To measure the lengths accurately using the standard measuring instruments like meter scale, centimeter scale and tape etc., we should take some precautions.

How to measure length accurately with a meter scale

In our day to day work, we use a wooden/plastic scale to measure lengths. It is marked or graduated in centimeters and millimeters. Suppose we are asked to measure the length of a table. We will take a meter scale. The zero mark on the scale is made to coincide with one end of the table and the reading at the point which is coinciding with the other end of the table is taken. Since a meter scale has some thickness, we may make an error if the eye is not correctly positioned. The correct position of the eye is "B" (Fig. 9) which is vertically above the end where the reading is to be taken.

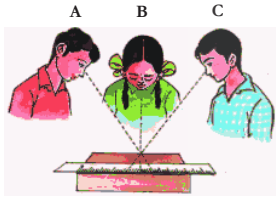


Fig. 9

Precautions while using a meter scale

We must take the following precautions while using a meter scale for measuring length :

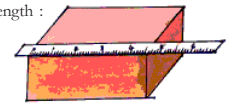


Fig. 10

1. The scale should be placed exactly along the length to be measured.
2. Zero point on the scale should coincide with the starting point of the length to be measured.
3. Our eye must be vertically above the point of coincidence of scale where the measurement is to be taken.
4. Ensure that the ends of the scale are not worn out.
5. Measure the length of an object more than two times and then take the average of these measurements for accuracy.

Think! What can you do to know a scale is accurate or not

How can we measure a small thickness?

Can you accurately measure the thickness of the cover page of your text book or a coin using the scale? If we want to measure the thickness of a page of notebook or a coin it is not possible to directly use a scale. Let us look at the method to measure the thickness of a coin.

Activity-3: Measuring thickness of a coin

Take about 10 one rupee coins of same size and place them one upon the other as shown in Fig. 11. Measure the total thickness with a scale and then divide it by the number of coins to get the thickness of one coin.

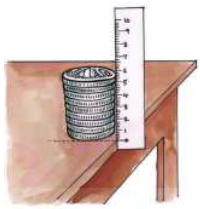


Fig. 11

In the same way, try to measure the thickness of a page of your text book.

We generally use a scale to measure the lengths which are in a straight line like the length of a room, length of a table etc. There are certain situations where the lengths are in curved line like the perimeter of bucket, perimeter of a tava or kadai etc.

Can we measure these curved lengths with a meter scale? If not why?

Activity-4: Measuring the length of a curved path

Fix alpins at the ends of the curved line to be measured as shown in the Fig. 12. Now tie a knot with cotton thread at the first point A of the alpin A and move the cotton thread along points B, C, D, E etc.

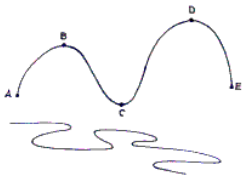


Fig. 12

Care should be taken that the thread is neither too tight nor too loose and see that the thread coincides with the curve at each point while moving along the path. When the thread reaches the extreme end of the curved path, cut it at that point.

Remove the thread from A and then place it straight along the length of a meter scale, and measure its length.

The length of the thread is the measure of the length of the curved path.

The foot is divided into 12 inches

The initial metric unit of mass, the "gram," was defined as the mass of one cubic centimeter (a cube that is 0.01 meter on each side) of water at its temperature of maximum density.

Measurement of area

Ramu and Ravi's father brought two drawing sheets for them. After taking these sheets from their father, Ramu and Ravi started quarrelling with each other, each one claiming that his sheet was shorter than the others.

Which sheet is smaller? Which sheet is bigger? How can we decide?

Activity-5:

Sheet A Fig. 13 Sheet B

See Fig. 13. Can you decide which is the bigger and which is the smaller sheet by observing them? If not, what method do you adopt to decide the bigger one or smaller one?

Let us do:

Take two sheets of A4 paper and cut them in the shapes of shown in Fig. 13. Now take some empty matchboxes of equal size and keep them on the sheet. Starting from one corner of the sheet, count how many matchboxes are needed to cover the entire surface of the sheet. Similarly repeat the process for the second sheet also and record the findings in your notebook.

- Which sheet needs more number of matchboxes? Which is bigger in size?

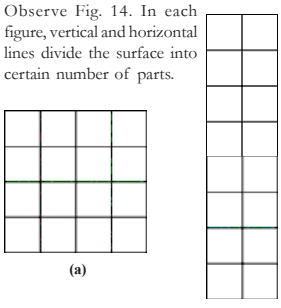
You may find that one of the sheets needs more number of matchboxes which shows that one sheet is bigger in size than the other. Thus, we need to measure the surface of an object to decide whether it is bigger or smaller.

Area is the measure of the extent of plane surface occupied by an object.

In the above activity, a matchbox is taken as a unit to measure area but it is not a standard unit. We need a standard unit to measure the area.

What is the standard unit to measure area?

Observe Fig. 14. In each figure, vertical and horizontal lines divide the surface into certain number of parts.



(a) (b)

Fig. 14

The Arthashastra offers a wealth of evidence for the wide varieties of standardized weights and measures of the time.

- Which figure has more area and why?
- Are all the parts in both figures equal?
- What is the shape of the smaller part in each diagram?
- Is the length and breadth of each smaller part equal?
- Measure the length and breadth of any one part of each diagram. What do you notice?

You may notice that the small parts in each diagram have equal lengths and breadth, one centimeter each. Area of each part is equal to one square centimeter and it is written as cm^2.

- Since Fig. 14 (a) and 14 (b) have same number of squares, of area 1 cm^2 each, both the figures have a total area of 16 cm^2 each. Thus, these figures have different shapes but equal areas.

Square centimeter (cm^2) is a standard unit to measure the area of a surface.

We use m^2 (square meter), mm^2 (square millimeter), $foot^2$ (square foot), etc., also to measure the areas according to need and requirement of the situation.

Table 3 : Units of measurement

S.No.	Units of Length	Symbol	Units of Area	Symbol
1	Meter	m	Square metre	m^2
2	Centimeter	cm	Square Centimetre	cm^2
3	Millimeter	mm	Square millimetre	mm^2
4	Feet	ft	Square feet	ft^2

Activity-6: Measuring the area of a regular surface

Cut a cardboard into a shape of rectangle having length 4 cm and breadth 2 cm as shown in Fig. 15. Let us measure its area.

The convenient unit to measure the area of given cardboard would be cm^2.

Take a centimeter graph paper. Each small square on this graph paper has a

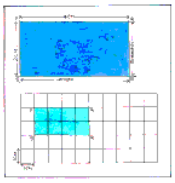


Fig. 15

The Mughal measurement system measured land in terms of "gaz" and "bigha".

side equal to 1 cm. The area of each small square on this graph paper is 1 cm^2.

Place the cardboard on the centimeter graph paper (Fig. 15) and draw its outline with the help of a sharp pencil. Now remove the cardboard and mark the shape as PQRS. Count the number of squares inside the outline. The number of squares is 8.

Area of the cardboard is equal to the area covered by PQRS on the graph paper.

Area of PQRS = Total area of unit squares inside the PQRS

= 8 × area of 1 unit square

= 8 × 1cm^2

= 8 cm^2

In this case, the cardboard we used has a regular shape - rectangle.

- Can you relate the measured area to some formula of finding area?

Activity-6: Measurement of irregular plane surface

Let us find out the area of a surface, say a banana peel or a leaf, which has irregular shape. Place the leaf on a graph paper as shown in Fig. 16. Mark the boundary of the piece of leaf on the graph paper with a pencil. Now remove the leaf to find the outline or boundary of the leaf on graph paper.

Fig. 16

Count the number of complete squares (each of 1 cm^2 area) inside the boundary. Also count those squares, inside the boundary, which are half or greater than half. Add this to the number of complete squares.

This total number of squares inside the boundary gives the area of the leaf. If there are 'n' squares inside the boundary, the area of the leaf becomes n cm^2.

Neglect those squares, inside the boundary, which are less than half.

This process will gives us the value of area which is close to the actual area.

- How can you use the graph paper to get a more accurate answer?

The Republic of India adopted the metric system on April 1, 1957.

Measurement of volume

- How do you find the volume of a solid?

Mrs. John is constructing a house. She needs sand and enquired about prices. The supplier informed her that two tractor loads of sand costs Rs. 4000/- and one lorry load of sand costs about Rs. 4000/-.

- Which deal is cheaper for Mrs. John? A lorry or a tractor?
- How can you decide which load has more quantity of sand?

To decide the quantity contained either in a lorry or tractor, we need to know the volume of the body of lorry as well as that of the body of tractor.

Volume is a measure of the extent of space occupied by a body.

Measurement of volume of liquids

- How can you measure the volume of kerosene?
- How do you decide the volume of milk?

We use some measuring cylinders to measure the volumes of liquids such as kerosene, milk, oils, water, etc. The volume of liquids is expressed in liters (l) or milliliters (ml)

Measuring cylinder

It is cylindrical in shape, with graduations marked on its body. Measuring cylinders are available in different sizes. They are used in laboratories to measure a certain volume of a liquid and to measure milk, oils, etc by shop keepers. We can fill it with the liquid to be measured and then read the marking at the lowest point of the concave surface of liquid. We must bring our eyes in line with this level of liquid and then read it.

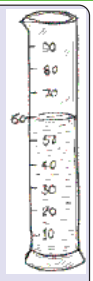


Fig. 17

Apart from measuring the volumes of liquids, we also measure the volumes of solids, for example, loose solids like sand, clay, and ready mix of cement.

- What is the standard unit of measuring the volume of solids?
- Are you able to measure the volume of loose solids?
- How can you decide a standard unit of volume of a solid?

Look at Fig. 18. There are certain number of identical cubes of length, breadth and height 1 cm each, and a cardboard box of length 3 cm, breadth 2 cm, and height 2 cm.

The distance travelled by Aeroplane or Ship per hour is measured by knots or nautical miles. 1 Knot is equal to 1.852 Km/h.

Fig. 18

Place three cubes in a line so as to cover the entire length. Along the side of this line, place another line of three cubes so as to completely cover the base of the box (Fig. 19). How many cubes have you used so far?

How many cubes do you need to cover the entire empty space in the box?

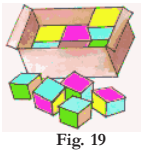


Fig. 19

Place more cubes over this set of blocks; so that the total space is occupied by the blocks. Calculate the number of cubes occupying the rectangular box.

- How many cubes occupy the rectangular box?
- Can you gusses volume of rectangluar box.

Since each cube has measurement of 1 cm length, 1 cm breadth, and 1 cm height, the volume of one cube is equal to 1cm x 1cm x 1cm = $1cm^3$ which is known as 1 cubic centimeter and written as 1 cm^3.

Cubic centimeter is a standard unit for measurement of volume of solids.

Therefore the volume of the rectangular cardboard box is equal to the total number of cubes occupying it.

Therefore volume of rectangular cardboard box = 12 × 1 cm^3 = 12 cm^3.

However, if we multiply length, breadth and height, it would be

3 cm × 2 cm × 2 cm = 12 cm^3

Therefore, we can say volume of a box = length × breadth × height

Do you know?

You must have noticed that the volumes of liquids are written in ml while those of solids are written in cm^3. Do you know the relation between these two units. The two units are related as follows :

1 ml = 1 cm^3

Measurement of volume of irregular solids using a measuring cylinder

Take a measuring cylinder and fill almost half of it with water. Record the volume of water (Fig. 20). Let us assume it is "a" cm^3 (or "a" ml).

1 mile is equal to 1.61 kms

Now tie a small irregular solid (stone) with a fine cotton thread. Put the solid gently into the water in the cylinder so that it is completely immersed in water.

What changes do you notice in the water level of the cylinder?

You may notice that the level of water in the measuring cylinder rises as the stone displaces water equal to its own volume. Record the new volume of water. Let us assume that it is "b" ml.

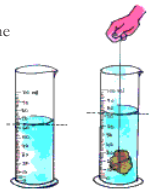


Fig. 20

Now the volume of stone will be the difference between the second volume and the first volume i.e volume of the stone = (b - a) cm^3.

Keywords

Measure, standard unit area, volume, regular surface, irregular surface, rectangular body, measuring cylinder, graph paper

What we have learnt

- We use some conventional ways like hand-span, foot - span, cubit, etc. for rough measurements in our daily life.
- We need standard instruments to measure lengths accurately.
- Meter scale is a standard instrument to measure length.
- Meter is the standard unit for measuring length. Larger distances can be measured in kilometers.
- Area is a measure of the extent of the plane surface occupied by an object.
- Generally we measure area in square meters or square centimeters etc.
- Volume is a measure of the extent of space occupied by a body.
- Volume of solids is measured in cubic meters, cubic centimeters, etc.
- Volume of liquids is measured in liters or milliliters.

1cm^3 = 1ml

Improve your learning

1. What is the smallest distance that you can measure with a centimeter scale?
2. Are we able to measure the thickness of a metal wire using a scale? Explain.

Astronomers use a method called parallax to measure the distance to some stars

3. A school hall measures 20 m in length and 15 m in breadth. Find its area.

4. Ramu's father had a rectangular plot of length 60 ft. and breadth 50 ft. He built a house occupying length 40 ft. of the plot and breadth 40 ft. and in the remaining area he planned a garden.

   Can you help Ramu to find out the area of his garden?

5. Match the following :

	A		B
a)	A liter	i)	10000 m^2
b)	A meter	ii)	1000 ml
c)	A Kilometer	iii)	100 cm
d)	A Centimeter	iv)	1000 m
e)	1 hectare	v)	10 mm

6. Milliliter is a unit for measuring _____

7. For measuring long distances we can use _____ as a unit.

8. What method will you adopt to measure the volume of a banana? Explain?

9. Identify incorrect statements among the following and rewrite them with necessary corrections :

a) One square meter is equal to 100 square centimeters.

b) The appropriate unit for reporting the volume of a cylindrical rod is cm^2.

c) The appropriate instrument to measure the thickness of a 25 paisa coin is a tailor's tape.

d) A measuring cylinder can directly measure the volume of solids.

11. How will you measure the area of your palm using graph paper? Explain.

12. Measure the volume of "Kalakanda" (sugar crystal) and piece of "Patika" (alum). Record your measurements in table 4.

    Ask your friends to measure volumes of the same pieces of Kalakanda and Patika and record the values.

Nanometer - A metric unit which equals to a 1/1,000,000,000 of a meter

Table 4

S. No.	Name of the student	Volume of Kalakanda	Volume of Patika
1			
2			
3			
4			

- Are all the values of volumes of Kalakanda equal?
- Are all the values of volumes of Patika equal?
- If not , state the possible reasons.

13. A carpenter who makes wooden furniture, needs acquaracy in measurments. Do you ever notice how he measures? How whould you appreciate him.

14. Make a visit to panchayat office collect information how VRO measure areas of agricultural lands in your village. Prepare a questionaire for this.

15. Collect any invitation card with envolpe. Find out the difference between the measurments of card and cover. Write down the process that you follow.

16. The distance between numbers in a clock is accurately same. List out the things that you observe in your surroundings with accurate distance between them.

17. Try to imagine the area of CD, sim card, mobile phone then find out the area of the above by using graph paper. Compare the values of your guess with graph paper measurment. Which thing is closely related to your guess?

* * * * *

Computer memory is measured by Bites, Kilobyte (KB), Megabyte (MB), Gigabyte (GB) and Terabyte (TB)

14 Movements in Animals

While doing physical exercise we move our body parts in different ways. We lift and bend our legs, hands and other body parts. We can also rotate some parts of our body Have you ever noticed how we are able to move this way? What parts of our body are responsible for these movements?

Usually, when we have to go a short distance from one place to another, we walk or run. But how do animals like fish, snails, snakes etc. move their body or move from one place to another? Can all animal move their body parts like us?

Let us look closely at some of our own movements.

Activity-1: Human body and its movement

Do the following actions :

Bowl an imaginary ball at an imaginary wicket. Lie down and try to rotate your leg at the hip. Bend your arm at the elbow and your leg at the knee. Stretch your arms sideways, chew some food, bend your arm to touch your shoulder with your finger and try to move other body parts as well. Record your observations in table 1.

Table 1

S. No.	Body Part	Rotates Partially/Completely	Bends (Yes/No)	Lifts (Yes/No)	Moves (Yes/No)
1	Neck				
2	Wrist				
3	Fingers				
4	Knee				
5	Ankle				
6	Toes				

The cheetah (Acinonyx jubatus) is one of the fastest mammals found in the animal kingdom today. (97 km/hr)

S. No.	Body Part	Rotates Partially/Completely	Bends (Yes/No)	Lifts (Yes/No)	Moves (Yes/No)
7	Back				
8	Head				
9	Elbow				
10	Arm				
11	Upper jaw				

All these movement are done with the help of certain parts of our body that lie beneath our skin. We cannot see these parts directly but we can get a sense of their movement under our skin. Can you guess the names of these bodyparts?

Do you know?

We can perform different types of movements with the help of muscles and bones. They are situated inside the body. We can't see and study them like we can see our hair, skin, eyes, nose, ears etc.

Let us study how muscles and bones help in movement. For this, we will try to observe our body carefully so that we can sense these internal parts from outside. We will also take the help of their pictures.

Muscles

If you observe a cow, bull or horse, walking or running, you can see some fleshy structures moving beneath their skin, usually around the shoulders and hips. These tender fleshy structures are called **muscles**.

We shall perform a few experiments to find out how these muscles help the various parts of the body to move. We shall also see some of the activities that these muscles perform in the body.

Activity-2 : Touch your sholder

Make a fist with one hand, bend your arm at the elbow and touch your shoulder with the fist. Also touch your upper arm with the other hand, as shown in Fig. 1. Can you feel a swollen region inside your upper arm?

Snails and slugs travel at speeds that vary from slow (0.013 m/s) to very slow (0.0028 m/s).

Fig. 1

This is muscle. The muscle bulges due to contraction. When contracted, muscle becomes shorter, stiffer and thicker.

Activity-3: Fold and un-fold

Hold one of your hands in front of you, in the manner shown in Fig. 2(b), with the palm facing downwards. Fold and unfold the fingers of this hand one by one. Observe the back of your palm between the fingers and the wrist and study the movement of the muscles.

- Could you identify the different muscles that move as you open and close each finger?

Now hold your hand with the palm facing upwards, in the manner shown in Fig. 2(a), and fold and unfold your fingers one by one. Study the moving muscles between the wrist and elbow.

- Could you identify the movements in different muscles?

Try to open and fold your fingers without moving these muscles. Is it possible to do so?

Fig. 2(a)

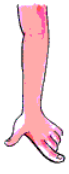


Fig. 2(b)

In a similar manner, try to feel movements of muscles in your legs and toes as well.

After doing all these activities try to find out the relation between moving body parts and muscles?

Perform the following actions and say whether you were able to feel the movement of muscle here as well:

- Fluttering your eyelashes.
- Chewing.
- Breathing in and out.
- Lifting a weight.
- Moving your toes.

There are more than 2,700 species of snakes in the world

How do Muscles work?

Muscles work in pairs. When one of them contracts, the bone is pulled in that direction and the other muscle of the pair relaxes. To move the bone in the opposite direction, the relaxed muscle contracts and the first one relaxes. Thus two muscles have to work together to move a bone. Are the muscles attached to bones? Some muscles are connected directly to bones.

Fig. 4 (a)

Do you know?

Almost all our body movements depend on muscles, bones and joints. Expansion and contraction of muscle makes the bone move.Muscles always work in pairs.

Some muscles have round, white, rope-like fibres at their ends that connect them to the bone (Fig. 3). These fibrous structures are called **tendons**.

Fig. 3

You can feel the tendons in several parts of your body like; for example, above the elbow, beneath the knee, near the ankle (Fig. 4 (a,b,c)) . Try to find out if you can feel them in other parts of your body.

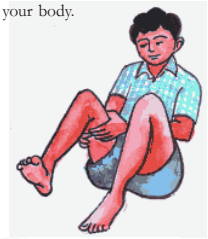


Fig. 4 (b)

Fig. 4 (c)

The smallest bird is the Bee Hummingbird at 2.24 in (5.7cm)

Bones

The different bones of different body parts combine together to form a single structure or system. This structure is called the **skeleton**. It is very intresting to study the skeletal system, and it is funny to think, how we are with our skeleton.

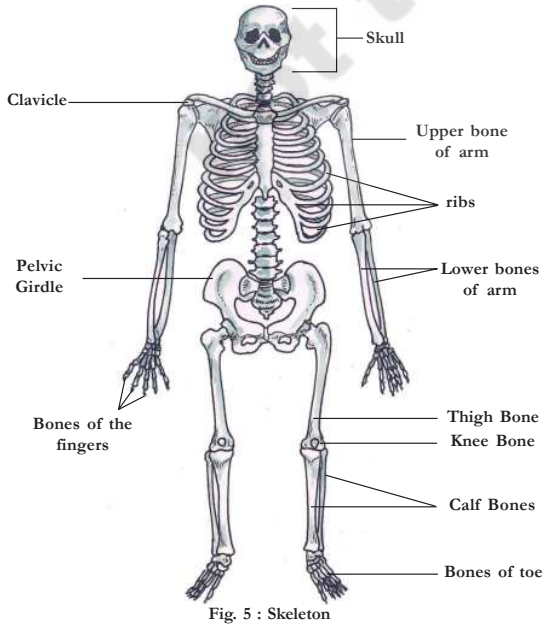


Fig. 5 : Skeleton

The average adult male ostrich, the world's largest living bird, weighs up to 345 kgs.

You saw earlier that muscles are joined to the bones to help them move. In the same way, two bones are joined together in a special way by fibres. These fibres are called **ligaments** (Fig. 6).

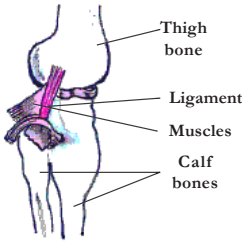


Fig. 6

Activity-4: Jaw bone

Fig. 7

Ask your friend to open his mouth and move his lower jaw up and down as well as sideways. Observe his face carefully.

- Did you notice any joint in the bones near his ear?

This is the place where the lower jaw bone is joined to the skull. Press your finger on both sides of your face and spot where you have these joints. These are fixed joints.

Activity-5: The clavicle

Fold one arm and rest it on your waist. Now slowly lift your arm and shoulder together (Fig. 8).

Fig. 8

Run a finger of your other hand from just below your neck towards your shoulder. Try and locate a raised bone

The femur is the longest and strongest bone in the body. It is located in your thigh.

there and the one behind it. The raised bone is called clavicle and the bone behind it is the shoulder blade.

There are two bones protruding from the shoulder called shoulder bones.

Fig. 9

Look at Fig. 9 showing where the clavicle joins the shoulder blade. Now try to locate the joint between the clavicle and shoulder blade.

Activity-6: The ribs

Take a deep breath and hold it for a little while.

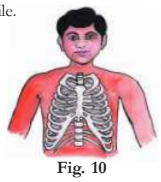


Fig. 10

Feel your chest bones by gently pressing the middle of the chest. Count as many ribs as possible.

Ribs are curiously bent and join the chest bone and the back bone together to form a box. This is called the rib cage. Some important internal parts of our body lie protected inside this cage. Try to guess what those important parts are.

Activity-7: Backbone

Ask your friend to stand up, bend forward at the waist and try to touch his toes with his palms. Run a finger along the centre of his back from below the neck.

Fig. 11

A long structure running down the middle of his back is called the backbone (spinal cord). The small bones that make up this backbone are called vertebrae. The spinal cord passes through the vertebrae of the backbone.

The average adult heart beats 72 times a minute; 100,000 times a day; 3,600,000 times a year; and 2.5 billion times during a lifetime.

Do you know?

There are 33 separate vertebrae in the backbone of an infant. Later the nine lower vertebrae merge and form a single bone. Can you see how many vertebrae you now have?

Activity-8: Pelvic girdle

Press the area just below your waist with the fingers of both hands as shown in Fig. 12. Can you feel similarly shaped bones on both sides of your body. This is called pelvic girdle

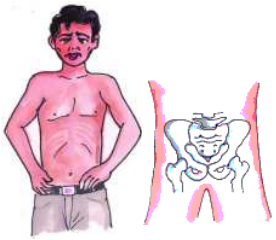


Fig. 12

This structure is made of pelvis bones. They enclose the portion of your body below stomach. This is also the part you sit on.

Skull

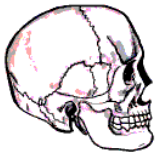


Fig. 13

The skull is made up of many bones joined together. It encloses and protects the brain. The joints between the skull bones are fused. They are also called fixed joints.

Activity-9: Flexible bones-cartilage

Hold your ear with your fingers, press it and bend it as shown in the Fig. 14. Also touch and feel the tip of your nose.

Fig. 14

Some parts of the ear and nose are soft and others are hard. The hard parts are made up of a structure called cartilage. This is also a bone but it is flexible. Do you find these flexible bones in any other part of your body? Cartilage is present

The volume of blood pumped by the heart can vary over a wide range, from five to 30 liters per minute.

in other parts of the skeleton as well, like, between the rib and sternum, between the vertebrae of the spinal cord etc.

Activity-10: Different types of joints

We knew that muscles help move a bone. How does one bone help the other to move? Is there any arrangement between bones? Are ligaments of bones sufficient for body movement? Let us understand diffrent types of joints in our body. Put a meter scale under your arm so that your elbow is in the centre. Ask your friend to tie the scale and your arm together as shown in Fig. 15. Now try to bend your elbow. Is it possible?

Fig. 15

Bones can't bend. You have seen that the human skeleton is made up of many bones. What will happen if bones can't move? Bones of our body move in their own way, How is it possible? These bones have joints between them. We can move various parts of our body because of these joints.

There are different types of joints in our body to help us carry out different movements and activities. Let us learn about them.

Ball and socket joint

You will have to make a model to understand how the joint between the shoulder blades and the bones of your arm works. Place a fused bulb inside the half shell of a coconut and rotate it in the way shown in Fig. 16(a).

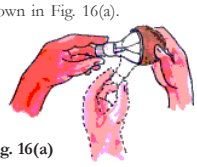


Fig. 16(a)

A joint made by fitting a ball into a socket is called a ball and socket joint. In this joint, a bone can rotate easily in all directions.

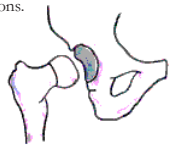


Fig. 16(b)

Hinge joint

Straighten your arm and hold your elbow in the palm of your other hand.

According to the Science Museum of Minnesota (SMM), the lungs are the only organ in the body that can float.

Try and rotate your forearm in all directions at the elbow joint. Is it possible at the elbow as well? No. Why?

Try one more thing; bend your arm towards your shoulder in the opposite direction. Repeat this exercise two to three times. Were you able to bend your arm downward after a limit?

Could you move your hand from your elbow in all the direction? Why?

Fig. 17 shows a hinge. Where do you find such hinges in your house? Observe how objects attached by these hinges move. Compare these things with that of your elbow and knee.

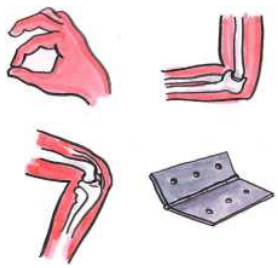


Fig. 17

Identify and list the hinge joints in your body by taking help of Fig. 17.

Your backbone is a spring

You may have often done the exercise in which you stand straight up and touch the floor with your palms by bending your body but without bending your knees. You may have also done the exercise in which you have bent your body to the left and right at the waist.

- Could you explain what property of the spinal cord enabled you to perform both these exercises?

There is tender and flexible cartilage between the vertebrae of the backbone. This cartilage between the vertebrae helps in rotating the backbone in different directions.

Fig. 18

Neck joint

Neck joint is different from both the hinge joint and the ball and the socket joint. This joint helps us to move our head up-down and side to side.

The small intestine in adults is a long and narrow tube about 7 meters (23 feet) long.

But we cannot rotate our head totally. Neck joint is a type of joint called **pivotal** joint.

Fixed joints

Some joints between bones in our head can't move; such joints are called fixed joints. These joints are fused and seem to be a single bone in the skull. When you open your mouth, you can move your lower jaw. Can you move the upper jaw as well?

There is a joint between the upper jaw and the rest of the head. It is a fixed joint. So you cannot move the upper jaw.

Fig. 19

Movements in other animals

We can move our body parts with the help of muscle bones and joints. Do all animals have these parts like us? Let us study how animals move.

Activity-11: Locomotion

Lets us see how animals move from one place to another. Fill your observations in table 2.

Table 2

Animal	Body part used for moving	How does the animal move
Cow	Legs	
Human		walks, jumps, ...
Snake		
Bird		hops, flies, ...
Insect		
Fish		

By analyzing table 2 you will see that different animals use different body parts for moving from one place to another (locomotion).

The skull is really 22 bones, not one single bone. The skull is also called a cranium.

Locomotion in fish

Fish swim in water. Do they swim the same way as humans? What is the difference? What features help fish in swimming and how?

Activity-12

Make a paper boat. Put it in water and push it with narrow end pointing forward (fig. 20.a). Now hold the boat sideways and push it into water from the broad side (fig. 20.b). What did you observe? In which process was it easy to move the boat?

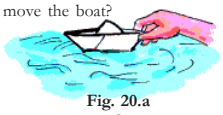


Fig. 20.a

Fig. 20.b

The body of the fish is streamlined. The shape is such that it allows the fish to move in water easily. The skeleton of the fish is covered with strong muscles. While swimming, muscles make the front part of the body swing towards one side while the tail swings its body towards the opposite side (fig. 21).

This creates a jerk and pushes the body forward. A series of such jerks help the fish swim forward. The tail fins also aid in this movement (Fig. 21).

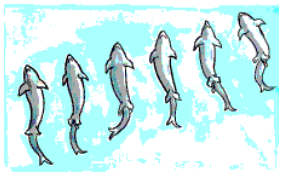


Fig. 21

Locomotion in birds

Fig. 22

Birds fly in the air and walk on the ground. Birds can fly because their bodies are well suited for flying. Their bones are hollow and light. The bones of the hind limbs are typical for walking and perching. Bony parts of the fore limbs are modified to hold muscle of

Most amphibian species have a life cycle that involves three stages, egg, larva, and adult.

flight which is used to move the wings up and down.

Activity 13: Observe Hen and Sparrow How do they move? Write your findings about similarity and disimilarities in your note book.

Locomotion in snake

Fig. 23

Snakes have a long back bone and several muscles. Usually the snake's body curves into many loops. Each loop of the snake gives it a forward push by pressing against the ground. This helps the snake move forward very fast. There are other ways in which snakes move. try to find out about them. Collect those pictures, information and display them on wall magazine

Activity-14: Locomotion in snail

Collect a snail from a garden. Have you seen the rounded structure it carries on it back? Place the snail on a glass plate and watch it, when it starts moving Fig. 24 (b). A thick structure may come out of an opening in the shell. the thick structure is its foot, made of strong muscle. The wavy motions of its foot is the reason why a snail moves slowly.

Fig. 24 (a)

Fig. 24 (b)

Don't forget to put back the snail from where you collected it. If you let it go away it will die. You are a student with concern towards bio diversity.

Movement or locomotion is an important function in every living organism. It is very intersting to watch ants running hurriedly in a line, squirrels and monkeys jumping on trees. Try to enjoy watching various locomotions in the animal kingdom.

Keywords

Bones, muscles, ligament, tendon, clavicle, pelvic girdle hinge joint, locomotion, cartilage, ball and socket joint.

What we have learnt

- The different bones of differents body parts combine together to form a single structure called, skeleton.
- There are different kinds of joints in our body like ball and socket, hinge, pivotal etc. to help us in performing several activities.
- Bones and muscles help us perform different movements and activities.
- Muscles work in pairs.
- Tendons join muscles to bones.
- Ligaments join one bone to other bone.
- Our backbone works like a spring.
- The joint between upper jaw and skull is fixed joint.

We have 208 bones and over 230 moveable and semi-moveable joints in our body.

Improve your learning

1. Imagine a situation where you have no bone in your body. Describe with reasons, what would happen.
2. Try and identify the joints in the body of a goat or a cow. Make a list of these joints.
3. What difficulties would you face if your fingers had only a single bone?
4. What is a ball and socket joint? How it is different from hinge joint?
5. **Fill in the blanks and give reasons:**

1) Joints of the bone help in the _____

2) The contraction of the ____ pulls the bones during movement.

3) The bones at the elbow are joined by a _____ joint.

6. **Guess who I am**

i) I am a joint that works like joint of doors and window.

ii)I help to join two bones.

iii) Joint between upper jaw and skull.

iv) I am a chain of small-small bones

v) I join bone and muscle

7. Collect X-Ray flims and identify which body parts they represent. Write a note on them.
8. Prepare a questionaire to take interview of a yoga teacher or PET sir about asanas and exercises.
9. Crawlling snake, jumping frog, flying bird are they amazing to you? Why you think so?
10. List out the activities that you performed at your home before coming to school. Which joints are involved in each activity.
11. "Which joints involved in plucking flowers, making garlands", Ravi's mother asked? What is his answer?
12. What is this instrument? How you use this?

Did you know that humans and giraffes have the same number of bones in their necks i.e. 8?

15 Light, Shadows and Images

One day Raju started for his home from school, late in the evening. When he started, he was able to see trees, buildings, animals, buses etc. on the road and on either side of the road. As he kept walking, it started growing dark and soon he was not able to see objects either on the road or on the sides as clearly as earlier. When he reached home, it was already dark. He started doing his homework. Suddenly the power went off. He was not able to see any objects in the room.

Raju started wondering.

- Why am I not able to see the objects clearly when it gets dark?
- Why am I not able to see the objects when power went off?
- How are we able to see the objects in the presence of light?
- Why are we not able to see the objects in the absence of light?

Activity-1: How can we see objects?

Make your room dark by shutting the door and windows; put on the light. Look at any one of the objects in the room. After that, hold a plank or a writing pad in front of your face. Is the object visible to you? Why is it not visible though there is light? What happens when you hold a plank between the object and you?

The object is visible when there is no obstruction between your eyes and the object. If we keep obstructions like plank or writing pad, they do not allow some thing that is coming from the object to reach us. What is that some thing coming from the object?

When we put on the bulb, light falls on the object, bounces from the object and reaches us. We can see an object only when light falls on it and bounces back to our eyes. See Fig. 1 and observe the direction of the arrowheads.

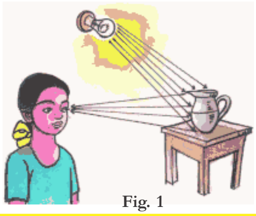


Fig. 1

It takes 8 minutes 17 seconds for light to travel from the Sun's surface to the Earth.

- Where does light come from? Which objects give us light? Think and write below :

..............................., ...

..............................., ...

A substance which gives light is known as a light source. Sun, a glowing bulb, lightened candle etc. are some sources of light. Any object which burns or glows acts as a source of light.

- Can you give some more examples for source of light?

You might have seen your shadow many times

- When did you see it? Is it during day time or at night?

It is our common experience that we see shadows in daytime. Are shadows forme at night?

Try to see your shadow in moonlight on a full moon day. It is also possible to get your shadow at night, in your house, when the electric bulb is on. Is it possible to form shadows when there is no sunlight, bulb or any other light?

- What do we need to form a shadow?

We need light to get the shadow of any object.

Activity-2: Do all objects form shadows?

Try to form shadows of a book, a pen, a duster, a polythene cover, and a glass plate on the wall of your classroom with the help of a torch.

Do you find any differences in the shadows of the above objects? Do all objects form shadow?

- Which objects form the shadows?

..............................., ...

..............................., ...

- Which objects do not form shadows?

..............................., ...

..............................., ...

- Think and write why some objects form shadows? And others do not?

....

....

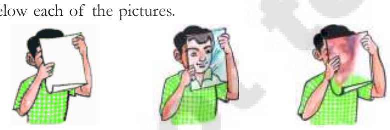
The substances like paper, plank, wood, iron etc. don't allow light to pass through them. These objects form shadow. These are called **opaque substances.**

The substances like glass and air allow light to pass through them and hence we don't get their shadows. Such substances are called **transparent.**

The substances such as polythene cover and oily paper partially allows the light to pass through them. Their shadows are unclear. These are called **translucent** substances. You have also come across these terms in the chapter on materials.

Red, green and blue are the primary colours of light. Mixing them in various ways will make all other colours, including white.

Observe Fig. 2. Write whether the sheet held by the boy is transparent, translucent or opaque below each of the pictures.



. . . .

Fig. 2

Think, guess and write in table 1 which objects in your classroom and at home form shadows, which do not form shadows and which form an unclear shadow.

Table 1

Objects which form shadows.	
Objects which form unclear shadows.	
Objects which don't form shadows.	

Check the above objects in sunlight to verify your guess and make corrections in table 1 if needed. After checking, give your own examples for transparent, translucent and opaque substances.

Transparent Substances : ....

....

Translucent Substances : ....

....

Opaque Substances : ....

....

Thus we see that all objects do not form shadows. Only opaque objects form shadows. We need a source of light and an opaque object to get a shadow.

Are sources of light and an opaque object enough to get shadows? Do we need something more?

When sunlight is intercepted by a drop of water in the atmosphere it gives RAINBOW

Activity-3

Do this activity in a dark room with a torch and a book. Focus the light on the book with a torch as shown in Fig. 3 (keep the distance about 30 cm between the book and the torch).

- Where do you find the shadow of the book in the room?

Fig. 3

Now put the torch under the book at a distance of about 30 cm (Fig. 4).

- Where do you find the shadow of the book this time?

Fig. 4

Do the same activity, in open air (outside) at night. Where are the shadows formed in this situation? Do you see a shadow in open air when the torch is under the book? If not, why?

Place a drawing sheet or a plank (Fig. 5) at a distance of 1 m. above the book and try to find the shadow of the book.

Fig. 5

- Do you find the shadow of the book if you remove the sheet?
- What do you understand from the above activity?

We understand that only light and opaque object are not enough to form the shadow of an object. In addition to these, we need a screen. In the above activity, we used a drawing sheet or plank to get the shadow.

When you turn on a light bulb only 10 per cent of the electricity used is turned into light, the other 90 per cent is wasted as heat.

In our day-to-day life, we observe many shadows on the surface of the Earth. In all these cases, the earth is the screen.

Do you know?

Shadow puppetry is one of our traditional recreational activities. In this, some puppets are used to form shadows on a screen and a story is narrated with the help of these shadows. Observe Fig. 6. Try to make puppets and do a shadow puppet show in your school.

Fig. 6

Can we guess the object by observing its shadow?

Observe the shadows given in Fig. 7(a). Guess and write the names of the objects which form the shadows.

....

Fig. 7(a)

See the objects in Fig. 7(b) and compare them with the names guessed by you.

Fig. 7(b)

The speed of light is the speed at which light travels. It is about 300,000 kilometres per second. Nothing travels faster than light.

- What do you find?
- Were you able to guess the object correctly in all cases?

You must have wondered when you compared your guesses and the actual objects of which shadows are formed. You may notice that the shadows that look like bird and animal are actually formed by hands. (Try to form similar shadows with your hands.)

- What can you conclude from the above activity?
- Can we guess the object by observing its shadow?

Activity-4: Colour of a shadow

Take four balls of equal size but different colours. Try to form shadow of each ball as shown in Fig. 8. Ask your friend who is facing the screen and not able to see the balls to guess the colour of each ball.

Fig. 8

- Is your friend able to guess the colour of the ball correctly?
- Is it possible to guess the colour of the object by observing it's shadow? If not why?

Shadow is an area where light is absent. Hence, the shadow is colourless irrespective of colour of the object.

We have seen that we can't guess the object by observing it's shadow.

- Can we guess the shape of the shadow that would be formed by an object?

Let us find.

Activity-5: Shape of shadow

Observe the shadows of a book, a pen a duster, a ball and a round plate, one by one, in sunlight. While doing this, rotate the objects to change their positions and observe the changes in shadows. Try to answer the following questions on the basis of your observations :

- Is there any similarity between the shadows of ball and a plate? If yes, what?
- What change do you observe in the shadows formed when you hold the pen horizontally and then vertically?
- What differences do you observe in the shadows when the duster is kept in different positions by rotating it?

Scientists study the properties and behaviors of light in a branch of physics known as optics.

- Why are the shapes of the shadows of the same object different when you change the position of the object?

Observe the objects, formation of shadows and the path of light in Fig. 9(a) and 9(b). Similarly, draw the shadows for the objects given in Fig. 9(c, d). Extend the path of light and draw shadow on given screen.

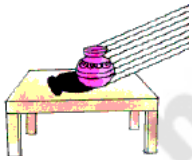


Fig. 9(a)

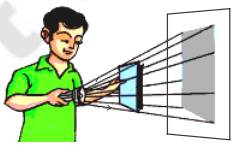


Fig. 9(b)

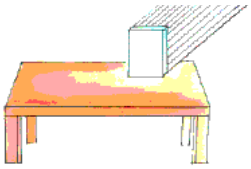


Fig. 9(c)

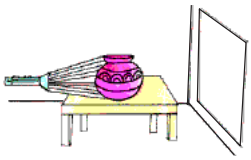


Fig. 9(d)

We have drawn arrows in the above figures assuming that light travels like rays that are straight. We can predict the shapes of the shadows only when we consider that light travel as rays along a straight path. In ancient days people by observing the shapes of shadows came to an understanding that light travels in a straight line.

Activity-6: Getting different shapes of shadows of a single object:

Take a rectangular piece of cardboard. Try to form shadows of different shapes by using it. You can do this in the sunlight or with the light from torch. Now, answer the following questions :

Light takes 1.255 seconds to get from the Earth to the Moon.

- Were you able to make a square shaped shadow?
- Were you able to make a traingular shadow?
- Were you able to make a circular shadow?
- What are the other possible shapes?
- Why are we getting different shapes of shadows when the object is same?

Because of the straight line path followed by light rays, we can get different shaped shadows for a single object by changing its position. The nature of straight line motion of light can also be understood by pinhole camera.

- Have you ever heard of a pinhole camera?

With this camera we can observe a big object through a pinhole. Isn't it interesting? Lets make a pinhole camera.

Activity-7: Making a pinhole camera

You will need :

A pvc pipe, about 8 cm in diameter and of length 30 cm.

A pvc pipe, about 7 cm in diameter and of length 20 cm.

One black drawing sheet.

oil - 1 ml, two rubber bands, a pin, and A4 sheet.

(If you cannot get pvc pipes, take a thick sheet of paper and roll it to form tubes. The diameter and length of the tubes should be the same as that given for the pipes.)

Cut a piece of black paper and put it like a cap at one end of the big pvc pipe and fix it with a rubber band as shown in Fig. 10(a). Put the white paper like a cap at one end of the thinner pvc pipe. Fix it with a rubber band as shown in Fig. 10(a). Now make a hole in the middle of black paper cap with the help of a pin. Put 2 to 3 drops of oil on the white paper cap so that it becomes translucent.

Fig. 10(a)

Insert the thin pipe into the big pipe.

Your pinhole camera is ready.

Arrange a lighted candle in front of the pinhole of the camera. Move the thinner pipe forward and backward to get a clear picture of the candle on the screen of the thin pipe.

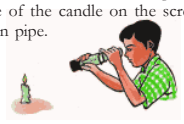


Fig. 10(b)

Sunlight can reach a depth of around 80 metres (262 feet) in the ocean.

This picture is to be observed from the back of the thin pipe (see figure 10b).

What do you see? The flame of the candle appears inverted on the screen. Why is it like that? This is not the shadow of the candle. It is its image.

By observing Fig. 11(a), try to understand how light enters into the pinhole camera. This will explain the reason for inversion of image.

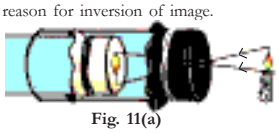


Fig. 11(a)

The light from the candle travels straight in all directions from each point of the flame of the candle. But only the light coming in some particular directions can enter into the camera through its pinhole.

Light which comes from the point at the top of the flame goes straight towards the bottom of the screen and light which comes from the point at the bottom of the flame goes straight towards the top of the screen, as shown in Fig. 11(a). In this way, the light coming in a particular direction from each point of the flame, will be able to enter into the pinhole, and light going in other directions is blocked by the black sheet.

This leads to the formation of an inverted image.

The formation of inverted image on the screen of the pinhole camera explains that light travels in a straight line.

Now look at a tree through the pinhole camera as shown in figure 11(b).

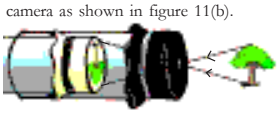


Fig. 11(b)

What do you see?

We get the full image of the tree in the pinhole camera. But when we put a candle in front of the pinhole camera, we get the image of the flame only. Why is it so?

- Predict what would happen if we make two pin holes in the camera? Try it and write down your observations in your notebook.
- Did your predictions match with your observations?

Activity-8: Fun with a magnifying lens

Take a magnifying lens and try to form an image of a tree on a white drawing sheet.

The white light from the sun is a mixture of all colours of the rainbow.

- What do you observe in the image formed on the sheet?

The image on the white drawing sheet is inverted. Isn't it? What difference do you notice between the images formed through the pinhole camera and through the magnifying glass?

You may notice that the image formed through the magnifying lens is clearer than that formed with a pinhole camera.

Diffrence between Image and Shadow:

We see our face in the mirror everyday. Is this picture in mirror a shadow or an image? How did you decide that?

We know that shadows are not coloured but an image has colours that are same as that of the object. Also, a shadow shows only the outline of the object but an image shows the complete object as it is, just like a photograph.

- Can you find any other differences or similarities between shadows and images? Write in your note book.

Can you show the diffrence of a shadow and an image through a drawing?

Draw the shadow and image of the object shown in Fig. 12

Fig. 12

Activity-9: Observe the Reflection

Make your calss room dark by closing doors and windows. Ask one of your friends to hold a mirror in his hand. Take a torch and cover its glass with a black paper leaving only slit in the middle. Now switch on the torch and adjust it so that light falls on the mirror in your friend's hand. Ask your friend A to adjust the mirror so that the patch of light falls on another friend standing in front of him at some distance. (see Fig. 13).

Fig. 13

- What do you observe from the above activity?

When light falls on any object, it rebounds back. This is called **reflection**.

Ask your friend A to cover the mirror

Laser is also a kind of light. Lasers are used to destroy and kill tumours and many other purposes.

with a book. Now switch on the torch and focus it on the book. Can you see the patch of light on your friend? Why? Did the light that fell on the book not get reflected? We know that we can see the objects only after light is reflected from them, as mentioned in activity 1.

If light falls on any object, it is reflected back . But we see reflected light, as if from a source, only when it falls on the objects like mirror.

Precaution: You can reflect sunlight using mirrors and play with it. But make sure that the reflected light does not enter your eyes.

Keywords

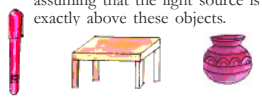
Light, sources of light, shadow, transparent substances, translucent substances, opaque substances, pinhole camera, image, reflection

What we have learnt

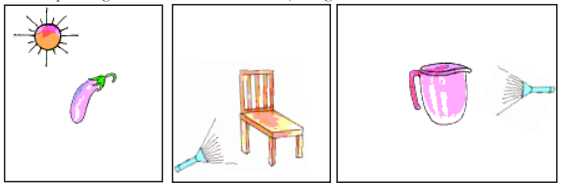
- We need light to see objects.
- A substance which gives light is known as a source of light.
- Shadows are formed when opaque objects obstruct the path of light.
- In addition to light and object we also need a screen to obtain the shadow of an opaque object.
- Colour of objects cannot be determined by looking at their shadows.
- Light travels in a straight line.
- Light gets reflected when it falls on any object.
- People came to an understanding that light travels in a straight line by observing the shapes of shadows.
- An image is different from a shadow.

Improve your learning

1. Classify the following objects into transparent, translucent, and opaque :
   Cardboard, duster, polythene cover, oily paper, glass, spectacle lens, piece of chalk, ball, table, book, window glass, palm, school bag, mirror, air, water.
   Which type of materials do you find more in your surroundings?
2. Hold a glass slab at one and with your hand and stand in sunlight. See the shadows of your hand and glass slab. Explain what you observed.
3. We can't identify the presence of completly transparent objects even in light. Is it correct or not? Support your answer.
4. Why can't we see objects which are behind us?
5. If we focus a coloured light on an opaque object, does the shadow of the object posses colour or not? Predict and do the experiment to verfiy your predictions. (Coloured light can be obtained by covering torch glass with transparent coloured paper)
6. Between an electric bulb and a tube light, which forms sharp shadows of objects? Do experiment to find and give the reason.
7. What is required to get a shadow of a opaque body?
8. How can you explain the straight line motion of the light?
9. Explain what happens if the size of the hole in a pinhole camera is as big as the size of a green gram? Increase the size of the hole in pin hole camera and look at any object with that camera. What do you find? Write reasons for that.
10. Draw the shadows in your note book for the objects given below assuming that the light source is exactly above these objects.



11. Where do you find reflection of light in your daily life? Write few examples.
12. We would not be able to see any object around us if light does not get reflected. How do you appreciate this property of objects?
13. Can we use a plain mirror as a rear view mirror? If not why?
14. A mirror is kept on the wall of your room. Your friend is sitting on a chair in that room. You are not visible to him in the mirror. How do you adjust your place so that you are visible to your friend in the mirror? Explain.
15. Why do we get shadows of different shapes for same object?
16. What are the diffrences between a shadow and an image?
17. Malati noticed changes in lengths of her shadows during the day time. She got some doubts about this. What could be those doubts?
18. Observe the light source and mark the place where the screens should be kept to get the shadows of the objects given below.



Sundials use shadows to tell the time.

Light travels slower through different mediums such as glass, water and air.

16 Living and Non-Living

Ventkatesh likes his blue shirt which he bought in the previous year. Now it does not fit him. He wants to alter it. He went to a nearby tailor shop along with his friend Tanvir. The tailor refused to alter the shirt because he said that it is not possible to increase the size of a shirt. On the way back, the friends saw a dog lying on the roadside as if it was fast asleep. Ventkatesh wondered whether the dog was alive. "It is quite obvious that the dog is alive, Its stomach is telling us that it is alive. Look at it carefully." said Tanvir.

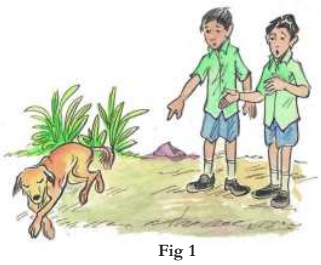


Fig 1

- Why do you think Venkatesh's favourite blue shirt does not fit him now?
- How will you decide whether the dog is alive or not?
- Can you decide whether a plant is alive or not by using the same reason?

There are many things around us; different types of plants, table, chair, soil, rock clothes, different animals, insects, birds. We can categorize them in various groups. Members of a common group share some common characteristics. In the previous chapter, we categorized materials as solids, liquids and gases. Another type of category is that of living things and non living things.

- Do all living things share some common characteristics?
- What are these characteristics?
- To be a part of living group is it necessary to bear all the characteristics of living things?

The seeds of an Indian Lotus plant remain viable for 300 to 400 years.

Activity-1: Some things are living some things are non living

List out as many living things as you can. Don't forget to give reasons for why you think something is living.

Chair and tables also have four legs like buffalo. But they can't move, why? Trees cannot move but they can produce seeds which give birth to new plants. How do we know whether some things are living and some others are non-living? You will notice that there are many characteristics of living things. Do all living things have common characteristics that make them different from nonliving things?

- Do you know you are a living being? How can you say that?

Activity-2: Compare characteristics

Some characteristics that are listed in Table 1 tell you that you are a living being. Compare these characteristics with plants, animals and rocks.

Table 1

S. No.	Characteristics	In you	In plants	In animals	In rocks
1	Growth	✓	✓	✓	×
2	Movement				
3	Taking Food				
4	Breathing				
5	Getting rid of waste				
6	Respond to Heat				
7	Respond to touch				
8	Respond to light				
9	Giving birth to young ones				

A new born blue whale measures 20-26 feet (6.0 - 7.9 meters) long and weighs up to 6,614 pounds (3003 kg).

- Do plants and animals possess the same characteristics as you do?
- In which way do the characteristics of plants differ from you or from other animals?
- What characteristics are same in plants and animals?
- Do you agree that you are the same as other animals?
- What characteristics do you observe in rocks?

The things around us that possess the characteristics listed above are known as living things. Those which do not possess these characteristics are known as non-living.

Some of the characteristics are common in all living things. Can we say all characteristics listed in activity 2 apply to all living beings?

You know that plants are also living beings like us. Plants grow like we do but do they move like us?

Is it essential for a living thing to have all of these properties or could a thing be considered living if it has some of these properties? Let's take a closer look at the characteristics of living things.

Movement in living beings

- How do the following living beings go from one place to another? Observe the following table discuss in groups and write the way the organisms move.

Table 2

Living organism	Means of motion
Myself	walk, run, ...
Housefly	
Grasshopper	
Frog	
Snake	crawls, ...
Birds	
Fish	
Plant	

Do you have more examples of different kinds of movements in animals? List them in your notebook.

- We see that plants don't move like us. Should we consider them as living beings?

There are some movements in plants for example, closing and opening of flowers. Discuss in groups. List out the movements in plants. Track your discussions in your notebook.

- We say that plants don't move but we find plants of the same types in different locations. How is this possible?
- Other than plantation by human beings there are many natural ways of seed dispersion. The seeds grow into plants and we feel that plants have moved from one place to another. Can you list these natural ways of seed dispersal? We will learn more about this in the next class.

The longest living cells in the body are brain cells which can live an entire lifetime.

Food and living beings

We have seen in the chapters on food that we as well as all other animals need food for smooth functioning of different activities.

- Do plants also need food?

In the chapter "plants parts and functions", we have seen that some parts of plants like root, stem and fruits store food.

- What are the sources of their food?

Most of the plants absorb water and minerals from the soil and prepare their food in the presence of sunlight. The leaf is the place where the food is prepared.

Do you know?

We also prepare food. Is our process of preparing food the same as that of the plants? By using carbon dioxide, green colour substance in the leaves and sunlight plants prepare their own food. This is called photosynthesis.

Growth in living beings

You notice that kittens, pups and chicks grow into adults. You become taller every year. Similarly, a seed germinates into a plant. Some plants grow day by day into trees. A human child grows into man/woman. Plants also produce branches that show their growth. They grow throughout their life but we don't grow like that. We will grow upto certain age and height. But some parts of the body grow throughout our life. Think what those parts are?

Fig. 2(a)

Activity-3: Grow - Doesn't Grow

You listed several living things in activity 1. How do they grow? Analyze your observations. Also add some things that don't grow. Record in table 4.

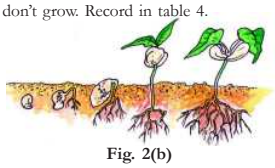


Fig. 2(b)

The average cough comes out of your mouth at 60 miles (96.5 km) per hour.

Table 3

Grows for a certain period	hen, ...
Grows throughout its life	
Doesn't Grow	rock, ...

- Do all living things grow throughout life?
- Pick up any item from the column 'doesn't grow' in the above. Does it need food?
- Do you grow for life time or not why?

If we grew like trees, how would we look like? It's funny to think. Have you read stories of Lilliputs, David and Goliath?

Non-living things cannot grow. Growth is also a characteristic feature of living things. Is it common to all living things?

Do all living things breath

Observe the abdomen of a cow when it is in rest position. How is it? It moves slowly. This shows that the cow is breathing. If you keep a finger in front of your nose, you feel air coming out of your nostrils. When we breathe in or inhale, air moves from outside to inside our body. When we breathe out or exhale the air inside comes out.

- Do all birds have noses? How do they breathe?
- Fish can't remain alive in air. How might they breathe while remaining in water?

Do all living things breathe? Do plants breathe like us? We know that they don't have a nose. How would they breathe? Let us try to understand.

Activity-4: Plant has nose

Take any fleshy leaf like, alovera. Peel from it and put it on a slide. Observe this under a microscope. You will see the structures as shown in Fig. 3. They are called stomata. These are useful for exchange of gases.

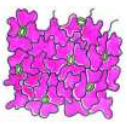


Fig 3 (a)

Fig 3 (b) stomata

Do all living things get rid of their waste?

We know that all living things take in food. After digestion, wastes have to be removed from the body. Our body produces different types of waste materials during different life processes. When we work hard our body becomes

An egg white is made mainly of a protein called albumen

wet with sweat. This is a waste material. The process of getting rid of wastes is called **excretion**. In what forms do animals excrete?

Animals excrete wastes in different forms - dung, urine, sweat etc. Plants also excrete their wastes but this is not in the same way as animals. Have you ever observed sticky substance on the stems of trees? Actually this gummy substance are the excretions. Generally we feel that excretions are useless and foul smelling material. But excretory products of animals are used as manure. Secretions of plants like, gums and resins, are also useful for us.

Fig 4(a)

Living things give birth to young ones

Activity-5: Egg or Baby

Make a group with 4 or 5 students. List out birds and animals from your surrounding. How do they produce their young ones? Write in table 5 whether they lay eggs or they give birth to young ones. Write the table in your note book and Extend the list.

Fig. 4(b)

Table 4

Animals/ birds that lay eggs	Those which give birth to young ones

Fig 4(c)

Birds and animals that lay eggs for giving birth to young one are known as **oviparous**. Those which give birth to young ones without laying eggs are known as **viviparous**.

The leg muscles of a locust are about 1000 times more powerful than an equal weight of human muscle.

- Can plants be classified as Oviparous or Viviparous?

We know that seed germinates into plants. This means that plants also produce their young ones. Seed germination is one of the ways of doing this.

- Are there any other ways in which plants produce their young ones?

Response to stimulus

Activity-6 : What will happen

When you step on a sharp object what would you do? You will take back your feet. Is not it? Discuss with your friend how we would we respond in the conditions given in table 5

Table 5

Stimulus	Response
When you step on a sharp object	
Touch a flame or fire	
Touch ice-cream	
See a bright light	Blink, ...
Get bitten by an ant or mosquito	
When you hear the word 'tamarind'	Mouth waters, ...

All living beings possess the characteristic feature of response to stimulus.

- Do other animals also respond to stimuli like us?
- Do plants respond to stimuli like animals?

Activity-7 : Atti-Patti

It is very intresting to observe a touch me not (Atti-patti or mimosa)plant. Touch it. Record your observations.

How does this plant respond when you touch it? How much time does it take to return to its previous position?

Fig 5

The Atlantic Giant Squid's eye can be as large as 15.75 inches (40 centimeters) wide.

This observation explains that plants also respond to stimulus. Some plants bloom in the morning and some at night. These respond to sunlight. When winter comes many trees shed their leaves. They respond to change in temperature.

Activity-8: Response to light by earthworms

Get an earthworm from nearby, moist soil. Take a glass jar. Cover half of the glass jar with black paper as shown in Fig. 6. Put some soil in the jar and put the earthworm in the jar. Close the jar with a lid that contains small holes, to allow air into the jar. When earthworm crawls out of the covered portion, shed some light on the jar. What happens?

Fig. 6

When we shed light on the earthworm, it moves to the dark portion. It seems that earthworms show response to stimulus, in this case light.

Seeds - Living or not

Seeds are produced from plants. We know that plant is a living being. Can we say that seeds are also living? Let us discuss what characteristics of living beings seeds have?

- Does a seed take in food? From where?
- Will it die if stored for a long time?
- What happens when a seed is sown in soil?

Fig. 6(a)

Seeds germinate and turn into a whole plant. So we can say that seed is a living thing. Can you think of any way of deciding whether dry seeds are living?

Venkatesh noticed that growth, breathing, excretion, taking food, giving birth to young ones, response to stimulus, movement are some of the characteristics of living beings. He also observed that these are not common among all living organisms.

But, non-living things do not possess these characters. He observed that people depend upon both living and non-living things. Generally we are told that the plant is dead when it has dry leaves and stem. If an animal doesn't

The average human brain has about 100 billion nerve cells

Fig. 7

show living characteristics, we can say that the animal is dead. Is a dead plant or a dead animal non-living?

Dead plants, animals or any other living beings decompose to form non-living constituents. So we can't say dead things are non-living things. They are intermediate things between living and non-living things.

Living things under a microscope

The letters in a book are quiet small. What do old people do to read books? Children frequently play with magnifying lens. When we see objects through magnifying lens they seem to be bigger than their actual size.

Activity-9 : Prepare your own magnifier

Collect an used electric bulb. Remove its filament. Fill water in half of the bulb. See a book through this bulb. Do the letters in the book seem bigger?

Are all things around us visible to us? Name some small animals that you see. Can we see mouth and antenna of ants and small insects with our naked eye? When you touch flowers, a yellow colour powder sticks your fingers. If you want to know what it is, what can you do?

We cannot see all things around us with our naked eye. Because those things like antenna of ants, yellow powder of flowers are very small. In the living world there are some things that are not visible. We cannot see them. We can see those small organisms under a microscope. Living beings that we can see only under the microscope are called micro-organisms. Let us try to understand about a microscope and then use it for observing some micro-organisms.

What is a microscope?

Microscope is an instrument with the help of which we are able to see minute things that we cannot see with our eyes. It works like a hand or magnifying lens but it is much more powerful.

The human heart creates enough pressure to squirt blood 30 feet (9 m).

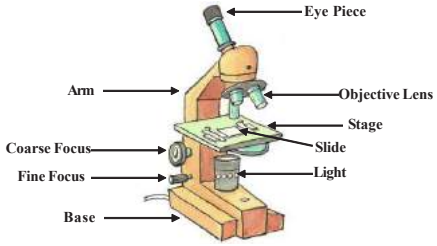


Fig 8

Basically, there are two components in a microscope - the structural component and the visual components

Structural components are the head/ body, base and arm. Visual components are eyepiece, objective, nosepiece, coarse and fine adjustment knobs, stage, aperture etc.

Fig. 8 shows a labeled diagram of a compound microscope. Taking its help identify different parts of microscope in your school.

Now we want to see some microorganism. Where can we find them?

Activity-10: Bread Mould

Generally our elder say that we should not put wet spoons in pickle jars. Why do they say this? When you put wet spoons in a pickle jar, the pickle will spoil. What happens when you pack bread or vegetable and keep for a couple of days? You observe that they become rotten and there is a foul smell. We can see thin, thread like grey colour substance. After some days this grey colour substance turns black. If you touch this material black colour substance sticks to your fingers.

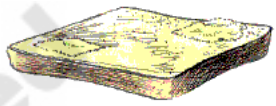


Fig. 9

Collect this rotten material and observe it under a microscope. Note your observation and discuss with your friends. Draw the structures seen by you under the microscope.

Bacteria are found everywhere - in air, water, soil, animals, people and food.

These tiny thread like structure are commonly called mould. Can we say that mould is also living?

The mould that develops on spoiled material is able to produce new mould. It grows. So we can say the mould is also living.

We all know that cows gives us milk. So they are useful. Do micro-organisms help us in any way?

- Why is idly mixture prepared the day before?
- Why do we add little amount of butter milk to milk to get curd?

Activity-11: Let us see microscopic organisms

Take the watery substance in curd. Put a drop of this substance on a glass slide. Cover it gently with another slide. Observe this under a microscope. Note your observations. Draw a picture of what you see under the microscope.

The micro-organisms that you see under the microscope are called bacteria. Bacteria are in different shapes. The bacterium that you see in curd is helpful. This bacteria helps to convert milk into curd.

Are bacteria harmful?

Discuss with your teacher how bacteria are harmful. Some bacteria cause diseases in human beings as well as animals and birds. These bacteria spread from one person to the other and cause various types of diseases. They spread all over the world. There is no place in the world without bacteria.

Fig. 10

When you suffer from a disease, the doctor advises you to take boiled water. Are there micro-organisms in water? Is the water that you drink regularly, pure?

Activity-12: Micro organisms in water

Collect water samples from a pond, well, bore well. Keep them separately. Put a drop of water on a slide. Keep another slide on it. Observe under microscope. What type of micro-organisms do you see in water samples? Do all water samples have the same type of micro-organisms? Is there any water without micro-organisms? Which water contains larger number of micro-organisms? Draw what you have observed. Describe the shapes of the micro-organisms.

- Which water contains larger number of micro-organisms? Why?

Some moulds are used in food production such as cheese manufacture

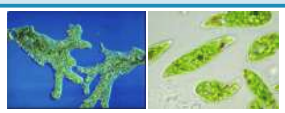


Fig. 11

- What difference do you find in the appearance of micro-organisms in pond water and bore well water?

Thus we see that micro-organisms are present everywhere, although they are not visible to naked eyes. From our activities, we could see only a few of them. But there is a vast world of micro-organisms and they are all part of the living world.

Keywords

Living things, non-living things, growth, breathing, excretion, response, stimulus, movement, micro-organisms, microscope

What we have learnt

- There are living and non-living things around us.
- When living things lose their life they become dead.
- Dead is an intermediate stage between living and non-living things.
- Dead material decomposes to form non-living things.
- Living things possess characteristics like growth, breathing, excretion, movement, response to stimulus and giving birth to young ones.
- Among living things, plants and trees can't move like animals.
- Seed is also a living thing but it doesn't have all characteristics of the living world.
- We can see minute things under a microscope.

Improve your learning

1. List out common characteristics of living things.
2. Why do cockroaches come out of their places when lights are put out?
3. Which characteristics are same in both living and non-living things?
4. Which of the following are derived from living things : sugar, coconut oil, pen, rice, fan, omelet, bus, wooden chair, garland, mango, clothes, fruit juice.
5. How can you say that a tree is living even though it doesn't move?
6. What is the use of microscope?

In humans the compound used to transport of oxygen in respiration is known by the name haemoglobin.

7. Thread like structure developed in bread are ----------

8. Which of the following is not a response to stimulus :

   a) Feeling cold by touching ice.

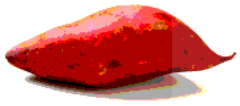
   b) Feeling the weight of carrying a bag of books.

   c) Scratching the skin at the place of ant bite.

   d) Closing eyes immediately after seeing bright light.

9. Collect sweet potato, bottle, salt, and water. Take a bottle full of water and add salt, then put the sweet potato inside the bottle. Observe for a few days. What happens? Note your observations. How can you prove that sweet potato is also a living thing?

10. Venkatesh argues with his friend Tanveer about "seed is living" Think. What questions does Tanveer ask?

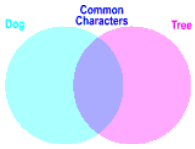


11. What will happen if there is no stomata in leaves? Write your predictions.

12. Write down the steps of the experiment that you did in the lab to observe micro-organisms in pond water.

13. How do you feel when you touch 'Touch me not' plant? Write your feelings.

14. Prepare Venn diagram to represent living non living characters of dog and tree.



15. Do you think both living and non living things are necessary for our environment. Why?

16. Collect information from your school library / internet about Sir J.C. Bose who invented response to stimulus in plants.

The brain operates on the same amount of power as 10-watt light bulb.