SCIENCE (Term - I)

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Unit 1 Measurements

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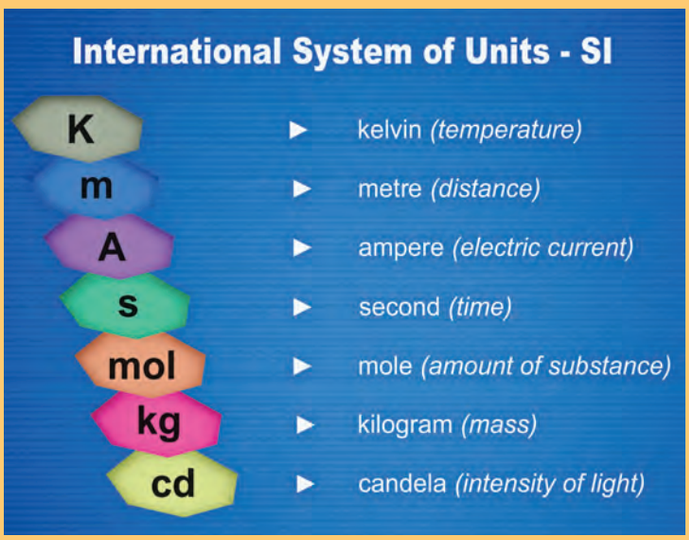
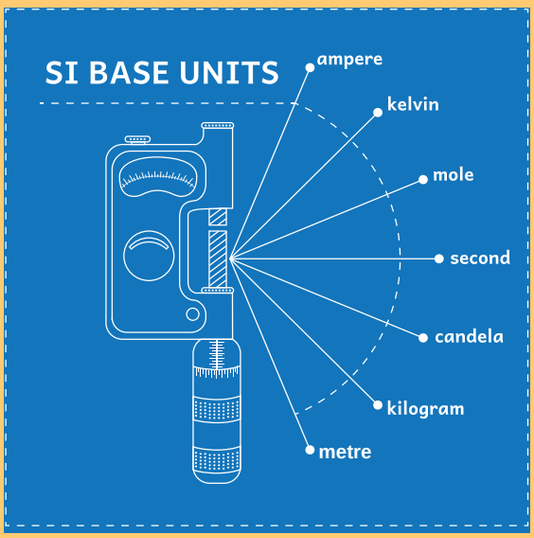




Learning Objectives

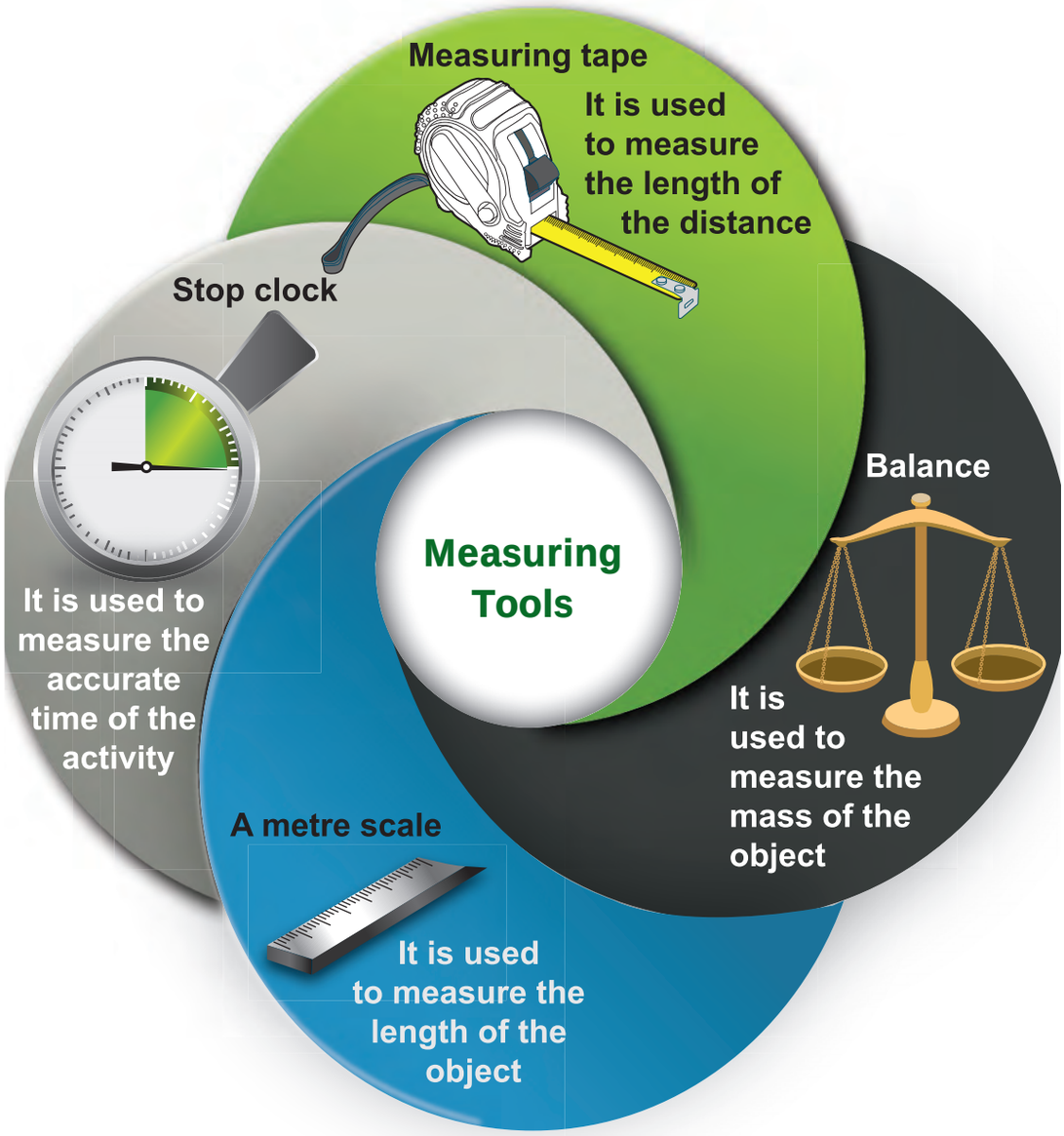
- To understand the need for measurement in daily life.
- To define length, mass and time.
- To evaluate the values of some physical quantities in terms of their units and sub-units.
- To identify zero error and parallax error.
- To construct measuring tools (models).
- To solve problems based on conversion of units.

Introduction

- Your brother asks you what your height is. How will you measure it and tell him?
- Your friends decide to play kabbadi. How will you measure and draw the border lines?
- Your father gives you a bag and asks you to get potatoes. How will you ask the shopkeeper?
- Your mother gets milk from the milkman daily. How much does she get?
- How long will it take to reach your school from your house?
- How does the shopkeeper measure kerosene while selling it?

To do the tasks given above, we need to know about measurement. The comparison of unknown quantities with some known quantities is known as measurement. Measurement of a quantity has two parts: a number and a unit.

To measure the quantities we need measuring tools. What are the measuring tools that you know? Which of those tools you will use to do the tasks listed above and the similar ones?



We hear the terms related to measurement like weight, kilogram, litres, millilitres, kilometre, length, distance etc. In this chapter let's study in detail about length, mass and time and the necessity to measure them.

1.1 Length

What is length? The distance between one point and the other desired point is known as length. It may be the distance between the edges of your book or the corners of the football ground in your school or even from your home to school.

The standard unit of length is 'metre'. It is represented by the letter 'm'. Very small lengths can be measured in millimetre (mm) and centimetre (cm). Larger measures, say height of a building, length of a banner or height of a lamp post are all measured in metre. How to express still longer lengths say, distance between two cities or villages or distance between your school and home? It is expressed in kilometre (km).

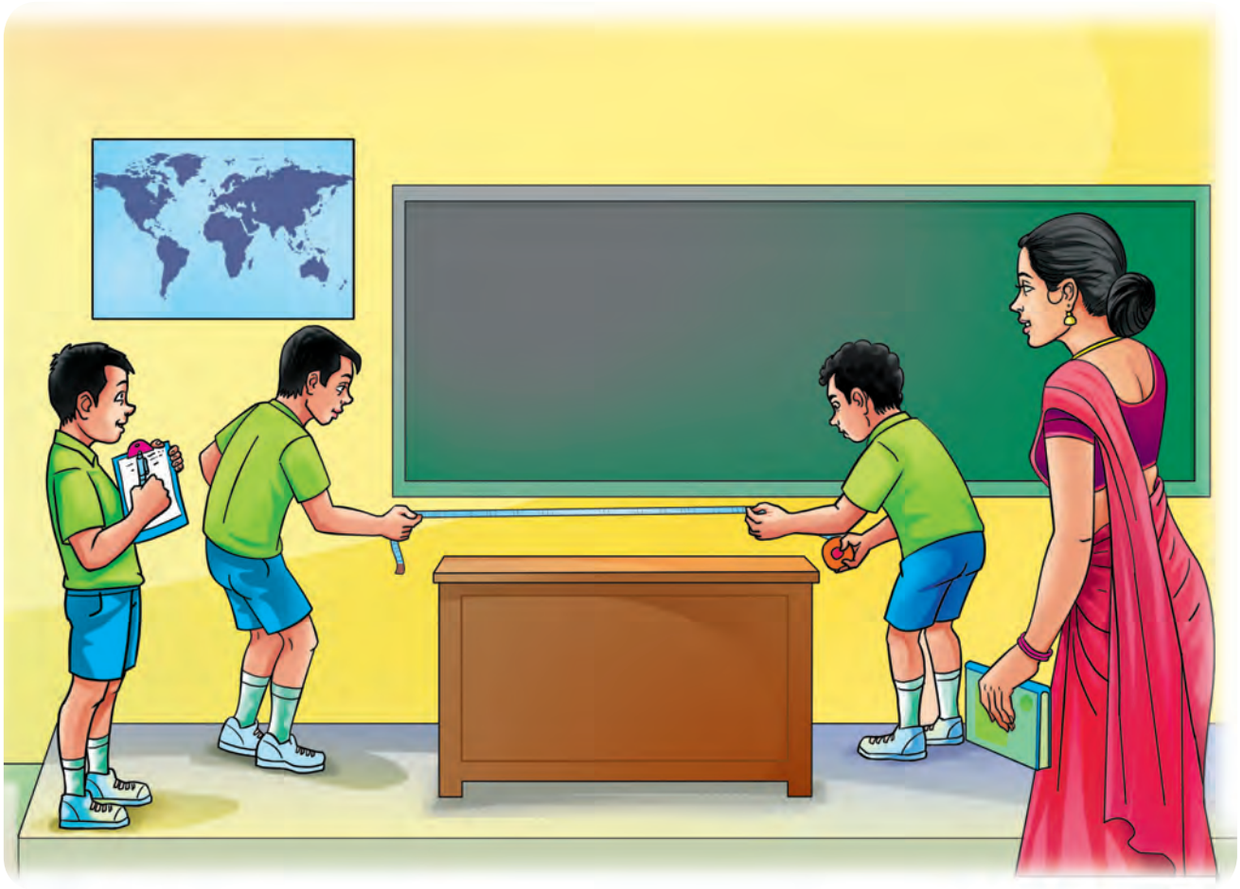
Know the unit of length

1 km (kilometre) = 1000 m (metre)
1 m (metre) = 100 cm (centimetre)
1 cm (centimetre) = 10 mm (millimetre)

Think: Can you express 1 km in cm?

Let us measure the length of your pencil.

1. Take the meter scale
2. Notice the lines with marking 1,2,3,4 ... till 15 (for smaller scales) or 30 (bigger scales). The distance between two numbers (say between 1 and 2) denotes a centimetre (written as 'cm').

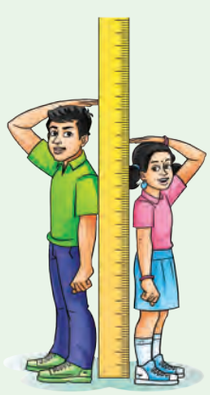


3. Notice, in between 1 and 2 there will be smaller markings. If you count, there will be 9 such lines. The distance between any two consecutive smaller markings within a 'cm' denotes a millimetre (written as 'mm').

Why do we need SI Units?

Activity 1

Form a group of 5 members. Select one person and let others measure her/his height individually using hand span and cubit. Compare your answers with others. Do you find any difference? Why? Now you all stand in front of a wall and mark your height on the wall. Measure your height with a scale. What differences do you infer?



From the activity 1, you see that your measurement is different from that of your friends. Similarly different measuring units are used in different countries.

For the sake of uniformity, scientists all over the world have adopted a common set of units to express measurements. This system is called as the International System of Units or SI Units.

- SI unit for length is metre
- SI unit for mass is kilogram
- SI unit for time is second
- SI unit for area is m^2
- SI unit for volume is m^3

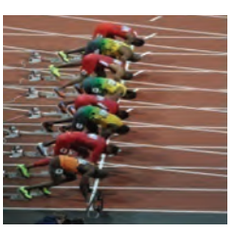
Prefix

Multiples and sub-multiples of SI units are given as prefixes. Some prefixes are given in the table.

Multiples and Sub-multiples of SI Units

Prefix	Abbreviation	Submultiple / Multiple	For Metre
Deci	d	Submultiple: 1/10	10 decimetre = 1 metre
Centi	c	Submultiple: 1/100	100 centimetre = 1 metre
Milli	m	Submultiple: 1/1000	1000 millimetre = 1 metre
Nano	n	Submultiple: 1/1000000000	1000000000 nano metre = 1 metre
Kilo	k	Multiple: 1000	1000 metre = 1 kilometre

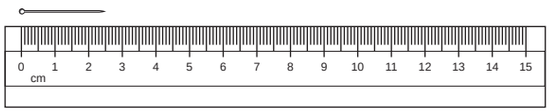
Measure the objects/event given in the table using suitable measuring units and express them with suitable multiple and submultiples.

Picture	Activity	Measuring Unit m / kg / s	Multiple / Submultiple
	Length of tip of pencil.	metre	millimetre
	Length of the pen.		
	Distance between two cities.		
	Mass of dry fruits in table.		
	Mass of ornaments.		
	Time taken to finish 100 m race.		

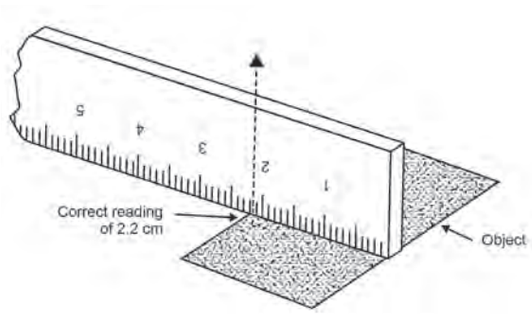
Corrective measures for Measurement

Measurement has to be accurate and the approach has to be correct always. In our day to day life approximation may not have much impact. But it has a large impact in scientific calculations. For example, if the curvature of key (lock and key) is changed even by 1 mm, the lock would not open. So, measurements have to be accurate in scientific calculations. Let us look at some common mistakes that occur while using a scale.

To measure the length of a pin



- The head of the pin has to coincide with '0' of the scale.
- Count the number of centimetre and from there count the number of finer divisions. The count of the division is in 'mm'
- In the above example the length of pin is 2 cm and 6 mm.
- Write the correct submultiple completely.



Note:

- Always keep the object parallel to the scale.
- Start the measurement from '0' of the scale.

Activity 2

Aim: To find the length of a curved line using a string.

Materials needed: A meter scale, a measuring tape, a string and a sketch pen

Method:

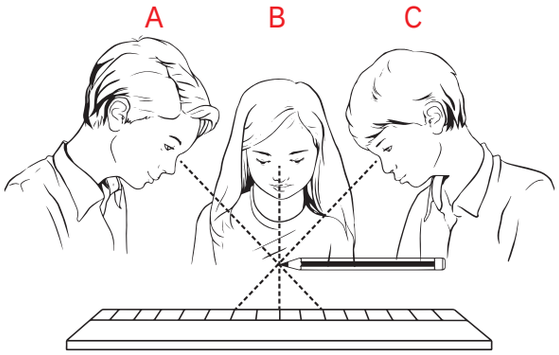
- Draw a curved line AB on a piece of paper
- Place a string along the curved line. Make sure that the string covers every bit of the curved line.
- Mark the points where the curved line begins and ends on the string.
- Now, stretch the string along the length of a meter scale and measure the distance between the two markings of the string and note it.
- This will give you the length of a curved line.

Find the length of a banana.

Parallax Error

Parallax is a displacement or difference in the apparent position of an object viewed along two different lines of sight.

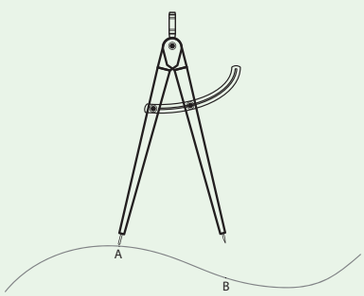
Correct position of the eye is also important for taking measurement. Your eye must be vertically above the point where the measurement has to be



taken. In the above representation, to avoid parallax error, reading from B will be correct. From positions 'A' and 'C', the readings will be different and erroneous.

Activity 3

Aim: Measuring the length of a curved line using a divider.



Draw a curved line AB on a piece of paper.

Separate the legs of the divider by 0.5 cm or 1 cm using a ruler.

Place it on the curved line starting from one end. Mark the position of the other end. Move it along the line again and again cutting the line into number of segments of equal lengths. The remaining parts of the line can be measured using a scale. Count the number of segments.

Therefore, the length of the line = (Number of segments × Length of each segment) + Length of the left over part.

1.2 Mass

Mass is the measure of the amount of matter in an object. The SI unit of mass is kilogram. It is represented by 'kg'. Weight is the gravitational pull experienced by matter. The weight is directly proportional to the mass on the Earth's surface.

Hold a sheet of paper in one hand and a book in other hand. Which hand feels the heaviness? The mass of the book is more than that of a single sheet of paper. Therefore, the pull on the book is more than that is on the paper. Hence, our hand needs more force to hold a book than a piece of paper. The force what we experience is called as 'heaviness'.

DO YOU KNOW?

On the moon where the gravitational force is less than that is on the earth, the weight will reduce but the mass will remain same. The moon's gravitational pull is one sixth of the earth's pull. Thus objects weigh six times lighter on the Moon than on the Earth.

What is your mass? If you measure it in grams, that would be a huge number. Is it not? So, it is expressed in kilogram. Bigger weights are measured in tonne or metric tonne.

1000 milligram	=	1 gram
1000 gram	=	1 kilogram
1000 kilogram	=	1 tonne

Beam Balance

We use beam balance to measure mass. A beam balance works by comparing the mass of an object to that of known mass (called a standard mass).

Activity 4

Construct your own beam balance using two scrapped coconut shells, strings or twines, thick cardboard as frame and a little sharpened pencil as index needle.

What can you achieve?

1. Find which object is heavier.
2. Find the approximate weight of lighter things like leaves, piece of papers etc.

Electronic Balance

An electronic balance is a device used to find the accurate measurements of weight. It is used very commonly in laboratories for weighing chemicals to ensure a precise measurement of those chemicals for using in various experiments. Electronic balances may also be used to weigh food, other grocery items, as well as jewellery.

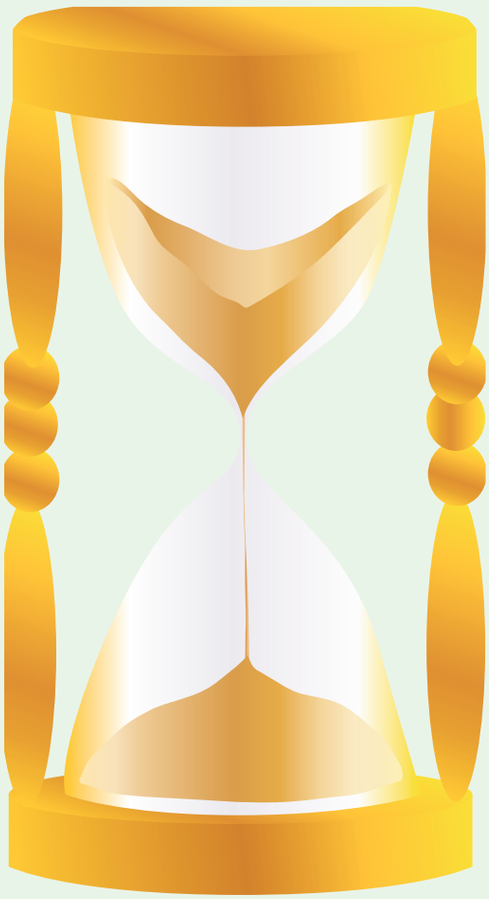
1.3 Time

Day changes into night and night in to day. Seasons also change. We know time also changes. How do we measure change of time? Clocks are used to measure time. You know how to read a clock face and note the time. You can also use your pulse to measure the time roughly. Count the number of pulses. That can tell you the time elapsed.

Activity 5 : Ask four or five of your friends to run a race from one end of the school to the other end. Mark the starting point and the ending point. Using your pulse (or counting by counting 1,2,3,.....) count the time taken by each of them to complete the race. Check who is fast?

DO YOU KNOW?

In the earlier days, people used sand clock and sundial to measure the passage of time during day time. The shadow cast by a stick can be used to estimate time. A vessel having a small hole is filled with sand and it is used as a clock. The sand in the vessel is allowed to come down and it is used to estimate the time.



Sand Clock

These are rough methods for counting passage of time. We can use electronic clock, stopwatch and other instruments to count even smaller durations of time.

Fast Facts

An odometer is a device used for indicating distance travelled by an automobile.

The metric system or standard set of units was created by the French in 1790.

A ruler or scale, used now a days to measure length, was invented by William Bedwell in the 16th century.

A standard metre rod made of an alloy of platinum and iridium is placed at the Bureau of Weights and Measures in Paris. National Physical Laboratory in Delhi has a copy of this metre rod.

One kilogram is equal to the mass of a certain bar of platinum-iridium alloy that has been kept at the International Bureau of Weights and Measures in Sèvres, France since 1889.

Numerical Problems

Look at a meter scale carefully and answer the following.

- How many millimieter divisions are there in a centimeter?
- How many centimeter divisions are there in a meter?

Complete the following.

- 7875 cm = _____ m _____ cm
- 1195 m = _____ km _____ m
- 15 cm 10 mm = _____ mm
- 45 km 33 m = _____ m.

Some open ended questions

- During your school sport day, it is planned to conduct a mini marathon race within the school campus. They decided that the running distance be 2 kilometres. Is it possible to have a school campus with the circumference of 2km? Discuss with your friends, how big the campus should be. Give other options if it is not a big campus.
- Is the distance in the sea also calculated in kilometres? How is it possible to calculate the distance in sea water? Explore!
- We know that the distance between celestial bodies is calculated in terms of light year. Light year is the distance travelled by light in one year. Now without calculator find how many kilometres light would have travelled in a year. Get the speed of light from your teacher.
- We see that the distances between Chennai and Madurai is written as '462' kms. But from which point to which point is this distance calculated?. As we are science students we need to know it with the precision. Is it between the two bus stands? Or between the two railway stations? Discuss and figure it out. Check your answers with your teacher.
- A person needs to drink two litres of water a day. Note down how much water you drink each day? Make a rough calculation and check if you are drinking the required amount of water.

Points to Remember

- The comparison of an unknown quantity with some known quantity is known as measurement.
- All physical quantities have standard units for the sake of uniformity.
- Length, mass and time are some of the fundamental physical quantities.
- The SI units are:

Length	-	metre
Mass	-	kilogram
Time	-	second

- While using a ruler, the accurate measurement can be arrived by avoiding three types of possible errors.
- Electronic balance is an instrument which provides accurate measurement of mass correct upto milligram.

Evaluation

ATIPDL

I. Choose the correct answer.

1. The height of a tree can be measured by

   a) metre scale c) plastic ruler

   b) metre rod d) measuring tape

2. Conversion of 7 m into cm gives _____

   a) 70 cm c) 700 cm

   b) 7 cm d) 7000 cm

3. Quantity that can be measured is called _____

   a) physical quantity c) unit

   b) measurement d) motion

4. Choose the correct one

   a) km > mm > cm > m

   b) km > mm > m > cm

   c) km > m > cm > mm

   d) km > cm > m > mm

5. While measuring the length of an object using a ruler, the position of your eye should be

   a) left side of the point.

   b) vertically above the point where the measurement is to be taken.

   c) right side of the point

   d) any where according to one's convenience.

II. Fill in the blanks.

1. SI Unit of length is _____.
2. 500 gm = _____ kilogram.
3. The distance between Delhi and Chennai can be measured in _____.
4. 1 m = _____ cm.
5. 5 km = _____ m.

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

1. We can say that mass of an object is 126 kg.
2. Length of one's chest can be measured using metre scale.
3. Ten millimetre makes one centimetre.
4. A hand span is a reliable measure of length.
5. The SI system of units is accepted everywhere in the world.

IV. Complete the analogy.

1. Sugar : Beam balance :: Lime juice :___?
2. Height of a person : cm :: Length of your sharpened pencil lead :___?
3. Milk : Volume :: Vegetables :___?

V. Match the following.

1. Length of the fore arm	a. metre
2. SI unit of length	b. second
3. Nano	c. 10^3
4. SI Unit of time	d. 10^{-9}
5. Kilo	e. Cubit

VI. Arrange the following in the increasing order of unit.

1 Metre, 1 centimetre, 1 kilometre, and 1 millimetre.

VII. Answer in a word or two.

1. What is the full form of SI system?
2. Name any one instrument used for measuring mass.
3. Find the odd one out.

   kilogram, millimetre, centimetre, nanometre

4. What is the SI Unit of mass?
5. What are the two parts present in a measurement?

VIII. Find the answer for the following questions within the grid.

1. 10^{-3} is one _____
2. SI Unit of time is _____

3. Cross view of reading a measurement leads to _____
4. _____ is the one what a clock reads.
5. _____ is the amount of substance present in an object.
6. _____ can be taken to get the final reading of the recordings of different students for a single measurement.
7. _____ is a fundamental quantity.
8. _____ shows the distance covered by an automobile
9. A tailor uses _____ to take measurements to stitch the cloth.
10. Liquids are measured with this physical quantity.

IX. Answer briefly.

1. Define measurement.
2. Define mass.
3. The distance between two places is 43.65 km. Convert it into metre and cm.
4. What are the rules to be followed to make accurate measurement with scale?

X. Solve the following.

1. The distance between your school and your house is 2250 m. Express this distance in kilometre.
2. While measuring the length of a sharpened pencil, reading of the scale at one end is 2.0 cm and at the other end is 12.1 cm. What is the length of the pencil?

XI. Answer in detail.

1. Explain two methods that you can use to measure the length of a curved line.

A		P		L								R		K
C		O		E								O		S
M		K		N								R		I
P		R		G								R		T
R	H	E	S	T	E	D	L	L	I	T	R	E	D	A
L		T		H						D		H		P
O		E		O					N			K		E
A		M		S				O				R		V
V		I		E			C					T		O
E		L		K		E						S		S
R		L		I	S				T			K		H
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E		Z		D		E	S	K	P	G	I	W	M	F
Z	T	D	K	H			O	D	O	M	E	T	E	R

2. Fill in the following chart.

Property	Definition	Basic Unit	Instrument used for measuring
Length			
Mass			
Volume			
Time			

ICT CORNER

AREA & PERIMETER

Lets play with Area N Perimeter

Steps:

- Access the application by typing **Area N Perimeter** or install with the help of the link given below or the given QR code
- Open the Application and click **START** button.
- You can see the field whose area is to be measured. Drag and put the tiles on field.
- Use the (+) and (-) to find out the area of the given field.
- Click the **CHECK** button to check your answer.
- You can view your whole results by clicking the **RESULT** button.

Step1

Step2

Step3

Step4

URL:

https://play.google.com/store/apps/details?id=com.bodhaguru.AreaNPerimeter

*Pictures are indicative only

Unit 2 Force and Motion

ATSKF9

Learning Objectives

- To identify that push or pull or both are involved when there is a motion.
- To understand that some forces are contact forces and some are non-contact forces.
- To know that when a force is applied, it can make things move, change the direction or change its shape and size.
- To distinguish between rest and motion and understand that they are relative.
- To infer motion is caused by application of force.
- To classify different types of motion.
- To deduce the definition of speed.
- To understand and use the unit of speed.
- To distinguish uniform and non-uniform motion.
- To compute time, distance and speed.

Introduction

We have studied in our earlier classes that push or pull results in some motion of the object. When we open the door or kick a football or lift our school bag, motion is involved and there is some push or pull.

2.1 Motion and Rest

What is rest? What is motion?

Suppose there is a book on your table right in the middle. Is the book moving? You will say it is not moving; it is at rest. If you push the book to one side of the table to clear the space for keeping your notebook, then you will say the book is moving. When the book was at the same place with respect to the table, it was at rest; but when it was pushed from one place on the table to another place, it was moving.

Activity 1

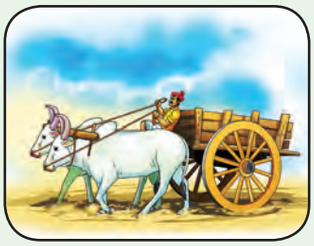
Can you identify whether it is push or pull that results in motion in the following cases?

Push / Pull

Push / Pull

Push / Pull

Push / Pull



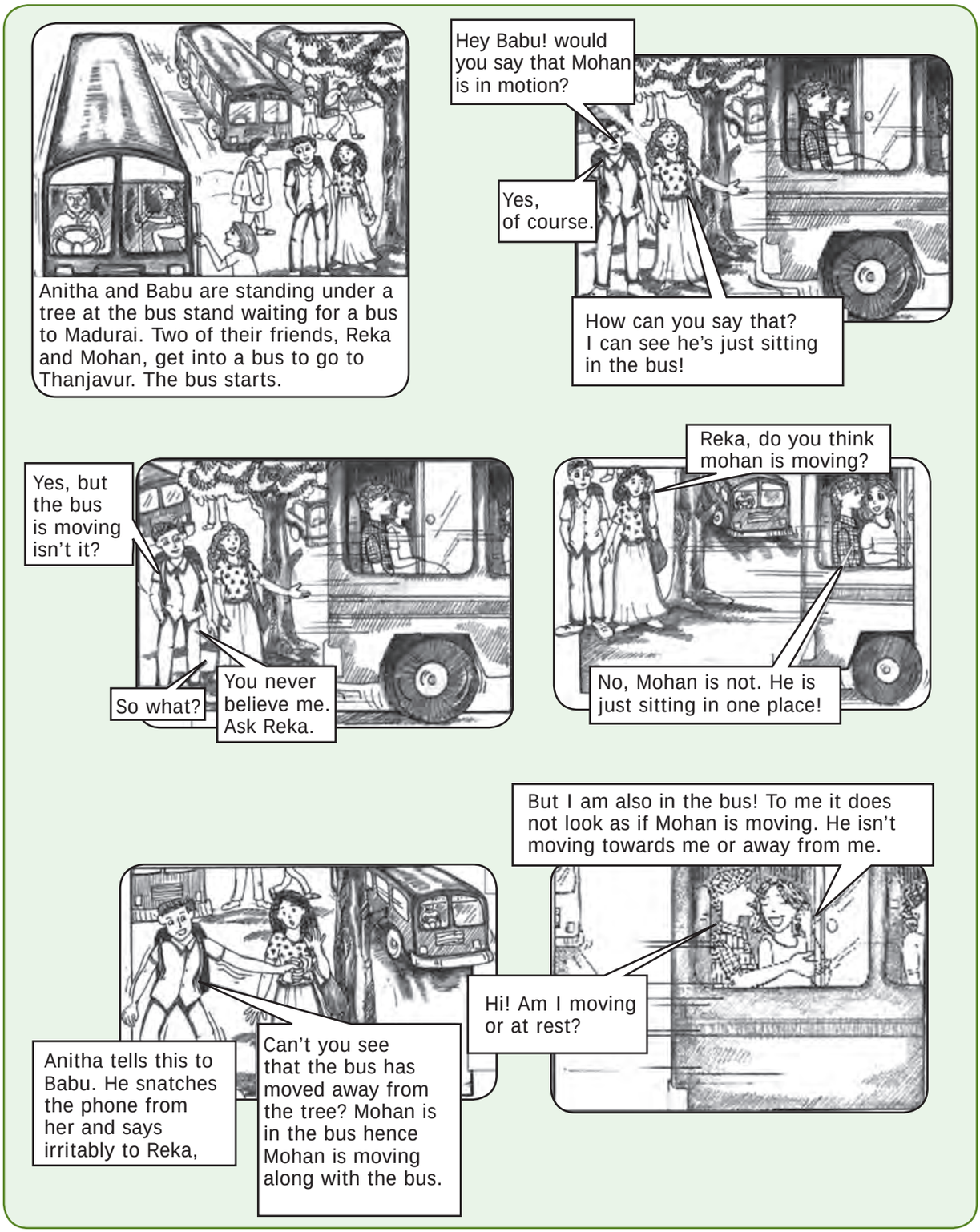
Push / Pull

Push / Pull

When there is a change in the position of an object with respect to time, then it is called motion. If it remains stationary it is called rest.

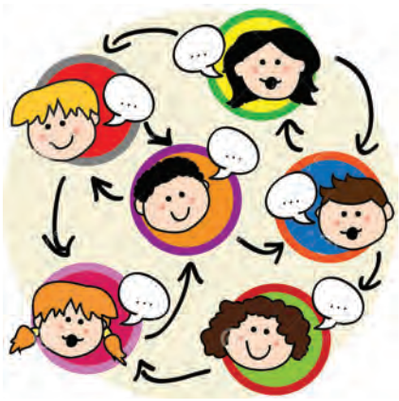
Is Mohan in motion?

Observe the following pictures and say whether Mohan is in motion or at rest



Discuss: Who is correct? Is Mohan really in motion?

We can clearly say that both Reka and Babu are correct. From the point of view of Babu, Mohan along with the bus is in motion; but for Reka who is sitting beside him, he is at one place; therefore stationary. So, according to Babu, Mohan is in motion; Mohan is at rest from Reka's observation. Can you think any other examples?



Answer by observing the situation in the picture

Event 1: The man in the boat is **moving** with respect to the bank of river. He is at **rest** with respect to the boat.

Event 2:

The girl on the swing is _____ with respect to the seat of the swing.

She is _____ with respect to the garden.

Event 3: Nisha is going to her grandmother's house by bicycle. Sitting on the bicycle, Nisha is _____ with respect to the road.

She is _____ with respect to the bicycle.

Take the case of a book on a table at rest. Is it really without any motion? We know that Earth is rotating on its axis; therefore the table along with the book must be rotating. Is it not? We are also moving along with the earth. Therefore, from the point of view of the ground on which we stand, the book is at 'rest'. Similarly, while travelling in a bus, we feel that the poles and trees seem to move backwards, and the things inside the bus are stationary.

An object may appear to be stationary for one observer and appear to be moving for another. An object is at rest in relation to a certain set of objects and moving in relation to another set of objects. **This implies that rest and motion are relative.**

Activity 2

Moon or Cloud?

Observe the moon on a windy night with a fair bit of cloud cover in the sky. As the cloud passes in front of the moon you sometimes think it is the moon which is moving behind the cloud. What would you think if you were to observe a tree at the same time?

Aryabatta, an ancient Indian astronomer, said, "As the banks of the river appear to move back to a person in a boat floating gently in a river, the night sky studded with stars appear to move from the east to the west and so the Earth rotates from the west to the east."

How things move?

When we kick a ball it moves. When we push the book on the table, it moves. When a bullock pulls, the cart moves. Motion occurs when an object is pulled or pushed by an agency.

In our daily life, we pull out water from the well using bucket. Animals pull a bullock cart. It is a person or animal, that is an animate agency that does the pushing or pulling.

Sometimes we see a tall grass in the meadow dancing in the wind or a piece of wood moving down a stream. What pushes or pulls them? We know that blowing wind and flowing water is the cause. Sometimes the push or pull can be due to the inanimate agency.

Forces are push or pull by an animate or inanimate agency.

Contact, Non-contact Forces

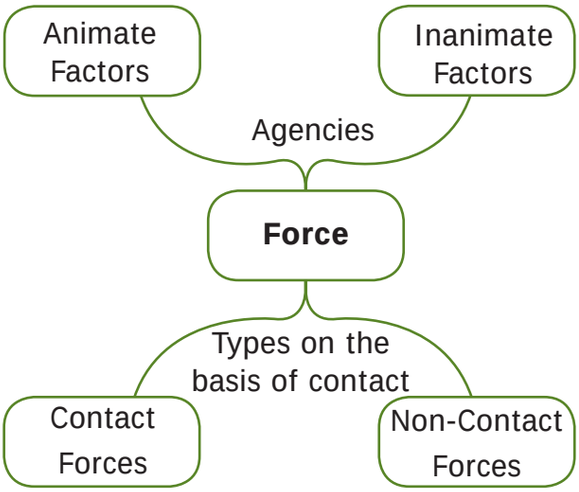
Forces can be classified into two major types; contact and non-contact forces.

Wind making a flag flutter, a bullock pulling a cart are contact forces. Magnetism, gravity are some examples of non-contact forces.

In all the above cases, the force is executed by touching the body. So, this type of forces are called contact forces.

Mysteriously, ripen coconut falls to the ground. What pulls it to the ground? We would have heard about 'force of gravity' of Earth. Gravity pulls the ripen coconut from the tree to the ground.

When we bring a magnet near a small iron nail, the nail jumps into the air and sticks with the magnet. Observe that the magnet and the nail did not touch each other. Still, there was a pulling force that made the nail to jump towards the magnet. In these two examples, the force is applied without touching the object. Such forces are known as non-contact forces.

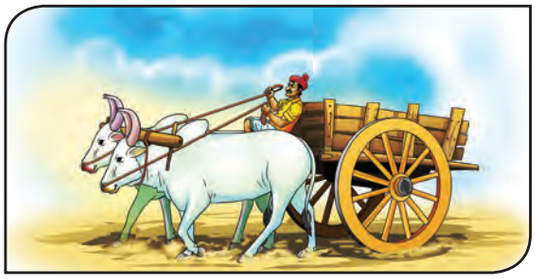


What happens when we apply a force on an object?

What happens when you apply a force on an object? Say, you push a book on the table. The book moves. Application of force in an object results in motion from a state of rest.

What happens when a batsman hit a ball? The ball is already in motion, but with the strike, the speed of the ball increases. Moreover the direction of the ball changes. Application of force on an object results in a change in its speed and change in its direction.

When we crush a balloon or press roti dough or pull a rubber band, the shape of the object changes on application of force. Application of force in object results in expansion or contraction.



Look at this picture. The person is applying force to stop the cart from moving. When the force is applied against the direction of the motion, the speed can be reduced, or even the motion is stopped completely. Discuss what happens when you apply break in a speeding bicycle.

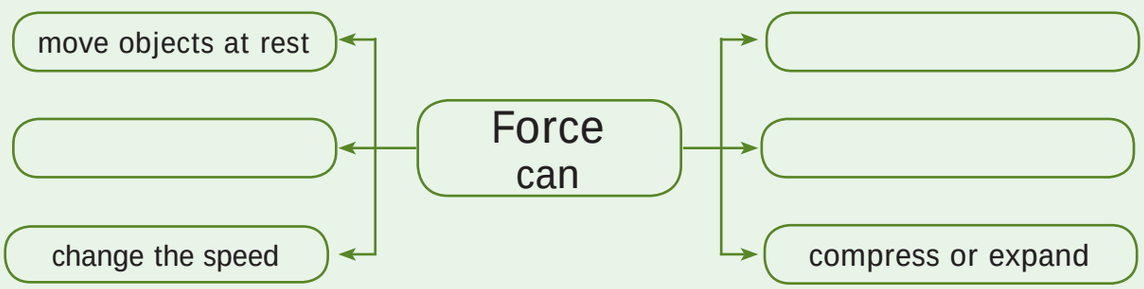
In a nutshell, we can say that the applied force is an interaction of one object on another that causes the second object to move from rest, speed up, slow down, stop the motion, change the direction, compress or expand.

Forces can

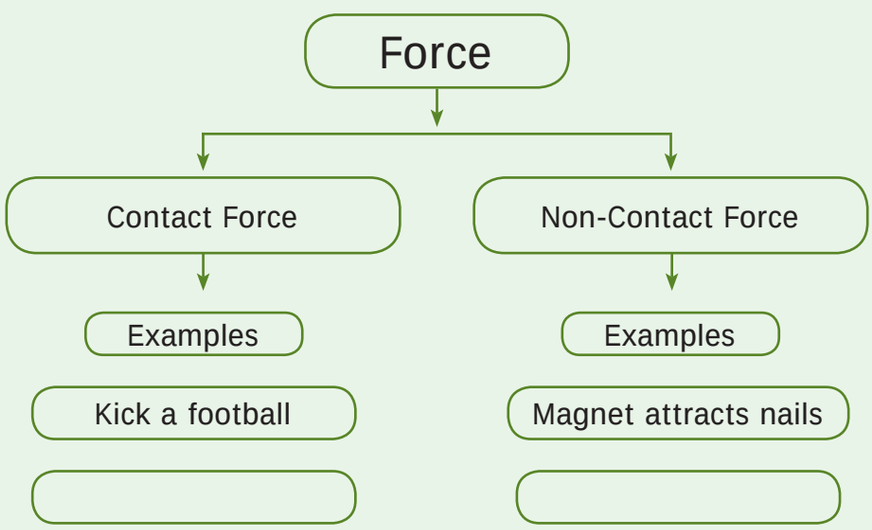
1. Change the states of a body from rest to motion or motion to rest.
2. Either change the speed or direction or both of the body.
3. Change the shape of the body.

Activity 3

Fill in the empty spaces



Can you give example for contact and non-contact forces?



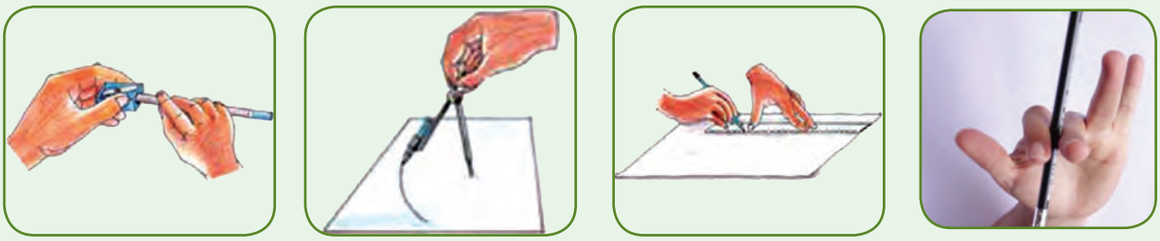
2.2. Types of motion

Activity 4

Play with pencil

Do what Shanthi did...

(i) Shanthi took a pencil and sharpened it with a sharpener. (ii) Then she drew a circle using the pencil and a compass. (iii) Later she took her ruler (scale) and drew a straight line in another paper. (iv) Then she kept the pencil between her fingers and moved it back and forth.



Now, look at the motion of the pencil in all these four cases. How was it?

(i) In the first case, the pencil **rotated in its axis.**

(ii) In the second case, it went in **a circle.**

(iii) In the third case, the pencil travelled in **a straight line.**

(iv) In the fourth case, the pencil tip moved **back and forth,** that is it oscillated like a swing.

We can say that the motion of the pencil was rotational, circular, straight line or linear and later oscillatory.

Throw paper aeroplanes or paper dart. Watch its flight path when you throw it at an angle. The path curves i.e the paper flight is moving ahead but its direction is changing while moving. Such paths are called curvilinear.

A fly buzzing around the room is a combination of all these motions and flight path is zigzag.

You can classify the motion according to the path taken by the object.

a. Linear motion - Motion in a straight line. Eg. A person walking on a straight path.

b. Curvilinear motion - Motion of a body moving ahead but changing direction. Eg. Motion of a ball thrown.

c. Circular motion - Motion in a circle. Eg. Swirling stone tied to the rope.

d. Rotatory motion - Motion of a body about its own axis. Eg. Rotating top.

e. Oscillatory motion - A body coming back to the same position after a fixed time interval. Eg. A pendulum.

f. Zigzag (irregular) - The motion of a body in different direction. Eg. People walking in a crowded street.

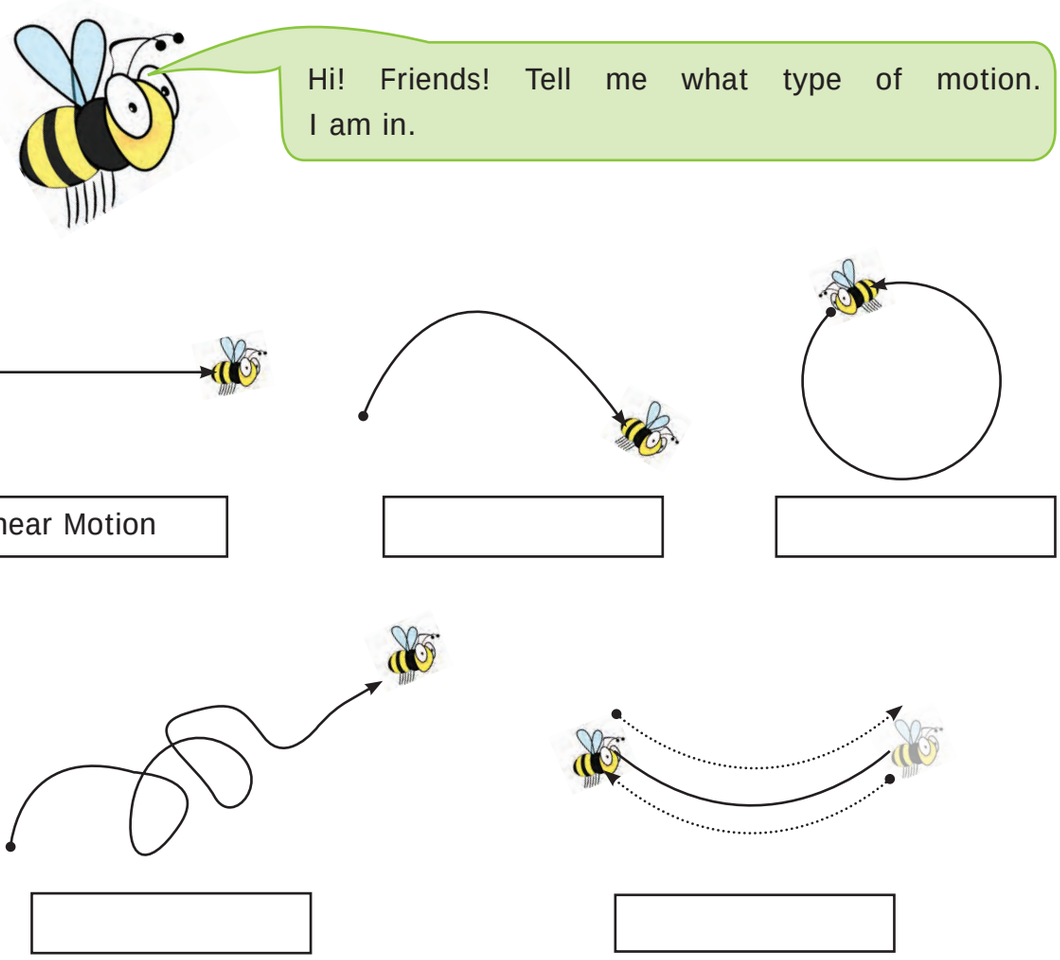
DO YOU KNOW?

Oscillations at Greater Speed

Ask your friend to hold the two ends of a stretched rubber band. Strike it in the middle. Do you see that it oscillates very fast? When the oscillation is very swift, it is called as vibration.

Fast oscillations are referred to as vibrations.

Activity 5



Activity 6

Classify the following according to the path it takes.

Linear, Curvilinear, Circular, Rotatory, Oscillatory, Zigzag (irregular)

• A sprinter running a 100 m race	
• A coconut falling from a tree	
• Striking a coin in a carom board game	
• Motion of flies and mosquitoes	
• Beating of heart	
• Children playing in a swing	
• The tip of hands of a clock	
• Flapping of elephant's ears	
• A stone thrown into the air at an angle	
• Movement of people in a bazaar	
• Athlete running around a track	
• Revolution of the moon around the earth	
• The movement of a ball kicked in a football match	
• Motion of a spinning top	
• Revolution of the earth around the sun	
• Swinging of a pendulum	
• Children skidding on a sliding board	
• Skidding down a playground slide	
• Wagging tail of a dog	
• Flapping of a flag in wind	
• A car driving around a curve	
• Woodcutter cutting with a saw	
• Motion of water wave	
• Motion of piston inside a syringe	
• Bouncing ball	
[Add five motions you observe to this list]	

Periodic and non-periodic motions

Take the case of the hour-hand of a clock. In one day it makes two rounds. Look at a bouncing ball. It bounces a certain number of times for a given time interval or period. Look at the water waves. In a given period that is in a time interval, a fixed number of waves hit the shore. Motion repeated in equal intervals of time is called as periodic motion.

Let us take the example of sapling swing in wind. This motion is not in uniform interval. Such motions are called non-periodic motion.

Revolution of the Moon around the Earth is periodic but not oscillatory. However, the children playing in a swing is both periodic and oscillatory.

DO YOU KNOW?

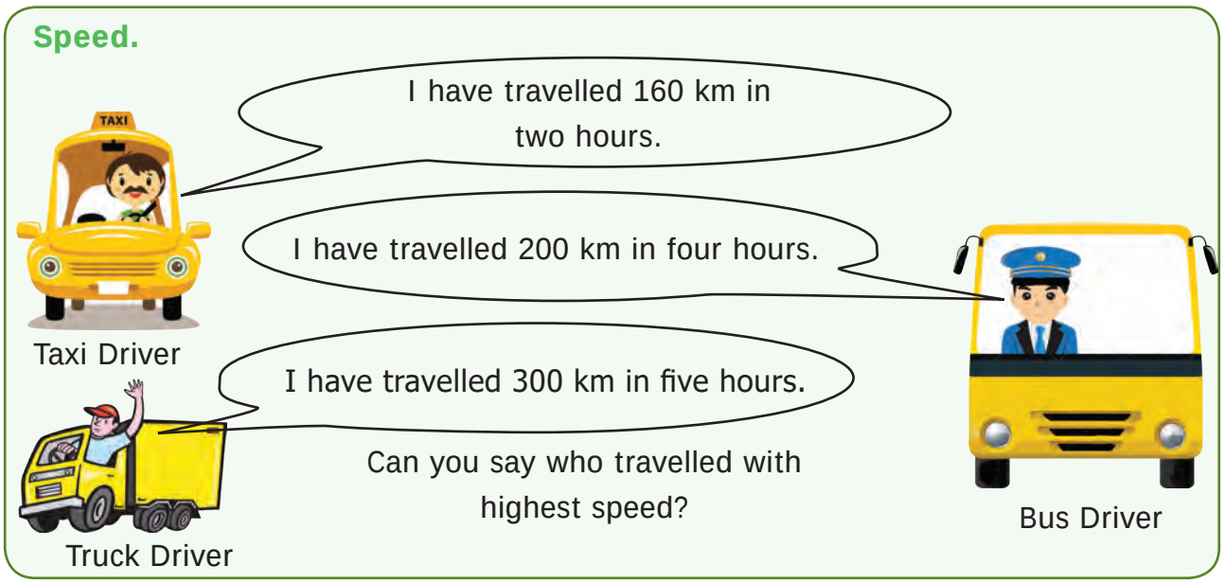
All oscillatory motions are periodic, but not all periodic motion are oscillatory motion.

Fast Vs Slow?

Look at a tall tree. When the wind is gentle, its branches are dancing slowly; but if the gentle wind becomes strong, the branches shake violently, and if the speed increases further, the branch may even break and fall. That is the motion can be slow or fast. Can we say a motion is slow or fast without comparing anything?

Compared to walking, cycling is fast, but a bus is faster than a cycle. The aeroplane is much faster than a bus. So, slow or fast is a relative concept which depends upon the motions we are comparing. Then how do we say a body moves at a particular speed?

Speed.



Can you say who travelled with highest speed?

Let us calculate how long they travelled in one hour?

- Distance travelled by the car in one hour = ____80____ km (160/2)
- Distance travelled by the bus in one hour = _____ km
- Distance travelled by the truck in one hour = _____ km

Have you found out? Say now.

Who is fast? _____,

Who is slow? _____

Have you noticed that saying who is fast or slow is easy when we calculate the distance they travelled in one hour? In other words, you divide the distance travelled by the time taken to get the speed.

The distance travelled by an object in unit time is called speed of the object.

If an object travelled a distance 'd' in time 't' then, its speed is given as:

$$\text{Speed (s)} = \frac{\text{Distance travelled}}{\text{Time taken}} = \frac{d}{t}$$

Suppose a car travels 300 km in one hour. Then we say that the speed of the car is '300 kmph' (We read it as 'three hundred kilometres per hour').

If an object travelled 10 metre in 2 second, then its speed is given as:

Speed (s) = Distance travelled (d) / Time taken (t)

= 10 metre/ 2 second

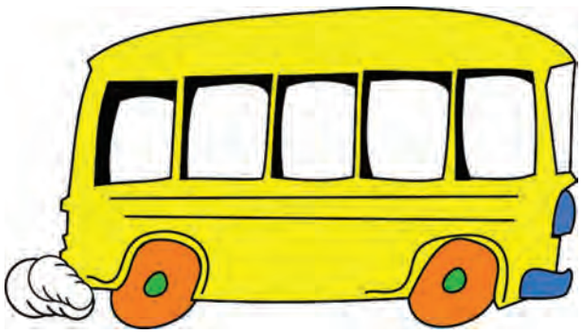
= 5 metre / second

A bus takes three hours to cover a distance of 180 kilometres. Then its speed is given as:

Speed (s) = Distance travelled (d) / Time taken (t)

= 180 kilometre/ 3 hour

= 60 kilometre / hour



Note that metre/second or kilometre/hour comes next to our answer for speed. What is it?

Observe the formula for speed. If we denote the distance in metre and time by second then the unit of speed is metre/second. If we denote the distance in kilometre and time in hour then the unit of speed is kilometre/hour. Sometimes we use units like centimetre/second.

In science we generally use SI units. In SI units the unit of distance is metre and the unit of time is second. So, the SI unit of speed is metre/second.

Let us calculate

1. A car travelled 150 metre in 10 second. What is its speed?
2. Priya rides her bicycle 40 km in two hours. What is her speed?

Our speed...

Let us play a small game. Go to the playground with your friends. Mark 100 metre distance for a race. Conduct a friendly running race and calculate the time taken by them to complete the distance. Now record the time in the table.

S. No	Name of the Student	Distance	Time taken (in seconds)	Speed = $\frac{\text{Distance travelled}}{\text{Time taken}}$	Speed (m/s)
1	Murugesan	100 m	12 S	100 M / 12 S	8.3 m/s
2		100 m			
3		100 m			
4		100 m			
5		100 m			

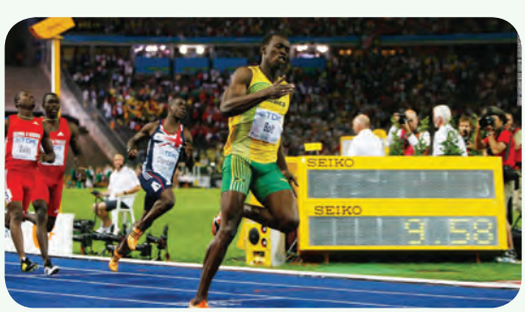
If you know the speed of an object and the time taken by it, then we can compute how much distance it had travelled.

We know that,

$$\text{Speed} = \frac{\text{Distance travelled}}{\text{Time taken}}$$

$$s = d/t \text{ or } st = d$$

Therefore, the distance travelled = speed × time.



Usain Bolt crossed 100 metre in 9.58 seconds and made a world record. If you are able to run faster than him, then Olympic Gold Medal is waiting for you.

If a ship travelled at a speed of 50 kmph and it sailed for five hours, how much distance it has travelled?

Distance = s × t

= 50 kmph × 5 h = 250 km

If we know the speed and distance travelled we can compute the time taken.

$$s = d/t \quad \text{or} \quad t = d/s$$

Time taken = Distance travelled / Speed

Suppose a bus travels at a speed of 50 kmph and has to cover a distance of 300 km, how much time will it take?

t = d/s = 300 km/50 kmph = 6 h.

Compute the following Numerical Problems.

1. If you travel 10 kilometres in 2 hours, your speed is _____ km per hour.
2. If you travel 15 kilometres in 1/2 hour, you would travel _____ km in one hour, and your speed is _____ km per hour.
3. If you run fast at 20 kilometres per hour for 2 hours, you will cover _____ km

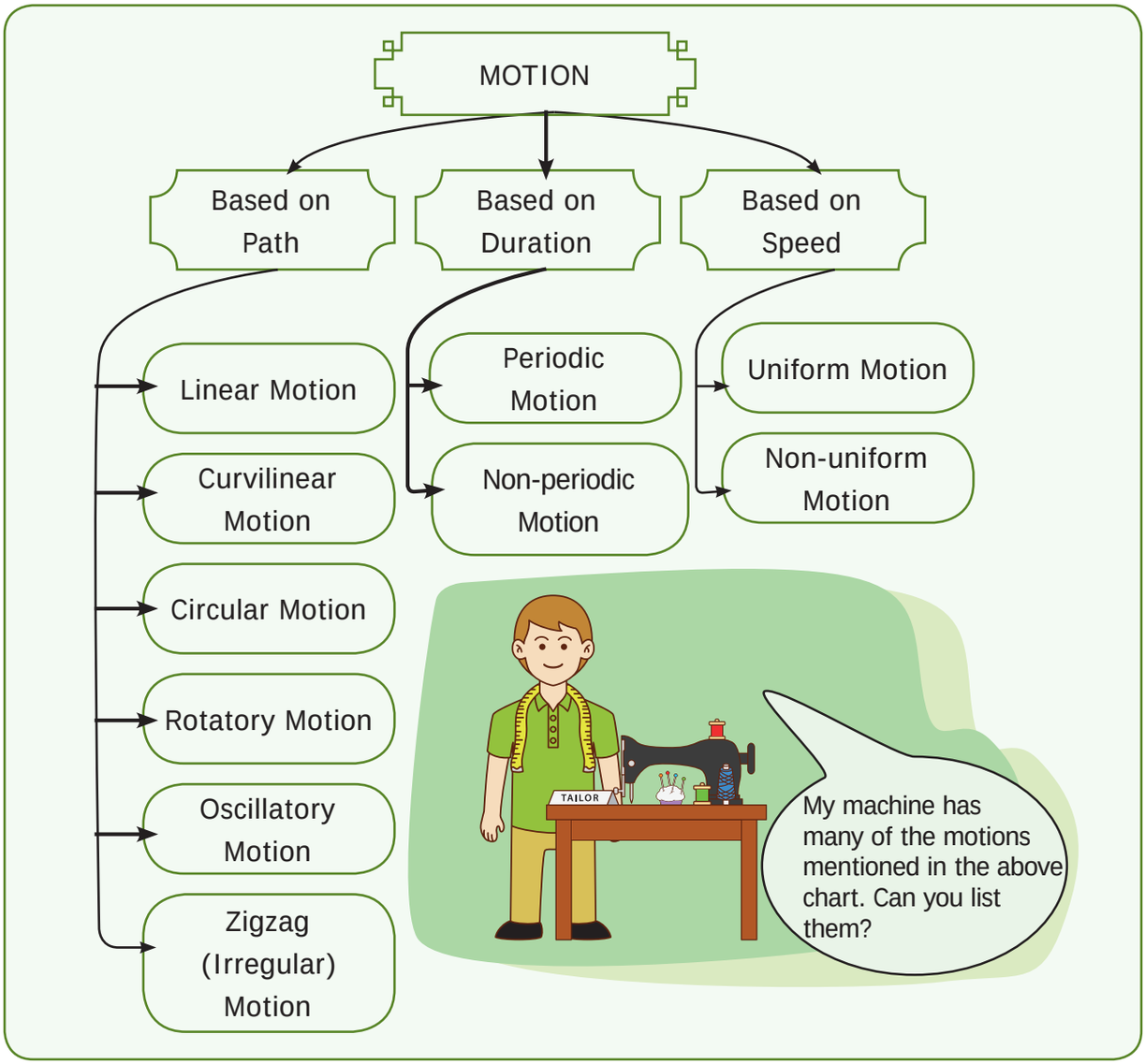
FACT FILE

A Cheetah is the fastest land animal running at a speed of 112 km/h.

Uniform and Non-uniform motion

Suppose a train leaves Thiruchirapalli and arrives at Madurai. Will the train travel in an uniform speed? First, the train will be stationary. When the train leaves the station, the motion will be slow. After it moved some distance it will gather speed. After that it may slow down while crossing bridges and stop at intermediate stations for passengers. Finally, as the train approaches Madurai, again it will slow and finally will come to a halt. It means that the speed is not the same all through the journey. That is, the speed is non-uniform. This motion is said to be non-uniform motion.

However, in between the journey, there may be a stretch where in the train might go at a constant speed. During that interval the train will be moving at uniform speed. That is, its motion is uniform.



Many motions we see in our day to day life are non-uniform. We will learn more about uniform and non-uniform motion in higher classes.

If an object covers uniform distances in uniform intervals then the motion of the object is called uniform motion. Otherwise the motion is called non-uniform motion.

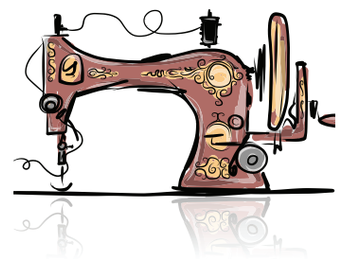
In a nutshell, we can classify the motion in terms of a) path b) if it is periodic or not c) if the speed is uniform or not. However, in real life, the motions are combinations of many types of motion.

Multiple Motion

Look at the bicycle in the picture. What type of motion does the wheel perform? What type of motion does the cycle in total perform?

The tyres rotate and make a rotatory motion, but the cycle as such moves forward in a linear path.

Multiple motion in a sewing machine



- Motion of the needle

  _____

- Motion of the wheel

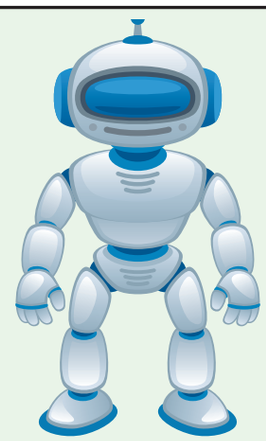
  _____

- Motion of footrest

  _____

2.3 Science Today - Robot

Robots are automatic machines. Some robots can perform mechanical and repetitive jobs faster and more accurately than people. Robots can also handle dangerous materials and explore distant planets.



A bipedal humanoid robot.

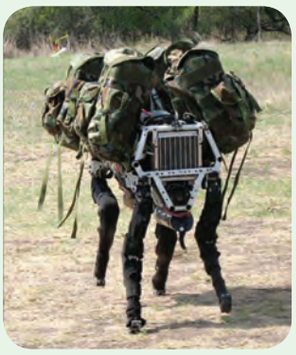
The term 'robot' comes from a czech word, 'robota' meaning 'forced labour'. Robotics is the science and study of robots.

What can Robots do?

Robots can sense and respond to their surroundings. They can handle delicate objects or apply great force. For example, they can perform eye operations guided by a human surgeon, or assemble a car. With **artificial intelligence**, robots will also be able to make decisions for themselves.

How do Robots sense?

Electronic sensors function as robot's eyes and ears. Twin video cameras give the robot a 3-D view of the world. Microphones detect sounds. Pressure sensors give the robot a sense of touch, to judge how to grip an egg or heavy luggage. Built-in computers send and receive information with radio waves.



The quadrupedal military robot

Artificial Intelligence

Artificial intelligence attempts to create computer programs that think like human brains. Current research has not achieved this, but some computers can be programmed to recognize faces in a crowd.

Can Robots think?

Robots can think. They can play complex games, such as chess, better than human beings. But will a robot ever know that it is thinking? Humans are conscious - we know we are thinking. But we do not know how consciousness works. We do not know if Robots can ever be conscious.

Articulated welding robots (industrial)

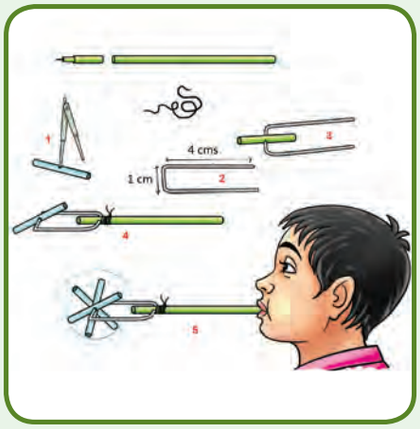
Nanorobotics

Nanobots are robots scaled down to microscopic size in order to put them into very small spaces to perform a function. Future nanobots could be placed in the blood stream to perform surgical procedures that are too delicate or too difficult for standard surgery. Imagine if a nanobot could target cancer cells and destroy them without touching healthy cells nearby.

Future of Nanorobotics

Activity 7

Simple Spinner



Let us enjoy by making a simple spinner. Make it by the following instruction.

Cut a 2cm long piece from an old ball-pen refill and make a hole in its center with a divider point (Fig. 1).

Take a thin wire of length 9cm and fold it into a U-shape (Fig. 2).

Weave the refill spinner in the U-shaped wire (Fig. 3).

Wrap the two ends of the wire on the plastic refill, leaving enough clearance for the spinner to rotate (Fig. 4).

On blowing through the refill, the spinner rotates (Fig. 5).

For obtaining maximum speed adjust the wires so that air is directed towards the ends of the spinner.

Have you enjoyed with simple spinner? Do you observe the motions in the toy? Can you answer the following questions?

1. Motion of the air in tube is _____ motion.
2. Motion of the refill stick is _____ motion.
3. The toy converts _____ motion into _____ motion.

Think

In a simple spinner linear motion is converted into rotatory motion. Can you make a toy which converts rotatory motion into linear motion?

Points to Remember

- Motion and rest are relative.
- All things that are at rest may seem to be in motion from a different point of view, and all motion may seem to be at rest from a different perspective.
- Application of forces is implemented by a push or pull. Forces can be applied by animate as well as inanimate agency.
- Application of forces result in motion of an object at rest, increase or decrease its speed, change its direction, and distortion of the shape.
- Some forces act only when they are in contact. There are some forces which can even have effect at a distance.
- Speed = Distance travelled / Time taken (s= d/t)
- The motion can be classified according to the path (periodic or non-periodic) or according to speed (uniform or non-uniform).
- Unit of speed is m/s.

Evaluation

ATIPDL

I. Choose the correct answer.

1. Unit of speed is

   a. m b. s c. kg d. m/s

2. Which among the following is an oscillatory motion?

   a. Rotation of the earth about its axis.

   b. Revolution of the moon about the earth.

   c. To and fro movement of a vibrating string.

   d. All of these.

3. The correct relation among the following is

   a. Speed = Distance × Time

   b. Speed = Distance / Time

   c. Speed = Time / Distance

   d. Speed = 1 / (Distance × Time)

4. Gita travels with her father in a bike to her uncle's house which is 40 km away from her home. She takes 40 minutes to reach there.

   Statement 1 : She travels at a speed of 1 km / minute.

   Statement 2 : She travels at a speed of 1 km/hour.

   a. Statement 1 alone is correct.

   b. Statement 2 alone is correct.

   c. Both statements are correct.

   d. Neither statement 1 nor statement 2 is correct.

II. Fill in the blanks.

1. A bike moving on a straight road is an example for _____ motion.
2. Gravitational force is a _____ force.
3. Motion of a potter's wheel is an example for _____ motion.
4. When an object covers equal distances in equal interval of time, it is said to be in _____ motion.

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

1. To and fro motion is called oscillatory motion.
2. Vibratory motion and rotatory motion are periodic motions.
5. Vehicles moving with varying speeds are said to be in uniform motion.
6. Robots will replace human in future.

IV. Match the following.

1.  a. Circular motion

2.  b. Oscillatory motion

3.  c. Linear motion

4.  d. Rotatory motion

5.  e. Linear and rotatory motion

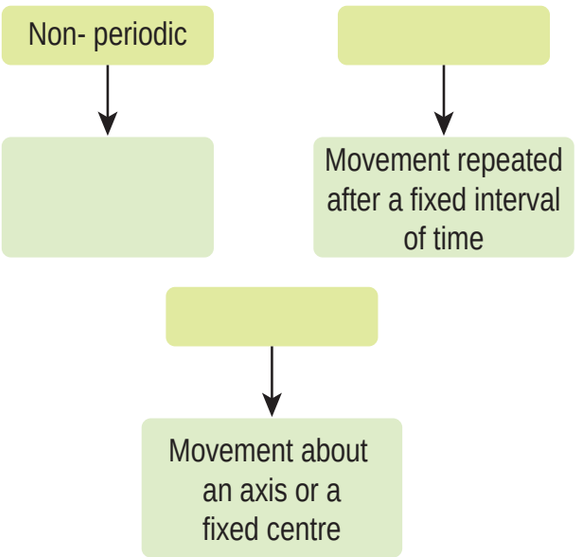
V. Given below is the distance-travelled by an elephant across a forest with uniform speed. Complete the data of the table given below with the idea of uniform speed.

Distance (m)	0	4		12		20
Time (s)	0	2	4		8	10

VI. Complete the analogy.

1. Kicking a ball : Contact force :: Falling of leaf : _____?
2. Distance : metre :: Speed : _____ ?
3. Circulatory motion : A spinning top :: Oscillatory motion : _____?

VII. Complete the web chart.



VIII. Answer in a word or two.

1. The force which acts on an object without physical contact. _____
2. A change in the position of an object with time. _____
3. The motion which repeats itself after a fixed interval of time. _____
4. The motion of an object which covers equal distances in equal intervals of time. _____
5. A machine capable of carrying out a complex series of actions automatically. _____

IX. Answer briefly.

1. Define force.
2. Name different types of motion based on the path.
3. If you are sitting in a moving car, will you be at rest or motion with respect your friend sitting next to you?
4. Rotation of the earth is a periodic motion. Justify.
5. Differentiate between rotational and curvilinear motion

X. Answer in detail.

1. What is motion? Classify different types of motion with examples.

XI. Problems.

1. A vehicle covers a distance of 400km in 5 hour. Calculate its speed.

XII. Give examples.

Linear motion	
Curvilinear motion	
Self rotatory motion	Motion of the wheel in a cart
Circular motion	
Oscillatory motion	
Irregular motion	

ICT CORNER

Force and motion

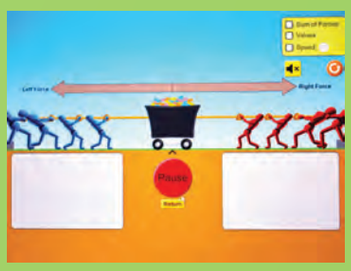
Play with force and motion.

Steps:

- Lets learn force and motion on **PhET** in Google browser. Download and install.
- Drag any one side and place him in the knot portion of the rope. Now click **go**.
- If placed on the right side then the load will move in that direction. The place of the man and the number of man can be changed. The direction of force and the unit of force will display on the screen.
- If we place equal number of men on both the sides the load will not move.
- By changing the number of men the strength of force can be changed.

Step1

Step2



Step3

URL:

https://phet.colorado.edu/en/simulation/forces-and-motion-basics

*Pictures are indicative only

SCIENCE TERM - II

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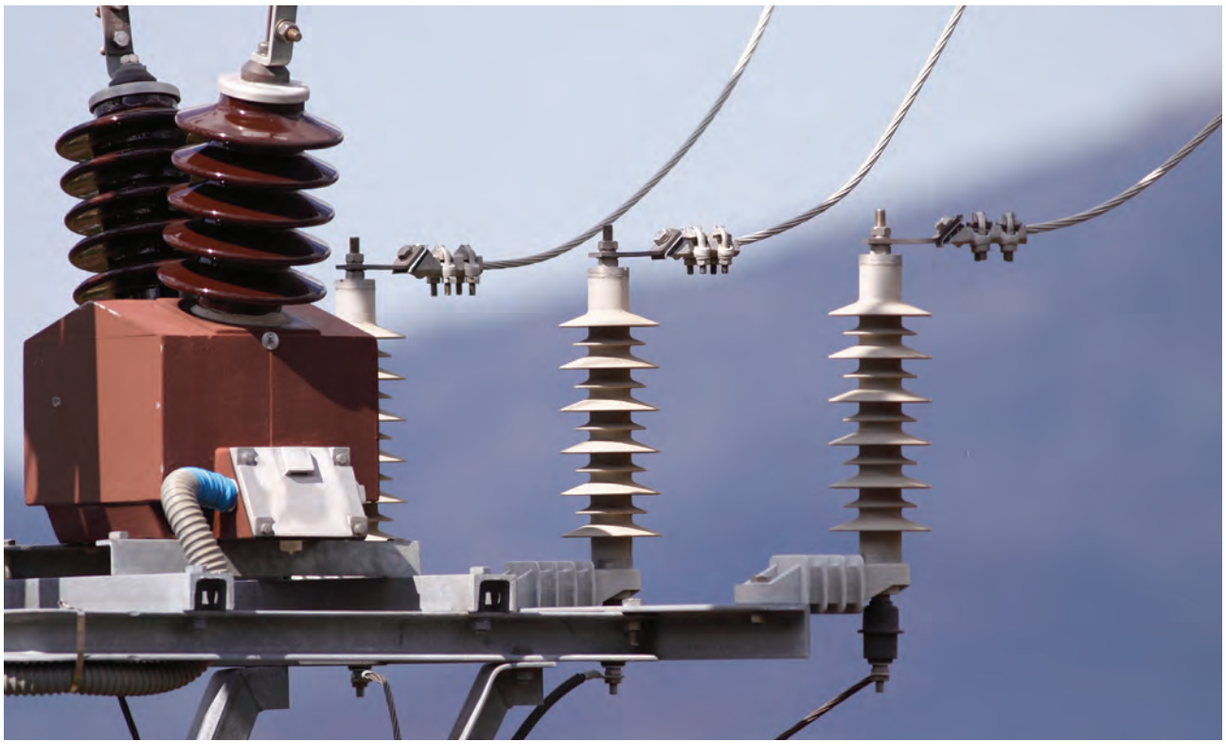

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SCIENCE

Unit 1 Heat

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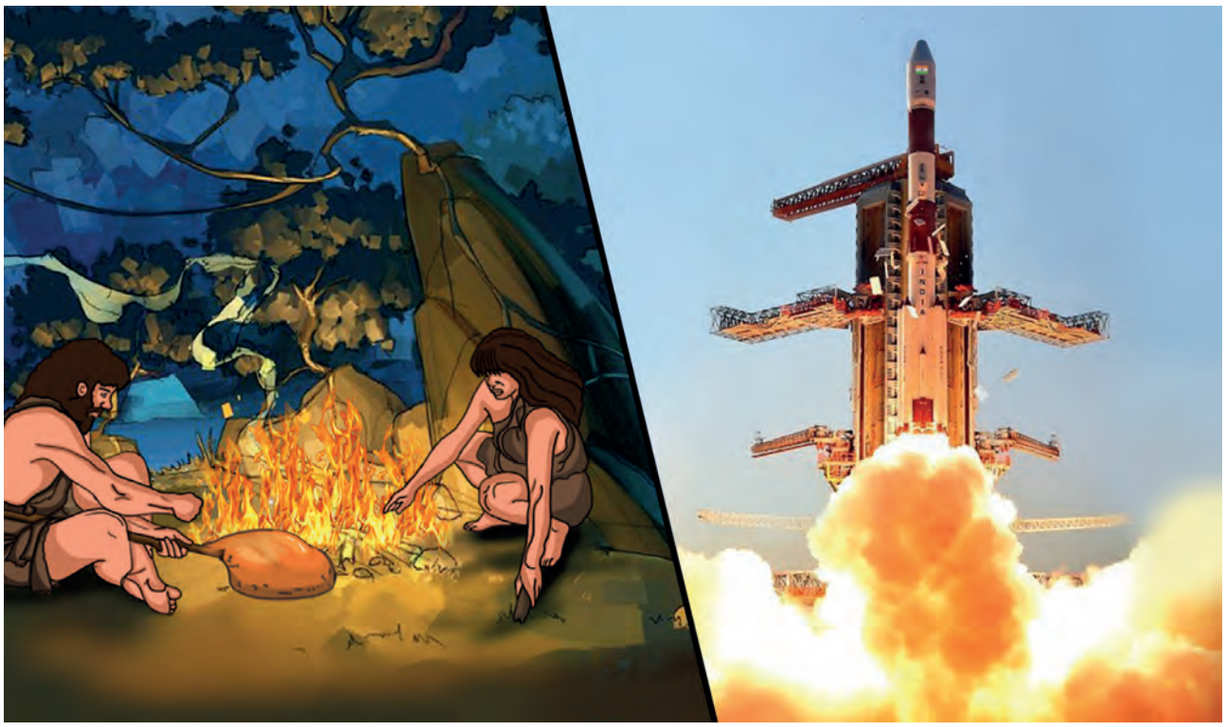


Learning Objectives

- To list out the sources of heat
- To define heat
- To distinguish hot and cold objects
- To define temperature
- To differentiate heat and temperature
- To understand the conditions for thermal equilibrium
- To understand why thermal expansion take place in solids
- To list out the practical applications of thermal expansion in day - to - day life

Introduction

We are all familiar with heat. We feel it on our body when the sun shines. We use heat for cooking our food, We reduce the heat by adding ice cubes while preparing fruit juice. Let us learn about sources of heat.

1.1 Sources of heat

❖ **Sun**

We all know that the sun gives us light. Does it give us heat? After standing under the sun light for some time, touch your head. Does it feel hot? Yes, it feels hot because the sun gives out heat besides light. Now, You can understand why it is difficult to walk bare-footed on sunny days in the afternoon.

❖ **Combustion (Burning)**

Heat energy can be generated by the burning of fuels like wood, kerosene, coal, charcoal, gasoline/petrol, oil, etc., In your home, how do you get heat energy to cook food?

❖ **Friction**

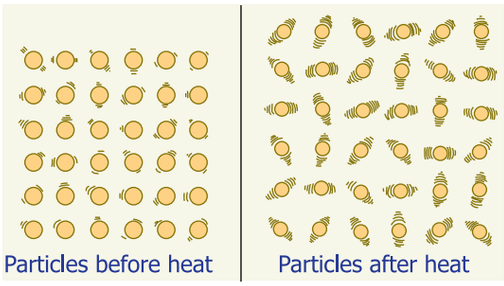
Rub your palms for some time and then hold them to your cheeks. How do you feel? We can generate heat by rubbing two surfaces of some substances. In the past people used to rub two stones together to light fire.

❖ **Electricity**

When electric current flows through a conductor, heat energy is produced. The water heater, iron box, electric kettle etc., work on this principle.

1.2 Heat

Molecules in objects are constantly vibrating or moving inside objects. We cannot see that movement with our naked eye. When we heat the object this vibration and movement of molecules increases and temperature of the object also increases.



Thus, **Heat is an energy that raises the temperature of a thing by causing the molecules in that thing to move faster.**

Heat is not a matter. It doesn't occupy space. It has no weight. Like light, sound and electricity, heat is a form of energy.

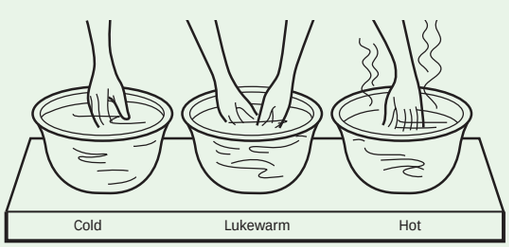
In short, Heat is the total kinetic energy of constituent particles of objects. **SI Unit of Heat is joule**. The unit calorie is also used.

1.3 Hot and cold objects

In our day-to-day life, we come across a number of objects. Some of them are hot and some of them are cold. How do we decide which object is hotter than the other?

We use the tip of our finger to find out whether the tea in a cup has enough heat to drink or whether milk has been cooled enough to set for making curds. We often determine heat by touching the objects. But is our sense of touch reliable?

Activity 1: Take three bowls. Pour very cold water in the first bowl. (you can also add ice cube for cooling). Place luke warm water in the second. Half fill the third with hot water (-not hot enough to burn!) Set them in a row on the table, with the lukewarm water in the center. Place your right hand in the cold water, and your left hand in the hot water. Keep them in for a few minutes. Then take them out, shake off the water and put both into the middle bowl. How do they feel?



Priya says,"My right hand tells me that the water in the bowl is hot and the left hand tells me that the same water is cold."

Write down in your own words what do you experience? Discuss in the class why this happens.

_____

_____

When you placed your left hand in the hot tub, the heat from the bowl made the molecules on your hand vibrate faster. When you keep the same hot hand in the second bowl the vibrations transferred from your hand to make the particles in the water vibrate. Therefore you feel loss of heat and hence your hand feels cold.

In the same way, your right hand which was placed in cold water, feels hot when you insert it into the lukewarm water. Because it takes heat energy from lukewarm water.

So, the same lukewarm water gives your hands different feeling according to the temperature of your hand. **Measuring temperature by touching is not correct.**

Thermometers are used to measure temperature accurately and quantitatively.

1.4 Temperature

Definition of Temperature

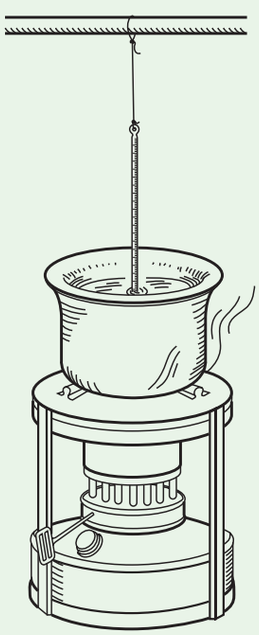
The measurement of warmness or coldness of a substance is known as its Temperature.

SI unit of temperature is kelvin. Celsius and Fahrenheit are the other units used. Celsius is called as Centigrade as well.

It determines the direction of flow of heat when two bodies are placed in contact.

Activity 2: The Temperature of Boiling Water

Take water in a vessel and place the vessel on a stove. Fix the thermometer as shown in figure (Caution: The thermometer should not touch the vessel in which the water is being heated. Otherwise the thermometer will be broken at high temperature.)



All students have to read the temperature of the water and note the reading on the blackboard. Do you notice that the temperature is raising?

What is the temperature of water when it is boiling?

_____

Does the temperature of the boiling water rise further after that?

_____

When boiling water is heated for some time, the water continues to receive more heat, but it's temperature does not rise further. The point at which the water boils and temperature becomes stable is called the **boiling point** of water.

Guess and Write:

(Check your assumption with the help of a thermometer.)

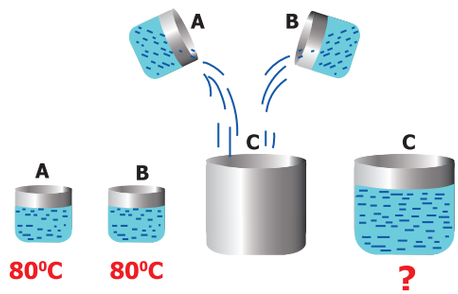
- Approximate temperature of the tea when you drink _____
- Approximate temperature of cool lemon juice when you drink _____

Normally, the room temperature of water is approximately 30°C. When we heat water, its temperature raises and it boils at 100°C. If we cool the water, it freezes at 0°C.

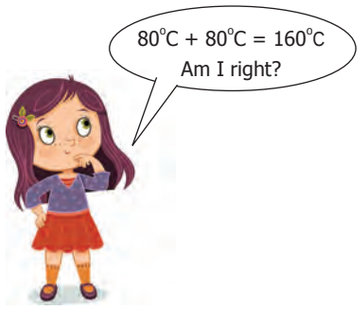
(Note : you have to say 30°C as 30 degree celsius or 30 degree centigrade)

Is Neela correct?

Beaker A and B has water at 80° C.



Then pour the water of A and B to an empty beaker C. Now, What is the temperature of the water in the beaker C? Neela says it will be 160°C.



What is your opinion? Does Neela say correctly? Make a guess and verify it experimentally.

_____

_____

DO YOU KNOW?

One day in 1922, the air temperature was measured at 59°C in the shade in Libya, Africa. The coldest temperature in the world was measured in the Antarctic continent. It was approximately – 89°C. The minus sign (–) is used when the temperature falls below the freezing point of water, which is 0°C. If water becomes ice at 0°C, you can imagine how cold – 89° C would be. Our normal body temperature is 37°C. Our body feels cool if the air temperature is around 15 to 20 degree Celsius.

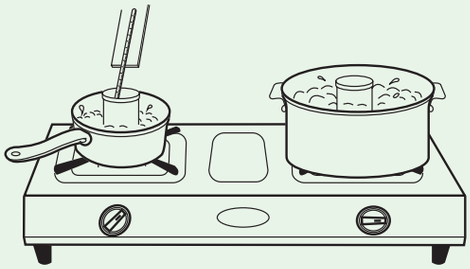
Can you estimate the night temperature in your village or city during winter?

1.5 Heat and Temperature

Heat and temperature are not the same thing, they in fact mean two different things;

- Temperature is related to how fast the atoms or molecules move or vibrate within the substance.
- Heat not only depends on the temperature of the substance but also depends on how many molecules are there in the object.
- Temperature measures the average kinetic energy of molecules. Heat measures the total Kinetic Energy of the molecules in the substance.

Activity 3: Take one litre water in a pan, and heat it on a stove. Calculate the time taken to start boiling. (i.e. the time taken to thermometer reading goes up to 100°C). Take five litre water in another pan and heat it on the same stove. Calculate the time taken by the water to start boiling.



In which pan the water starts to boil earlier?

- ☐ One litre water
- ☐ Five litre water.

Both, however, show a temperature of 100°C at the boiling point. Five litre

water takes more time to boil i.e. more heat is needed to boil the larger amount of water. So, five litre boiling water has more heat energy than one litre water.

Place an open can of lukewarm water in each pan. Observe their temperature to find out which can gets hotter.

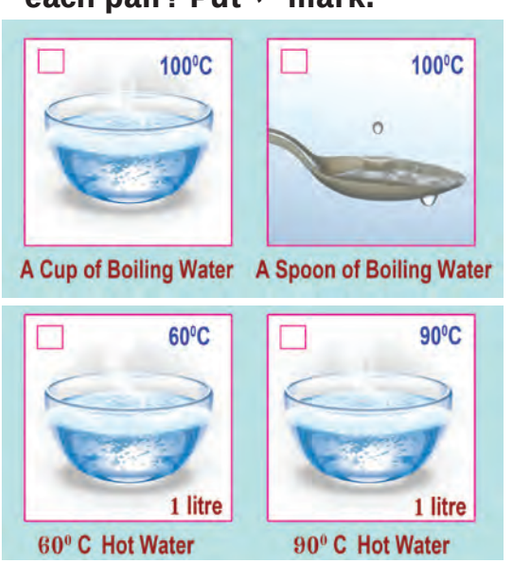
In which can water shows quick rise in temperature?

- ☐ Can in One litre boiled water
- ☐ Can in five litre boiled water.

You can see that, five litre water pan will raise the can of water to a higher temperature. Though, both pans of boiling water have the temperature of 100°C the five litre water can give off more heat energy than one litre water. Because it has more heat energy, and gives more energy to the water in the can.

Total heat is measured by **calorie,** the amount of heat needed to raise one gram of water by one degree centigrade.

❖ **Which has more heat energy in each pair? Put ✓ mark.**



Let Us Think

Pavithra is having tea while watching the pond near her house. Surely, tea is in higher temperature than the water in the pond. Now, a question is arising in Pavithra's mind. Which one has more heat energy, a cup of tea or the water in the pond? What do you think? _____

_____

_____

_____

Even though the temperature of the tea is higher than that of pond water, the volume of the water in pond is very high, hence the amount of molecules in the water in the pond is higher than the tea in the cup. So, pond has more heat energy than tea cup.

1.6 Flow of Heat

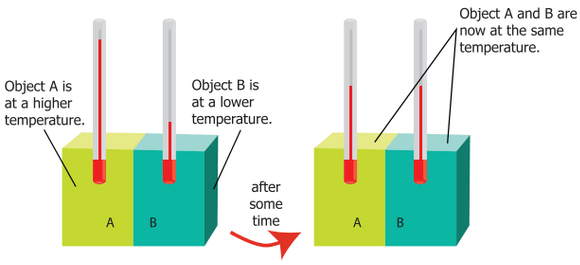
An analogy between temperature and water level:

A17Y8U

Water **'flows'** when there is a difference in the **'levels'** of water in different places. It does not matter if there is more water in one place or another. Water from a puddle can flow into a reservoir or the other way around. The **'temperature'** of an object is like the water level – it

determines the direction in which **'heat'** will flow. Heat energy flows from higher temperature to lower temperature.

Thermal contact and Thermal equilibrium



▲Two objects at different temperatures are put together

Consider two bodies A and B. Let the temperature of A be higher than that of B. On bringing bodies A and B in contact , heat will flow from hot body A to the cold body B. Heat will continue to flow till both the bodies attain the same temperature.

The temperature determines the direction of flow of heat.

1. You are holding a hot cup of coffee. Would the Heat energy transfer from

   a. Your body to the coffee, or

   b. The coffee to your body?

2. You are standing outside on a summer day. It is 40°C outside (note that normal body temperature is 37°C). Would the Heat energy transfer from.

   a. Your body to the air particles, or

   b. The air particles to your body?

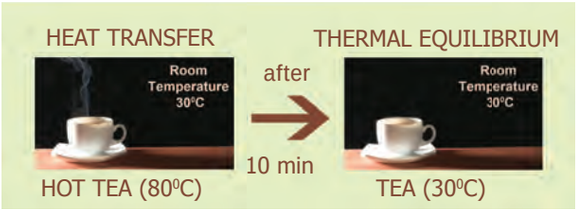
3. You are standing outside on a winter day. It is 23°C outside. Would the heat energy transfer from:

   a. Your body to the air particles, or

   b. The air particles to your body?

Two objects are said to be in **thermal contact** if they can exchange heat energy. **Thermal equilibrium** exists when two objects in thermal contact no longer affect each other's temperature.

For example, if a pot of milk from the refrigerator is set on the kitchen table, the two objects are in thermal contact. After certain period, their temperatures are the same, and they are said to be in thermal equilibrium.

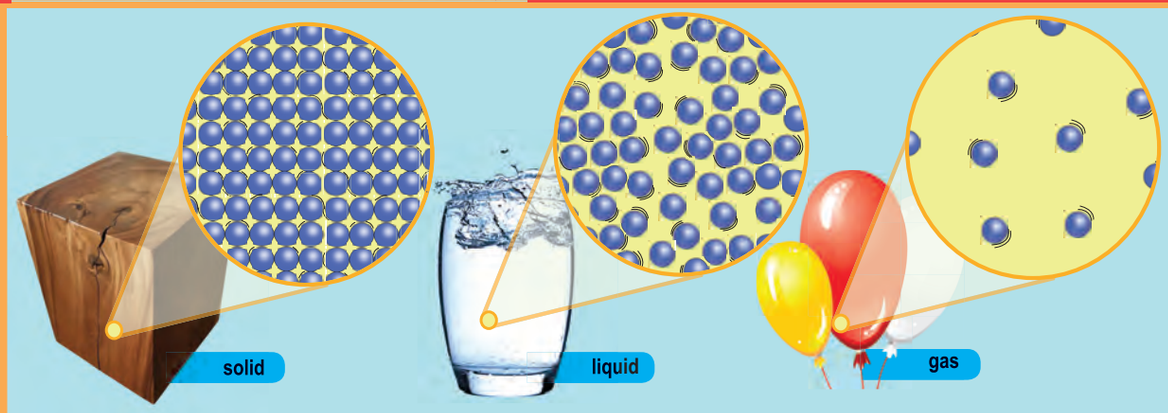


1.7 Expansion in solids

Sam is trying to open a tight jar, but he cannot open it. He asks his uncle to help. His uncle says that pour some hot water on the lid of the jar. Sam does so and tries to open it now. Wow! The jar is opened easily!

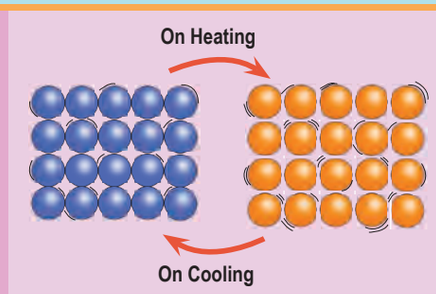
Do you have such experience? How do you open a tightly closed cap of the

HEAT - AN INTERNAL VIEW

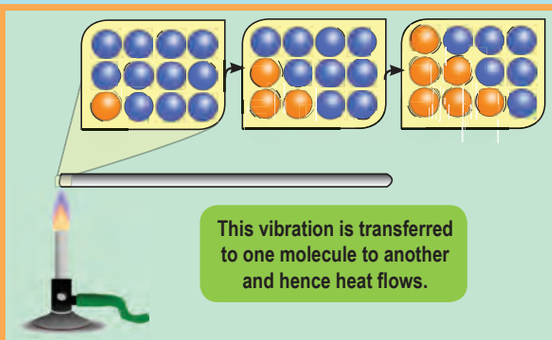


Substances are made up of molecules. The molecules in any object are in a state of vibration or movement. This cannot be seen with our naked eyes

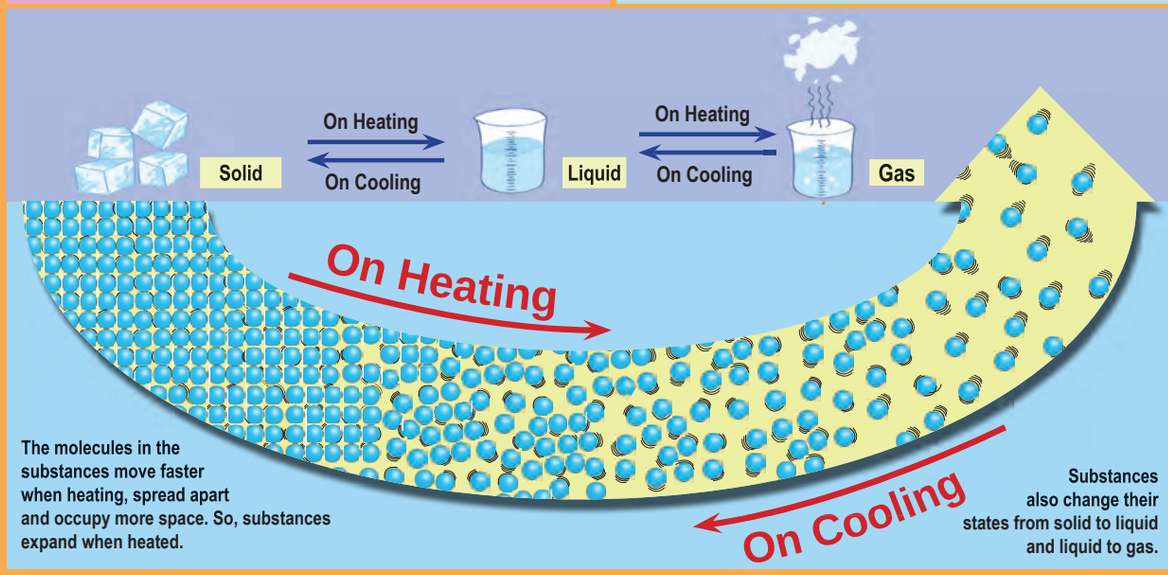
When substances are heated the vibration and movement are increasing



The total number of molecules remain unchanging after heating. Hence, No Change in weight.



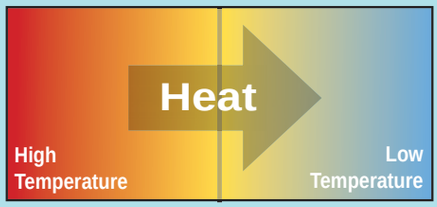
This vibration is transferred to one molecule to another and hence heat flows.



The molecules in the substances move faster when heating, spread apart and occupy more space. So, substances expand when heated.

Substances also change their states from solid to liquid and liquid to gas.

Water 'flows' when there is a difference in the 'levels' of water in different places. The 'temperature' of an object is like the water level – it determines the direction in which 'heat' will flow.



pen which could not be opened by you normally?

Most substances expand when heated and

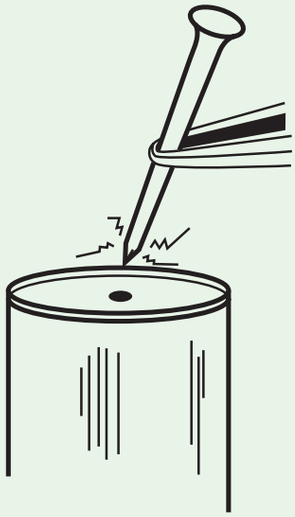
Activity 4:

Hammer a nail into a tin can. Ease the nail out. Put it in again to make sure that the hole is large enough for the nail. Then, holding the nail with a pair of pliers, scissors or forceps, heat the nail over a candle, in hot water, or over the stove. Try to put it into the hole in the can.

I see that:_____

_____

You will see that, now it is hard to put the nail into the hole. Heat expands solids. The molecules in the solid move faster, spread apart and occupy more space.



contract when cooled. The change in length / area or volume (due to contraction / expansion) is directly related to temperature change.

The expansion of a substance on heating is called, the thermal expansion of that substance.

1.8 Linear and Cubical Expansion

A solid has a definite shape, so when a solid is heated, it expands in all directions i.e., in length, area and volume, all increase on heating.

The expansion in length is called linear expansion and the expansion in volume is called cubical expansion.

Why is the iron rim of a bullock cart wheel heated before it is fitted onto the wheel? Why is a small gap left between two lengths of railway lines?

We can perform an interesting experiment to find out an answer to these questions. All we need to do is to heat a cycle spoke.

Activity 5: Linear Expansion

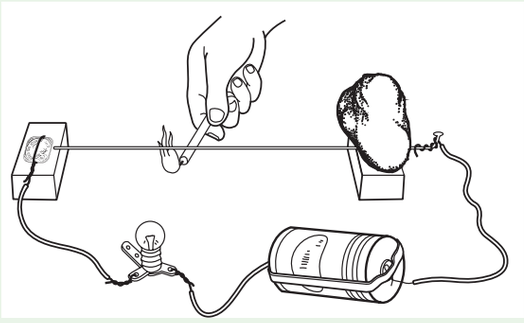
Take a bulb, dry cell, candle, cycle spoke, coin (or broad - headed nail) and two wooden blocks.

Place one end of the cycle spoke on a wooden block and connect an electric wire to it. Put a stone over the spoke to hold it firmly in place on the wooden block,

A1D7LK

as shown in Figure . The spoke should be parallel to the ground. Place the second wooden block under the free end of the spoke. Wrap some electric wire around the coin (or nail) and place it on the block. You may put a stone over the coin to hold it in place.

Connect a bulb and dry cell to the free ends of the wires connected to the coin and the spoke and make the circuit shown in the figure.



When the tip of the free end of the spoke touches the coin, the circuit is completed and the bulb lights up. Check to ensure this. If the bulb does not light up, it means the circuit is not complete, so check your connections properly. (**Note:** We will learn about electric circuit elaborately in electricity lesson.) Now slide a page of your book between the coin and spoke and then slide it out. That way you would get a gap between the coin and spoke equal to the thickness of the sheet of paper.

❖ Does the bulb light up? If it does not, what could be the reason?

_____

_____

You saw that the bulb does not light up when the spoke does not touch the coin. Now light the candle and heat the spoke with it.

❖ Did the bulb light up after the spoke was heated for some time?

_____

❖ If it did, then explain how the spoke touched the coin after it was heated.

_____

_____

❖ Why does the bulb go off some time after the candle is taken away from the spoke?

_____

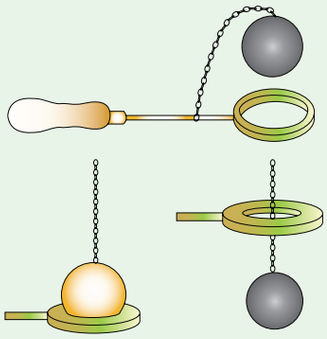
_____

❖ What happens to the length of the spoke when it is heated or cooled?

_____

Activity 6: Cubical Expansion

Take a metal ring and metal ball of such size that the ball just passes through the ring.



❖ Heat the ball and check whether it passes through the ring.

☐ Passed through

☐ Not passed through

❖ Now let the ball cool down, and check whether it passes through the ring.

☐ Passed through

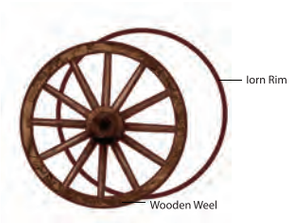
☐ Not passed through

Solids expand due to heat and come back to the original state if heat is removed.

1.9 Uses of Thermal Expansion

Fitting the iron rim on the wooden wheel

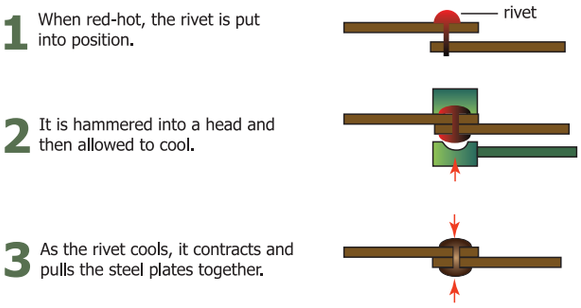
The diameter of the iron ring is slightly less than that of the wooden wheel. Therefore, it cannot be easily slipped on from the rim of wooden wheel.



The iron ring is, therefore, first heated to a higher temperature so that it expands in size and the hot ring is then easily slipped over to the rim of the wooden wheel. Cold water is now poured on the iron ring so that it contracts in size and holds the wooden wheel tightly.

Rivetting

Rivets are used to join two steel plates together. Hot rivet is driven through the hole in the plates. One end of the rivet is hammered to form a new rivet head. When cooled, the rivet will contract and hold the two plates tightly together.



1.10 Thermal Expansion Examples

Give Reasons for the following

1. Gaps are left in between rails while laying a railway track.

_____

_____

_____

2. Gaps are left in between two joints of a concrete bridge.

_____

_____

_____

Cracking of a thick glass tumbler

Glass is a poor conductor of heat. When hot liquid is poured into the tumbler, the inner surface of the tumbler becomes hot and expands while the outer surface remains at the room temperature and does not expand. Due to this unequal expansion, the tumbler cracks.

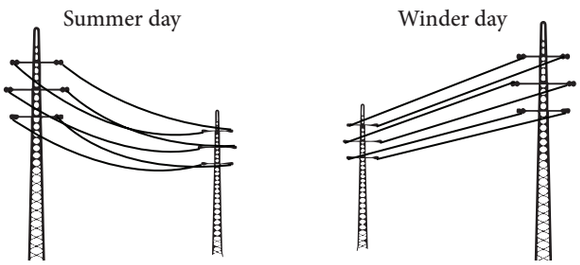
Electric wires

Electric wires between electric posts contract on cold days and sag in summers. To solve this problem, we leave wires slack

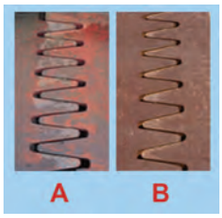
DO YOU KNOW?

Glassware used in kitchen and laboratory are generally made up of Borosilicate glass (pyrex glass). The reason is that the Borosilicate glass do not expand much on being heated and therefore they do not crack.

so that they are free to change length.



❖ The photographs below show an expansion joint at the end of a bridge in winter and in summer. Which season is shown in each picture? Explain how do you know?



_____

_____

_____

1.11 Numerical problems

1. I put a kettle containing 1 litre of cold water on the gas stove, and it takes 5 minutes to reach the boiling point. My friend puts on a small electric kettle, containing ½ litre of cold water, and it takes 5 minutes to get up to boiling point. Which gives more heat in 5 minutes?

a. the gas supply; or

b. the electricity supply?

Can you say how many times as much?

2. One calorie heat energy is needed to raise the temperature of the water from 30°C to 31°C. How much heat energy is needed to raise the temperature of the water from 30°C to 35°C.

Points to remember

❖ The main source of heat is sun, we can obtain heat from combustion, friction, and electricity.

❖ Heat is an energy that raises the temperature of a thing by causing the molecules in that thing to move faster

❖ Heat is the total Kinetic energy of constituent particles of objects.

❖ SI unit of Heat is joule (J).

❖ The measurement of warmness or coldness of a substance is known as its temperature.

❖ SI unit of temperature is kelvin.

❖ Temperature determines the direction of flow of heat when two bodies are placed in contact.

❖ Two objects are said to be in thermal contact if they can affect each other's temperature.

❖ Thermal equilibrium exists when two objects in thermal contact no longer affect each other's temperature.

❖ Most substances expand when heated and contract when cooled. The expansion of a substance on heating is called the thermal expansion of that substance.

❖ A solid has a definite shape, so when a solid is heated, it expands in all directions i.e., in length, area and volume, all increase on heating.

ICT Corner

Heat

Through this activity you will be able to understand the 'Thermal Energy Transfer'.

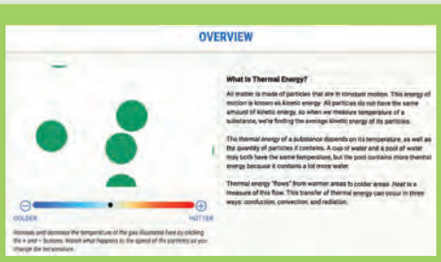
Step 1: Use the given URL in the browser. 'THERMAL ENERGY TRANSFER activity page will open.

Step 2: Click the = icon on the top left of the activity window, a list will drop down, from the list select a title.

Step 3: A small flash video window will open, click the play icon to play the video and observe.

Step 4: From the list select any title under the 'Example" list, a small flash activity window will open, click anyone of the tab given under the window to know the process of thermal transfer. Repeat the activity with different titles from the menu.

Step 1



Step 2

Step 3

Step 4

THERMAL ENERGY TRANSFER URL:

http://d3tt741pwxqwm0.cloudfront.net/WGBH/conv16/conv16-int-thermalenergy/index.html#/intro

*Pictures are indicative only

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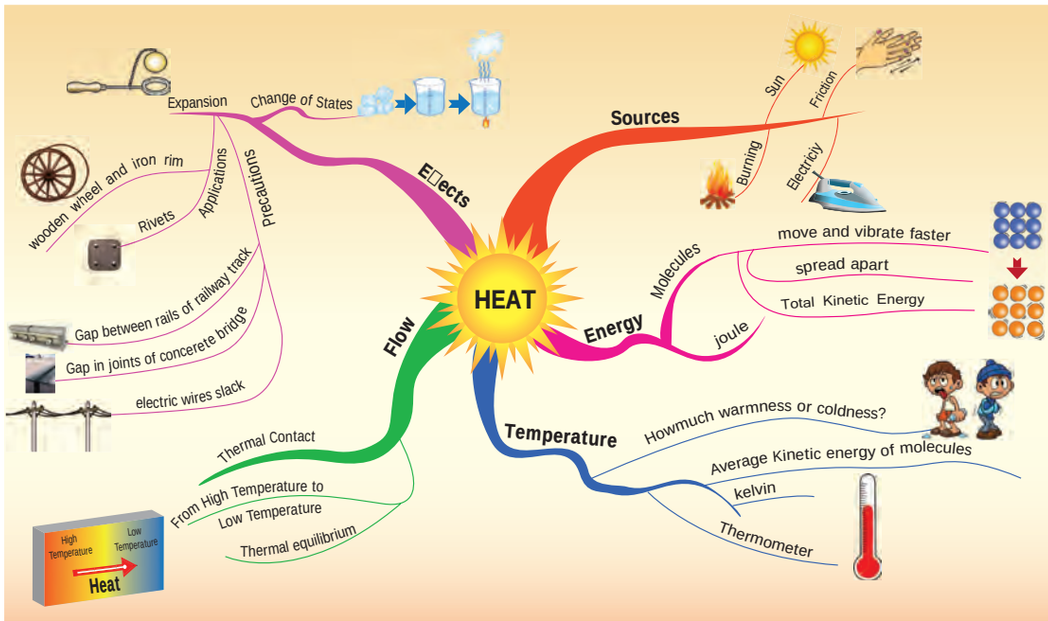


Evaluation

A1GUAH

I. Choose the appropriate answer

1. When an object is heated, the molecules that make up the object

   a. begin to move faster

   b. lose energy

   c. become heavier

   d. become lighter

2. The unit of heat is

   a. newton

   b. joule

   c. volt

   d. celsius

3. One litre of water at 30°C is mixed with one litre of water at 50°C. The temperature of the mixture will be

   a. 80°C

   b. More than 50°C but less than 80°C

   c. 20°C

   d. around 40°C

4. An iron ball at 50°C is dropped in a mug containing water at 50°C. The heat will

   a. flow from iron ball to water.

   b. not flow from iron ball to water or from water to iron ball.

   c. flow from water to iron ball.

   d. increase the temperature of both.

II. Fill in the blanks

1. Heat flows from a _____ body to a _____ body.

2. The hotness of the object is determined by its _____

3. The SI unit of temperature is _____

4. Solids_____ on heating and_____ on cooling.

5. Two bodies are said to be in the state of thermal_____ if there is no transfer of heat taking place.

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

1. Heat is a kind of energy that flows from a hot body to a cold body.
2. Steam is formed when heat is released from water.
3. Thermal expansion is always a nuisance.
4. Borosilicate glass do not expand much on being heated.
5. The unit of heat and temperature are the same.

IV. Give reasons for the following

1. An ordinary glass bottle cracks when boiling water is poured into it, but a borosilicate glass bottle does not.
2. The electric wire which sag in summer become straight in winter.
3. Rivet is heated before fixing in hole to join two metal plates.

V. Match the following

1.	Heat	-	$0^{o}C$
2.	Temperature	-	$100^{o}C$
3.	Thermal Equilibrium	-	kelvin
4.	Ice cube	-	No heat flow
5.	Boiling water	-	joule

VI. Analogy

1. Heat : Joule :: Temperature : _____
2. ice cube : $0^{o}C$ :: Boiling water :_____
3. Total Kinetic Energy of molecules: Heat :: Average Kinetic Energy : _____

VII. Give very short answer

1. Make a list of electrical equipments at home which we get heat from.
2. What is temperature?
3. What is thermal expansion?
4. What do you understand by thermal equilibrium?

VIII. Give short answer

1. What difference do you think heating the solid will make in their molecules ?
2. Distinguish between heat and temperature.

IX. Answer in detail

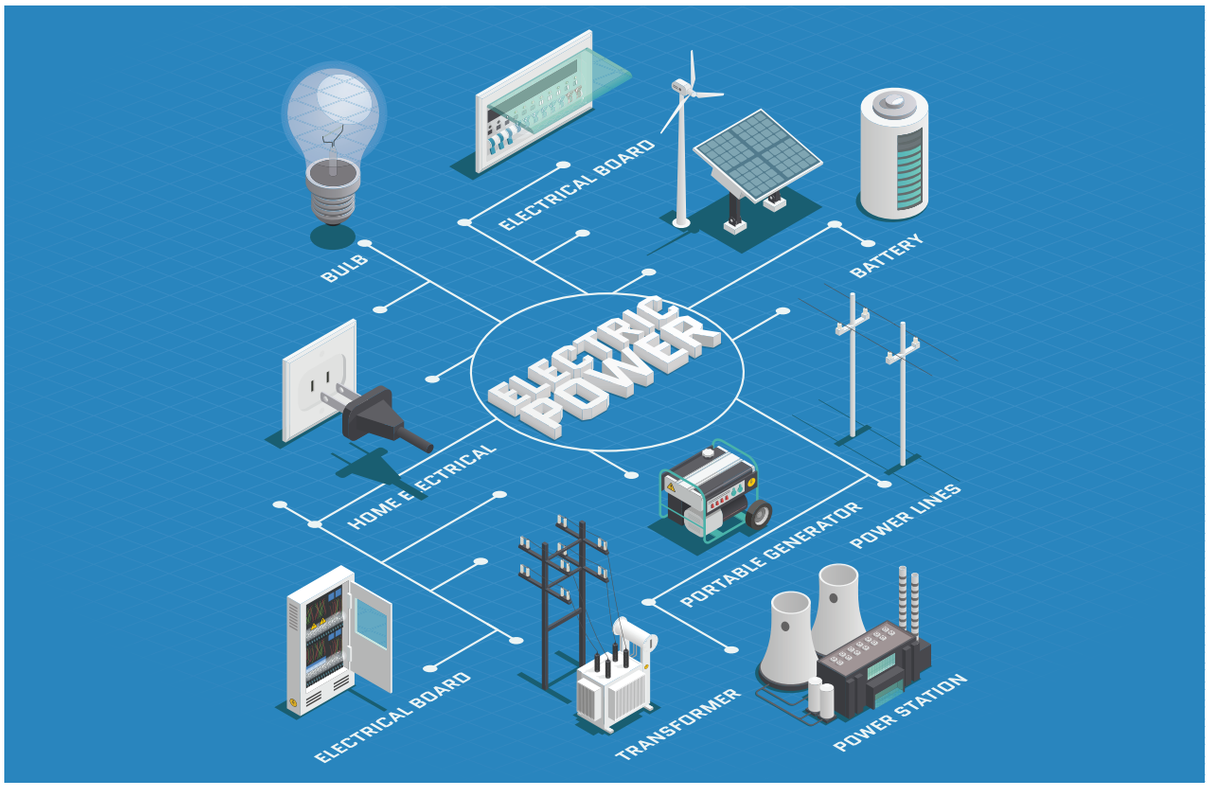
1. Explain thermal expansion with suitable examples.

X. Questions based on Higher Order Thinking Skills

1. When a window is accidentally left open on a winter night, will you feel uncomfortable because the cold is getting in, or because the heat is escaping from the room?
2. Suppose your normal body temperature were lower than what it is. How would the sensation of hot and cold change?
3. If you heat a circular disk with a hole, what change do you expect in the diameter of the hole? Remember that the effect of heating increases the separation between any pair of particles.

Unit 2 Electricity

A1M3N8



Learning Objectives

- To know the sources of electricity
- To be aware of the equipments working on electricity
- To know the different kinds of electric cells and understand their applications
- To be able to use different types of cells in different applications
- To understand the symbols of circuits and apply them in different circuits
- To identify conductors and insulators
- To be able to make their own batteries

Introduction

We use electricity in our day to day life. Have we ever wondered from where do we get this electricity? How does this electricity work? Can we imagine a day without electricity? If you ask your grandfather, you can come to know a period without electricity. They used oil lamps for light, cooked on fires of wood or coal. By the advent of electricity, our day to day works are made easy and the world is on our hands. What are the appliances those work on electricity? What are the materials those allow electricity to flow through? What are electric circuits? What are electric cells and batteries? Come on, let us descend into this lesson to know more about electricity.

Activity 1:

List out the electrical appliances used in your home.

_____

_____

_____

_____

2.1 Sources of Electricity

Selvan and Selvi are twins. They are studying in sixth standard. They visited their grandparent's village during summer vacation. At 6 O'clock in the evening Selvan's Grandfather switched on the light. The whole house was illuminated. Seeing this Selvan asked his grandfather "How do we get light by switching on the switch?" So, his grandfather took him to the nearest electricity board and enquired about the electricity.

Let us look in to the conversation given below.

Selvan: Sir, How do the electric bulb lighten up when we switch on the switch?

Engineer: Due to electricity.

Selvan: Oh! From where do we get this electricity?

Engineer: We get electricity from *thermal power, hydel power, tidal power, wind power, solar power* etc., as sources of electricity.

Selvan: Sir! Are these plants exist everywhere?

Engineer: No, these plants are constructed depending upon the natural resources available at that particular place. For example, we have thermal power plant in Neyveli, Tamilnadu as lignite is available there.

Selvan: Yes, I have seen wind mills near the hills of Tirunelveli District which has potential wind resource. Thank you sir, for your valuable information.

Grandfather: (while walking back to home) Do you think we get electricity only from the above mentioned sources.

Selvan: (while entering into the home, noticing the clock on the wall) Grandpa! look at that wall clock, How does it work?.

Grandfather: It needs electrical energy to work. Apart from the above mentioned sources, we get electricity from cells, and batteries.

Selvan: Yes, Grandpa , now I am going to discuss about all these with Selvi.

What do you infer from the above dialogue? **Any device from which electricity is produced is called the source of electricity.** We get electricity from different sources.

The Major Electric power stations in Tamilnadu are: Thermal stations (Neyveli in Cuddalore District, Ennore in Thiruvallur District), Hydel power stations (Mettur in Salem District, Papanasam in Tirunelveli District), Atomic power stations (Kalpakkam in Kanchipuram District, Koodankulam in Tirunelveli District), and Wind mills (Aralvaimozhi in Kanyakumari District Kayatharu in Tirunelveli District). Apart from these Solar panels which are prevalent in many places are used to produce electricity.

Let us discuss in shortly about working power stations.

1. Thermal Power stations

In thermal power stations, the thermal energy generated by burning coal, diesel or gas is used to produce steam. The steam thus produced is used to rotate the turbine. While the turbine rotates, the coil of wire

kept between the electromagnet rotates. Due to electro magnetic induction electricity is produced. Here heat energy is converted into electrical energy.

2. Hydel power stations

In hydel power stations, the turbine is made to rotate by the flow of water from dams to produce electricity. Here kinetic energy is converted into electrical energy. Hydel stations have long economic lives and low operating cost.

3. Atomic power stations

In atomic power stations, nuclear energy is used to boil water.

The steam thus produced is used to rotate the turbine. As a result, electricity is produced. Atomic power stations are also called as nuclear power stations. Here nuclear energy is converted into mechanical energy and then electrical energy.

4. Wind mills

In wind mills, wind energy is used to rotate the turbine to produce electricity. Here kinetic energy is converted into electrical energy.

2.2 Cell

A device that converts chemical energy into electrical energy is called a cell.

A chemical solution which produces positive and negative ions is used as electrolyte. Two different metal plates are inserted into electrolyte as electrodes to form a cell. Due to chemical reactions, one electrode gets positive charge and the other gets negative charge producing a continuous flow of electric current.

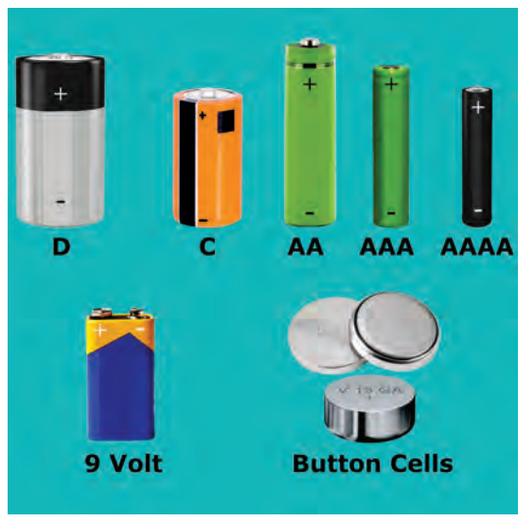
Depending on the continuity of flow of electric current cells are classified in to two types. They are primary cells and secondary cells.

Primary Cells

They can not be recharged. So they can be used only once. Hence, the primary cells are usually produced in small sizes.

Examples

cells used in clocks, watches and toys etc., are primary cells.



Secondary Cells

A cell that can be recharged many times is called secondary cell. These cells can be recharged by passing electric current. So they can be used again and again. The size of the secondary cells can be small or even large depending upon the usage. While the secondary cells used in mobiles are in the size of a hand, the cells used in automobiles like cars and buses are large and very heavy.

Examples

Secondary Cells are used in Mobile phones, laptops, emergency lamps and vehicle batteries.

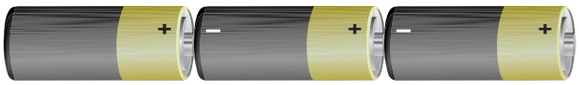
Activity 2: From the following pictures, identify those use primary cell and secondary cell. Mark Primary cell as **'P'** Secondary cell as **'S'**.





Battery

Often, we call cells as 'batteries'. However only when two or more cells are combined together they make a battery. A cell is a single unit that converts chemical energy into electrical energy, and a **battery is a collection of cells**.



Battery

Activity 3: Take a dry cell used in a flashlight or clock. Read the label and note the following

1. Where is the '+' and '–' symbol?

2. What is the output voltage?

Look at the cells that you come across and note down the symbols and voltage.

Warning

All experiments with electricity should only be performed with batteries used in a torch or radio. Do not, under any circumstance, make the mistake of performing these experiments with the electricity supply in your home, farm or school. Playing with the household electric supply will be extremely dangerous!

2.3 Electric Circuits

Grandfather asked Selvi to bring torchlight. While taking the torchlight, it fell down and the cells came out. She puts the cells back and switched it on (Fig. A)

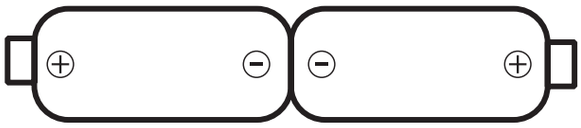


Fig: A

The torchlight did not glow. She thought the torchlight was worn out. She was afraid that grandfather might scold her. She started crying. Her uncle came there and asked the reason for crying. She conveyed the matter. Her uncle removed the cells and reversed them (Fig B)

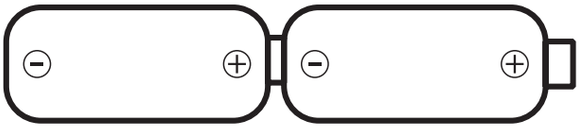
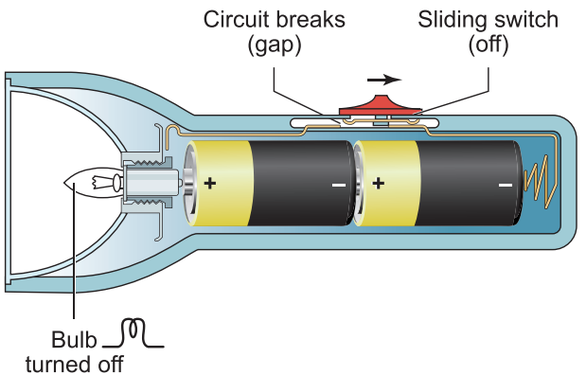


Fig: B

Now, the torch glows. Selvi's face also glows. Uncle told her the reason and explained her about electric circuits.

Inside view of torch



An **electric circuit** is the continuous or unbroken closed path along which electric current flows from the positive terminal to the negative terminal of the battery. A circuit generally has:

a) **A cell are battery**- a source of electric current

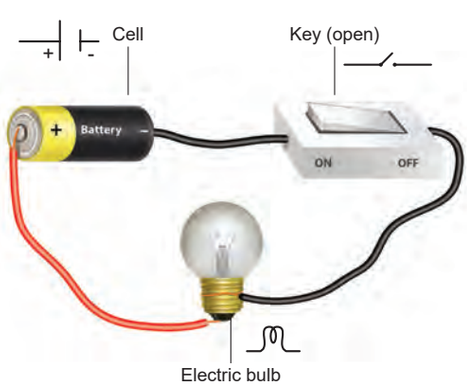
b) **Connecting wires**- for carrying current

c) **A bulb**- a device that consumes the electricity

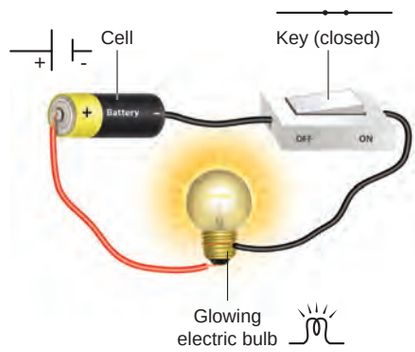
d) **A key or a switch**- this may be connected anywhere along the circuit to stop or allow the flow of current.

a. Open Circuit

In a circuit if the key is in open (off) condition, then electricity will not flow and the circuit is called an open circuit. The bulb will not glow in this circuit.



b. Closed Circuit



In a circuit if the key is in closed (on) condition, then electricity will flow and the circuit is called a closed circuit. The bulb will glow in this circuit.

Can you make a simple switch own by simple things available to you?

Types of Circuits

1. **Simple Circuit**
2. **Series Circuit**
3. **Parallel Circuits**

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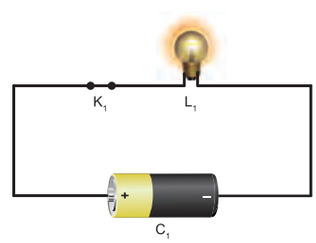
1. Simple Circuit

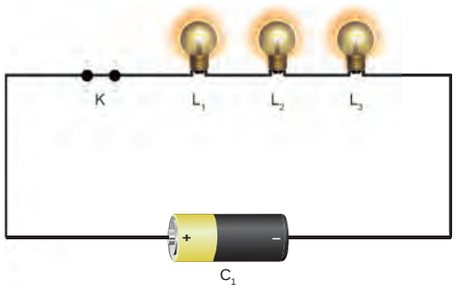
A circuit consisting of a cell, key, bulb and connecting wires is called a simple circuit.



2. Series Circuit

If two or more bulbs are connected in series in a circuit, then that type of circuit is called series circuit. If any one of the bulbs

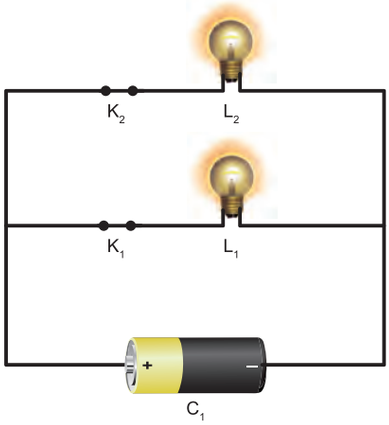
is damaged or disconnected, the entire circuit will not work.



3. Parallel Circuit

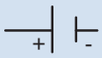
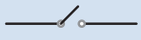
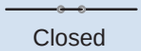
If two or more bulbs are connected in parallel in a circuit, then that type of circuit is called parallel circuit.

If any one of the bulb is damaged or disconnected the other part of the circuit will work. So parallel circuits are used in homes.



Symbols of Electric Components

In the circuits discussed above, we used the figures of electric components. Using electric components in complicated circuits is difficult. So, symbols of the components are used instead of figures. If these symbols used in electric circuits, even complicated circuits can be easily understood.

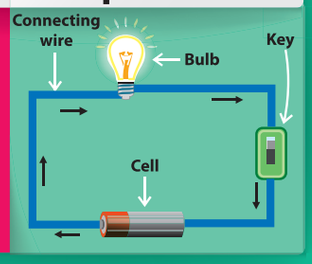
Sl.no.	Electric component	Figure	Symbol	Remarks
1	Electric cell	 Cell		Longer terminal refers positive and shorter terminal refers negative.
2	Battery	 Battery		Two or more cells connected in series
3	Switch-open		 Open	Switch is in off position
4	Switch-closed		 Closed	Switch is in on position
5	Electric bulb			The bulb does not glow
				The bulb glows
6	Connecting wires			Used to connect devices.

The flow of electric charge in a circuit is called Electric Current.

electricity

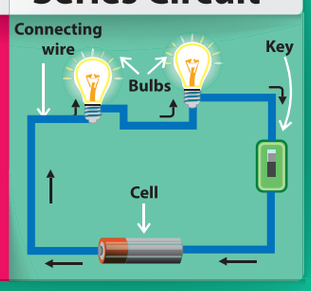
01 Simple Circuit

A circuit consisting of a cell, key, bulb and connecting wires is called a simple circuit



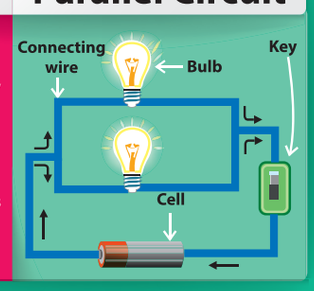
02 Series Circuit

A circuit consisting of a battery, key, bulbs and connecting wires connected in series is called a series circuit



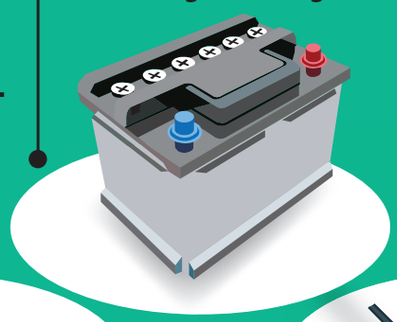
03 Parallel Circuit

A circuit consisting of a battery, key, bulbs and connecting wires connected in parallel is called a parallel circuit



SECONDARY CELL

Secondary cells can be recharged by passing current and used again and again.



CONNECTING WIRE

Connecting wires are made up of conductors & covered with insulators

PRIMARY CELL

Primary cells can be used only once.

DO YOU KNOW?

Electric Eel is a kind of fish which is able to produce electric current. This fish can produce an electric shock to safeguard itself from enemies and also to catch its food.

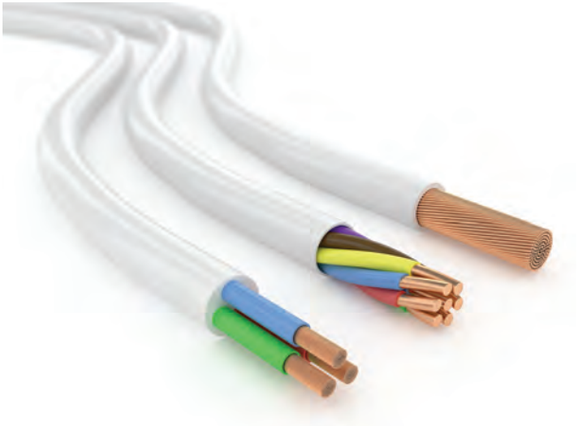
More to Know

Ammeter is an instrument used in electric circuits to find the quantity of current flowing through the circuit. This is to be connected in series.

2.4 Conductors and Insulators

Will electric current pass throw all materials?

If an electric wire is cut, we could see a metal wire surrounded by another material. Do you know why it is so?



Conductors

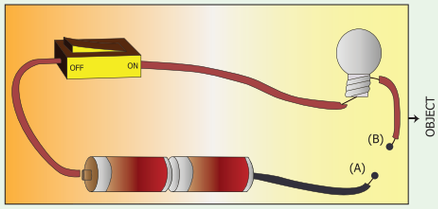
The rate of flow of electric charges in a circuit is called electric current. **The materials which allow electric charges to pass through them are called conductors.** Examples: Copper, iron, aluminum, impure water, earth etc.,

Insulators (Non-Conductors)

The materials which do not allow electric charges to pass through them are called insulators or non-conductors.

Examples: plastic, glass, wood, rubber, china clay, ebonite etc.,

Activity 4: Connect the objects given in the table between A and B and write whether the bulb glows or not.



S l . No.	Objects	Materials of the objects	Glow or not glow
1.	Pin		
2.	Match stick		
3.	Safety pin		
4.	Pencil		
5.	Metal spoon		
6.	Rubber		
7.	Pen		
8.	Wooden scale		
9.	Hairpin		
10.	Glass piece		

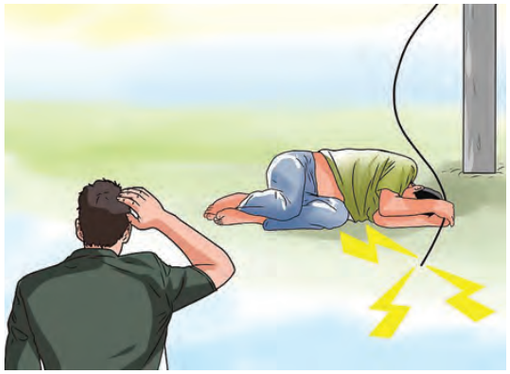
Safety measures to safeguard a person from electric shock

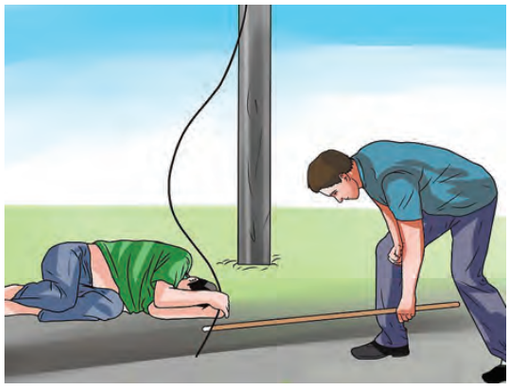
I. Switch off the power supply.

II. Remove the connection from the switch.

III. Push him away using non - conducing materials.

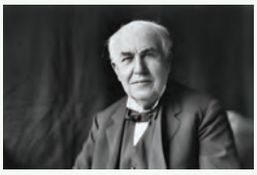
IV. Give him first aid and take him to the nearest health centre.





More to Know

Thomas Alva Edison (February 11, 1847 – October 18, 1931) was an American inventor. He invented more than 1000 useful inventions and most of them are electrical appliances used in homes. He is remembered for the invention of electric bulb.

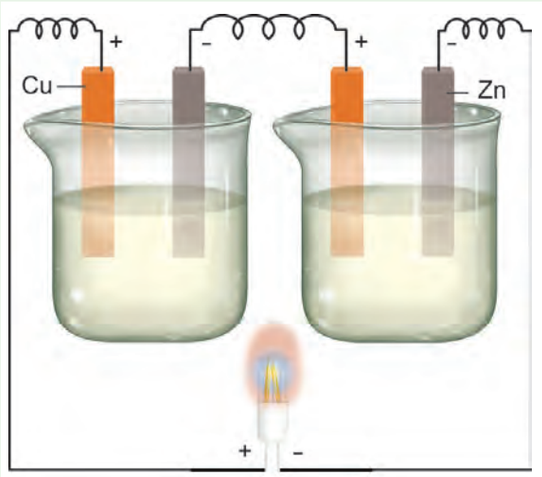

Thomas Alva Edison

Activity 5:

Produce electricity using copper plates, zinc plate, connecting wires, key, beaker and porridge (rice water) [the older the porridge the better will be the current]

Arrange copper and zinc plates in series as shown in the figure. Half fill two beakers with porridge. Connect the copper plate with the positive of and LED bulb and zinc to the negative. Observe what happens.

Now you can replace porridge with curd, potato, lemon etc.



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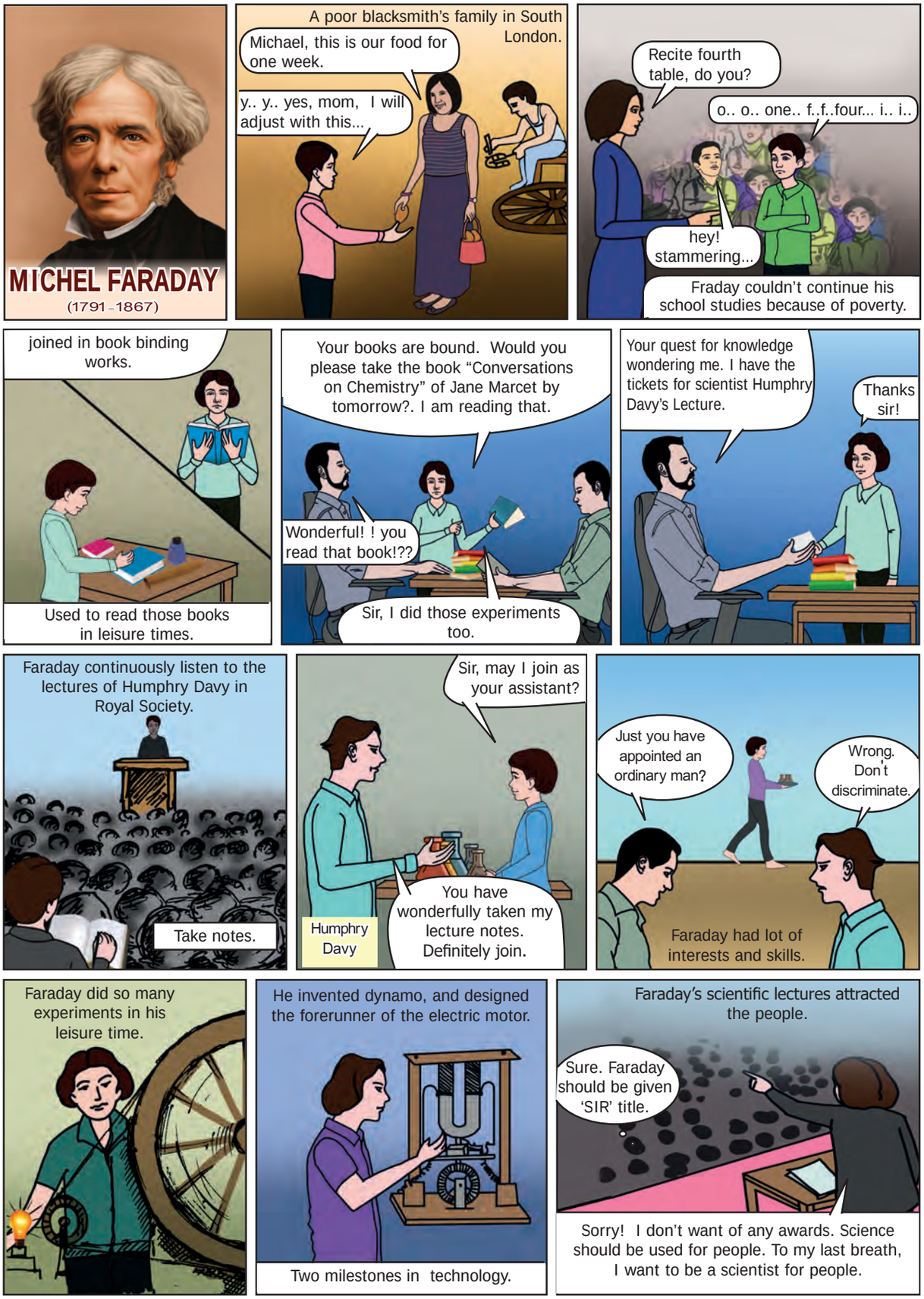
Points to remember

- Any device from which electricity is produced, is called the source of electricity.
- There are many sources of electricity such as thermal power stations, hydel electric power stations, wind mills, atomic power station etc.
- Device that converts chemical energy into electrical energy is called a cell.
- Electric cells are of two types depending on the continuity of flow of electric current.
- Primary cell is a cell that is designed to be used once and discarded.
- A cell that can be recharged many times is called secondary cell.
- Two or more cells combined together to make a battery.
- An electric circuit is the continuous or unbroken closed path along with electric current flows from the positive terminal to the negative terminal of the battery.
- A circuit consisting of a cell, key, bulb and connecting wires is called a simple circuit
- If two or more bulbs are connected in series in a circuit, then that type of circuit is called series circuit.
- If two or more bulbs are connected in parallel in a circuit, then that type of circuit is called parallel circuit.
- Symbols of electrical components are used to represent complicated circuits in simple way.
- The materials which allow electric charges to pass through them are called conductors.
- The materials which do not allow electric charges to pass through them are called insulators or non-conductors.

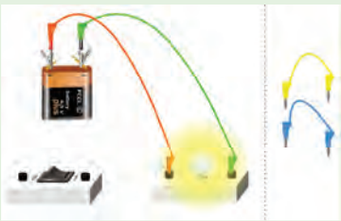
Scientist for the People



ICT Corner

Electricity

Through this activity you will be able to form a simple circuit.



Step 1: Use the given URL in the browser. 'Simple Circuit will open.

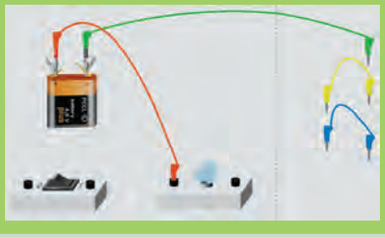
Step 2: In right side of the activity window there are diagrams of some wires and in the left side diagrams of a battery, switch and a bulb are given.

Step 3: By using the mouse drag and drop the wires to the battery and switch to make connections. Click on the switch, if the circuit is formed correctly the bulb will glow.

Step 4: Use the second URL to try Series and parallel circuits.

Step 1

Step 2



Step 3

Simple Circuit's URL:

http://www.physics-chemistry-interactive-flash-animation.com/electricity_electromagnetism_interactive/simple_circuit.htm

Series and parallel circuits url

http://www.physics-chemistry-interactive-flash-animation.com/electricity_electromagnetism_interactive/components_circuits_association-series_parallel.htm

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*Pictures are indicative only

Evaluation

A25URI

I. Choose the appropriate answer

1. The device which converts chemical energy into electrical energy is

   a. fan b. solar cell

   c. cell d. television

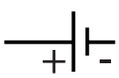
2. Electricity is produced in

   a. transformer b. power station

   c. electric wire d. television

3. Choose the symbol for battery

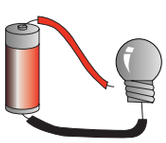
a. 

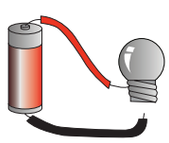
b. 

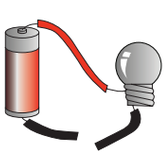
c. 

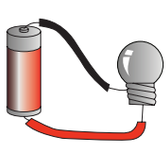
d.

4. In which among the following circuits does the bulb glow?

a. 

b. 

c. 

d. 

5. _____ is a good conductor

   a. silver b. wood

   c. rubber d. plastic

II. Fill in the blanks

1. _____ are the materials which allow electric current to pass through them.
2. Flow of electricity through a closed circuit is _____.
3. _____ is the device used to close or open an electric circuit.
4. The long perpendicular line in the electrical symbol represents its _____ terminal.
5. The combination of two or more cells is called a _____.

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

1. In a parallel circuit, the electricity has more than one path.
2. To make a battery of two cells, the negative terminal of one cell is connected to the negative terminal of the other cell.
3. The switch is used to close or open an electric circuit.
4. Pure water is a good conductor of electricity.
5. Secondary cell can be used only once.

IV. Match the following

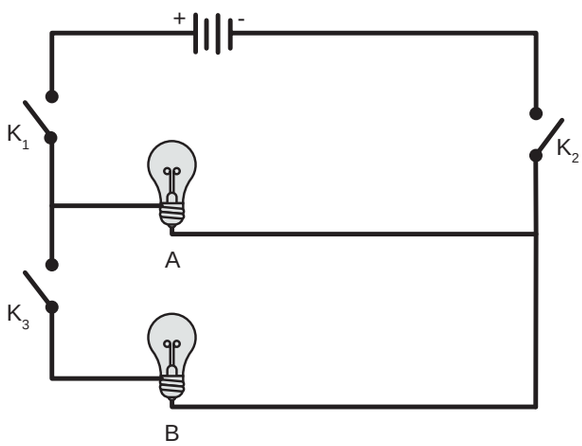
sl.no.	Symbol	Description
1		open key
2		cell
3		bulb glows
4		battery
5		bulb does not glow

V. Arrange in sequence

A CELL	A DEVICE	ELECTRICAL ENERGY
IS CALLED	IN TO	CHEMICAL ENERGY
THAT CONVERTS		

VI. Give very short answer

1. In the given circuit diagram, which of the given switch(s) should be closed. So that only the bulb A glows.



2. Assertion (A) : It is very easy for our body to receive electric shock.

   Reason (R) : Human body is a good conductor of electricity.

   a. Both A and R are correct and R is the correct explanation for A.

   b. A is correct, but R is not the correct explanation for A.

   c. A is wrong but R is correct.

   d. Both A and R are correct and R is not the correct explanation for A.

3. Can you produce electricity from lemon?

4. Identify the conductor from the following figures.

5. What type of circuit is there in a torch light?

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

   Switch, Bulb, Battery, Generator.

VII. Give short answer

1. Draw the circuit diagram for series connection.

2. Can the cell used in the clock gives us an electric shock? Justify your answer.

3. Silver is a good conductor but it is not preferred for making electric wires. Why?

VIII. Answer in detail

1. What is the source of electricity? Explain the various power stations in India?

2. Tabulate the different components of an electric circuit and their respective symbols.

3. Write short notes on conductors and insulators.

IX. Question based on Higher Order Thinking Skills

1. Rahul wants to make an electric circuit. He has a bulb, two wires, a safety pin and a piece of copper. He does not have any electric cell or battery. Suddenly he gets some idea. He uses a lemon instead of a battery and makes a circuit. Will the bulb glow?

X. Search ten words in the given word grid and classify them as conductors and insulators

A	G	H	R	N	A	E	J	U	R
R	H	A	E	A	R	T	H	M	A
E	R	S	S	A	L	G	U	M	Q
T	P	L	A	S	T	I	C	N	T
A	T	I	R	O	N	A	A	O	N
W	J	A	E	I	W	O	O	D	T
A	B	D	M	C	O	P	P	E	R
E	R	U	B	B	E	R	M	P	T
S	L	R	H	E	S	S	A	I	I
A	T	N	A	S	B	H	N	L	R

S.No.	CONDUCTORS	INSULATORS

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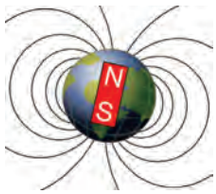


Unit 1 Magnetism

ECYPFM

Learning Objectives

- To know about the discovery of magnets
- To identify Magnetic and Non Magnetic Materials
- To distinguish between north and south poles
- To list out the properties of magnets
- To explain the principle of Maglev Train

Introduction

You might have seen magnets. Have you ever enjoyed playing with them?

Take a steel glass. Take a needle through which thread is passed. Press the thread with a finger near the hole of the needle as shown in the figure and raise the glass upward slowly.

What happens?

_____

Observe the same activity performed by your teacher and note it.

_____

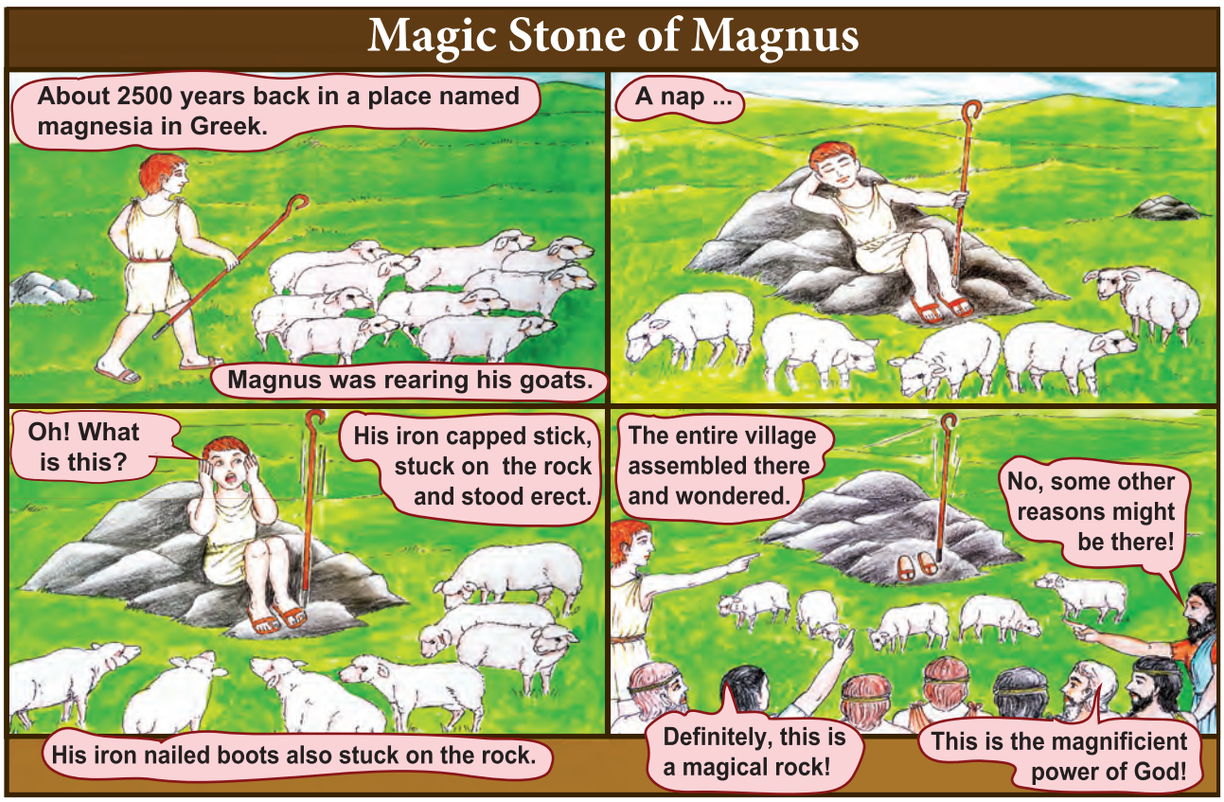
_____

Does the needle stand vertically up without touching the glass? Why this happens?

_____

_____

1.1 Discovery of Magnets



People wondered about this incident, Each and everyone expressed their views. What might be the reason for the stick, to get stuck on the rock?

_____

Yes, you are right. That is a magnetic rock. People found it attracting not only for the stick of Magnus, but also for all the materials made of iron. The more rocks of these kinds were found worldwide. These magnetic rocks were named **'Magnets'** and the ore is called as

'Magnetite' after the name of the boy Magnus. The name is also supposed to come after the name of the place (Magnesia) in which it was found.

Magnetite was the ore with attracting property found in that region. Magnetites are **natural magnets**. They are called magnetic stones.

Magnetite

Natural magnets do not have a definite shape. Since, they are used for finding direction, they are also called **'leading stones'** or **'lode stones'.**

1.2 Magnet of different shapes

After learning the method of changing the piece of iron into magnet (magnetization) we have been making and using several kinds of magnets. Such man-made magnets are called **artificial magnets**.

Bar-magnet, Horseshoe magnet, Ring magnet and Needle magnet are generally used artificial magnets.

Bar-magnet

Horseshoe magnet

Ring magnet

Needle magnet

Oval-shape, Disc shapes and Cylindrical magnets are also available.

Oval-shape

Disc shape

Cylindrical shape

Activity 1: Take a magnet. Take the magnet Closer to the objects surrounding you.

What happens? Observe and note.

The objects attracted by the magnet : _____

The objects, not attracted by the magnet : _____

Which substances are used to make the objects attracted by the magnet?

_____

1.3 Magnetic and Non Magnetic Materials

Substances which are attracted by magnet are called **magnetic substances**. Iron, cobalt, nickel are magnetic substances.

Substances which are not attracted by magnet are called **non-magnetic substances.** Paper, plastic are called non-magnetic substances.

1.4 Magnetic Poles

Place some iron filings on a paper. Place a bar magnet horizontally in the filings and turn it over a few times. Now lift the magnet. What do you see? Which part of the magnet has more iron filings sticking to it?

Which part of the magnet has almost no filings sticking to it?

The parts of the magnet those attract the largest amount of iron filings are called as its poles. **The attractive force of the magnet is very large near the two ends. These two ends are called its poles.**

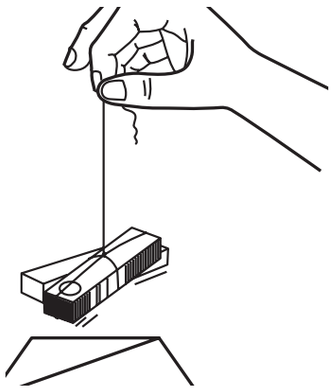
In experiments with magnets you will need to use iron filings again and again. You can do this by placing a magnet in a pile of sand and turning it around in the sand. The small pieces of iron present in the sand will stick to the magnet. If you cannot find sand you can look for iron pieces in clayey soil as well.

If you don't have iron filings, you can collect small pieces of iron and they will serve the purpose as well.

If you have a horseshoe magnet, or any other type of magnet at home, find the position of its poles by this experiment.

1.5 Finding directions with a magnet

Tie a piece of thread to the centre of a bar magnet and suspend it. Note, in which direction the magnet stops. Draw a line on a sheet of cardboard or the table along the direction in which the bar magnet stops



(i.e) a line parallel to the bar magnet). Turn the magnet gently and let it come to stop again. Repeat it three or four times.

Does the bar magnet stop in the same direction each time? _____

In which direction does the magnet stop every time? _____

This is roughly the north-south direction. The end of the magnet that points to the north is called the **North Pole.** The end that points to the south is called the **South Pole.**

A freely suspended magnet always comes to rest in north-south direction.

DO YOU KNOW?

The directive property of magnets has been used for centuries to find directions. Around 800 years ago, the Chinese discovered that a suspended lode stone stops in the north-south direction. Chinese used these lode stones to find directions.

The navigators of that country used to keep a piece of lode stone suspended in their boats and during a storm or mist, they used the lode stone to locate directions.

1.6 Magnetic compass

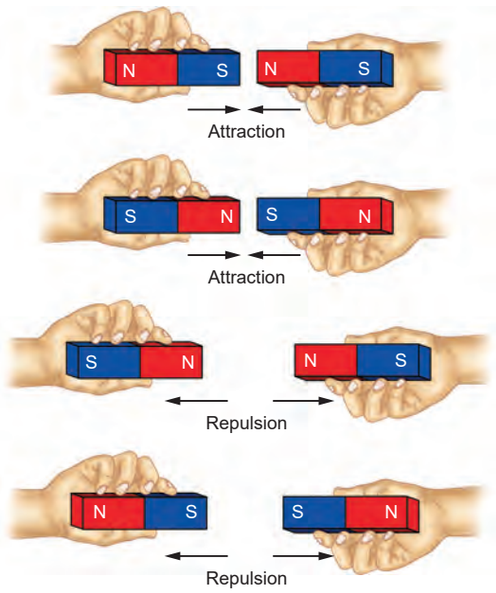
A compass is an instrument which is used to find directions. It is mostly used in ships and airplanes. As a rule, mountaineers also carry a compass with them so that they do not lose their way in unknown places.

The compass has a magnetic needle that can rotate easily. The marked end of the needle is the North Pole of the magnet. **Can you use magnetic compass to find west direction?** Ask your teacher to help you in using magnetic compass.

1.7 Properties of Magnets

Attraction or Repulsion

Take two similar magnets, place them in four different ways as shown in Figure.



What do you observe? When do the magnets attract each other?

_____

_____

When do the magnets repel each other?

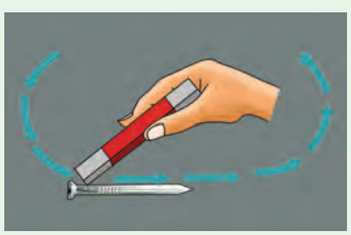
_____

_____

Unlike poles (S-N, N-S) attract each other. Like Poles (N-N, S-S) repel each other.

Activity 2: **LET US MAKE MAGNETS**

Take a nail / a piece of Iron and place it on a table. Now take a bar magnet and place one of its poles near one edge of the nail / piece of Iron and rub from one end to another end without changing the direction of the pole of the magnet. Repeat the process for 30 to 40 times.

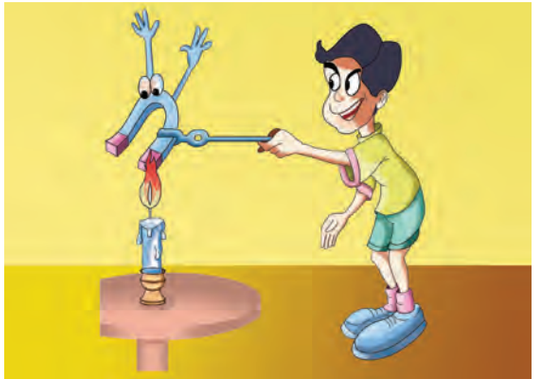


Bring a pin or some iron filings near the nail / piece of Iron to check whether it has become a magnet. Does the nail/ piece of iron attract the pin / iron filings? If not, continue the same process for some more time.

1.8 Do magnets lose their properties ? When?

ED8KHA

Magnets lose their properties if they are heated or dropped from a height or hit with a hammer.



When heated

When dropped

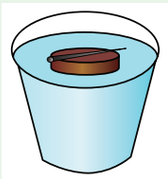
When hammered

DO YOU KNOW?

Magnets lose their properties when they are placed near Cellphone, Computer, DVDs. These objects will also get affected by magnetic field.

Activity 3: **Make your own magnetic compass**

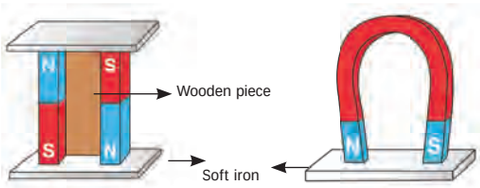
Insert the magnetized needle, that you made in the activity 2, in to two styrofoam balls (Thermocol balls) and place the needle in bowl of water. Test whether the floating needle is always turned in rest on north - south direction.



Note: If you don't have styrofoam balls you can use dry leaf or a cork piece.

1.9 Storage of Magnets

Improper storage can also cause magnets to lose their properties. To keep them safe, bar magnets should be kept in pairs with their unlike poles on the same side. They must be separated by a piece of wood and two pieces of soft iron should be placed across their ends.



For a horse-shoe magnet a single piece of soft iron can be used as a magnetic keeper across the poles.

1.10 Usage of Magnets

We use various equipment with magnets in day to day life.

Discuss with your friends about the usage of the magnets in the following instances.

In speakers

In small electric motors

In some door locks

Bags

In some toys

In compasses

In pencil boxes

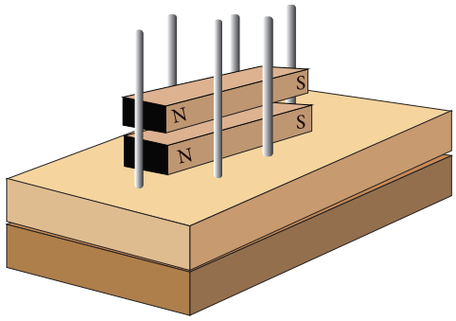
Stickers on refrigerators

Phone covers

Pin holders

Magnetic crane

1.11 Science Today – Bullet Trains

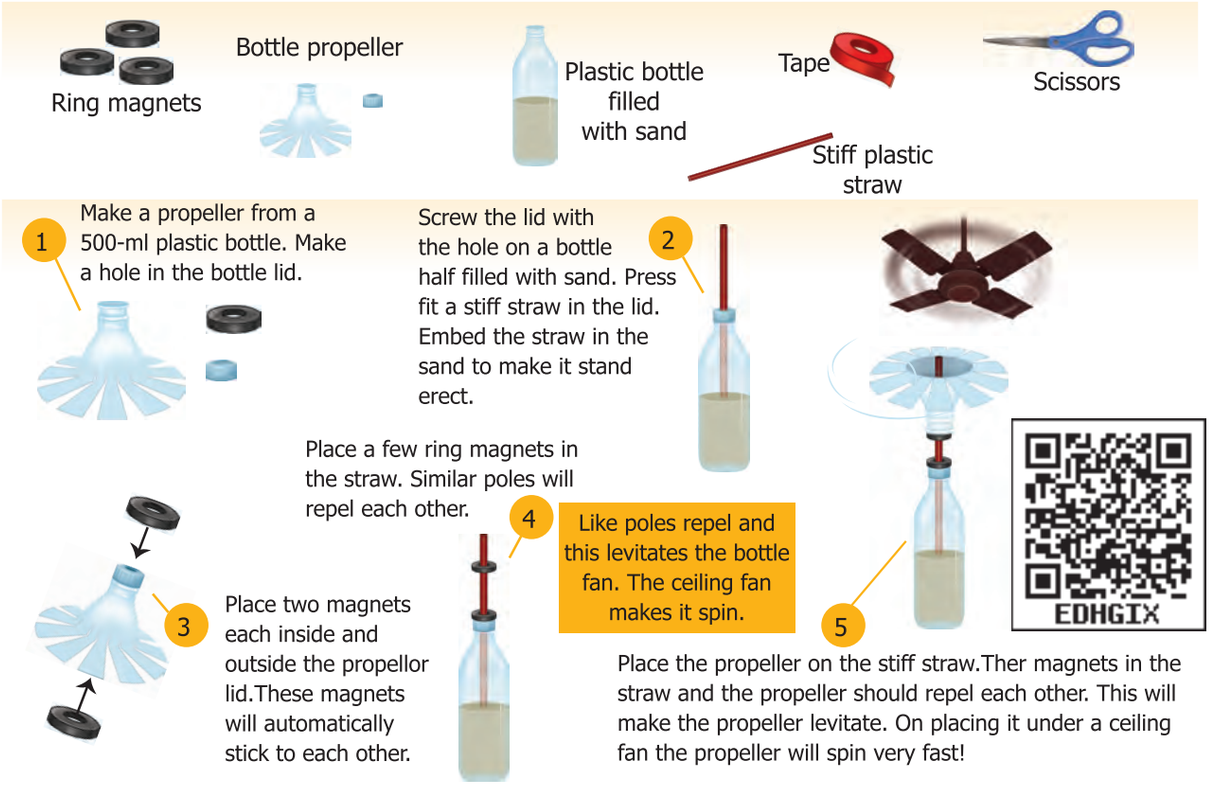


We Know that Like poles of the magnet repel each other. Keep two Bar magnets as shown in the Figure.

What do you observe? _____

By using repulsion we can levitate a magnetic object. Let us make a toy and enjoy magnetic levitation.

Levitating propeller

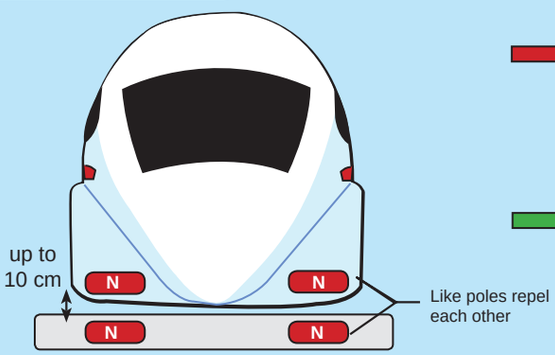


Have you enjoyed with this toy? Electromagnetic train is working in the same principle. Have you heard about it?

Electromagnetic train is called as suspension train and also called as flying train. It does not require diesel or petrol. This technology uses the property of magnetic attraction and repulsion to run these super fast electromagnetic trains.

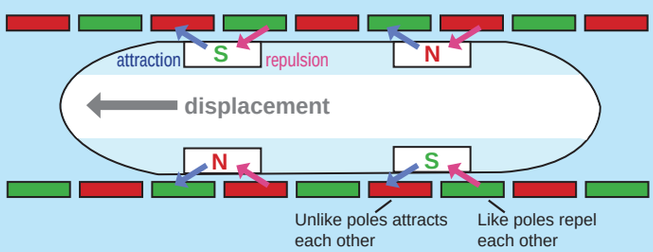
Maglev Train

Levitation

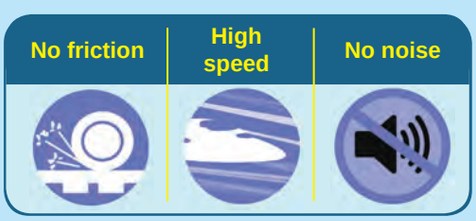


Propulsion

- By using attraction and repulsion at the same time the train move forward. The magnets are controlled by electricity.



Key features



Which Countries?

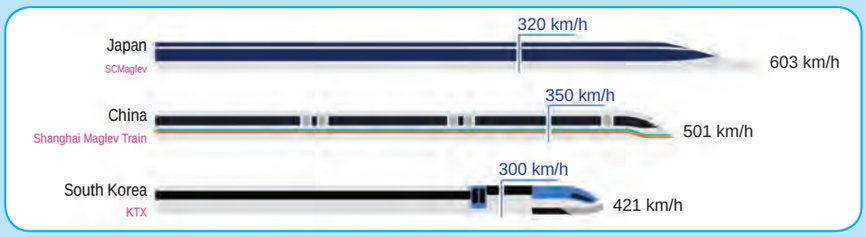
China Japan South Korea

These three countries are currently using Maglev Trains for public transport. Many countries explore possibilites to use it.

In India

Mumbai-Delhi, Mumbai-Nagpur, Chennai-Bengaluru-Mysuru routes are considered for proposal.

How much Speed?



How does the electromagnetic train work?

EDRCKK

Electromagnets are used in Electromagnetic train. Electromagnets are magnetised only when current flows through them. When the direction of current is changed the poles of the electromagnets are also changed. Like poles of the magnets which are attached at the bottom of the train and rail track repel each other. So, the train is lifted from the track up to a height of 10 cm.

We Know that we can move any magnetic object with the force of attraction or repulsion properties of magnets. This train also moves with the help of the magnets attached on the sides of track and the magnets fitted at the bottom sideway of the train. By controlling the current we can control the magnets and movement of the train.

As there are no moving parts, there is no friction. So, the train can easily attain a speed of 300 km per hour. These trains are capable of running up to 600 km/ hour. They do not make any noise. They require less energy and they are eco-friendly.

Even though, many countries have taken effort to use these trains, such trains are used for public transport only in China, Japan and South Korea. In India the possibilities of introducing these trains are under consideration.

Write the differences between a normal train and an electromagnetic train.

_____

_____

_____

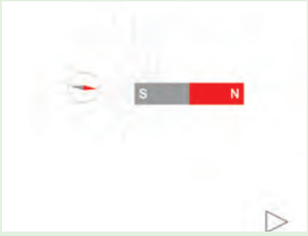
Points to remember

- Magnetites are natural magnets. They are called magnetic stones.
- Man-made magnets are called artificial magnets.
- Substances which are attracted by magnet are called as magnetic substances.
- Substances which are not attracted by magnet are called non-magnetic substances.
- A freely suspended magnet always comes to rest in north-south direction.
- The end of the magnet that points to the north is called the North Pole. The end that points to the south is called the South Pole.
- A compass is an instrument which is used to find directions.
- Like Poles (N-N, S-S) repel each other and unlike poles (N-S, S-N) attract each other.
- Magnets lose their properties if they are heated or dropped from a height or hit with a hammer.

ICT Corner

Magnet

Through this activity you'll be able to understand the properties of magnetic poles and magnetic field lines.



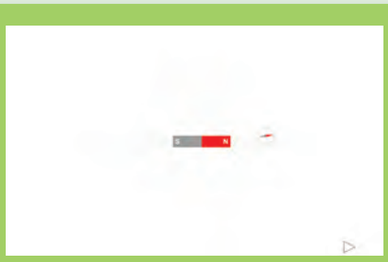
Step 1: Type the URL given or scan the QR code to launch the activity page.

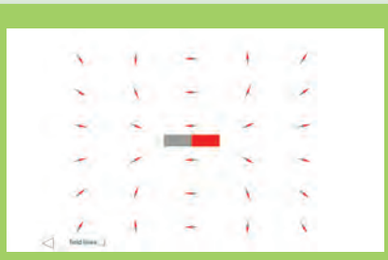
Step 2: A diagram of a bar magnet and a magnetic needle are there. Click and drag the magnetic needle with the use of mouse, around the bar magnet. Observe the position of the magnetic field lines and how the needle rotates according the poles.

Step 3: Click the 'Next navigation icon'. A grid of magnetic needles around a bar magnet will appear. Click and drag the bar magnet. Observe the changes of the needles.

Step 4: Click the 'field lines' check box at the bottom of the activity window to see the magnetic field lines.

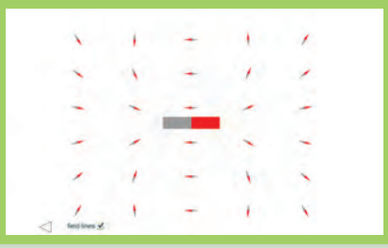
Step 1

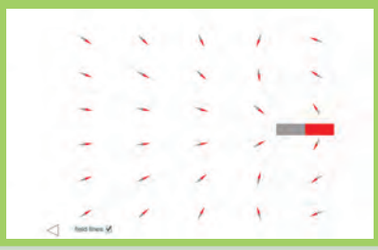




Step 2

Step 3





Step 4

Magnet URL:

http://www.physics-chemistry-interactive-flash-animation.com/electricity_electromagnetism_interactive/bar_magnet_magnetic_field_lines.htm

*Pictures are indicative only

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Evaluation

EE18M8

I. Choose the appropriate answer

1. An object that is attracted by magnet.

   a. wooden piece b. plain pins

   c. eraser d. a piece of paper

2. People who made mariner's compass for the first time.

   a. Indians b. Europeans

   c. Chinese d. Egyptians

3. A freely suspended magnet always comes to rest in the _____ direction

   a. North - east b. South - west

   c. East - west d. North - south

4. Magnets lose their properties when they are

   a. used b. stored

   c. hit with a hammer d. cleaned

5. Mariner's compass is used to find the

   a. speed b. displacement

   c. direction d. motion.

II. Fill in the Blanks

1. Artificial magnets are made in different shapes such as _____, _____ and _____.

2. The Materials which are attracted towards the magnet are called_____.

3. Paper is not a _____ material.

4. In olden days, sailors used to find direction by suspending a piece of _____.

5. A magnet always has _____ poles.

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

1. A cylindrical magnet has only one pole.

2. Similar poles of a magnet repel each other.

3. Maximum iron filings stick in the middle of a bar magnet when it is brought near them.

4. A compass can be used to find East-West direction at any place.

5. Rubber is a magnetic material.

IV. Match the following

1.	Compass	-	Maximum magnetic strength
2.	Attraction	-	Like poles
3.	Repulsion	-	Opposite poles
4.	Magnetic poles	-	Magnetic needle

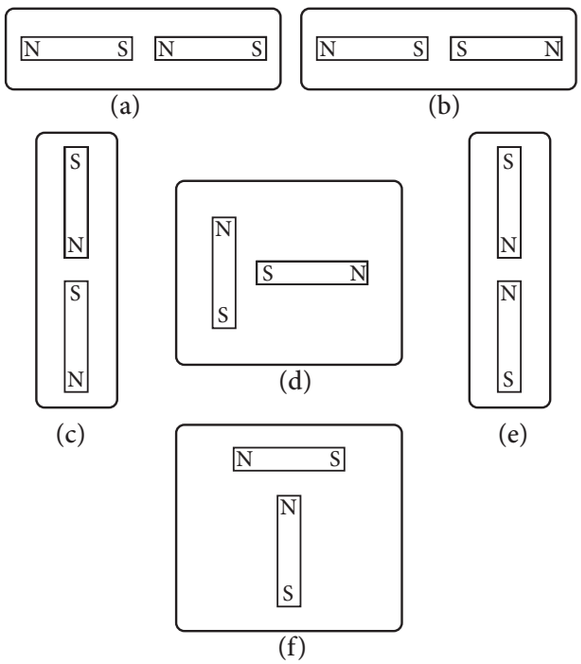
V. Circle the odd ones and give reasons

1. Iron nail, pins, rubber tube , needle.

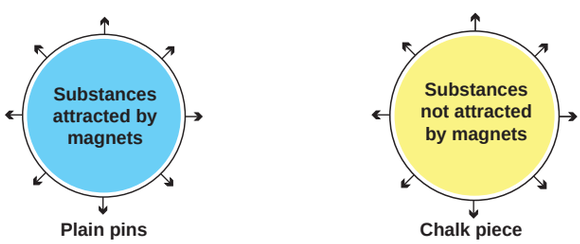
2. Lift, escalator, electromagnetic train, electric bulb.

3. Attraction, repulsion, pointing direction, illumination.

VI. The following diagrams show two magnets near one another. Use the words, 'Attract, Repel, Turn around' to describe what happens in each case.



VII. Write down the names of substances.



VIII. Give short answer

1. Explain the attraction and repulsion between magnetic poles.

2. A student who checked some magnets in the school laboratory found out that their magnetic force is worn out. Give three reasons for that?

IX. Answer in detail

1. You are provided with an iron needle. How will you magnetize it ?

2. How does the electromagnetic train work?

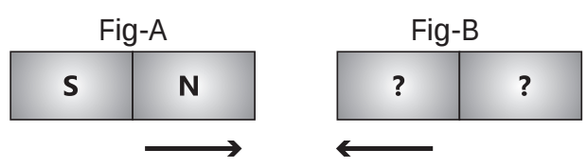
X. Questions based on Higher Order Thinking Skills

1. You are provided with iron filings and a bar magnet without labelling the poles of the magnet. Using this...

   a. How will you identify the poles of the magnet?

   b. Which part of the bar magnet attracts more iron filings? Why?

2. Two bar magnets are given in the figure A and B. By the property of attraction,identify the North pole and the South pole in the bar magnet (B)



3. Take a glass of water with a few pins inside. How will you take out the pins without dipping your hands into water?