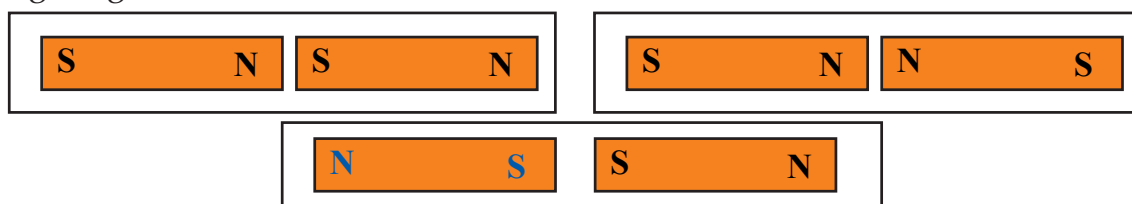


Examine the figures given below.

Which of them are correct?



What happens if the poles are brought near to each other as shown in the figure given below?



Perform the experiments and tabulate the observations.

Situations of attraction	Situations of repulsion

- Which poles attract each other when the magnets are brought near?
- Which poles repel each other when the magnets are brought near?

Poles of the same type in magnets are the like poles and those of the opposite poles are the unlike poles. Like poles of magnets repel each other whereas unlike poles attract each other.

Conduct experiments using magnets of different shapes and write down the findings in your science diary.

### Let's make a magnet

Can magnetic substances be made into magnets?

Materials required: a powerful magnet, a big sewing needle and a blade.

**Activity:**

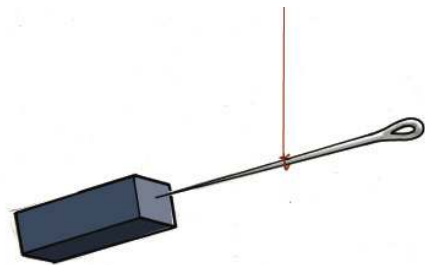
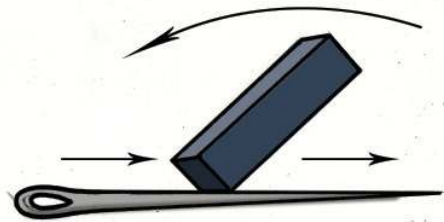
Place the needle on a surface. Using one pole of the magnet rub the needle from one end to the other. Repeat the process by lifting the magnet and bringing it to the original position. Rub the needle 15 - 20 times.

- Rub using one pole alone.
- Rub in the same direction only.

How will you find out whether this needle has acquired magnetism or not?

Can this magnetised needle be used in determining the poles of magnets of different shapes?

Suspend the needle using a thread in such a way that it is balanced. Bring a bar magnet near the needle. What do you observe? Bring the other end of the magnet near the needle. Record your findings in your science diary.



Can you find out the polarity of the magnetised needle?

Similarly magnetise a blade. Then take a vessel filled with water and gently place the blade on water so that it floats.

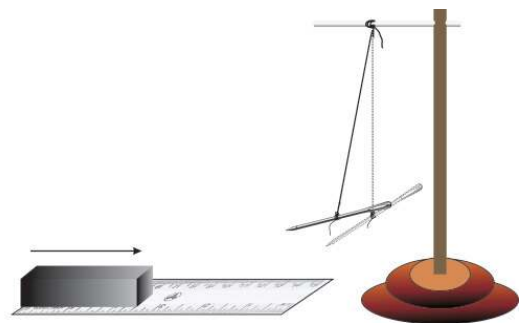
What can you infer if the blade comes to rest in the north - south direction?

**The range of attraction**

To what distance can a magnet attract other substances?

Is the attractive power of the magnet same everywhere? Let's examine.

Materials required: magnet, needle, scale and stand.

**Activity:**

Suspend the needle using the thread in such a way that it is balanced.

Place the scale on the table in such a way that one end of it is below the needle. Move the magnet on the scale from the other end to the side of the needle. Stop moving the magnet when the attractive force is felt on the needle. Measure the distance to the needle.

Slowly move the magnet towards the needle. Observe the changes in the needle in each instance.

Is there a change in the attractive force on bringing the magnet near the needle?

When is the force of attraction of the needle at the maximum?

Place an A4 size chart paper on the table as shown in the figure. Sprinkle some iron dust over it loosely. Bring the magnet below the paper. Gently tap the paper.



- Measure the extent of the magnetic field by observing the movement of the iron dust.

Record your activities and observations in the science diary.

The magnetic strength is stronger at the regions near the poles. As the distance from the pole increases the magnetic strength weakens. The region around a magnet where the force of the magnet is felt is the magnetic field.

Repeat the experiment using different magnets.

- Is the attractive power the same for all magnets?
- Is there any difference while using a U magnet? Write down your inference in the science diary.

### Let's collect magnets

There are magnets in toys, some vanity bags, purse etc. Examine discarded toys, speakers and mini motors. Don't you see magnets in them? Collect magnets from them.



Why don't we make a toy using magnets?



## Let's make a toy

Materials required: thermocol, a small ring magnet, string, a small wooden stick and metal screw.

Make models of fish using thermocol. Fix metal screw at the mouth of each. Put the fish into water in a wide vessel. Make a fishing rod using small wooden stick, string and a ring magnet. Can you catch fish using the fishing rod?

Try to design the following toys using magnets.

- Doll that clings together.
- A bird that remains only in one direction.
- Fish that swim towards rice grains.
- A palm that is directed to the south only.

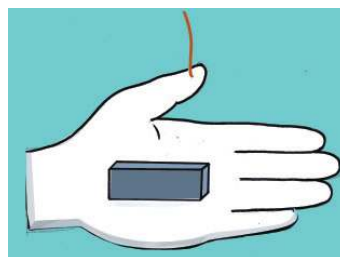


Exhibit in the science club the toys and devices you have made.



## Significant learning outcomes

The learner can

- recognise and explain the features of a magnet.
- explain the concept of magnetic field.
- classify substances as magnetic and non magnetic.
- understand the uses of magnets of different sizes and shapes and give examples.
- make toys using magnets.



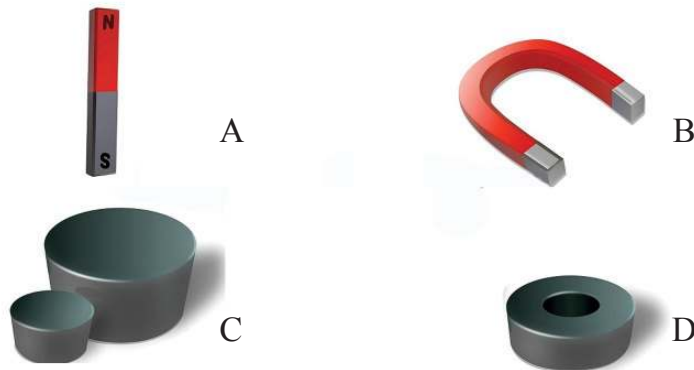
## Let us assess

1. Of two identical substances, one is an iron piece and the other is a magnet. How do you distinguish between the two?

2. Two bar magnets remain attracted. One pole is marked. Mark the other poles.

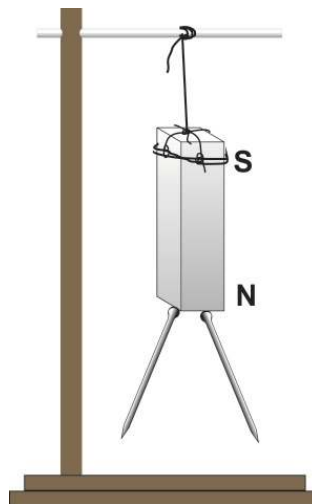


3. Which of the following magnets is used in a speaker?



### Extended activities

- Two pins are stuck to the north pole of a magnet. The picture shows the free ends of the pins to be divergent. Is it correct? What is the polarity at the ends? How will the pins remain when placed at the South Pole? Try to do.





8

## Moon and Stars

January 8  
Tuesday

The celestial sights have always fascinated me. How does the sun rise in the east and set in the west on all days? The sun is always there in the sky during the day. What about the moon? On one day in the evening it is like a crescent on the western horizon and on another day, at night, it is like a full circle on the eastern horizon. The position of stars is also changing. How do these things happen?



The excerpt given above is from Shaji's diary entries. Have you ever had similar doubts?

What have you learnt about the sun, the earth and the moon so far?

- The Earth is spherical in shape.
- The Earth and the moon receive light from the sun.

- 
- 

### Day and night

- Does light fall everywhere on the earth at the same time?
- What causes days and nights?

Let's do an activity.

Materials required: Model of earth (globe), a steel rod and an arrangement for lighting a bulb

### Activity

Remove the globe's stand. Arrange the bulb and the globe as shown in the figure. The north pole of the globe should be towards the north. Light the bulb after ensuring maximum darkness in the class room. The bulb is used in place of the sun. Imagine that the globe is the earth.

Now observe the globe from the side of its north pole. Don't you see light in the portion facing the sun and darkness on the other side? Gently turn the globe to the left. Now don't you see that the dark portion entering to the lighted area and the lighted area moving into the dark area?

When you turn the globe to the left, in which direction is its rotation? Put ✓ mark at the appropriate box:

- From east to west
- From west to east



Photograph of earth from outer space



What do you understand from this activity? Write down your findings in the science diary.

The earth spins from west to east. It is due to the earth's rotation that day and night continuously appear.



See 'Ravum Pakalum' in School Resources in IT@School, Edubuntu.

### Sunrise and sunset

We see the sun rising in the east and setting in the west. The very next day the sun rises in the east again.

How does the sun setting in the west rise in the east again?

#### Activity

- Locate our approximate position in the globe.
- On that area, fix a pin in the east-west direction using a cellotape.
- Fix a small red colour *bindi* at the top end, a white one in the middle and green at the bottom.
- Imagine that you are on the white *bindi*. Now the *bindis* at the ends are in your east and west.
- What is the colour of the *bindi* on the east?
- What about colour of the one in the west?



Light the bulb and gently turn it to the left.

Observe the positions of the white *bindi* when there is sunrise, noon and sunset.

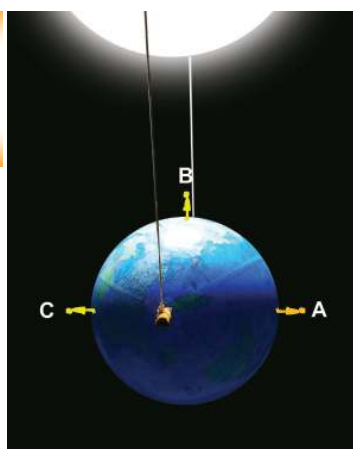
On the basis of your findings complete the following table.

Time	The position of white <i>bindi</i>
Sunrise	.....
Noon	.....
Sunset	When the white <i>bindi</i> moves from light to darkness.

Due to the rotation of the earth, those in the region moving from darkness to light feel sunrise and for those going from light to darkness experience the sunset.

Mark positions A, B and C on the globe, as shown in the figure. Make models of children using thermocol and fix them in these positions. Which is the east and the west of each child?

On the basis of the observations, complete the following table:



1	In which position will the child see the sunrise?	
2	In which direction does A see the sun?	
3	In which position does the child experience noon?	
4	Where does B see the sun?	
5	In which position does the child see the sunset?	
6	In which direction does C see the sun?	

What are the inferences you arrive at by analysing the table?

Try to turn the globe from the north pole. Don't you see that people in each place experience sunrise and sunset? In fact, the sun which appears in the east in the morning, the sun above the head at noon and the sun which sets in the west in the evening remains in the same place. It is the rotation of the earth that causes day and night.

### The moon's path in the sky

We see the sun rising in the east and setting in the west every day. But do you see the moon like this every day ?

Where did you see the moon last night?

Do you see the moon every day in the same place during sunset?

What is the secret behind the moon appearing at different positions each day?

## Let's observe the moon

Given below are the positions of the moon at the time of sunset observed by Appu on three different days.



- Is there a change in the position of the moon?
- In which direction does the change of position take place ?

The position of the moon appears to change because of the revolution of the moon around the earth. Moon completes one revolution around the earth in  $27\frac{1}{3}$  days.

## The mystery of moon's crescent

Did you notice any other features when you observed the moon?

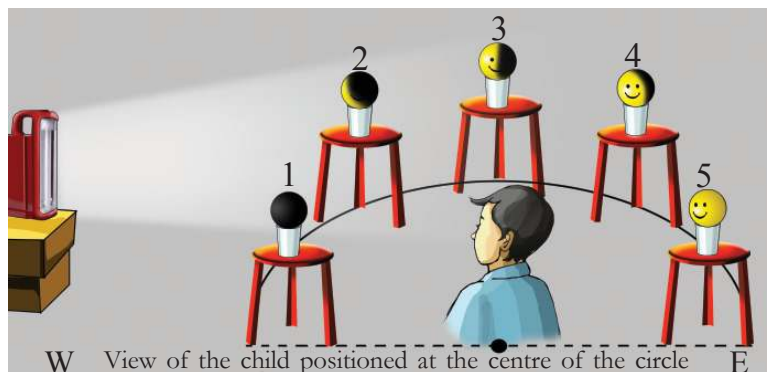
Don't you see that the shape of the moon also changes along with its change in position each day? Sometimes we see it in the shape of a crescent and sometimes as a full circle. Why is it so?

Try out the following activity.

Materials required: Five yellow plastic smiley balls, five glass cups, five stools and an emergency lamp.

### Activity

Draw a semicircle on the floor of the class room in east-west direction. Arrange the stools, the cups and the balls in five equidistant positions as shown in the figure. The



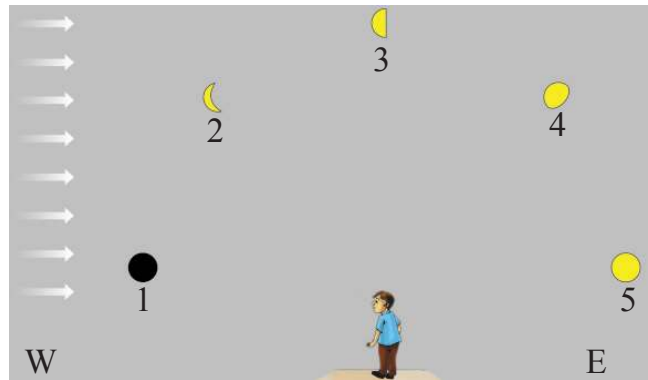
smiling face of all the balls should face the centre of the circle. Light the emergency lamp and place it in the west side in such a way that the light falls on the balls. As far as possible, prevent the light from the outside entering the classroom by closing doors and windows. From the centre of the circle, observe all the five balls.

- The smiling face of the ball placed in which position is completely exposed to light?
- The smiling face of the ball placed in which position is not exposed to any light at all?
- The smiling face of the ball placed in which position is partially lit by the light?

Imagine that the semicircle is the half of the path along which the moon revolves, and the balls as the moon you see on different days.

Observe the figure.

Different positions of the moon in its path of revolution around the earth are depicted here.



- Is it possible to see the moon when it reaches the position marked 1? Why?
- What change occurs in the appearance of the moon when it comes to the position marked 2?
- In which position do you see the full moon?
- In which position do you see the half moon?

Analyse the figure and match the facts given below by drawing lines:

Table 1
When the moon comes to 1
When the moon comes to 3
When the moon comes to 5

Table 2
Half of the lighted area of the moon is seen (Half Moon)
The whole of the lighted portion of the moon faces the earth (Full Moon day)
Since the dark area of the moon faces the earth, the moon cannot be seen (New Moon day)

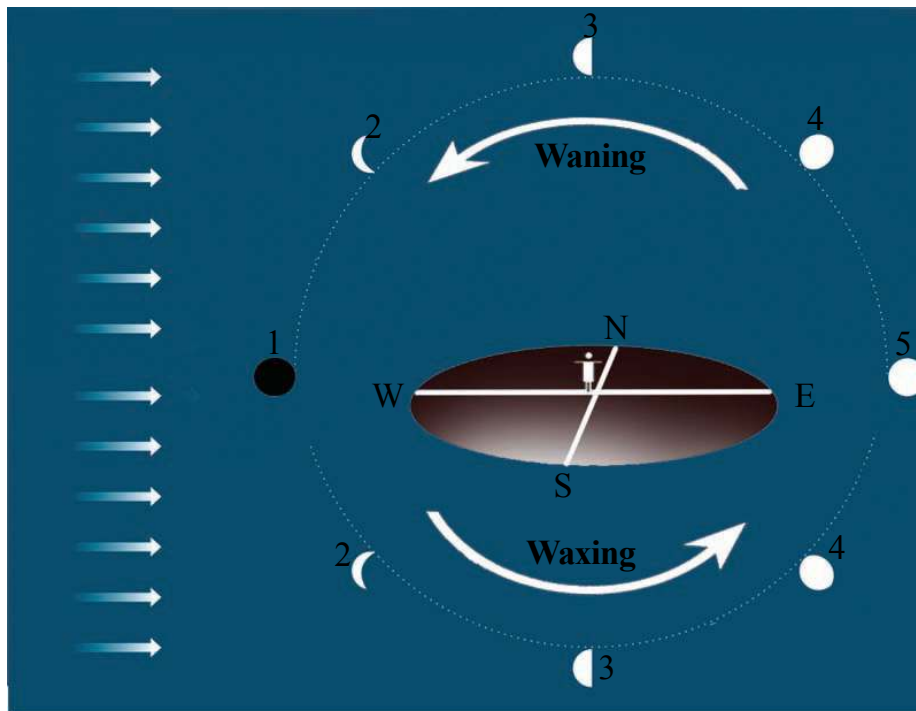




The moon's illuminated portion becomes increasingly visible on the earth from the new moon day to the full moon day.

What about the changes that happen from full moon day to new moon day?

Repeat the above experiment by bringing slight changes. Change the semicircle drawn on the ground into a full circle. Place the balls in positions 2, 3 and 4 in their corresponding positions on the other semicircle. The smiling face should face the centre of the circle. Switch on the emergency lamp. Standing at the centre of the circle, observe the balls in the order from 5 to 1. Write down your findings in the science diary.



The difference in the visibility of the lighted and dark areas of the moon when observed from the earth is the reason for waxing and waning of the moon. From the new moon day to the full moon day, the lighted portion of the moon becomes more visible. This is called waxing. From the full moon day to the new moon day, there is a decrease in the visibility of the lighted area of moon from the earth. This is called waning.

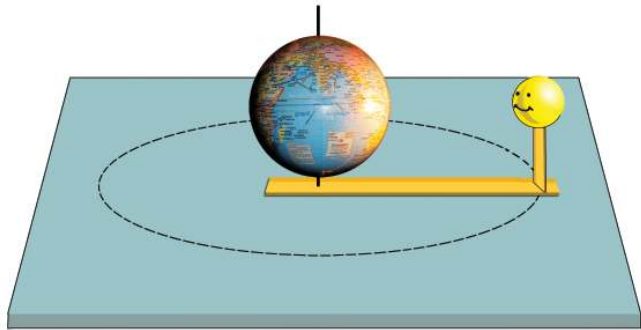
## The peculiarity of lunar rotation

We have learnt about the earth's rotation. Does the moon also rotate like this?

Try this activity.

Materials required: Reaper pieces of 30 cm and 10 cm length, two yellow smiley balls, a small globe without its stand, an umbrella rib and a double sided tape.

- Make a small hole at one end of the reaper. Fix the small reaper at the other end, perpendicular to the surface.
- Insert the rib of the umbrella through the poles of the globe and fix it on the table through the hole in the reaper.
- Using the double sided tape, fix the smiley ball on the reaper in such a way that it faces the equatorial part of the globe.



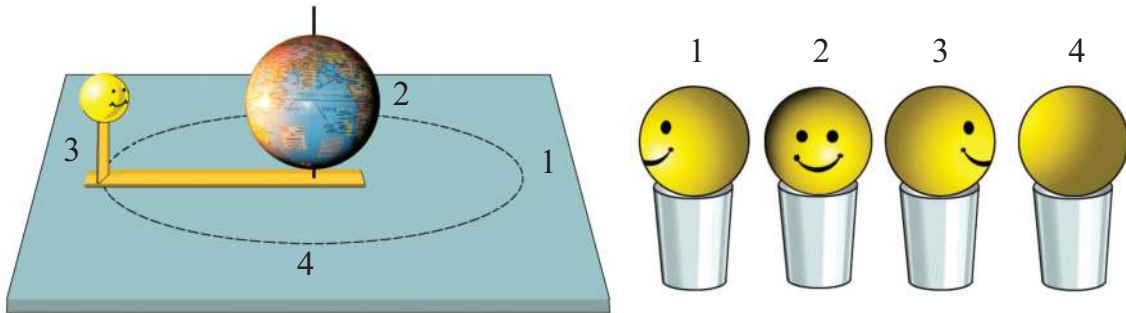
Holding the umbrella rib firmly pressed, complete a revolution by turning. Observe the direction of the smiling face. Doesn't the ball revolve showing the same face?

This is how the moon revolves around the earth.

But, has rotation taken place here? Do the above activity once again to find this out. Place another ball on a glass tumbler on the table. The smiling face of the ball on the glass and the ball on the reaper must face the same direction.



Now, make the moon revolve one fourth of the path. In which direction is the face of the moon now? Next rotate the ball on the glass without changing its position. Make the moon revolve one fourth of the circle each. Turn the ball on the glass cup accordingly. Doesn't the ball complete one rotation by the time the moon completes one revolution?



Let's do the activity once again. Write down your findings in the science diary.

The moon completes a revolution around the earth in  $27\frac{1}{3}$  days. It takes the same time to complete one rotation as well. That is why only one face of the moon appears in the direction of the earth always.

### Celestial friends

Do you see only the moon in the sky at night? What are the other things you see?

- 
- 

How interesting it is to watch the stars on a clear sky at night! Are they all of the same colour? What are the colours of the stars you see? Don't you see dim as well as bright stars?

How many stars in the sky can you count at a time?

With the help of reading notes, record your findings in the science diary.

### Lo! The innumerable stars!

We can see around 3000 stars at a time if we observe the sky from a dark place. Due to the earth's rotation, the stars appear to rise and set. Hence you can see around 6000 stars if you observe the sky throughout the night. Lakhs of stars can be seen if observed through a telescope. There are many crores of stars in the universe.

### Shape of stars

Draw the picture of a star in your science diary.

Compare the picture you have drawn with that of your friends. With which shape given here does your drawing match?

The sun, the moon and the stars are all celestial spheres. In which shape do we draw a full moon?

If so, don't you think the sun and stars should be drawn in the same shape?

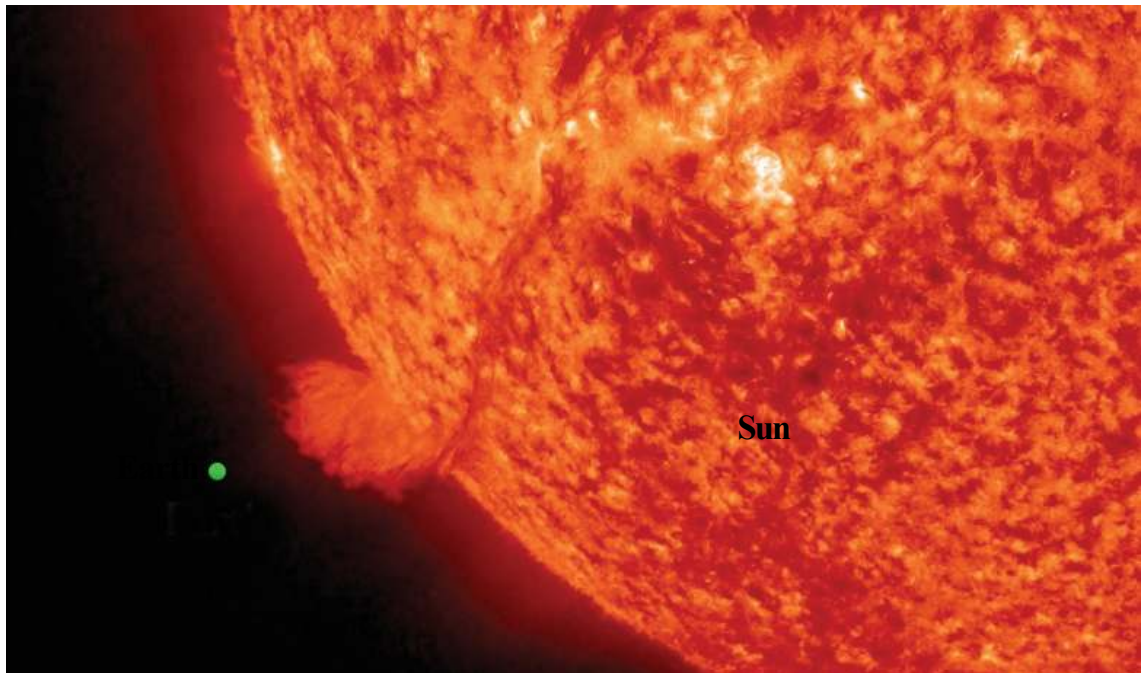


Stars are self luminous celestial bodies. The rays of light from the stars undergo continuous change in its direction while traversing through various layers in the atmosphere. This is why stars appear to twinkle.

### Size of stars

Which star is the nearest to the earth? How big does the sun appear to us? Is the sun bigger than the earth?

Analyse the following figure:

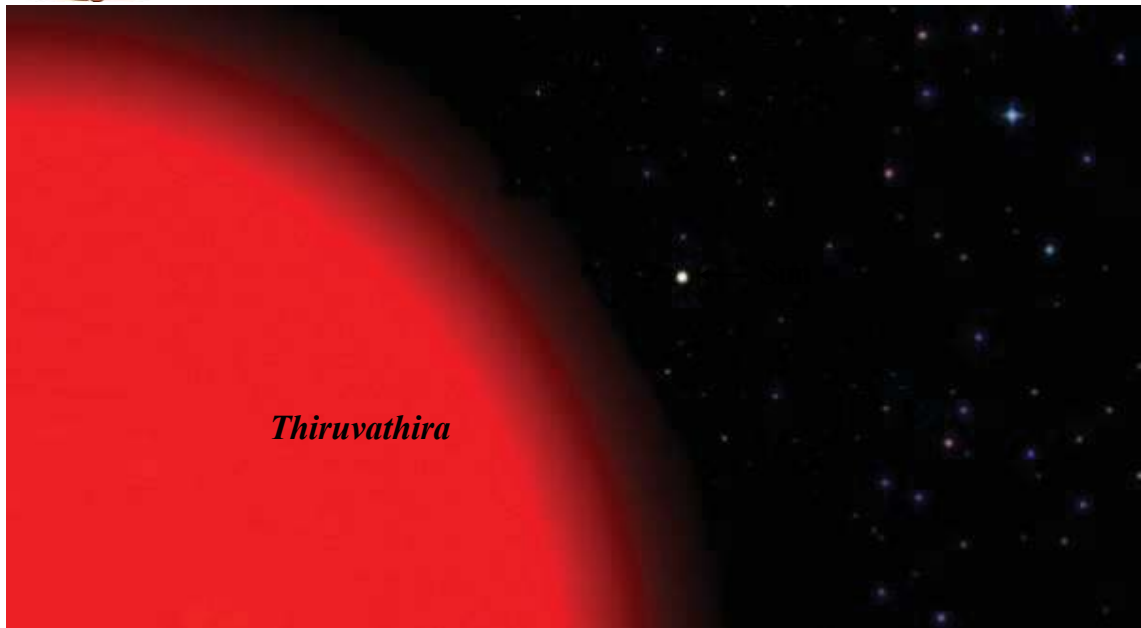


The sun is a star that can hold about 12 lakh earths within it.



How big is our Sun!  
Are there stars  
bigger than the sun?

Do you also share the child's doubt? Take a look at the figure showing a comparison of the size of the star *thiruvathira* and the sun.




The size of stars are something beyond our imagination.

Despite being so big, why do the stars appear small in size?

Haven't you seen aeroplanes in the sky?

Most of the aeroplanes you see usually carry on board a large number of people.

But when they go up a few kilometres don't you see them diminished in size? You might have now realised why the stars which are crores of kilometres away appear small in size.



If someone makes a call from America, we can listen to it at the same time, thanks to the existing modern technology. Apart from the sun, Alpha Centauri is a star closest to the Earth. But if you make a telephone call from Alpha Centauri which is sun's nearest star, it will take more than 4 years for the sound to reach the earth!

### The picture book in the sky

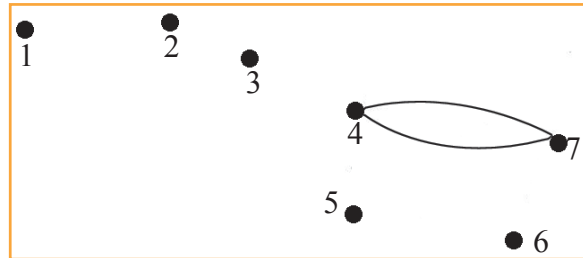
Don't you feel like starting a friendship with stars?

Don't you want to get to know them closer?

How would you distinguish the stars from one another, all of which look alike?

Try joining the dots from 1 to 7 continuously.

What shape do you get?



This is the picture one gets when the seven stars which appear moderately bright in the northern part of the sky are joined. The westerners gave it the name 'big dipper', meaning 'big spoon'. We in India call them *Saptharshis*. We see them in the northern sky in the evening, in the summer season. In the months of December and January, they are seen at midnight.

### Constellations

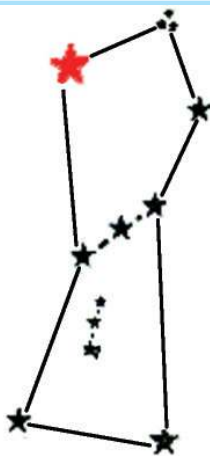
You are now familiar with the *Saptharshis*. Similarly, constellations are groups of stars, imagined into shapes by joining them together using lines.

Can you find out any other shapes in the sky?

Note it down in your science diary, giving it a suitable name.

Let's familiarise ourselves with a few more similar shapes imagined by people who observed the sky in ancient times.

### Orion



This is the constellation used by people in the past to ascertain direction while travelling in deserts and the sea. The line joining the head and the sword of Orion (hunter) reaches the polar star.

This constellation can be seen after dusk in the months of January, February and March. *Thiruvathira* is the star in red colour on Orion's right shoulder.



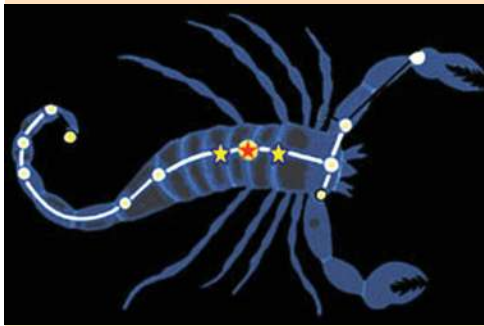
### Cassiopeia

Cassiopeia is seen in the sky in the evening from October to December.



Cassiopeia

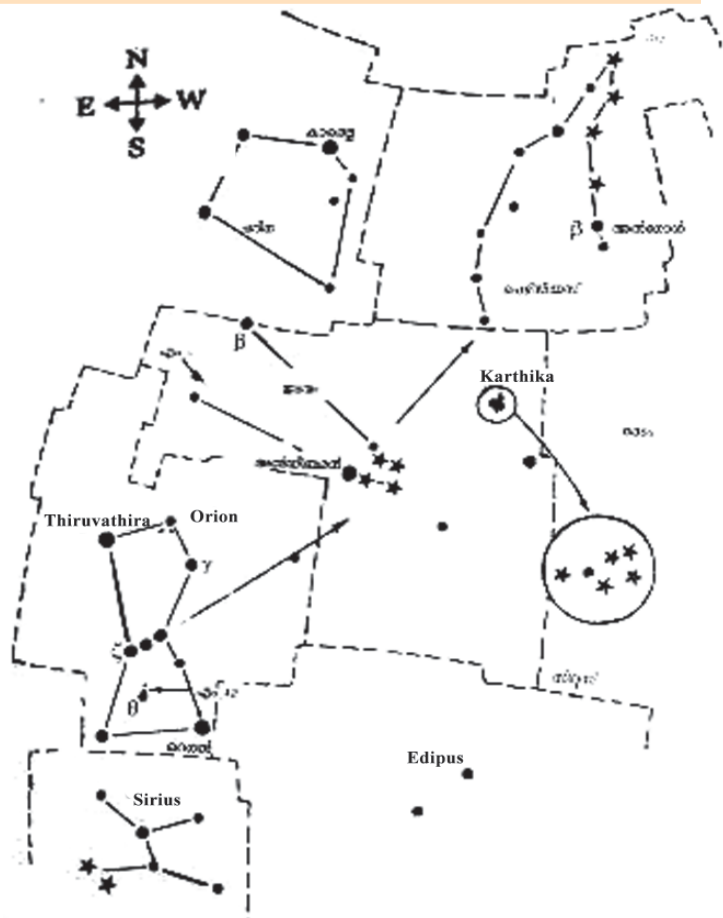
### Malayalam months and constellations



The figure shows a group of bright stars seen above us a little towards the south in the sky in the months of August and September. What shape do you obtain by joining the dots sequentially? The shape of this big scorpion is named scorpis (*vrischikam*). It is also the name of a Malayalam month. Likewise, there are 12 constellations imagined in the names of the twelve Malayalam months.

### Star map

Aren't you eager to identify more stars? We can use a star map for this purpose. You have to look at it holding it upside down and in accordance with the direction, above your head. On holding it upside down above the head with its north towards the north, we get the east-west directions correct. This map will help you to observe the evening sky from December to March. Likewise, there are star maps for each month and season.





*See more stars using 'stellarium' in IT@School, Edubuntu*

### Observing planets

You have already learned about the planets in the solar system. Among them, Mercury, Venus, Mars, Jupiter and Saturn can at times be seen in the sky with naked eyes. Planets generally do not twinkle. Generally they appear bigger and brighter than the stars. Try to familiarise yourselves with stars and planets by organising a sky watch programme at school.



### Significant learning outcomes

The learner can

- explain that it is due to the rotation of the earth that the sun appears to rise in the east and set in the west.
- explain that the position of the moon changes due to the revolution of moon around the earth.
- explain how waxing and waning of the moon occurs.
- explain why only one face of the moon always faces the earth.
- observe the constellations and help others to observe stars.
- observe and distinguish some of the planets in the sky.
- make models to show the earth's rotation and the moon's revolution.



### Let us assess

- 1) Is it in Gujarat or Assam that the sunrise is seen first? Why?



- 2) If the moon does not rotate along with its revolution, will it be possible to see all parts of the moon from the earth? Justify your answer.
- 3) Prepare a questionnaire for conducting a quiz programme on astronomy in such a way that the following are the answers.
  - a) Sun
  - b) Constellations
  - c) Alpha Centauri
  - d) *Saptharshis*
  - e) Full moon
  - f) *Thiruvathira*
  - g) Rotation of the earth
  - h)  $27\frac{1}{3}$  days



### Extended activities

- 1) How long does it take for the moon to complete one revolution?

We have learnt that the moon revolves around the earth. How can we find out the time required for the completion of one revolution by observing the change of position of the moon in the sky?

How many days are required to see the moon which appeared on the western horizon at sunset to be seen right above the head? Within this time, how much of its revolution is completed by the moon?

After how many days do we see the moon, in the eastern horizon during sunset? Within this period, how much of its revolution will have been completed by the moon? How many days will be required for the moon to reach the western horizon? Observe the moon and tabulate your findings. Formulate your own inferences.

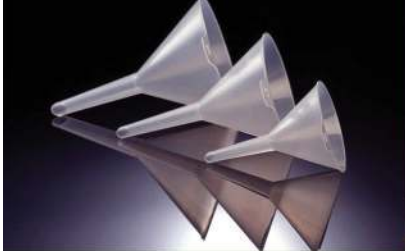
Position of the moon in the evening	The part completed in the path of revolution	Number of days needed
When the moon travels from the western horizon to a position right above your head.		
When it reaches the eastern horizon from the western horizon.		
When it reaches the western horizon from the western horizon.		

How many days does it take to see the moon in the same position where it was spotted earlier?

You have learnt that the period of revolution of the moon around the earth is  $27\frac{1}{3}$  days.

Does your finding agree with this? If not, why?

2. Conduct a study trip to a planetarium.



# 9

## Mix and Separate

You are all fond of sugar candies. Have you tasted sugar candies? What is its taste? What other specialities does the sugar candy possess?

Examine and write.

- Colour .....
- Odour .....
- State .....



Taste the sugar candy after breaking it into smaller particles. Is there any difference? Break a small crystal of the sugar candy and observe it using a hand lens. Is it possible to break it further?

If this process is repeated, we will ultimately get a small particle invisible to our naked eye, possessing all the properties of sugar. This particle is what we call as a molecule of sugar.

### Molecule

The smallest particle of a substance retaining all the properties of that substance is known as its molecule. Substances that exist in the solid, liquid and gaseous states are made up of molecules.



See 'Thanmathra' in School Resources in IT@School, Edubuntu

## Pure Substances

Only sugar molecules are present in the sugar candy. If a substance contains only one type of molecules, it is known as a pure substance.

Water is a pure substance.

Let us see more examples of pure substances.

- Salt
- Aluminium
- Glycerine
- Baking soda
- Copper
- Potassium permanganate
- Oxygen
- Silver
- Copper sulphate (Blue vitriol)

What molecules will be present in a solution made by dissolving sugar candy in water?

- 
- 

## Mixture

If there are more than one type of molecules present in a substance, it is called a mixture.



Examine the table given below.

Substance	Molecules present
Sugar solution	Sugar, water
Soda	Water, Carbon dioxide
Oxygen	Oxygen
Air	Nitrogen, Oxygen, Water vapour, Carbon dioxide
Mercury	Mercury
Iron	Iron
Copper sulphate (Blue vitriol)	Copper sulphate

Analyse the table and classify them into pure substances and mixtures.

## Different types of mixtures

Fill two glass tumblers with water. Put some salt in one tumbler and chalk powder in the other and



stir well. After some time, examine both these glasses with a lens. What differences do you observe? Do salt and chalk powder get distributed in water in the same way? Using a straw, taste the salt solution from different parts of the solution.

Do they taste the same?

### Homogeneous Mixture

If a mixture exhibits the same property throughout, that mixture is called homogeneous mixture.

Haven't you observed the solution of chalk powder in water? Are the chalk particles distributed uniformly in the mixture?

Take some butter milk in a glass tumbler and observe. What all particles do you see? Are they distributed uniformly?



### Heterogeneous Mixture

If a mixture exhibits different properties in different parts, that mixture is called heterogeneous mixture.

Tabulate some mixtures that you are familiar with.

- Lemon juice
- Karingali water
- 

Observe these mixtures closely. Classify them into homogeneous and heterogeneous mixtures.



## Different types of solutions

You have already studied about solute, solvent and solutions. All solutions are homogeneous mixtures.

Most of the solutions that we use are those in which a solid substance is dissolved in a liquid. But all solutions do not exist in the liquid state. Solutions also exist in solid and gaseous states.

Examine the table

Solution	Constituent particles
Brass	Zinc, Copper
Soda	Water, carbon dioxide
Glycerine dissolved in water	Glycerine, water
Air	Nitrogen, Oxygen, Carbon dioxide, Water vapour, etc.

Based on the constituent particles, identify the characteristics of each solution.

- Brass - solid dissolved in solid
- 
- 
- 

## Separation of mixtures

Till now we have discussed substances that have more than one substance mixed or dissolved. Can such substances be separated?

Add some sand in a glass of water and stir well. What will be the result?

Add some salt to water taken in another glass. What happens to the salt?

What difference do you notice in the mixtures in the two glasses?



How can you separate sand from a mixture of sand and water? Try doing it after discussing with your friends. Which property of sand helped you in separating it in this method? Record these activities in your science diary. Can you separate salt from salt water?

Decantation is the process of separating the clear liquid above after sedimentation of the components of a mixture.

### Making water clear

Is the water obtained after decantation clear?

What else can be done to get water which is more clear? Select suitable materials from those given below and perform the activity.



Funnel



Tea strainer



Filter paper



Cloth piece



Bamboo basket

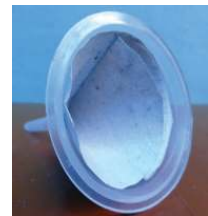
Which materials did you select? Why did you select them?

Filter water using a folded filter paper kept in a funnel as shown in the figure. Did you get water which is more clear?



What type of a mesh is used to sieve rice powder while preparing *puttu* and *pathiri*? Haven't you seen different types of sieves to separate sand during construction of buildings? What is the reason for this?

What property of the substance is made use of when the constituents of a mixture are separated using a sieve?



Filtration is the process of separating the constituent particles of a mixture using a sieve.

How can you separate the constituents of a mixture of chalk powder and water? What all materials are required? Do the experiment and record it in your science diary.

### Separation of dissolved components

Can you separate salt from salt solution using a sieve? Try to separate it using a filter paper.



Heat salt water in a steel spoon using a spirit lamp. What is left behind in the spoon when the water gets evaporated? Taste it. Have you seen salt pans where salt is separated from sea water?

How is salt separated?



Evaporation is the process by which a liquid absorbs heat and gets converted to vapour.

Which other mixtures can be separated into constituents through evaporation?

- 
- 
- 
- 

Which is the source of heat required to evaporate water in salt pans?

### Separating Iron powder

Remains of iron powder and aluminium powder while cutting iron and aluminium pipes stay mixed in a workshop that fabricates metal doors and gates. How can you separate iron powder from aluminium powder in this mixture? Are any of the methods we have come across suitable for this? Select the suitable material from those given below and try to separate.



Spoon, Filter paper, Funnel, Tea strainer, Magnet, Test tube

What property of iron powder did you make use of in this case?



What other instances do you know where the constituents of a mixture need to be separated? Observe the pictures.

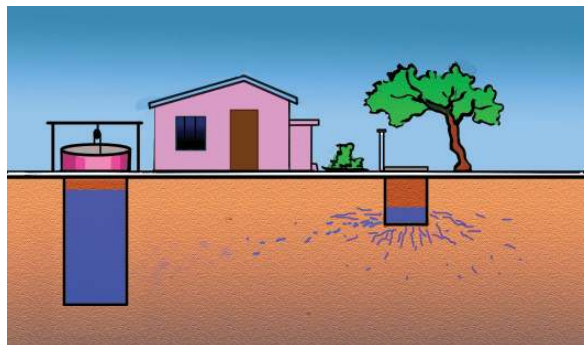


Are you familiar with the extraction of coconut oil from *copra*? What method is used in our homes to separate *copra* cake from coconut oil? Find out.

### Sand as a good sieve

Observe the picture. Does the water from the septic tank get mixed with sand?

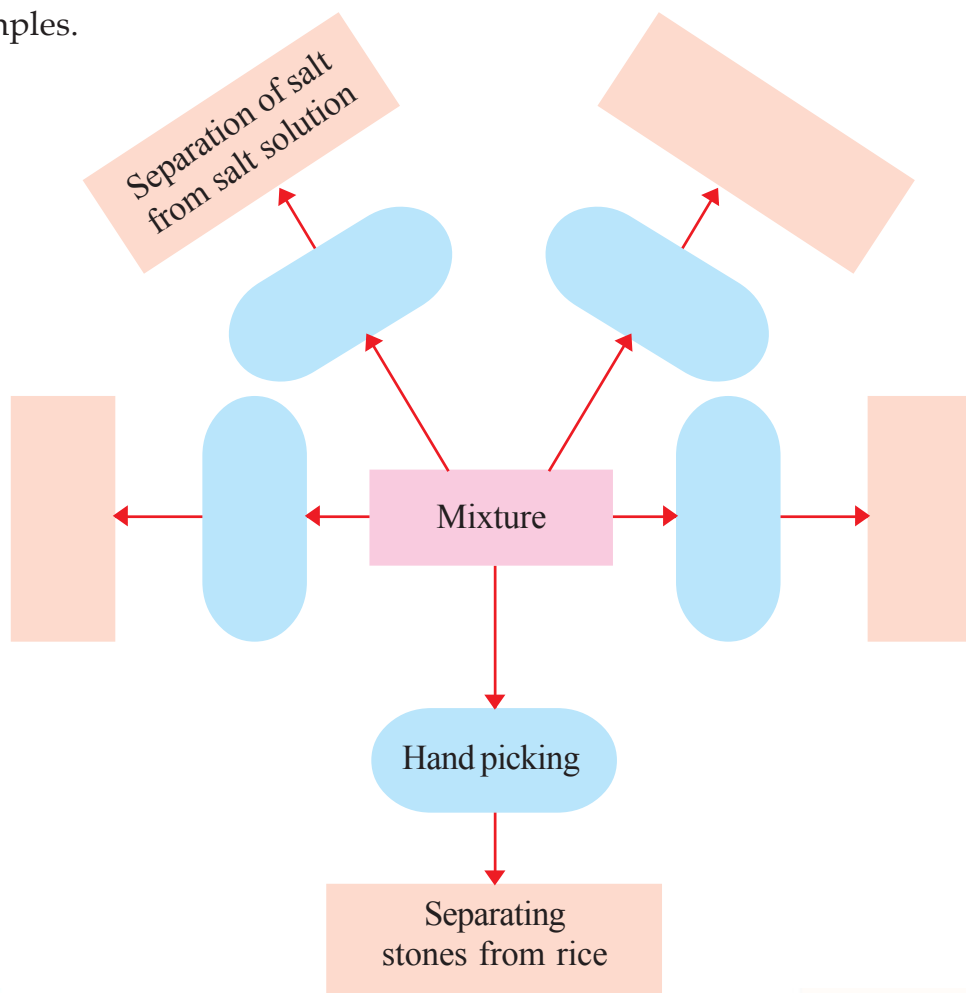
- Why is the water in wells clear?
- Is there any chance for the water in the well to get contaminated if the septic tank is close to the well?



Record in your science diary the precautions to be taken while constructing septic tanks.

We are now familiar with different methods that are employed to separate the constituents of a mixture.

Complete the concept map by writing the methods employed and cite examples.



### Significant learning outcomes

The learner can

- explain the concept of a molecule.
- classify substances into pure substances and mixtures.
- classify mixtures into homogeneous and heterogeneous and provide suitable examples

- suggest suitable methods to separate constituents of mixture.
- select suitable apparatus for separating the components of a mixture.



### Let us assess

1. Observe the materials given below.

A Wax powder
-----------------

B Iron
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C Salt
-----------

D Sand
-----------

- (i) How can you separate the components if A and B get mixed?
  - (ii) How can you separate the components if A and C get mixed?
  - (iii) How can you separate the components if A and D get mixed?
2. Using which equipment will you get water with maximum purity while filtering muddy water? Why?
    - a. Cloth
    - b. Filter paper
    - c. Tea strainer
  3. How does pure water differ from sugar solution based on the constituents present in them?



### Extended activities

1. Find out what all mixtures are prepared in the kitchen daily. Also examine whether constituents are being separated from mixtures. Which equipment are used for this purpose?

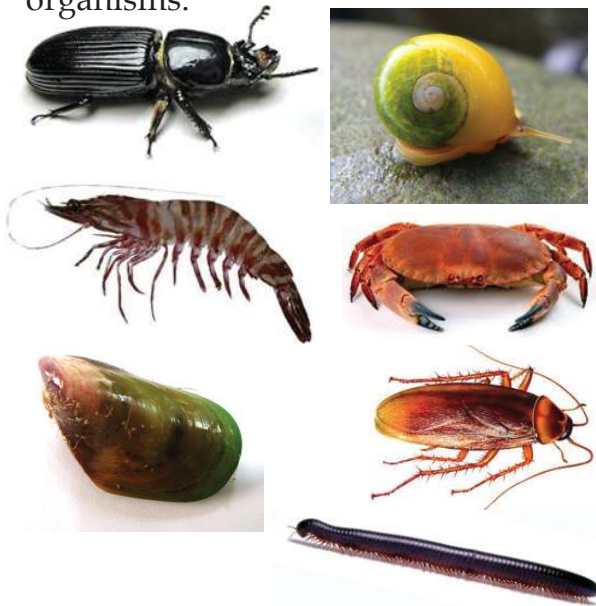


## For Shape and Strength



- Why can't the fox eat the tortoise?
- Are there other organisms that possess outer shells like that of the tortoise?
- How do hard shells help animals?

Observe the pictures and find out the characteristics of the shells of these organisms.



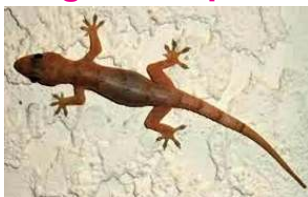
### For shape and protection

Snail, beetle, crab, oysters etc., have hard shells. The shells of centipede, millipede etc., are comparatively less hard. Shells help to protect the body parts, provide shape and help to escape from enemies. These coverings in the outer surface of the body are called exoskeleton. Scales of fishes and reptiles, feathers of birds, hairs, horns, hooves and nails of animals are all remnants of the exoskeleton.

- Are the outer shells of all organisms the same?
- How do the exoskeleton of centipede and millipede differ from others?
- What is the relation between the exoskeletons of animals and their shapes?
- How do these exoskeletons help animals?

Examine the reading material and write down your findings in the science diary.

### To give shape



### Colour diversity in exoskeleton

The beautiful patterns and colours in the exoskeletons make many organisms very attractive. This attractiveness becomes a threat to their existence too. Man captures these organisms without any concern for them. Many of such organisms are facing the threat of extinction.



Star Tortoise



Golden Beetle

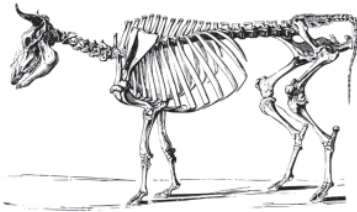
Cockroach and lizard are two small creatures always found in our houses, aren't they? Are their skeletons alike?

Draw the skeleton of a lizard in the following picture.



**Let us familiarise ourselves with skeletons**

The figures of skeletons of different organisms are given below. Observe the figures and identify the organisms to which they belong.



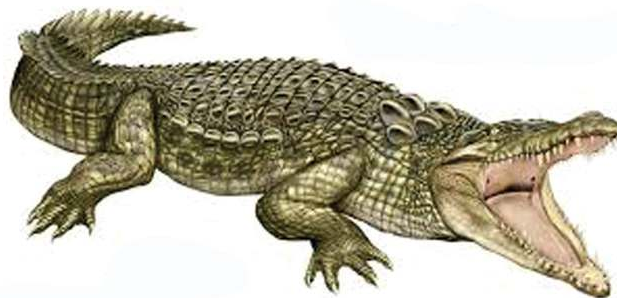
Assess yourself whether the diagram of the lizard's skeleton you have drawn is correct or not.

We have learnt that outer shells are the exoskeletons.

If so, what do we call the skeleton seen inside the body?

In cow, goat etc., the skeleton is seen inside the body. This is called endoskeleton.

Organisms like tortoise, crocodile etc., possess both endoskeleton and exoskeleton.



A cow has an endoskeleton. What would have been the shape of the cow if it had no skeleton?

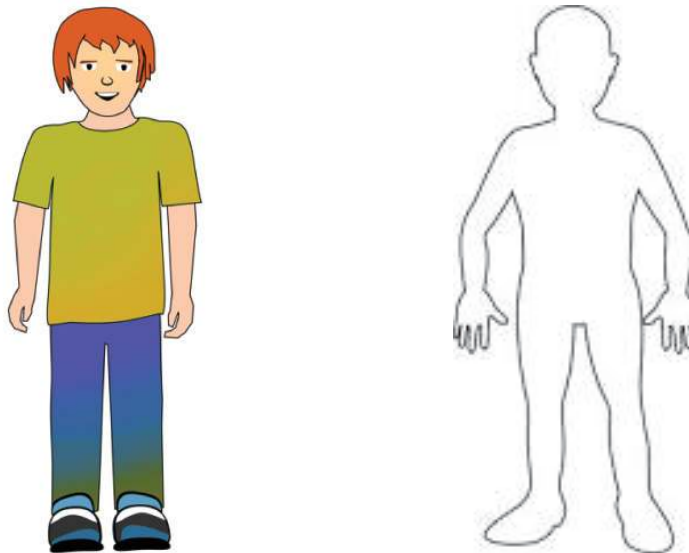
- In which ways do skeletons help animals?

Write down the findings in your science diary.

Bones provide shape and strength to the body. They also help in movement.

### Human skeleton

We have familiarised ourselves with the skeletons of various animals. We also have a skeleton. Learn the position and shape of different bones in our body by touching. Now, try to draw the structure of your skeleton in the following sketch.



Assess the diagram you have drawn on the basis of the given indicators.

- Are bones of various parts of the body included in the diagram?
- Have you drawn the size and shape of the bones correctly?
- Are the protective measures of the heart, brain and lungs properly included in the diagram you have drawn?

Examine the pictures of bones of various parts of the human body.



Skull



Ribs



Bones of the hand



Vertebral column

Observe the model of the skeleton in the Science Lab.

List the characteristics and functions of the bones you have observed.

Bone	Characteristics	Use
<ul style="list-style-type: none"> <li>● Skull</li> <li>● Ribs</li> <li>● Vertebral column</li> <li>● Bones in the hand</li> <li>● Bones in the leg</li> </ul>		

Analyse the table. What are your findings from the table?

- How do the bones of the human body differ in their size and shape?
- What is the significance of the skull?

### Youth Escaped

Kochi: A lorry hit on a two-wheeler. The passenger fell on the road. But his head was not injured as he was wearing a helmet. His hands and legs were severely injured.



- Why do two-wheeler riders have to wear helmets?



## Bones of many kinds

Skull, ribs, vertebral column and other bones differ in their size and shape. The skull protects the brain. In the skull, the lower jawbone alone is movable. The jawbone is the strongest bone in the body. The vertebral column keeps the body erect. Certain injuries in the vertebral column cause lifelong paralysis. Ribs cover and protect the lungs and the heart. The thigh bone is the largest bone in the human body. Stapes in the ear is the smallest bone in the human body.

## Proper postures of the body

Proper postures are to be maintained for the health and longevity of the vertebral column. Look at the right postures to be followed while sitting, standing and lying.

- Which posture has to be maintained while lifting a weight?
- How do you sit in the classroom?

It is necessary to keep the vertebral column straight in every instance. Bending of the vertebral column will adversely affect its health. This may also bring about backpain.





### How many bones?

Around 300 bones are there in the body at the time of birth. By adulthood, certain bones fuse together and the number reduces to 206. The number of bones in human body is as follows:

Skull	: 22	Vertebral column	: 33
Ribs	: 24	In each hand	: 32
In each leg	: 30	Chest bone	: 1
Waist (hip)	: 2		

Did you see any bones in the pinna and nose in the human skeleton you have observed?

Soft bones are seen in nose and ear. These are called cartilage.

Cartilages are more in number in children.

### For movement and locomotion

Try to do the following activities by tying a long stick behind your elbow.

- Act as if you are eating food by lifting the hand tied with the stick.
- Show with the same hand how you brush your teeth.

Why can't you do these activities?

What is the arrangement in your hand to help you perform these actions easily?




Move your palms and elbows. Can you move both in the same way? Examine the ways in which different parts of the body like neck, knee and fingers can be moved.

Body part	Movement/Characteristics
● palm	● Can move up and down
● elbow	●
● knee	●
● neck	●
● wrist	●

- Which of these can be moved only in one direction?
- Which can be moved in both directions?
- Which parts can be moved in many directions?

Analyse the table and record your findings.

Joints connect bones together and help us in various movements and actions.

Name of joint	Body parts	Characteristics
Ball and socket joint	Shoulder joint Hip joint 	Freely movable. The ball of one bone rotates in the socket of the other bone.
Hinge joint	Elbow Knee 	Like a hinge, can be moved only in one direction.
Pivot joint	Neck (Part where the skull and the anterior part of the vertebral column joins). 	A bone turns in opposite directions at an axis in the same plane.

### Let us construct models

1. Hinge joint: Construct a model showing the movement of the knee joint with two flat wooden pieces and a hinge.
2. Ball and socket joint: Construct a model of the shoulder joint using one ice cream ball, a small ball and a stick.
3. Pivot joint: Observe the movement of lids of certain powder tins, lotions etc., and construct a model of the pivot joint by using these lids.



- What would have been our difficulties if there were no joints in the human body?

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.....

- How can we perform the following actions if the neck bones are immovable? Try.
  - a. Walking
  - b. Reading
  - c. Looking at the person sitting behind you.

You have learnt about the bones and their functions in the human skeleton. What changes should be made in the diagram you first drew?

Modify the diagram and include it in the science diary.

### Let's protect the bones

- Have you ever had a bone fracture?
- When do the bones get fractured?
- How do you know that your bone is fractured?

### Bone fracture

Strong impact can cause the breaking of bones or appearance of fissures in the bones. Breaking of bones is called fracture. Sometimes the position of the bones is changed. This is called dislocation.

Bone fractures can be identified by examining the following symptoms.

- Pain in the injured part.
- Difficulty in moving the injured part.
- Swelling of the affected part.
- A slight bending at the site of injury.
- Structural change with respect to a similar bone.

## When a bone is fractured

A person whose bone is fractured should be taken immediately to a hospital. What all things are to be taken care of before taking the person to a hospital?

The broken parts should not be moved. Tying splints will be helpful.

### Splint

Splint is a strong support made of wood, plastic or metal. Tying the broken part using a splint helps to block its movement.

Try to practice tying splint, using a wooden scale.

You have familiarised yourselves with different types of skeletons and joints. What care should be taken for the health of bones?

What precautions should be taken to prevent fracture of bones? Conduct a discussion. Exhibit the main suggestions in the classroom.

Collect the pictures of skeletons of different animals and prepare an album.



### Significant learning outcomes

The learner can

- recognise the importance of exoskeleton and endoskeleton and explain their functions.
- give examples for organisms with endoskeleton and those with exoskeleton.

## Hardness of bones



Hardness of bones is due to the presence of calcium phosphate. So calcium and phosphorus are essential for the growth of bones. During the course of growth, minerals like calcium and phosphorus harden bone. In infants, the bones are not very hard because the deposition of calcium phosphate is less. In adults calcium required by the body is absorbed from the bones. This causes weakening of bones. Vegetables like ash gourd, snake gourd etc., fruits like guava, jambu etc., egg, milk and small fishes are rich in calcium.

- identify joints and explain their movements.
- construct models of joints.
- identify and practice the first aid to be administered when bone fracture occurs.

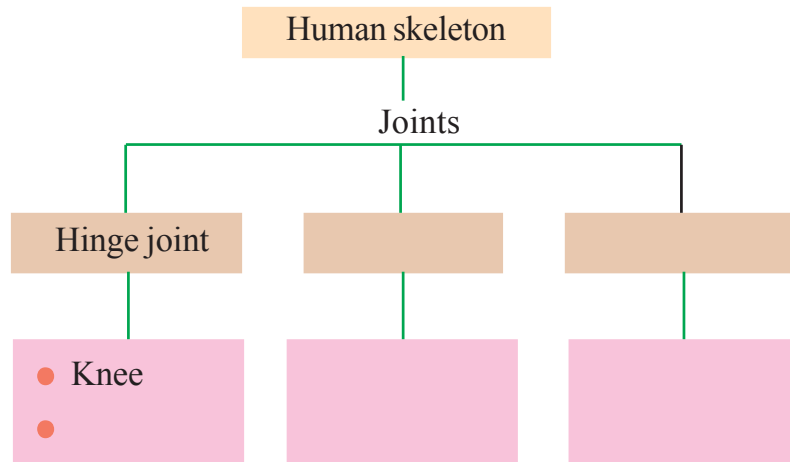


Let us assess

1. List out the characteristics of exoskeleton and endoskeleton.

Exoskeleton	Endoskeleton
●	●
●	●
●	●

2. Complete the concept map.

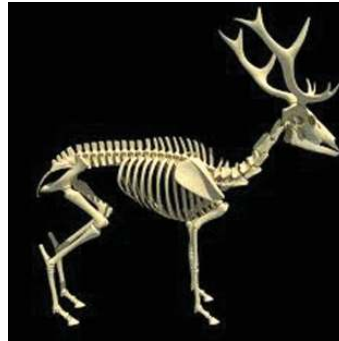


Extended activities

1. The pictures show the skeletons of a bird and an animal. What are the resemblances between their skeletons and human skeleton? Find out

using the hints.

- skull
- ribs
- bones in the legs and hands
- vertebral column



2. Observe the movements of the limbs of cow, dog and cat. Compare it with the movement of our hands and legs.