THEME 4

MOVING THINGS, PEOPLE AND IDEAS

ACTIVITY 35

What we have to do?

Measure the length of your classroom by counting the number of steps and to express the length in cm/m.

What do we need?

A scale (30 cm).

How do we proceed?

1. You will perform this activity in a group of five. Every one of you will measure individually and then compile your results in Table 35.1.
2. Identify one side/wall of your class along which you will measure the length.
3. Measure the length of the room with the help of your foot. Walk along the wall with one foot following the other (without leaving any gap in between the feet). See Fig. 35.1.
4. Count the number of steps.

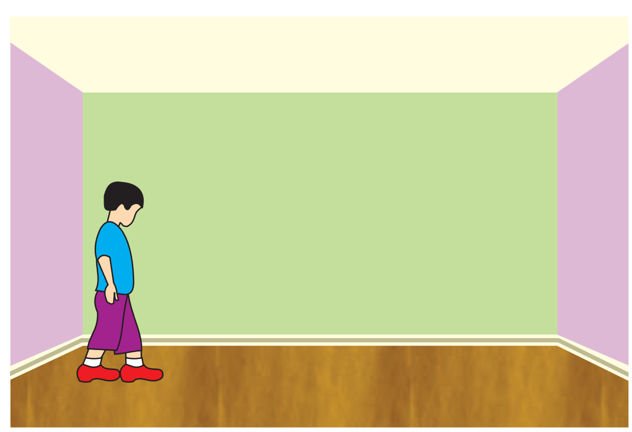

Figure 35.1
A student measuring the length of a room by walking from one wall to the opposite wall.

5. Now with the help of the scale measure the length of your foot.
6. Convert the length of the class recorded by you into cm and then in m.
7. Tabulate your data in the following format.

Table 35.1

S.No.	Name	Length of the wall in foot steps	Length of foot in cm	Length of the wall in cm	Length in m
1.					
2.					
3.					
4.					
5.					

(i) Is the length express in the number of steps by every member of your group the same? If not, then what could be the reason?

(ii) What can you say about the readings in meters? Are they all approximately equal?

(iii) Which of the readings will you use to communicate the length of the room to others? Why?

WHAT DO WE OBSERVE

- The length expressed in the number of steps was different for every member of the group.
- When length converted into centimeter or meter, every measurement was almost the same.

WHAT DO WE CONCLUDE?

- Every individual has feet of different length and one cannot communicate or rely upon any measurement using feet, hands, etc.
- One must use standard units (hence the standard instruments) for measuring any physical quantity.

Let us answer

1. It was instructed that while measuring the length with your foot, there must not be any gap in between your feet. Explain the reason.
2. Amit measured the length of a corridor walking straight along the wall and Rehana measured it walking along the wall but going around two chairs which were lying near the wall. Whose measurement will be correct and why?
3. Rewa, whose foot is 22 cm long, recorded the length of the room as 15 foot-lengths and concluded that the room is 4 m long. Is she correct? If not, what is the correct length?
4. Why is it necessary to use standard units of measurement?
5. You were asked to measure the length of your school ground. Which instrument will you use to do this and what precautions will you keep in mind while measuring?

What more can we do?

- Make a scale of folded paper by pasting a strip of a graph paper on it. Using this scale measure the length of your pencil box, textbook, pencil, eraser, your belt, etc.
- Explore the history of measurement and evolution of the standard unit system and make a report on it. Write a script to dramatise it and enact it in front of the class.

Note for the teacher

This activity can be done in groups. The students may be encouraged to share their observations, discuss and conclude in a team. The teacher may share stories such as that of the French emperor and the first attempt to standardise the unit of measurement. The teacher may make sure that while measuring the students are following the correct procedure. Look at Fig.35.2.

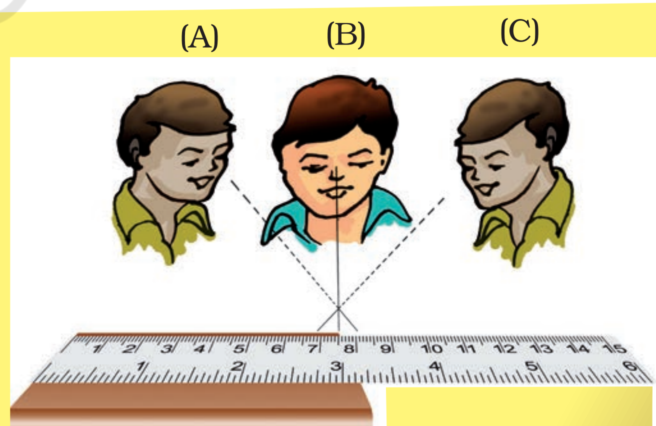

Figure 35.2
(B) is the proper position of eye for taking reading of the scale

ACTIVITY 36

What we have to do?

To find the speed of hopping on one leg.

What do we need?

A stop watch, a measuring tape or a metre stick

How do we proceed?

1. Draw a long straight line on the ground and a **Start Line**.
2. Draw **Finish Lines** at 20 m, 25 m, 30 m, 35 m and 40 m.
3. If measuring tape is not available, use a meter stick.
4. Choose a partner.
5. Both of you find the least count of the stop watch.
6. Ask your partner to be ready at the START line.

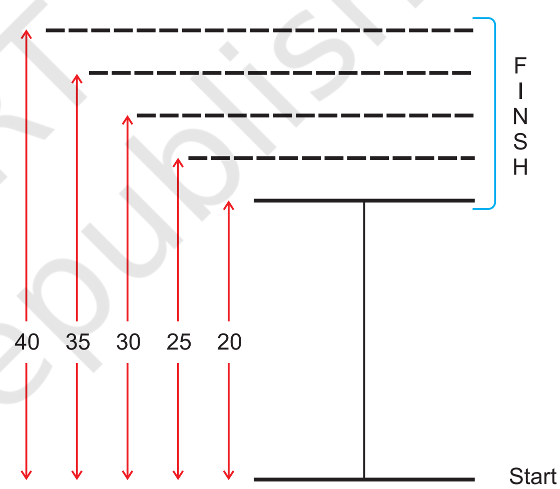

Figure 36.1

7. Hop on one leg from the START Line to the FINISH Line at 20 m.
8. Ask your partner to note the time taken by you.
9. Repeat this activity for FINISH Lines at 25 m, 30 m, 35 m and 40 m, each time asking your partner to note the time taken by you.
10. Now change places with your partner. You note the time and let your partner hop all the distances.

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Make a Table 36.1 and insert your observations.

Table 36.1

S.No.	Distance (m)	Time taken (s)	Speed = Distance/Time (m/s)
1.	20		
2.			
3.			
4.			
5.			
6.			

Average Speed =

11. Calculate speed for each distance and then the average speed for all distances.
12. Compare your average speed with the speeds calculated by your classmates.
13. Draw a graph of the data you have collected as indicated in Fig. 36.2.

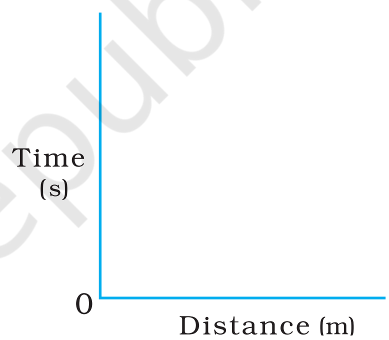

Figure 36.2

What do we observe?

We observe that the time taken for hopping on one leg for various distances was not the same. We calculate the speed for each distance and the average of all speeds. The average speed for each person was different.

What do we conclude?

We conclude that the speed of hopping on one leg is different for different students.

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Let us answer

1. What was the least count of the stop watch you used?
2. What precautions did you use in measuring distances?
3. If you used a metre stick, what additional precautions did you take?
4. While hopping, did you move along a straight line? Why is it necessary to do so?
5. In what units did you express your speed? Express your speed in units in which the speed of a bus is usually expressed.
6. A student expresses distance as:

   (i) 20 m (ii) 20 m. (iii) 20 meter (iv) 20 meters

   Which of these is/are correct expressions?
7. Your partner expressed time as follows:

   (i) 31 second (ii) 31 sec (iii) 31 s (iv) 31 seconds

   Which of these is/are correct expressions?

What more can we do?

Organise a competition in three-legged race for the class.

Note for the teacher

- Let students enjoy the game.
- Make sure that students measure distances along a straight line. It is better if a straight line is drawn first and then the distances measured.
- If a meter stick is used, ensure that students mark ends of the stick properly along a straight line and measure from end to end.
- **Possible paths of students**

  When students move, note if they stray away from the straight path. If they move along a zig-zag or a curved path (Fig. 36.3), they cover a larger distance than the designated distance, and their actual speed would be higher than that calculated by them.
- **Remember that here we define speed as distance covered/ time taken. This is the average speed. At this stage it is advisable to call average speed as speed.**

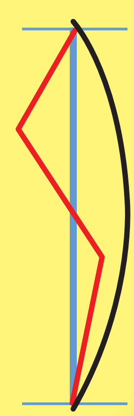

Figure 36.3

- Ensure that students note correctly the least count of the stop watch; otherwise the measurement of time may be incorrect.
- Make students practise conversion of speed from basic units to other units used in daily life such as km/h.
- If students have difficulty in drawing graphs, help them by revisiting the technique of drawing graphs.
- A cellphone may also be used as a stop watch.
- The correct way to express distance is 20 m or 20 meters. Similarly, the correct way to express time is 31 s or 31 seconds.

Notes

ACTIVITY 37

WHAT WE HAVE TO DO?

To understand the concept of net force.

WHAT DO WE NEED?

A heavy box or an almirah or a heavy table.

HOW DO WE PROCEED?

1. Choose a partner.
2. Look for an heavy object in your surrounding.
3. Push the heavy object alone in any direction, say to the right (Fig. 37.1). (The strength of your effort is shown by red arrow.) Can you move it?

Figure 37.1

4. Ask your partner to help you in pushing the object to the right (Fig. 37.2). (The strength of you partner is shown by blue arrow.)

Figure 37.2

5. Ask your friend now to push the object from the opposite side to the left (Fig. 37.3). Has it become easier or more difficult to move the object to the right or left?

Figure 37.3

6. Now both of you push the object to the left (Fig. 37.4). Has it become easier to move the object?

Figure 37.4

7. Now one of you pull it and the other push it in the same direction (Fig. 37.5).

Figure 37.5

What do we observe?

- We observe that when both of us apply force in the same direction by pulling or pushing as in Fig. 37.2, Fig. 37.4 and Fig. 37.5, the object can be easily moved. When both of us apply force in opposite directions as in Fig. 37.3, it becomes difficult to move the object.
- In fact, it is possible to prevent the object from moving at all by applying equal forces in opposite directions.

What do we conclude?

- When forces are applied in the same direction, the total or **net force** is said to be equal to the sum of these forces.
- When forces are applied in the opposite directions, the net force is the difference of the two forces and acts in the direction of the larger force.
- When forces applied in opposite directions have equal magnitudes, the net force is zero.

Let us answer

1. When you and your partner pushed the object in the same direction, did it become easier to move the object? What is the net force in this case?
2. When you and your partner pushed from opposite directions, was it possible to move the object? If yes, in which direction did the object move? What is the net force in this case?
3. When you pulled and your partner pushed, in which direction did the object move?
4. Suppose that you pulled and your partner pushed an object. Draw diagram to show the various situations. What is the net force in each case?
5. In the situation shown in Fig. 37.3, in which direction would the object move?

What more can we do?

- Arrange a tug of war game in the class. Let the students identify directions and magnitudes of forces by observing the direction in which the rope moves.
- If an object does not move on being pulled or pushed, identify the various forces (including the force of friction) acting on it, and their direction. For the force of friction refer to the Chapter on friction.

Note for the teacher

- The teacher can help students identify the various forces and their directions acting on an object when it is pushed on pulled.
- When the object does not move on being pushed or pulled, the teacher can ask students to identify the forces acting on it. She can use this opportunity to explain the role of the force of friction in opposing the applied force.

ACTIVITY 38

What we have to do?

To show that liquid pressure depends only upon the height of the liquid column and not the volume of the liquid.

What do we need?

Three to four transparent plastic bottles of different capacities (2 litre, 1.5 litre, 1 litre and 0.5 litre), Nail or compass to make holes in the bottle, Cello tape, Meter scale, Paper cup, a wooden stool or table to be used as a stand, water.

How do we proceed?

1. Take three transparent plastic bottles of different capacities.
2. Make one hole on the side of each of the bottle at the same distance from the base of the bottles.(Fig. 38.1)

Figure 38.1

3. Seal these holes with cello tape.
4. Make a mark near the top of the bottle of the least height. Measure the height of this mark from its bottom. Make marks at this height in the remaining two bottles too.
5. Fill each bottle with water using a paper cup. Note that the level of water is the same in all the bottles (till the mark made on each bottle). Count the number of cups used to fill each of the bottles.
6. Place one of the bottles on the wooden stool or table. Remove the cello tape from the hole. The water stream will come out of the hole.
7. Mark the point at which the water stream falls on the floor.

8. Measure the distance of this mark from the base of the stand (Fig. 38.2).
9. Repeat the same steps with all the bottles and tabulate the reading in Table 38.1. (Make sure that bottles are placed at the same position on the stool every time.

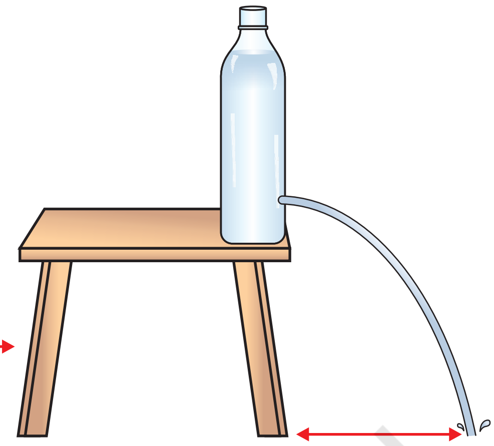

Figure 38.2

Table 38.1

Bottle	Distance of the mark from the stand (cm)

What can you say about the distances recorded by you? Are they approximately equal?

What do we observe?

Though the volume of water in different bottles was different still the distance at which the water stream from the holes hit the ground was almost the same for every bottle.

What do we conclude?

We conclude that the liquid pressure depends only upon the height of the liquid column and not the volume of the water in the container.

Let us answer

1. In the above activity, will you get the same observation if the level of water in each bottle was different?
2. Shyama has two water tanks of equal volume in her house. One is placed on the loft of her kitchen which is on the ground floor and

the other on the terrace of the second floor. The water from which of the tank will come with a greater pressure and why?

3. Observe the two sets of pictures given below and answer the question for each set (Fig. 38.3).

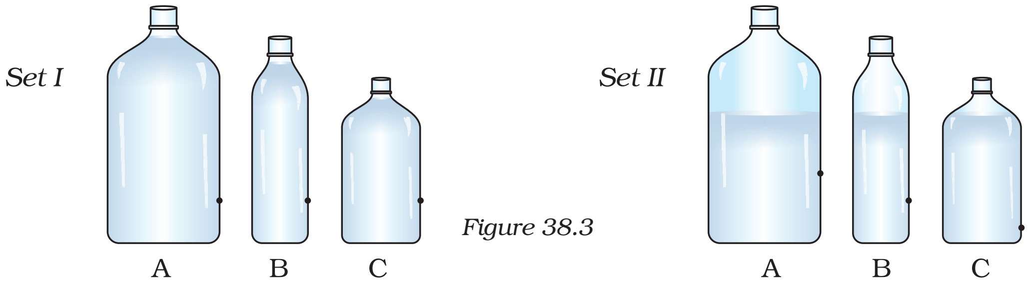

Figure 38.3

Out of the three bottles, water stream from which bottle will fall the closest from the bottle and why?

What more can we do?

- Take a long plastic bottle. Make three holes at different heights as shown in Fig. 38.4. Seal the holes with one long piece of cello tape. Fill the bottle with water. Place this bottle on a wooden stool or table and remove the tape. Observe the water streams coming out of the three holes. Water stream from which of the holes falls the farthest from the bottle. Give reason.

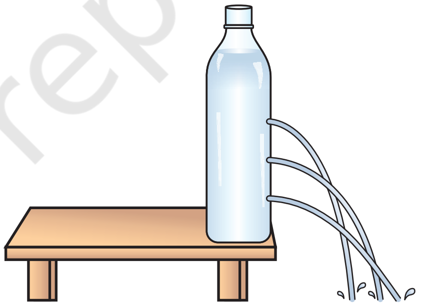

Figure 38.4

Note for the teacher

- This activity can be done in smaller groups. The students may be encouraged to share their observations, discuss and conclude in a team.
- The containers taken for the activity can be of any shape or size.
- Ensure that the water level in each bottle must be the same and the hole made must be at the same height from the base.
- The distance of the mark where the water stream hits at first needs to be considered every time.

ACTIVITY 39

What we have to do?

Explain the working principle of a rubber dropper.

What do we need?

A rubber dropper and a beaker with water.

How do we proceed?

1. Take a rubber dropper.
2. Press the rubber bulb of the dropper by keeping its nozzle on your finger tip. What do you feel?
3. Immerse this nozzle half into the water in the beaker and press the bulb.
4. Do you see any air bubble escaping the nozzle? Where is this air coming from (Fig. 39.1)?
5. Keeping the nozzle still inside the water, release the bulb. What do you observe?
6. Does it make any difference when you press the bulb harder?

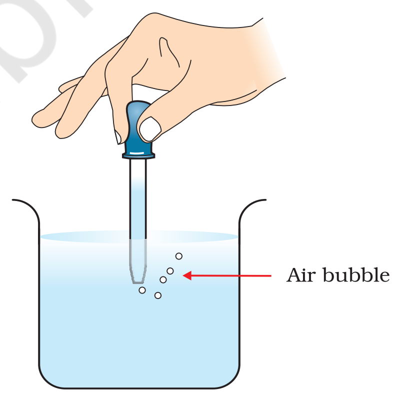

Figure 39.1

What do we observe?

- When the rubber bulb is pressed we feel some air coming out of it on our fingertip.
- When the bulb is pressed with the nozzle immersed inside water, air bubbles are seen escaping.
- When the bulb is released, the water from the beaker rushes into the dropper.
- When the bulb is pressed harder and released, large amount of water is filled in the dropper.

What do we conclude?

When the bulb is pressed, air from the nozzle of the dropper escapes from it and partial vacuum is created inside the nozzle. When the bulb is released, water rushes into the nozzle to fill this vacuum. This is because of the air pressure on the surface of water in the beaker (Fig. 39.2).

The harder we press, the larger the amount of air that is pushed out and greater the vacuum that is created. As a result more water is pushed in.

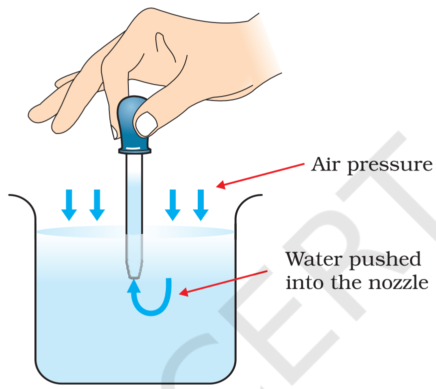

Figure 39.2

Let us answer

1. While drinking milk-shake with the help of a drinking straw, how does the milk rise up inside the straw?
2. Is there any similarity between the working of a syringe and the working of a rubber dropper?

What more can we do?

- Make a 'Pichkari' out of a thin plastic bottle using this principle.
- Your have a tank full of water. One way to take water out of it is to use a rubber pipe. Explain how you would draw water from the tank.

Note for the teacher

- Children may have the wrong notion that it is the pressure of water that is responsible for pushing water inside a dropper. This activity should also be used to dispel this notion.
- It is the principle of siphon that is used for transferring water from the water tank to a bucket.

Notes

ACTIVITY 40

What we have to do?

To show that the increase in weight will increase the static friction between two surfaces.

What do we need?

A wooden block with a hook (a nail can be fixed to the block and used as a hook), a medium sized (8-10 cm long) soft rubber band, some weights e.g., 1/2 kg, 1 kg, 2 kg, etc. and a meter scale.

How do we proceed?

1. Take the wooden block with the hook.
2. Tie the rubber band to the hook.
3. Place the block along a meter scale as shown (Fig. 40.1).

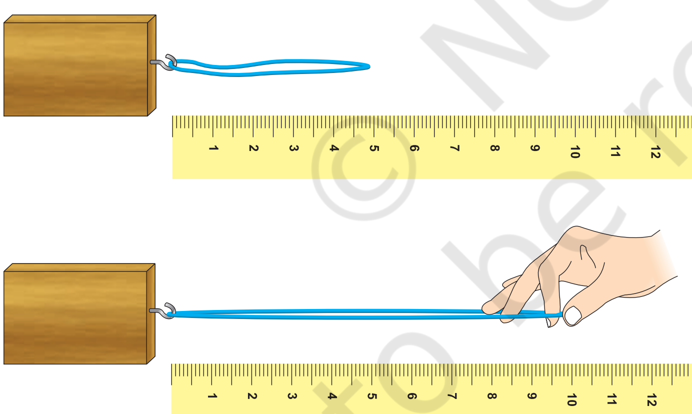

Figure 40.1

4. Try to pull the block.
5. Measure the length of the stretched rubber band when the block just start to move.
6. Put ½ kg weight on the block and repeat the same step again. Measure the length of the stretched rubber band.
7. Now put 1 kg weight and 2 kg weight one by one and measure the length of the stretched rubber band, when the block just start to move.

8. Record your observations in the Table 40.1.

Table 40.1

Mass of the weight placed on the block (kg)	Length of the stretched rubber band (cm)
0	
1/2	
1	
2	

9. What can you say about the lengths recorded by you? Is there any relation between the amount of weight put on the block and the stretching of the rubber band?
10. Draw a graph between the weight and the length of the stretched rubber band (Fig.40.3).

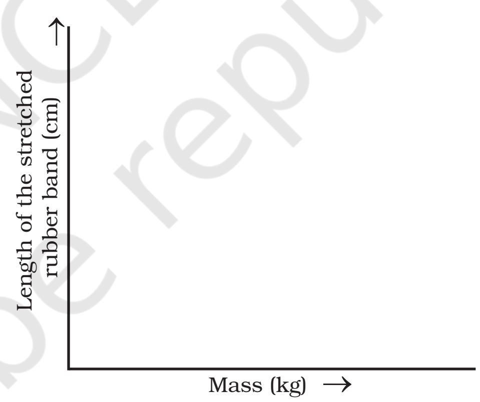

Figure 40.3

WHAT DO WE OBSERVE?

- The force required to pull the block increases with the increase in the weight on the block.
- The length of the stretched rubber band is proportional to the weight put on the block. The graph between the length of the stretched rubber band and the weight is almost a straight line.

WHAT DO WE CONCLUDE?

The interlocking of the irregularities between the surfaces of the block and the table increased when the surfaces were pressed harder by putting weight on the block. Hence, the static friction increases with the increase in weight.

LET US ANSWER

1. In the above activity what changes will you make to move the block easily.
2. A pile of book is lying on a table. When will the pile experience the force of friction?
3. Is there any type of friction acting in the following cases? If yes name the type of friction:
   (i) A heavy box pushed by a person, which does not move.
   (ii) An object moving with a constant speed.
4. Why does it become difficult for a rickshaw puller to pull the rickshaw when three people are sitting on it compared with the situation when only one person is sitting on it?

WHAT MORE CAN WE DO?

- Take a durry (mat) and try to pull it. Now ask one of your class mates to sit on the durry and try to pull it again. Repeat this activity with ten of your class mates. Arrange them in the order of increasing effort required by you to pull the durry with them sitting on it. Now confirm whether your estimation is correct by asking them their mass.

NOTE FOR THE TEACHER

- This activity can be done in pairs. The students may be encouraged to share their observations, discuss and conclude in a team.
- The students must be told that the force of friction between two surfaces comes into action only when some force is applied to move an object over the other. Static friction is the force of friction just before the sliding or rolling takes place.