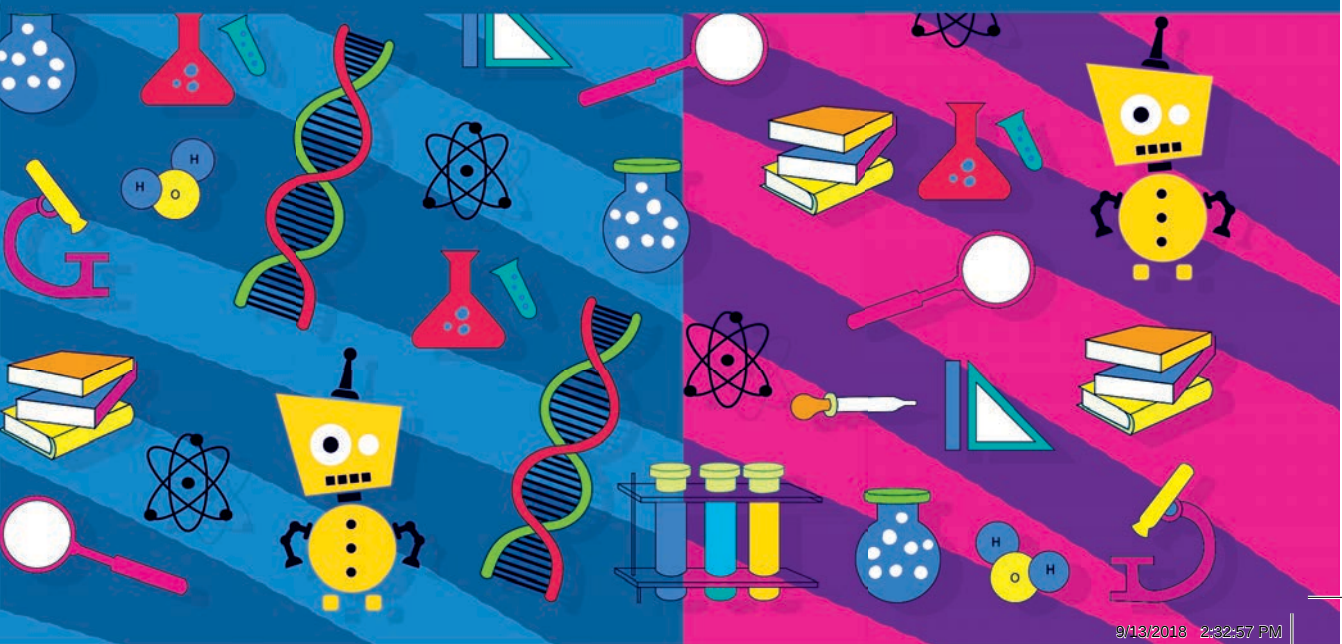
# Handbook on Understanding Science through Activities, Games and Toys





# Handbook on Understanding Science through Activities, Games and Toys



विद्यया ऽमृतमश्नुते

एन सी ई आर टी
NCERT

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
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# FOREWORD

The *National Curriculum Framework–2005* recommended that children's learning at school be linked to their life outside the school. It further advocates for adopting a constructivist approach of teaching where students and teachers are viewed as partners in the teaching-learning process. The teacher plays the role of a facilitator and helps children to express themselves, handle objects, and explore their natural and social milieu. In the context of teaching of science, the NCF–2005 suggested to provide opportunities to children to enable them to examine and analyse their everyday experiences and integrate the same in their learning of scientific concepts. In order to realise these objectives, there is a need to re-organise classroom practices which provides opportunities to children for interaction with the environment.

The present handbook attempts to translate the ideas advocated by NCF–2005 in teaching of science to the students at the upper primary level. Various scientific concepts have been illustrated through a series of fun activities, games and toys. The young learners would love to play and participate in these activities and games which will eventually make the learning of science interesting and enjoyable. In addition, this will also help in the learner's physical, social and emotional development.

I appreciate the efforts made by the Department of Education in Science and Mathematics of NCERT and the Development Team for bringing out this material. Several teachers contributed to the development of this material. We are grateful to these authorities for making this possible.

We solicit the suggestions and observations of the readers to bring out further improvement in the Handbook.



Hrushikesh Senapaty
*Director*
National Council of Educational
Research and Training

New Delhi
*July 2017*

# Preface

Activities and demonstrations are crucial in the teaching-learning process of science. Conducting activities on scientific concepts in a play-way method is expected to be more effective for children at the upper primary stage. The present publication is an attempt in this direction.

This book is an outcome of the efforts made in the direction of making science classrooms interactive, interesting and child centric. This becomes more relevant considering the declining interest of children in learning science. Attempts have been made to suggest activities in the form of some games, toys and fun generating activities for understanding the concepts of science at the upper primary stage through a child-centric approach.

The unique feature of the book is an attempt made to suggest some innovative pedagogical strategies. Traditional games, which are struggling for their existence among children in the present era of technology, have been used as a tool to transact the concept of science in an innovative manner. Development of a creative domain for a child through learning science is another area which is addressed through the activities suggested in the handbook to make learning of science stimulating and exciting.

The most important feature of the book is the scope for involvement of children with special needs. In each and every activity, this issue has been addressed and accordingly incorporated. It is expected to facilitate an inclusive set up in school in general and classroom in particular.

I am thankful to the development team who have put their efforts to bring out this handbook. Also, I thank the technical staff of the NCERT for their support in the entire process.

This handbook has been developed and is expected to stimulate and bring excitement for teaching-learing science. Suggestions, if any, for further improvement of the book are welcome.

Ruchi Verma
*Associate Professor*
Department of Education in
Science and Mathematics, NCERT

# Do You Know ?

According to the 86th Constitutional Amendment Act, 2002, free and compulsory education for all children in 6-14 year age group is now a Fundamental Right under Article 21-A of the Constitution.

**EDUCATION IS NEITHER A PRIVILEGE NOR FAVOUR BUT A BASIC HUMAN RIGHT TO WHICH ALL GIRLS AND WOMEN ARE ENTITLED**

*Give Girls Their Chance !*

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# Contents

# FUN ACTIVITIES

# Obedient Liquid

## Number of Participants

Entire class (each student will perform individually).

## Time Required

30 minutes

## Material Required

Sodium hydroxide pellets, a pair of tongs/forceps, phenolphthalein indicator, water and one 250/500 mL used transparent plastic bottle for each student.

## How to Proceed?

- The facilitator will make a solution of sodium hydroxide by dissolving 5 pellets in 500 mL water.

***Warning:*** *Never touch sodium hydroxide pellets. Lift them with a pair of tongs or forceps.*

- Give each student 10 mL of this solution.
- Ask them to add 100 mL (approximately) of water.
- Ask the students to add a drop of phenolphthalein indicator. Make sure that the solution becomes light pink.
- Ask students to 'talk to the solution' by speaking into their bottle "colour colour, go away".
- Ask them to shake the bottle every time they speak.
- Ask them to observe whether the colour has gone away.
- In case the colour has not disappeared, ask them to speak again.
- Keep repeating the step till the colour disappears.



## Points for Discussion

- What do you have to do to make the colour disappear?
- Will the colour disappear if students 'talk' to the liquid from a distance or keep the bottle closed?
- What happens when you 'talk' to the liquid from the mouth of the bottle?
- What is formed in the bottle?
- What makes the colour disappear?

## Science behind the Game

The bottle contains a diluted solution of sodium hydroxide, a base. Solution of sodium hydroxide shows a pink colour in the presence of phenolphthalein which is an acid-base indicator. When students 'talk' to the liquid, they exhale carbon dioxide into the solution. This carbon dioxide gets dissolved in the water, forming carbonic acid, which neutralises hydroxide solution. This is a neutralisation reaction. Phenolphthalein in acidic or neutral solution remains colourless. Hence, the colour disappears. It will reappear if more sodium hydroxide is added to the solution.

Fig. 1

Fig. 2

Fig. 3

## CWSN (Children With Special Needs)

A sighted peer may assist the visually impaired learner to describe the whole process and to give verbal cues to them. As written earlier, they may be asked to smell the solutions to find the difference.

# Balloon Rocket

## Number of Players

Two students in each group.

## Time Required

30–35 minutes

## Material Required

For each group — A long thick strong thread, a piece of stiff drinking straw, 3 balloons, broad sticking tape (used for packing) and a pair of scissors.

## How to Proceed?

- Stick a piece of straw along the length of the deflated balloon, roughly at its middle.
- Take the thread and tie its one end at a height approximately 2 m above the ground on a wall of the room.
- Pass the free end of the thread through the straw.
- Fix the other end of the thread at the opposite wall of the room at about the same height. Alternately, let two students hold the thread tightly.
- Inflate the balloon and hold its neck with your finger and thumb so that no air escapes (Fig. 1).
- Make sure that the thread is taut. Now remove your fingers from the balloon and let it go.

Fig. 1

- Observe the motion of the balloon.
- Repeat the activity by changing the inclination of the thread (Fig. 2).

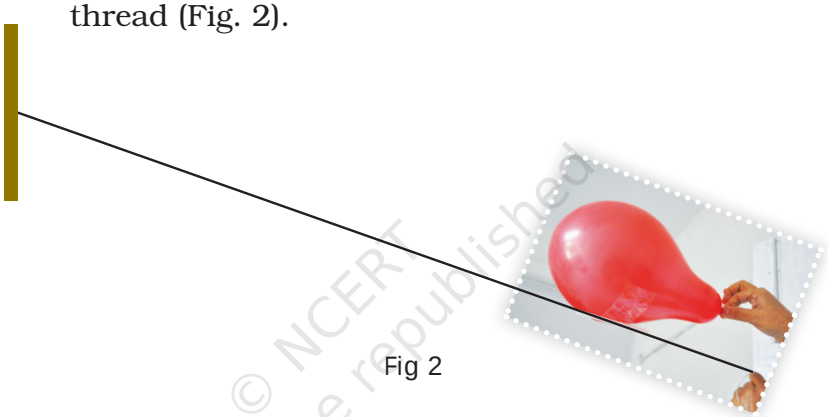


Fig 2



- You can repeat the activity by keeping the thread vertical while releasing the balloon from the lower end (Fig. 3).

Fig 3

- Does the balloon rise up along the thread?

## Points for Discussion

- Why does the balloon behave like a rocket ?
- Does the change in the inclination of the thread affect the speed of the balloon rocket?

## Science behind the Activity

When you let the balloon go, the air from it escapes with a force. The reaction to this force pushes the balloon in the opposite direction.

## Extended Activity

Repeat the whole activity by fixing a jet at the mouth of a balloon. A jet may be a piece of straw or a part of a ball pen.

## CWSN (Children With Special Needs)

The visually impaired learner may be given audio description to perform the activity and the observations may again be told to them either by their sighted peer or a facilitator. They may feel a gush of air by fitting a thin whistle.

# Lifting a Cup or a Glass Tumbler with a Balloon

## Number of Participants

Entire class (each student will do this individually)

## Time Required

5 minutes

## Material Required

One large sized balloon and a tea cup or a glass tumbler for each student. (Hard plastic cups and tumblers can also be used.)

## How to Proceed?

- Place a balloon near the cup or the tumbler in front of each student.
- Challenge the students to lift the cup or tumbler without holding it with hands.
- If no student succeeds, follow the steps given below.

- Place a balloon in the cup or tumbler with a part of it remaining outside (Fig. 1). Now blow air into it till the balloon presses into the inner surface of the cup (Fig.2).
- Now close the mouth of the balloon with your finger and thumb (Fig.3).
- Slowly and carefully lift the balloon.
- Observe that the cup also gets lifted along with the balloon.





Fig. 1 Fig. 2 Fig. 3

- As a precaution make a sand bed or place a piece of sponge below so that if the cup or the tumbler falls accidentally it does not break.

## Points for Discussion

- Why does the cup get lifted after the balloon is inflated?
- What would happen if the balloon is not inflated sufficiently?
- What will happen if you first blow the balloon and press it into the cup?

## Science behind the Activity

When you inflate the balloon, it pushes into the walls of the cup and holds it firmly. When the balloon is lifted, the cup gets lifted, too.

## Extended Activity

- Try the above activity by placing marbles in the cup one by one.
- Take two glass tumblers. Keep them on a table in a lying down position with their open ends facing each other. Place between these two, a balloon (Fig.4) and inflate it (Fig.5). Try to lift the tumblers with the balloon.

Fig. 4

Fig. 5



## Reference

The air pressure is discussed in Chapter 11 (Section 11.10) of *Science* Textbook for Class VIII (NCERT 2014).

## CWSN (Children With Special Needs)

Visually impaired children may be given the opportunity to do the activity on their own. Extent of freedom to do this independently will depend on the extent of disability. Audio description and physical support may be provided as and when required. Glass tumbler may be replaced with something unbreakable.

# TWINKLING STAR

## Number of Participants

Each student can try. However, a group of five students would be better.

## Time Required

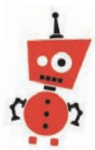
30–35 minutes

## Material Required

Black paper, pointed pin to punch small holes, cardboard box, bulb with holder, electric iron.

## How to Proceed?

- Place the bulb fixed on the holder inside the box. Make a small hole in the bottom to pass the electrical wire.
- Paste black paper on the outer face of the cardboard box.
- Pierce holes on this face preferably in the shape of any constellation.
- Place the cardboard box on a table near the black board.
- Switch on the bulb inside the box.
- Turn off the lights in the room and make the room as dark as possible.
- Let students stand 1m to 2m away from the table. Observe the darkened face of the box. Light will be seen coming out of the holes which appear like stars. But these stars will not be twinkling.
- Place an electric iron with its hot plate facing upwards (near the cardboard box). Switch on the electric iron. Wait for the iron to become sufficiently hot. Observe the stars once again.



- Now the stars will look like as if twinkling, just as the real stars in the sky.

## Points for Discussion

- Is there a difference in the refractive index of hot and cold air?
- If the air is still and not turbulent, will it still cause twinkling?
- If you go out into outer space, above the atmosphere, will stars still appear to twinkle?

## Science behind the Activity

Fig. 1

Light moving from a denser medium to a rarer medium gets refracted. In other words, it will change its direction. Light rays emerging from the box get refracted by the hot air. The turbulence in the hot air changes the path of light continuously and randomly resulting in twinkling phenomenon. The stars in the night sky also appear to twinkle as the star light passes through turbulent air in the atmosphere.

## CWSN (Children With Special Needs)

(For totally blind students)

The chosen constellation may be made tactile by using star shaped sequins and guiding threads to provide them an insight about it.

(For low vision students)

They may be able to perform the activity with the help of a sighted peer. Hot iron should not be handled by low vision students independently.

# PLAY WITH WORDS

## Number of Participants

All the students of the class (a group of 3–4 students to construct and solve a puzzle).

## Time Required

30 minutes

## Material Required

Plain paper, pen or pencil, science textbooks and scale.

## How to Proceed?

- A group of 3–4 students will sit together and prepare the blank puzzle grid, clues and answers for the puzzle based on terms appearing in the given chapter.
- All students of the class will participate in the preparation of puzzles. At the end, there will be around 10 puzzles based on 10 chapters.
- The facilitator will collect puzzles from all the groups and check the puzzles for the correction of clues.
- The blank puzzle sheets along with clues are distributed randomly to various groups. Care should be taken that a puzzle is not assigned to the group which has prepared it.
- Each group is given 15 minutes to solve the puzzle.
- When the time is over, the facilitator will collect the puzzle sheets.
- Each puzzle is corrected or checked with the help of answer sheet by the team that prepared it.



- For each correct answer provided in the puzzle sheet, 4 marks may be awarded. The team with maximum marks will be declared the winner.

## Science behind the Activity

The game helps in comprehending and revising the concepts and information provided in the Chapters already covered by the teacher in the classroom. Also, it will develop skill among the students to frame questions on the subject.

## Extension of the Activity

The puzzles can be prepared on a set of chapters.



### STEPS FOR PREPARING A PUZZLE

- Make a list of terms from the assigned chapter.
- Try fitting these terms in a blank grid. There must be a gap of at least one box between the ending and beginning of each term.
- Once the grid is complete, assign numbers in a sequential order, in the box, from where a word is to begin across or downward.
- Provide clues for the various terms. Indicate in brackets the number of letters for each word.

## Puzzle Based on Respiration

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | 3 | | | | | |
| | | | | | | | | | | | |
| | | | | | | 2 | 5 | | | | |
| 5 | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| 4 | | | 7 | | | | | | | 9 | |
| | | | | | 8 | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | 6 | | | | | | | | | |



**Clues**

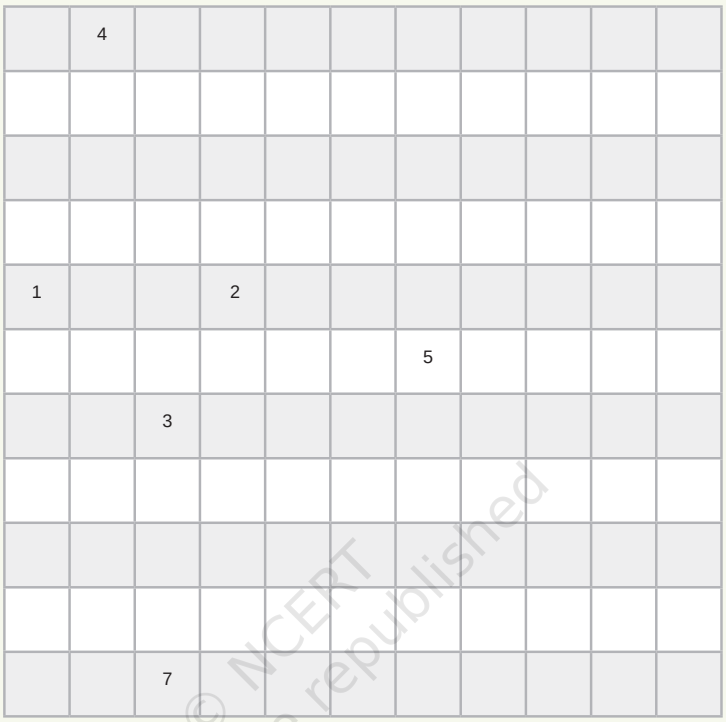
**Across**

1. Tiny pores on surface of leaf. (7)
2. Skeletal structures surrounding chest cavity. (4)
4. Respiratory organs of human beings. (5)
6. Also known as throat. (7)
8. Insects have a network of our tube called. (7)

**Down**

1. In cockroach, air enters the body through_____. (9)
3. Respiration that occurs in most plants and animals. (7)
5. Taking in air rich in oxygen into the body is called. (9)
7. Fishes respire through_____. (5)
9. Single celled organism that respire anaerobically. (5)

## Puzzle Based on Light






**Clues**

**Across**

1. A concave lens cannot make such an image. (4)
2. This is how your right side appears in your image in a plane mirror. (4)
3. A convex mirror cannot form such an image. (8)
4. Lens that forms an image which is erect and smaller in size than the object. (7)
5. The small opening in the iris. (5)

**Down**

1. Colorful display in the sky. (7)
2. Part of our eye. (4)
3. It is formed when light rays actually meet or appear to meet. (5)
4. Lens that is used as magnifying glass. (6)
5. It can split white light into various colours. (5)

## Solution of the Puzzle Based on Respiration

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [1]S | T | O | M | A | T | [3]A | | | | | |
| P | | | | | | E | | | | | |
| I | | | | | | [2]R | [5]I | B | S | | |
| R | | | | | | O | N | | | | |
| A | | | | | | B | H | | | | |
| C | | | | | | I | A | | | | |
| [4]L | U | N | [7]G | S | | C | L | | | [9]Y | |
| E | | | I | | [8]T | R | A | C | H | E | A |
| S | | | L | | | | T | | | A | |
| | | | L | | | | I | | | S | |
| | | | S | | | | O | | | T | |
| | | [6]P | H | A | R | Y | N | X | | | |

## Solution of the Puzzle Based on Light

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | [4]c | O | N | C | A | V | E | | | |
| | O | | | | | | | | | |
| | N | | | | | | | | | |
| | V | | | | | | | | | |
| [1]R | E | A | [2]L | E | F | T | | | | |
| A | X | | E | | | [5]P | U | P | I | L |
| I | | [3]I | N | V | E | R | T | E | D | |
| N | | M | S | | | I | | | | |
| B | | A | | | | S | | | | |
| O | | G | | | | M | | | | |
| W | | [7]E | R | E | C | T | | | | |

## CWSN (Children With Special Needs)

- Questions and answers and the clues must be converted to Braille script to make it accessible to the visually impaired learner.
- Questions based on purely visual concepts may be avoided for visually impaired children.

# WHO IS ROTATING THE BOTTLE?

## Number of Participants

The entire class in groups of two.

## Time Required

30–35 minutes

## Material Required

Empty water bottle (0.5 L size), reel of thin sewing thread, four empty ball pen refill (each about 10 cm long), knitting needle, candle, match box.

## How to Proceed?

- Take an empty bottle. Pierce four holes in it at equal distances along the circumference near its bottom such that each pair of holes is at the end of the diameters perpendicular to each other. The holes should be at the same height from the bottom. The holes can be made by a thick needle, like a knitting needle.

- To make holes, heat the pointed end of the knitting needle. Insert the hot end of the needle at the point you wish to make a hole. Let the needle emerge out at the other side of the bottle. This will ensure that the two holes are at exactly opposite ends of a diameter, provided the needle is pushed horizontally.
- Bend four pieces of empty refill tubes in L-shape. By bringing them one by one near (not in contact) the flame of a lighted candle (Fig.1).
- Insert bent pieces of refills into the four holes.
- To prevent any leakage, seal each hole with a drop of wax.



- The refill pieces should be fixed horizontally in such a manner that the open end of the bent refill pieces face in opposite directions (Fig.2).
- Tie a thread around the neck of the water bottle such that it can be suspended freely (Fig. 2).

Fig. 1

Fig. 2



- Pour water in the bottle.
- The water will escape from the openings of ball point refills.
- Observe. What happens? Does the bottle begin to rotate?

## Points for Discussion

- Why does the water come out?
- Why does the bottle rotate?
- What is the relation between the direction of the openings provided with refills and the direction of rotation of the bottle?
- What will happen if you cap the bottle when the water is flowing out through the refills?
- What will happen if the cap is removed again?

## Science behind the Activity

At any point in a liquid the pressure depends upon its depth from its top level. The pressure of water at the level of the holes in the bottle exerts the force that pushes water out. As water flows out, it exerts a force of reaction in opposite direction on the bottle. These forces make the bottle rotate.

## Extended Activity

- Note the change in the speed of rotation of the bottle as the water level in it decreases.

## CWSN (Children With Special Needs)

Assembled set up (bottles) may be provided to the Visually Impaired Children (VIC) with the help of a tactile measuring scale. Four equidistant holes can be made by the VIC. Activities like heating the needle may not be performed unaided by VIC. Direction of rotation of the bottle and water coming out may be felt by VIC.



# Tell Me If You Can

## Number of Participants

Entire class

## Time Required

30 minutes

## Materials Required

No material is required.

## How to Proceed?

- Students will sit in a semi-circle.
- One by one, each student will be asked to tell the facilitator (in a way that other students are not able to hear him) of any one use of water. The student will then communicate this use of water, only through gestures, to other students.

- The students sitting in the semi-circle will guess that use of water.
- Facilitator will judge the act as well as the responses of the students. When the correct use has been identified, the student will write it on the blackboard.
- In case the use is not identified, the teacher will reveal it and ask a student to write it on the board.
- Finally, a list of uses of water will emerge through the game, which will help in the class discussions about various uses of water and ways of conserving water.

## Points for Discussion

Some suggestive questions are given here which can be used to initiate discussion in the class.

- Do you think people often waste water in various activities? If yes, give some examples. Can they do anything about it?
- Can you suggest some ways by which wastage of water can be minimised in the examples suggested by you?
- Do you yourself try to save water? If yes, how?
- Can you suggest ways to involve your family and friends in minimising wastage of water and conserving it.

## Scientific Fact behind the Activity

Water is essential for all living beings. Its conservation is of prime importance because fresh water is a scarce resource. It should be used judiciously.

## CWSN (Children With Special Needs)

Visually impaired students may explain the use by using gestures but for guessing it from the other party they may need an interpreter.



# GAMES

# PICK ONE AT A TIME

## Number of Participants

Two

## Time Required

10 minutes

## Material Required

A bar magnet, wooden stick or scale (30 cm), thread, 10–15 iron screws (2 cm) or nails with large heads.

## How to Proceed?

- Tie a thread at the middle of a bar magnet. Tie the other end of the thread near one end of the wooden stick so that magnet can be suspended freely (as shown).
- Arrange 10–15 screws about 1 to 1.5 cm apart along a line. Screws can be placed in vertical position by resting them on their heads. You are now ready for the fun activity.
- Ask a student to hold the wooden stick so that the magnet is suspended freely from its other end (Fig. 1).



Fig. 1

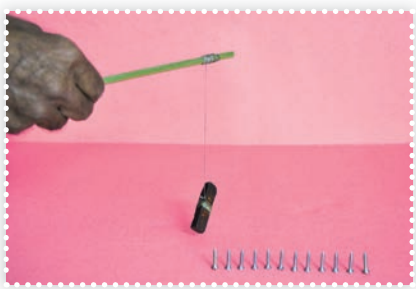


Fig. 2

- Now challenge the student to pick just one screw from the row of screws as shown in Fig. 2.
- The students gets a point if they succeed in picking just one screw. If the student fails to pick up a single screw in one attempt, chance should be given to another student. (The student will lose the chance if more than one screw gets stuck or even one or more screw falls while one of them is picked up by the magnet).
- The student who picks up the maximum number of screws is the winner.

## Science behind the Game

Magnets attract screws because they produce the magnetic field. This force pulls on other materials, such as iron, tin and can. Further, the magnetic field of the magnet can affect more than one screw. Therefore, to pick up a single screw one has to bring the magnet near the row of screws so carefully that it does not disturb nearby screws.



## CWSN (Children With Special Needs)

If the visually challenged need to be involved, the game could be played in pairs. Each visually impaired student can be paired with someone who will give instructions on how to move the magnet in order to pick the screw. For other teams where there is no visually impaired students, the student can be blind folded. The other person can give the instruction while the visually challenged or blindfolded ones will follow it.

# SINK OR SALVAGE

## Number of Participants

Two teams consisting of 2 students each.

## Time Required

30 minutes

## Material Required

Jug of water, salt, small pebbles, sand, chalk powder, a spoon or stirrer, two wide-base glass tumblers or gas jars. Two fresh eggs or tomatoes or lemons of nearly the same size.

## How to Proceed?

- Set up 'stations' as follows. On each station fill one tumbler up to nearly half with fresh water and the other tumbler with salt solution. Place an egg in one tumbler, a lemon or tomato in the other tumbler. Now you have on each station one tumbler with an egg or tomato or lemon floating in it and the other with an egg or lemon or tomato at its bottom. On the side of these tumblers provide small heaps of chalk powder, salt, small pebbles, sand and a jug or a bottle of fresh water.
- You can make as many such stations as possible depending on the resources available.
- Now you are ready to play the game.
- Explain to the students that the floating object has to be sunk and the sunk object has to be made to float. For this purpose they can use the material placed at each station. They are not allowed to touch the object. It is impressed on the students that the objects are not to be damaged.

- Make two students stand at each station.
- Blow a whistle indicating that students can start work.
- The team finishing its task in the shortest time is declared the winner.

## Science behind the Game

- An object floats in a liquid if the upthrust acting on it is higher than its weight.
- The upthrust acting on a floating object is equivalent to the weight of liquid displaced by it.
- To sink a floating object the density of the liquid is to be decreased which can be done by adding water in the tumbler containing salt solution.
- On the other hand, to float a sunk object, the density of liquid is to be increased, which can be done by dissolving salt in water.
- If there are visually impaired students in the class, they should be provided with help to participate in the game. The helping person get instructions from the visually impaired student to perform the task.



**Note for the Teacher**

- While preparing the salt solution, care should be taken that its density is just sufficient to float the egg/ lemon/ tomato. This is to ensure that salt solution could be diluted sufficiently by adding a small amount of water to make the object sink.
- It is advisable to try out the task before asking students to perform it.
- The salt solution may be stored in a separate bottle to be used in the event that the solution is spoiled by a student by adding sand or other materials to water.
- The students who are not playing can be asked to act as cheerleaders.


Fig. 1

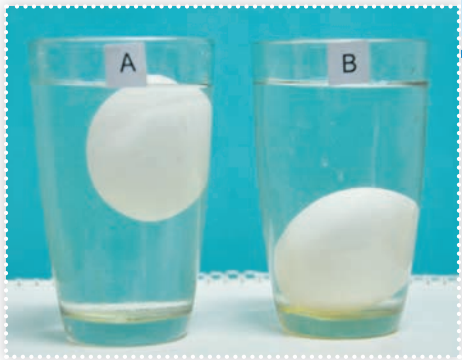



Fig. 2


Fig. 3

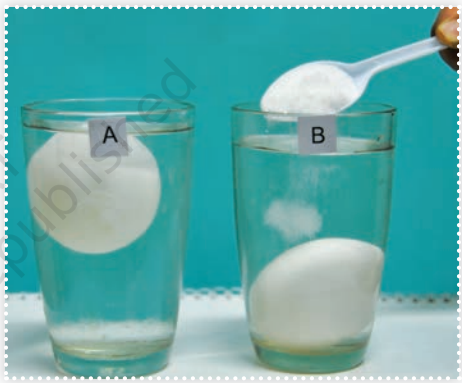



Fig. 4

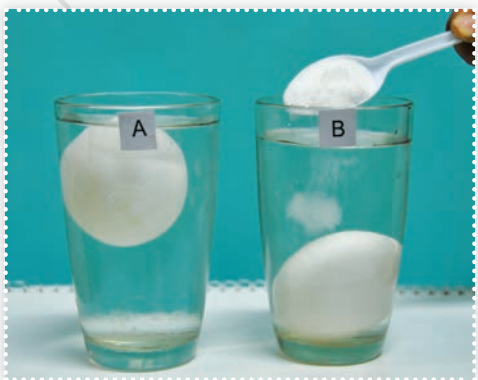



Fig. 5

## CWSN (Children With Special Needs)

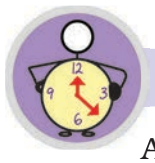
- With verbal instructions from their peers the visually impaired students can conduct the experiment successfully and by touching the object or with the help of a straw or stick they can tell when the object is sinking and when is it floating.
- For hearing impaired no modifications are required.
- For orthopedically handicapped no modifications are required. They may be assigned a peer to facilitate the movement of the wheel chair.



# WHO AM I?

## Number of Participants

Entire class



## Time Required

About 5 minutes per student

## Material Required

Pre-made cards (with the names of celestial bodies, like planets, the moon, the sun, asteroids, etc.)

## How to Proceed?

- Serial numbers will be allotted to students by draw of lots.
- Student with serial number 1 will stand before the class and turn the face towards the blackboard.

- Referee (to be selected from among the students) will randomly choose a card and pin it on the student so that the name of the celestial object is on the back of the student. The player will not know who the person is; but the class will be able to identify the same.
- The player will ask questions whose answers can be 'Yes' or 'No'. For example she/he can ask "Am I a terrestrial planet?" However, she/he cannot ask "Am I Earth or Venus or Mars?"
- With a maximum of four questions, the player should be able to guess who she/he is. If she/he guesses wrongly or is not able to make the correct guess even after asking four questions, then she/he is 'Out'. If she/he is able to make a correct

guess after asking up to four questions, then s/he is considered a winner. (If the facilitator feels that four questions are not sufficient for identifying objects, she can allow five or even six questions. Over a period of time the number of questions can be reduced.)

- If a student is not able to identify the object within the prescribed limits, the next student is called to take his/her turn.
- As students are encouraged to ask questions, a better understanding of the characteristics of celestial bodies could be expected.

**Note for the Teacher**

- Involve students in the preparation of the game.
- Allow students to perform the role of referees, preferably in groups.
- Let them explain the reason whenever a player is 'out' of the game. The facilitator can always help.
- Let it be an inclusive classroom. Each and every student should be given equal opportunity.
- This game could be helpful in comprehending characteristics of celestial objects.



## Points for Discussion

- If for any question, the reply given by the rest of the class is incorrect, the facilitator may pick up that point and discuss it further to aid learning.

## Science behind the Game

- The game allows a quick recapitulation of the characteristics of celestial bodies.

## CWSN (Children With Special Needs)

- Pre-made charts must be translated into Braille, so that the visually impaired children can feel and know about the celestial body being talked about.
- For hearing impaired students the communication has to be through their favoured mode.

# FIND THE UNIT

## Number of Participants

2 to 4 teams, each team of 2–4 students

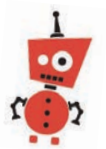
## Time Required

30 minutes

## Material Required

A piece of cardboard or mountboard (20 cm × 20 cm), plastic coins (*goti*) of different colours (like those used in the game of *ludo*), a dice with faces marked 1–6, copy of the chart for the board game as shown in Fig. 1.

## How to Proceed?



- Facilitator will form teams, each comprising 2–4 students.
- Each team will paste a copy of the chart (or draw it) on the piece of cardboard or the mountboard. If required, a larger sized board may be prepared or a larger number of boards may be provided to involve the entire class.
- The facilitator will explain the rules of the game.
  - Each team will be represented by a coin (*goti*) of different colour.
  - Coins for all teams will be stacked in the slot marked START at the innermost circle.
  - One member of the team that starts the game shall throw the dice. The coin representing the team shall be moved to the number marked on the board according to the number shown by the dice.



- After consulting one another the team members will announce the unit for the physical quantity written in the box where the coin is placed.
- The team that is to play next shall decide whether the answer is correct or incorrect. In case of a dispute, the decision of the facilitator shall be final.
- If the answer is correct, the coin remains in the box. If the answer is not correct, the coin will be brought back to the starting point.
- The same steps will be followed for the other teams. When all the teams have availed their first chance, the round comes to an end.
- In the next round, the first team will again throw the dice. If their answer in the first round was correct, the coin will be moved further by the number shown up by the dice. For example, if after Round 1, the coin was at No. 4 and the new number is 5 then the coin will be moved to No. 9. If the team fails to answer correctly the unit of the physical quantity in the box where the coin is placed, the coin will again be moved back to the starting point.
- The game continues till the coin of one of the teams reaches the box with No. 11 and the team answers correctly the unit of the physical quantity will be written there.
- In the event the coin of a team lands in a box for which the unit of the physical quantity has already been announced correctly, the team will be asked to throw the dice again. This step will be repeated till they get the number which enables them to move the coin to a box with a physical quantity whose unit has not been revealed so far.



## Science behind the Game

The objective of the game is to reinforce correct SI units of different physical quantities.

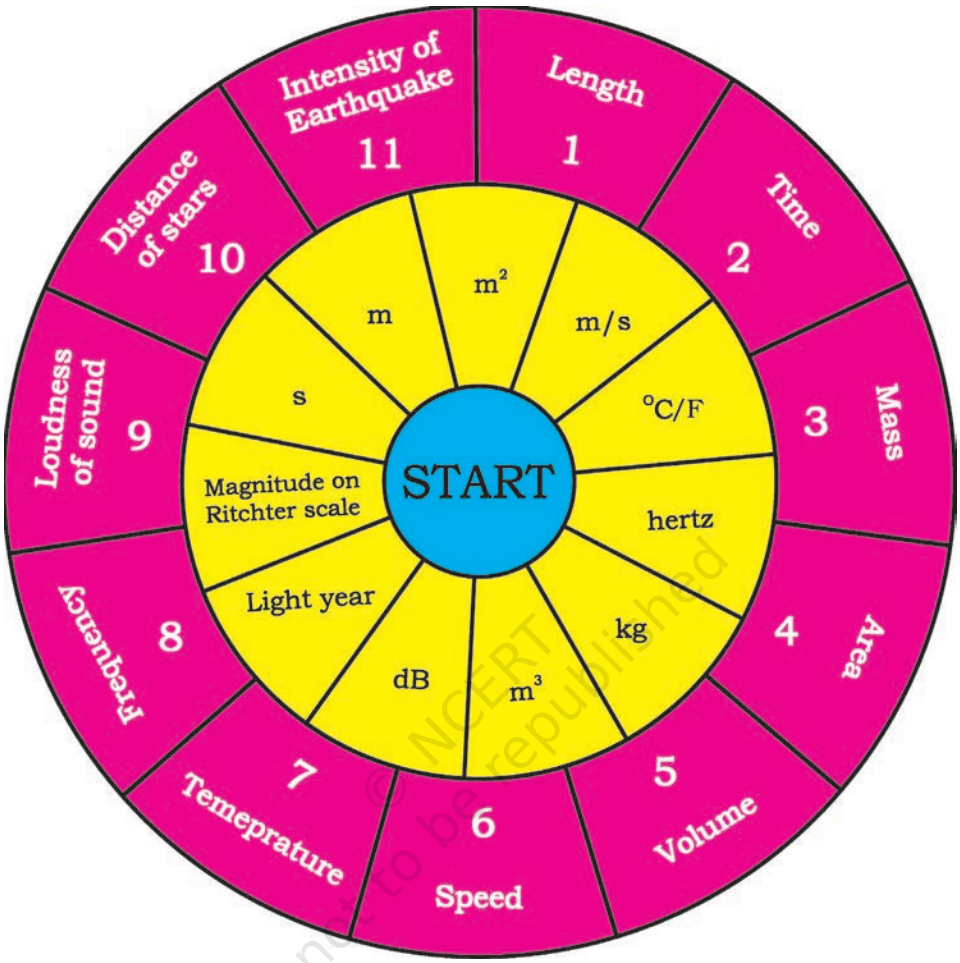



Fig. 1

## Extension of the Game

The game can be adapted for:

- elements and their atomic number.
- elements and their symbols.

## CWSN (Children With Special Needs)

- Physical quantities and the units may be Braille embossed or a sighted peer may verbalise the options of the units once the physical quantity is decided.
- No modifications for hearing impaired and orthopedically handicapped is required.

# DRAMATISE THE MOTION

## Number of Participants

Four groups of 4 students each.

## Time Required

30 minutes

## Material Required

No material is required.

## How to Proceed?

- The facilitator will form four groups (called A, B, C and D) of four students each. If the game is played more than once, all the students in the class can be accommodated. The procedure and rules of the game are flexible and the facilitator can adapt them as required.

- One of the teams, say Team A, will be asked to name a type of motion and dramatise it. The team will not only name the type but also act it through any art form. If the facilitator is satisfied that the type of motion chosen by the team has been dramatised properly, then the team will be awarded a maximum of 4 marks. For example, if the students say 'falling raindrops' as an example of rectilinear motion, then they must also act the motion, may be with a rain song, rain dance, or in any other manner they can think of at that moment. They may even march with their bags on their heads with the sound 'tip, 'tip'.
- If Team A can only name the type but is not able to dramatise it to the satisfaction of the facilitator, they may only earn half the marks. The dramatisation



part is passed on to the next team, say Team B. If Team B is able to dramatise properly, they earn 2 points. They will also be able to earn a maximum of 4 marks by giving another example of rectilinear motion and dramatising it. Whenever the task is not accomplished to the satisfaction of the facilitator, it will be passed on to the next team and so on.

- The same procedure will be adopted for the remaining teams.
- In the next round, the facilitator will assign another type of motion. The rules outlined above will govern this round, as well as Round 3.
- The children in a given group will be free to consult one another.
- Each group may be allowed to appoint a consultative group of 4 students for help from among those who are not playing the game that day. The consultative group will only help in suggesting possibilities. The actual task is to be performed by only the members of the group. Formation of consultative groups will also allow wider participation.

### Science behind the Game

The game will strengthen the student's understanding of the various types of motion.



## Extension of the Game

A group of 4 students will dramatise a particular type of motion through gestures or mimicry without saying it in words. The other group has to identify the type of motion being dramatised.

The examples of motion

1. Linear motion with constant velocity
2. Motion with constant speed
3. Accelerated linear motion

4. Curvilinear motion
5. Different types of periodic motion

## A Variation of this Game

Let a group name a type of motion. It is open to all other groups to dramatise this motion. The group which does this best will get the credit.

### CWSN (Children With Special Needs)

This activity is an excellent opportunity to engage special need learners. They should be explained the type of motion and they can involve in the dramatisation. Even learners with heavy impairment can be involved in miming.



# EXTEND A HELPING HAND

## *(SAATHI HAATH BADHAANA)*

### Number of Participants

Entire class (divide into teams of 5–6 members each)

### Time Required

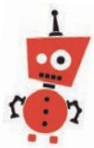
5 minutes for each team

### Material Required

Tub (20–22 cm diameter, height 5–7 cm) made of plastic (one tub for each team), bucket, mug and water.

### How to Proceed?

- The facilitator will divide the class to form teams, each having 5–6 students.
- The game may be played either in the playground or in any other open area.



- Place a bucket of water with a mug near one end of the play area.
- Ask members of each team to stand in a row, so that there is a gap of about one metre between any two members (Fig.1). Facilitator should ensure that the gap between two students in each team is such that a member can comfortably hand over the bucket to the next team-mate without moving from the position they are at.
- The facilitator will now explain the task to the participants. It may be announced that the member of each team standing at the starting point will be given a bucket full of water. Each team has to transfer the tub of water to the other end by passing

it over to the team-mate standing next to him/her. The participants will not be allowed to move from their position while handing over or receiving the tub. The challenge for each team is to carry the maximum amount of water to the finishing point—as much water as possible.

- Ask students at the starting point to fill their buckets up to the brim with water.
- Facilitator may announce 'Start' or blow a whistle when all teams are ready for the game.
- Facilitator will note the time taken by each team to transfer the tub from one end to the other.
- Students not participating in the game may be asked to help.
- Finally, the facilitator will ask each team to measure the amount of water transferred, using measuring cylinders.

## Science behind the Game

- The basic objective of the game is to help the student to have a first-hand experience of the property of inertia. When the tub full of water is moved quickly while transferring it to the next team-mate, water spills in the direction opposite to the direction of movement of the bucket, due to the property of inertia at rest. Similarly, when there is a sudden decrease in speed while handing over the tub, the water spills in the other direction due to inertia of motion.
- Additionally, the game will strengthen students' skill of measurement of volume.

## Points for Discussion

It may so happen that participants in their anxiety to win the game may fail to notice the direction in which the water spills or relate it to inertia of rest and inertia of motion. This may be demonstrated to the whole class after playing the game.

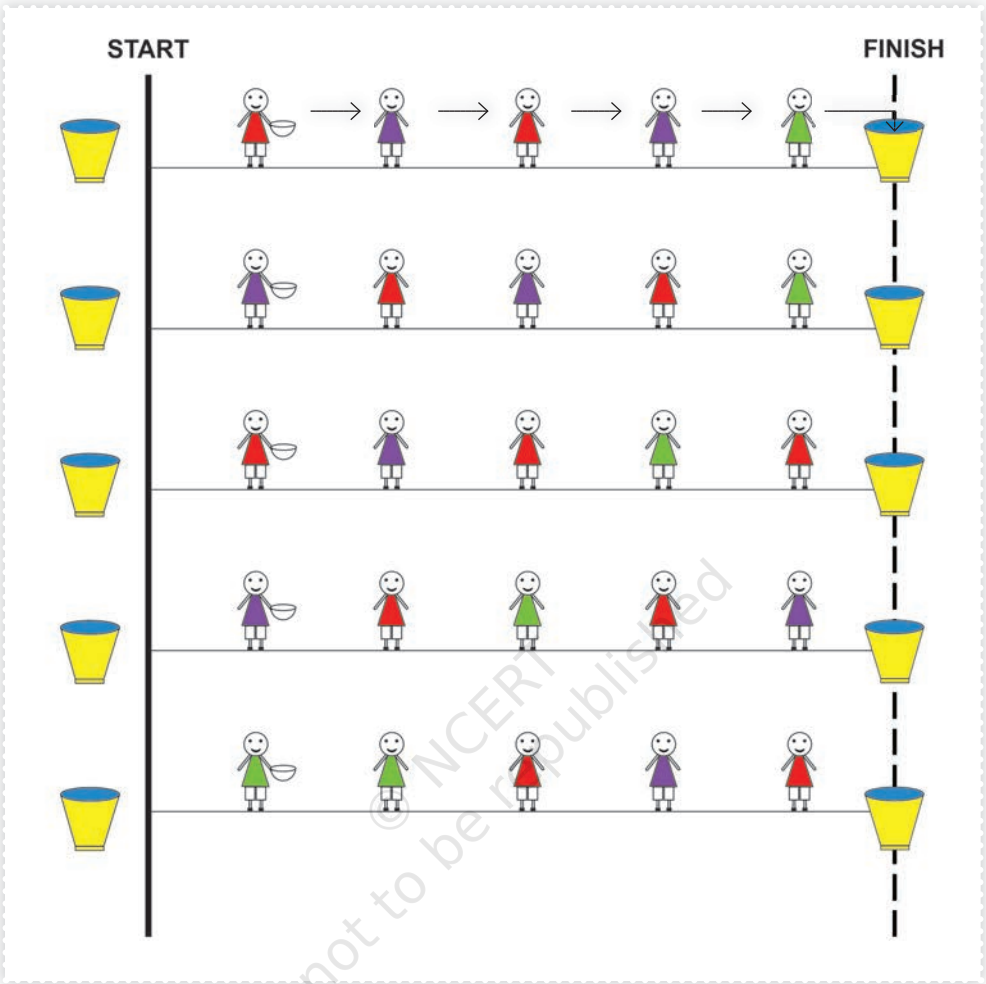





Fig. 1

## Extension of the Game

This game can be played with plates instead of tubs or dishes. Organise a 50 metre race where students carry plates or dishes filled with water. Measure the amount of water carried by each student at the end of the race. The student who reaches the finishing line with the maximum amount of water, wins the race.

## CWSN (Children With Special Needs)

Visually Impaired children can be asked to hold the tub by placing the fingers of both the hands in the direction of movement and the direction opposite to it so that they can feel the direction of the spillage. Later on the loss of water can be measured using an embossed scale or even a stick marked with initial reading of the water level.



# SEARCH ME OUT

## Number of Participants

Entire class (can be played individually or in teams).

## Time Required

30 minutes

## Material Required

Paper, blackboard, chalk in different colours and pencil or marker.

## How to Proceed?

- The facilitator will provide copies of a grid (shown on the next page) to students in groups of two.
- Hidden in this grid are terms related to stars and the solar system.
- Search these terms horizontally, vertically or diagonally.
- Mark associated terms in one colour. For example; sun and polestar, which are both stars.
- Use different colours for different pairs.
- The student who is able to list the maximum number of correct terms, using the given grid in the allotted time, will be the winner.



## Extension of the Game

This kind of grid can be made by using other terms from other topics. For example:

1. Names of elements
2. Skeleton system
3. Names of plants
4. Names of micro-organisms etc.

| E | M | Q | X | Y | L | H | G | S | H | O | W | E | R | S | E | P | B | L | Q |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F | N | A | M | O | P | Q | X | N | D | X | S | T | Z | A | O | Y | Z | M | B |
| B | L | C | A | Z | L | C | A | Y | B | L | I | G | H | T | Y | E | A | R | Y |
| G | O | B | R | M | A | Z | K | C | X | A | Y | C | Q | U | S | C | T | I | S |
| A | D | L | S | Q | E | C | L | I | P | S | E | D | M | R | A | R | Y | N | A |
| R | X | M | Z | I | X | G | Y | S | L | Q | M | O | O | N | Q | H | A | G | L |
| M | Z | E | A | E | R | O | M | D | A | Z | A | R | F | S | B | O | Z | S | X |
| S | A | T | M | F | G | I | S | L | N | S | Q | D | Z | C | E | R | P | C | S |
| T | O | E | P | L | B | W | U | A | E | R | G | H | T | X | M | I | B | T | A |
| R | M | O | R | S | C | O | N | S | T | E | L | L | A | T | I | O | N | M | S |
| O | Y | A | W | A | Z | X | F | I | H | Y | M | S | I | G | A | N | Z | O | T |
| N | L | R | N | Q | Z | A | R | L | X | O | D | Z | L | Q | L | F | D | A | R |
| G | C | X | E | B | Y | C | Z | A | Q | M | I | L | M | P | A | M | Q | Z | O |
| Z | E | P | H | A | S | E | S | G | H | Z | S | I | B | G | N | E | P | R | N |
| M | S | I | Q | G | E | T | Y | O | S | A | T | E | L | L | I | T | E | S | A |
| Q | Z | Y | A | X | L | N | I | A | Z | F | A | U | S | R | Q | E | C | M | U |
| T | C | Z | E | L | R | Y | Z | R | C | E | N | G | S | F | C | O | M | E | T |
| B | N | P | O | L | E | S | T | A | R | S | C | C | Z | M | Q | R | X | C | Y |
| O | A | Z | M | S | Z | O | C | S | N | V | E | N | U | S | L | O | B | Q | E |
| Y | L | X | Q | A | N | E | Y | M | A | N | G | A | L | Y | A | N | R | Z | A |



**Note for the Teacher**

This grid may be drawn on the blackboard or even the floor with the help of students and may be played with the entire class divided into two groups.

## Science behind the Game

This game will help students to learn many new words related to astronomy or any other topic selected for the game.

## CWSN (Children With Special Needs)

The grid must be translated into Braille and through tactual exploration the terms can be identified.

# SORT ME OUT

## Number of Participants

Entire class

## Time Required

30 minutes

## Material Required

Chalk and board, slips of paper (2''×2''), and pen or a marker.

## How to Proceed?

- Make some slips of paper.
- Number of paper slips should be equal to the number of students.
- Write one clue on each slip. This clue should concern properties of elements up to atomic number 20 and elements used in daily life. If the number of students exceeds 20, the same element can be used more than once with a different property. Examples of clues are:
  - I am highly reactive, thus stored in kerosene.
  - I am used to make jewellery.
  - I am malleable; so I am used to wrap food.
  - I can conduct electricity and I am present in the lead of pencils.
- These slips will be kept in front of students. Students will be asked to pick any one slip and read the clue written on it.
- Then the students have to identify whether the clue belongs to metals or non-metals.

- Students whose slips give clues for metals will make one team, while the students with clues for non-metals will make another team. In this way the students will be divided into two teams, one with properties of metals and the other with properties of non-metals.
- The facilitator will ask each student which metal or non-metal she/he represents.
- If a student has gone to the wrong group, she/he will be declared 'out'.
- One at a time, students in the two groups will speak out properties of their group whether metal or non-metal. Students declared 'out' are allowed to join their group if she/he adds some new thing to the answer. *[Hint for the facilitator:* Suppose students from the non-metal groups say that the non-metals are bad conductors of electricity and an 'out' student can point out that carbon is an exception, then she/he can be allowed to join her/his team.
- Once their physical properties have been exhausted, the use of these elements in daily life can be made a topic of contest between the two teams.

## Points for Discussion

Facilitator will discuss the following things with the students:

- Meaning of malleability, ductility, sonorousity, tensile strength, etc.
- Some examples of metals, like gold, aluminium, iron, silver and their properties as understood by the students.
- Some examples of non-metals, like carbon, phosphorous, oxygen, nitrogen and their properties as understood by the students.
- Uses of metals and non-metals in daily life.

## Science behind the Game

Metals and non-metals can be differentiated on the basis of their physical properties. Some exceptions among metals and non-metals like sodium, diamond and graphite, etc., to be discussed.

## Extension of the Game

In a higher class, the same game can be played to understand the chemical properties of metals and non-metals. This game can also be adapted to understand the physical properties of acids and bases, or any other basis of classification, for example, tissues in biology.

## CWSN (Children With Special Needs)

Visually challenged learners will need help in reading the slip, the content of the slip can be whispered in their ears and they can mime it or they can be Braille embossed.



# EAST OR WEST, HOME IS THE BEST

## Number of Participants

Entire class

## Time Required

30 minutes

## Material Required

Chart paper (for making headbands or placards) and marker pens.

## How to Proceed?

- Facilitator will ask students to make drawings of any animal they like and write the name of the animal in bold capital letters on a piece of chart paper to make headbands or placards. A variety of animals from diverse habitats should be included. For example, camel, rat, fish, snake, yak, snow leopard, *barasingha*, penguin, polar bear, etc.

- Similarly, signboards need to be prepared for different habitats such as desert, mountain region, grassland representing terrestrial habitats; and oceans, ponds/lakes representing aquatic habitat. We can also have spots for polar region or tropical rainforest. This is an outdoor game to play.
- Facilitator asks students to wear their headbands/ placards and go to the playfield.
- Facilitator selects suitable spots in and around the playfield and mark these as 'habitats' of animals by placing signboards at these spots.

- One student will be selected as a 'den' by the facilitator. (One can think of interesting ways of selecting student as a 'den'.)
- All players wearing or holding the placards of animals will run and 'den' will run after them, to catch them or touch them. One who is touched will become the 'den'. The new 'den' hands over his/her headband/ placard to the previous 'den' so that s/he now represents that animal and plays the game.
- In order to save themselves, players can go to the spot which represents their habitat and take refuge there. For example, camel cannot save itself by taking refuge in 'pond' habitat, it has to run towards 'desert' habitat and take refuge there. Once they are in their habitat; the 'den' cannot touch them.
- If the player takes shelter in the wrong habitat then she/he has to become 'den'.
- After playing the game for 20–25 minutes, facilitator will ask all the players to go and stand at their respective 'habitats' and ask each player (animal) to describe specific features of adaptation, which enable them to live in that habitat.



## Points for Discussion

Facilitator can initiate discussion by asking the following types of questions:

- What do you understand by habitat?
- What do you understand by adaptation?
- What will happen if the habitat of an animal is disturbed?
- Related issues like migration, endangered and extinct species, and effects of deforestation can also be taken up for discussion.

## Science behind the Game

- Different animals adapt to their surroundings in different ways.
- Several kinds of plants and animals may share the same habitat.
- The tropical and the polar regions are the two regions of the earth, which have severe climatic conditions.

## Extension of the Game

- This game can be played, on adaptations in plants (flora) and their habitats.
- A few more spots can be added, such as endemic species, endangered animals, etc., where a player can take refuge for not more than 30 seconds.
- The player who takes shelter in the 'wrong habitat' may be asked to enact the adaptations of that particular animal in the form of 'monoacting' to add a fun element.
- Facilitator may get face masks or headgears prepared in advance to give the look of the animals to the players they are representing.



**Note for the Teacher**

Take care that students do not stick around their habitat for too long. For this purpose, you can appoint observers/mentors to help you. This game can also be played in the following manner. Put all the headbands or placards in a pile. Each child picks up one headband or a placard. When the facilitator blows the whistle continuously for 10 seconds, each student has to run and take shelter in his/her respective habitat. The student will identify the students that are standing in wrong habitats and explain why. Several such rounds can be played.

Fig. 1

Fig. 2


Fig. 3

Fig. 4

Fig. 5

Fig. 6


Fig. 7



## CWSN (Children With Special Needs)

Visually Impaired children can be paired with a sighted partener who can read out the written part and help him move around. They can also tell about adaptive features.

# Find Your Partner

## Number of Participants

16

## Time Required

30 minutes

## Material Required

Paper slips (16) and a marker or a pen.

## How to Proceed?

- On each slip write down the following words or phrases: air (two slips), fast moving air, water vapour, oxygen, nitrogen, smoke, does not support burning, rotates a *phirki*, occupies space, helps in burning, wind, major component of air, carbon dioxide, burning of wood and condenses on cool surfaces.

- Number of students playing the game will depend on the number of paper slips prepared.
- Students (16) playing the game will stand in a circle.
- Paper slips mentioned above will be kept in a container placed at the centre of the circle.
- Students will go one by one to the container, pick out one paper slip from it and go back to their places.
- Students will read the word or phrase written on their slips loudly, one by one in a sequence, either clockwise or anti-clockwise.
- Now the facilitator will ask the students to move and form pairs or clusters in a way that the slips match to make sense.
- For example,
  - 'Smoke' matches with the 'burning of wood'.
  - 'Fast moving air' matches with the 'wind'.



- Each student will be asked to explain why she/he formed the pair, or why she/he is in the cluster.
- If there is anything wrong in the formation of the pairs or clusters, the facilitator will initiate a discussion to get the correct answer.
- Facilitator will help those students who are not able to form pairs or join clusters.

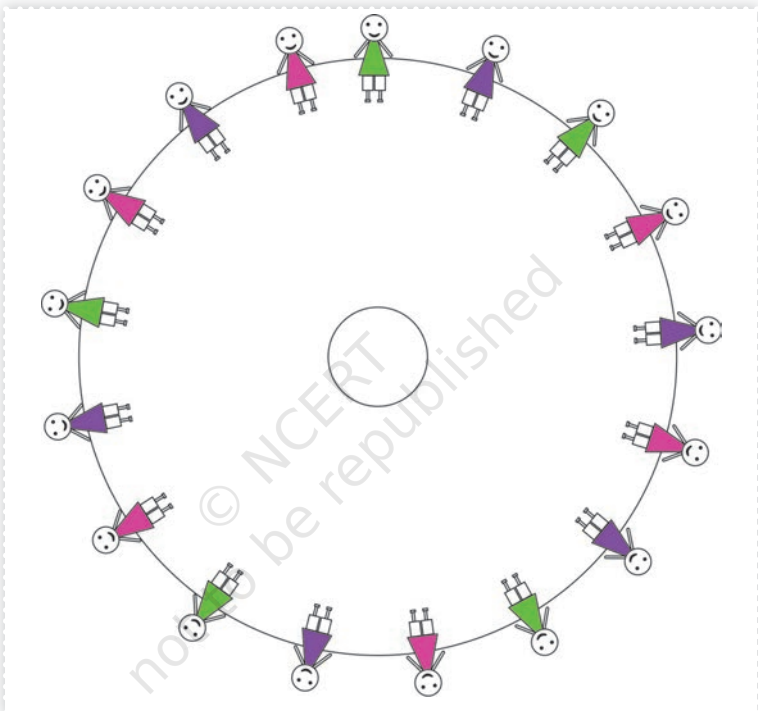



Fig. 1

## Points for Discussion

The game is based on concepts related to air. To clarify these concepts following questions can be asked.

- What makes a *phirki* rotate?
- Why do clothes hanging on a clothe line sway?
- What makes a kite fly?
- Why are bubbles formed when water is poured on the dry soil kept in a container?

- Why are bubbles formed along its inner surface?
- Why does a burning candle get extinguished when it is covered with a glass or a jar?
- What makes the wind-mill rotate?
- Why does a policeman standing at a traffic crossing wear a mask?

## Science behind the Game

From this game we may learn about the composition, properties and uses of air. For example, burning of wood in air produces smoke, which pollutes air. Facilitator may initiate a discussion aimed at teaching students that unnecessary burning of wood, dry leaves and other waste materials should be avoided. On the basis of this game, nature, composition, properties and uses of air may be discussed.

## Extension of the Game

The words given above for the slips are suggestive. Facilitator may develop slips related to this concept or any other concept. Encourage students to develop the slips and organise the game.



## CWSN (Children With Special Needs)

The words and phrases have to be verbalised and the location of players is shared with the visually impaired children or a sighted peer may be given to them to facilitate the pairing.

# Passing the Parcel

## Number of Participants

Entire class I

## Time Required

30 minutes

## Material Required

30–40 small chits with 'tasks' written on these, a bowl, an empty box wrapped with the newspaper to be used as the 'parcel'.

## How to Proceed?

- Small chits of paper with various 'tasks' related to science topics, to be 'performed' by the players will be prepared in advance. A suggested list is given. Students can prepare such a list according to the age group and cognitive level of them.

- Arrange the class in a big circle.
- When the music starts, students pass the parcel and when the music stops, the student holding the parcel is given a chit from the bowl to perform the 'task' or speak aloud the answer of the question written on the chit.
- The game resumes if the task is performed correctly by the player.
- If a player fails to complete the given task, the facilitator may ask other students to try, or may provide the correct answer.
- It is a fun game which can be played during the entire period.

List of suggested 'tasks' to be written on the small chits of paper:

- Name the elements with atomic numbers 11 to 15.
- Give symbols of elements from atomic number 10 to 7 (in descending order).
- 'Nogra' is an element spelt in reverse. Name the element and state one of its properties.
- Produce three different types of sounds.
- Imagine you are the mitochondria in a cell. Explain your role in the cell.
- Imagine you are the lysosome in a cell. Enact your role.
- Do you think air dissolves in water? Suggest a way to demonstrate it.
- Perform the movement of a frog, let the child on your left enact the movement of a bird and the child on your right enact the way a lizard moves. (You may add acts to show movement of fish, snail and snake). Facilitator may explain terms such as creep, crawl, slither, swim, jump, fly, run, walk (after the 'tasks' have been performed.)
- You are part of a group having a picnic in a park. Describe how you will help in cleaning the park before leaving it.
- Show the movement of that body part which has ball-and-socket joint. A student on your left whose name starts with 'D', should move that body part which has hinge joint. A student on your right whose name starts with 'A' will show the movement of that body part which has pivot joint.



## Science behind the Game

- This game has a lot of fun element. It helps students in developing an understanding of different topics of science.

- Facilitator may explain the related concepts. This can be done after the tasks have been completed.

## Extension of the Game

The facilitator has scope to add a variety of 'tasks'.

### CWSN (Children With Special Needs)

This game is in-built capacity to engage special needs learners. Visually challenged learners may need help to read the slip. Learners with hearing impairments should be given tasks of mime or enacting.

# CHAIN–CHAIN

## Number of Participants

30

## Time Required

30 minutes

## Material Required

Three sets of 10 placards (red, black and green) with markers of three different colours, and strings.

## How to Proceed?

- Prepare three sets of 10 placards. Make each set of placards with different colours.
- The 10 placards of each set will display the following labels. One item will be written on each placard:
  - Pulmonary veins
  - Left ventricle
  - Body organs
  - Right atrium
  - Pulmonary arteries
  - Left atrium
  - Aorta
  - Vena cavae
  - Right ventricle
  - Lungs
- Place three tables or baskets in an open ground. Make three rows of 10 students, in front of the three tables or baskets, as shown in the schematic sketch (Fig. 1).
- Randomly spread out 10 placards of mixed colours, on each table or basket, with labels facing down.
- The facilitator blows the whistle, each student of each row picks up a placard and, hangs it over his/her necks and immediately run to the playground.

- As soon as they reach the playground, they will quickly start forming groups in accordance with the colour of their placards.
- At the same time, they start forming chains by joining their hands as per the correct sequence of pathway of blood that flows through the heart.
- On completion of sequence. The group(s) quickly proceed to the 'Finish' line (Fig.3).
- The chain should not be broken at anytime.
- When a team reaches the 'Finish' line, facilitator will check the sequence for correctness. The correct sequence is:
- Pulmonary veins→Left atrium→Left ventricle→ Aorta→Body organs→Vena cavae→Right atrium→ Right ventricle→Pulmonary arteries→Lungs
- The team which has reached the 'FINISH' line first with the correct sequence will be the winner.



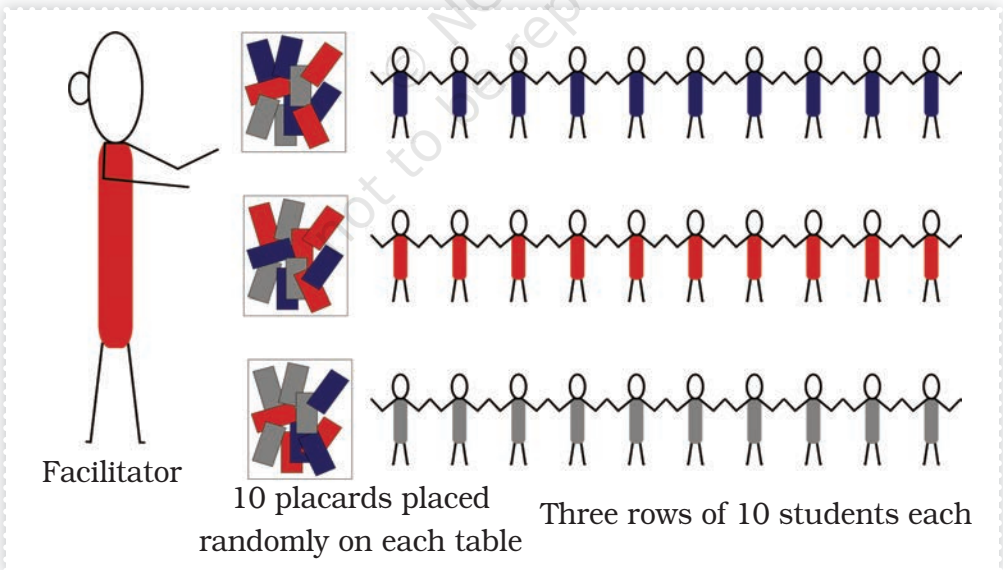



Fig. 1

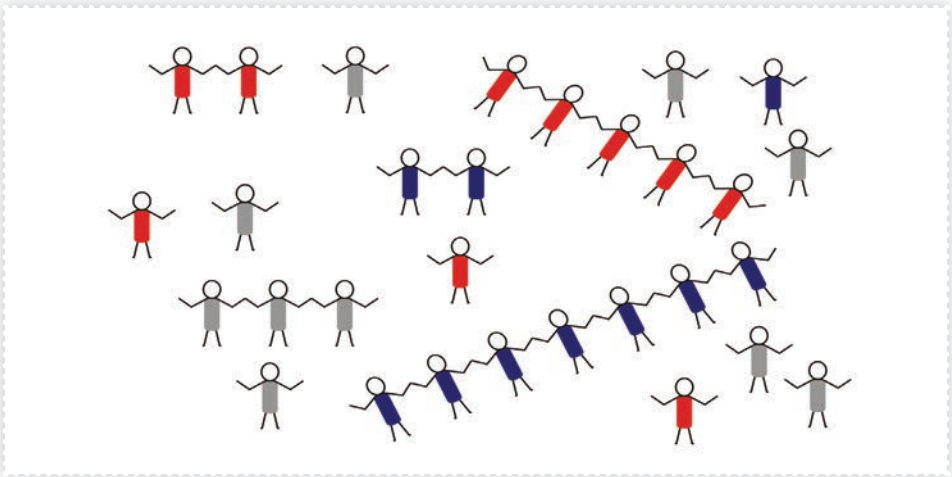


Fig. 2

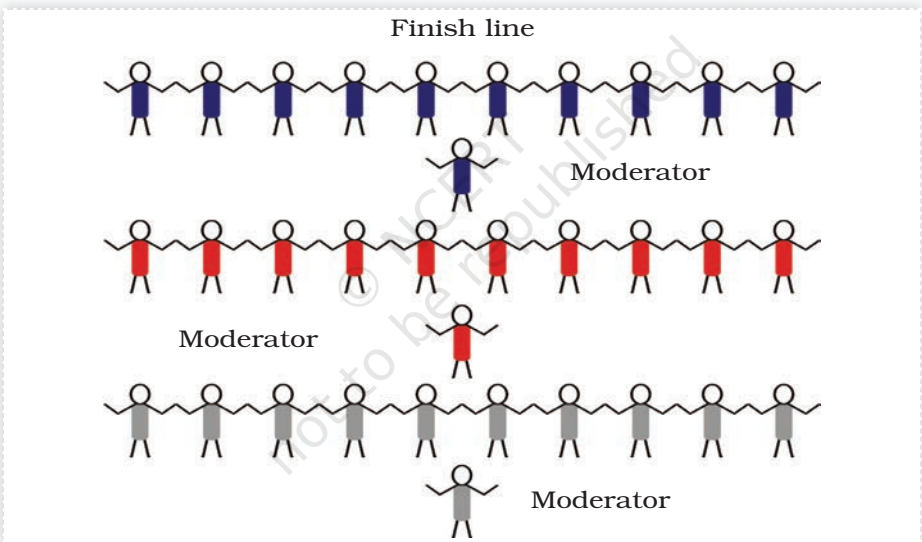





Fig. 3

## Points for Discussion

Discussion may be initiated by asking few questions related to the pathway of the blood in the human heart;

- Why do in vertebrates double circulation occurs?
- What is the role of the valves?
- Where does the blood go from the left atrium?
- Why do human heart has four chambers?

## Science behind the Game

- The heart which is a muscular organ has different chambers to prevent mixing of oxygenated and de-oxygenated blood. The carbondioxide rich blood has to reach the lungs for the removal of carbondioxide, and the oxygenated blood from the lungs has to be brought back to the heart. This oxygen rich blood is then pumped to the rest of the body.
- This game can be very helpful in making the students learn about the circulation path of blood in human.

## Extension of the Game

- This game can be played to make the students understand the pathway of flow of urine in the excretory system.
- Formation of reflex arc can also be effectively learnt via game, using the following sequence of events:

  Receptors (In skin)→Sensory Neuron→Spinal Cord→Message to Brain→Relay Neuron→Effectors (Muscles in Arm)



## CWSN (Children With Special Needs)

The cards must be Braille labelled and the child with visual impairment should be allotted the group by the teacher to avoid any accident, then the other students may verbalise the name of the parts they have. While discussion and their participation must be ensured.

# DUMB CHARADE

## Number of Participants

Entire class (to be divided in two teams namely; Robert Hook Team and Leeuwenhoek Team).

## Time Required

30 minutes

## Material Required

Coloured sketch pens, coloured A4 size sheets, score sheet or blackboard, marker or chalk, empty box, and dustbin.

## How to Proceed?

- Students will prepare colourful cards of various cell organelles, for example, cell membrane, cell wall, nucleus, cytoplasm, chloroplast, vacuole and mitochondria. They may draw these organelles on their own or use their pictures or photographs and paste them on the A4 sheets. Figure 1 shows an example of such a sheet.

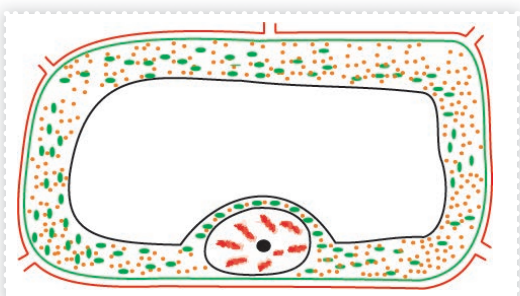


Fig. 1



- Each pictoral card may be folded and kept it in a big box and shuffled properly by the facilitator (teacher).
- The facilitator will divide the class in two teams and name them. For example, one team may be named as Robert Hooke Team and the other as Leeuwenhoek Team.
- The class will select a referee, a time keeper, and a scorer. Each team will identify 4–5 players to mime/act. The rest of the students of a team will guess the correct name of the cell organelle and will cheer their respective teams.
- The toss of a coin will decide which team will mime/act first.
- The toss winning team, say, Robert Hooke Team will depute one player amongst 4–5 players who have been identified as good in acting/miming.
- The player from Robert Hooke Team will pick one card from the box. He/She will be given two minutes for preparation and to act/mime. The player may enact either the shape or the function of this organelle. The Leeuwenhoek Team will guess which cell organelle was depicted/demonstrated.
- If Leeuwenhoek Team guesses correctly then two marks would be allotted to their team. If this team fails to guess correctly, the Robert Hooke Team will be given a chance to identify the cell organelle. If they guess correctly, the team is awarded one point as a bonus mark. In case they also fail then facilitator may give some clue to both teams for getting the correct reply/answer. The team which answers first correctly will get one bonus mark.
- Similarly, the game will proceed with the teams changing their roles.

## Discussion Point

- The game emphasises the development of creative/ performing art as the players have to think and act in simple steps so as to enable the other team members/ viewers to guess easily.
- This game will encourage students in learning the art of performance and expression.
- The game will help in building up the confidence level.

## Science behind the Game

The game facilitates recapitulation of different organelles of a cell and the cell structure.

## Extension of the Game

- The game can be extended to other topics, for example, hormones and their functions.
- One can explore the possibility of expression through other forms of art such as, dance, poetry, street play, etc.



## CWSN (Children With Special Needs)

- Cards should be Braille labelled and made tactile.
- The functions which are being enacted may be audio described to the blind students.

# SCIENCEBOLA

## Number of Participants

Entire class (to be played individually).

## Time Required

30 minutes + 30 minutes (two periods).

## Material Required

Pen and paper, blackboard and chalk.

## How to Proceed?

Preparation of Sciencebola tickets.

- Take coloured A4 size sheets of paper and make 16 boxes on each sheet.
- Players are asked to mark four boxes in which they will not write.

| | | | |
|---|---|---|---|
| ● | Cartilage | ● | – |
| – | – | – | – |
| ● | – | – | ● |
| – | – | – | – |

Fig. 1

- The facilitator writes down 30 terms from the selected topic on the blackboard, for example—

1. Body movement
2. Ball and socket joint
3. Bristles
4. Cartilage

5. Cavity
6. Fixed joint
7. Gait to animals
8. Hinge joint
9. Muscle
10. Outer skeleton
11. Pelvic bones
12. Pivotal joint
13. Rib cage
14. Shoulder bones
15. Skeleton
16. Streamlined
17. Contraction
18. Backbone
19. X-ray image
20. Breastbone
21. Shell
22. Forelimbs
23. Hindlimbs
24. Wings
25. Perching
26. Chest bone
27. Creep
28. Crawl
29. Lither
30. Earlobe

- Students are asked to make their 'Sciencebola' tickets by picking any 12 terms and writing them in the blank boxes.
- Now facilitator will speak out terms from the list of 30 terms in random order and each student will look at her/his 'ticket' and cross the term if it is on the ticket.
- The player who is able to cross all the terms on his/her ticket is the winner.
- The game will continue till the list of 30 terms is exhausted. As and when a player crosses all the terms on the ticket, she/he will read aloud all these terms.



**Discussion Point**

The functions of these terms can be discussed.

## Science behind the Game

- This game deals with keywords of the topic body movement.
- Students will get familiar with the terminology, their spellings, their pronunciation and their characteristics.

## Extension of the Game

- Facilitator may adapt this game to another topic or to a higher level by speaking out clues instead of terms. For example—Clue for the term 'Fixed Joint' may be 'the bones cannot move at these joints' and student will have to cross the term 'Fixed Joint' from the ticket.
- Likewise, on announcing the following clues, corresponding term in the ticket is crossed. For example—

| Clue | Term to be Crossed |
|---|---|
| 1. The joint where our neck joins the head. | Pivotal Joint |
| 2. Body shape which tapers at both ends. | Streamlined |
| 3. Parts of the skeleton that are not as hard as the bones. | Cartilage |



## CWSN (Children With Special Needs)

- Sciencebola tickets should be made tactile with demarcation for each box and Braille labelling.
- A suitable indicator should be given to cross out each filled box.
- For hearing impaired students flashcards may be used.

# WHO IS MY FRIEND?

## Number of Participants

Seventeen

## Time Required

30 minutes

## Material Required

Cardboard sheet, marker, pen and pair of scissors.

## How to Proceed?

- There will be two identical sets of eight placards on which the following phrases are written—
  1. Change in state
  2. Change in colour
  3. Change in size
  4. Change in shape
  5. No new substance is formed
  6. New substance is formed
  7. Change can be reversed
  8. Change cannot be reversed

- There will be several placards (say 20) on which examples of different kinds of 'changes' are written (one placard showing one 'change'). Examples of such changes are given below. You can add more.
  1. Cutting of paper
  2. Burning of paper
  3. Melting of snow on mountains
  4. Shedding of leaves
  5. Mixing of lemon juice in warm milk
  6. Development of larva into pupa



7. Development of bud into flower
8. Falling of hair
9. Rolling and baking of *chapaati*
10. Writing on blackboard with chalk
11. Roasting of corn
12. Adding vinegar to baking soda
13. Tarnishing of ornaments
14. Falling of acid rain on stone structures
15. Mixing of sawdust with iron dust
16. Shaving a pencil

- There will be two teams with eight members each.
- Each team will carry placards (A) to (H).
- The two teams will stand around a circle as shown in Figure 1.

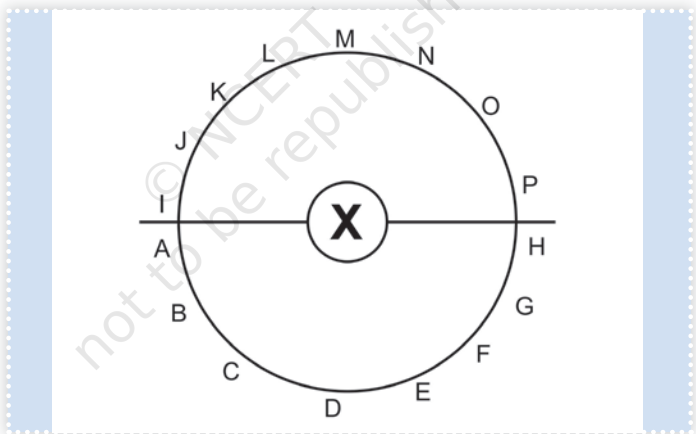



Fig. 1

- One student will stand at the place marked X. This student will carry placards on which examples of all the changes are written.
- To start the game the student at X will flash one placard to both the teams.
- The students from both the teams having the placards associated with the change flashed by the student X, will step forward.
- For example, X flashes the following (Fig. 2) placard.

## Development of Bud into Flower

Fig. 2

- Suppose students B, C and D stepped towards student X. Let us see how far the students who stepped forward are correct.
- B says that there is a change in colour (green bud changing into a red flower).
- C says that there is a change in size.
- D says that there is a change in shape.
- All the three are correct.
- But suppose M of the other team did not step forward, though she/he should have done so because the change cannot be reversed.
  - Those students who step forward will explain why they did so.
  - Each team can contest such claims and counter claims.
  - Similarly, other examples will be taken up one by one to complete the game.
  - A set of changes has been given here, but the facilitator may allow students to move around and note down as many changes as possible from their surroundings.



### Discussion Point

- List as many changes in your surroundings as you can.
- Categorise these changes as physical or chemical.

## Science behind the Game

- Changes in which one or more new substances are formed are called chemical changes.
- In a physical change, no new substance(s) is/are formed.

## CWSN (Children With Special Needs)

The sighted peer may verbalise the instruction/ phrases and visually impaired children can tell about the changes.

# 'STAPUU'

## STEP UP TO YOUR USE

### Number of Participants

Entire class

### Time Required

30 minutes

### Material Required

Seven small flat stones (*Giitii*), chalk, coloured chart papers, marker pens and scissor.

### How to Proceed?

- Before the game begins, the players will make two rectangular '*Stapus*' (hopscotch counts) side by side, (as shown in the Figure 1) with the help of facilitator and procure two flat stones.
- Two types of slips will be prepared with the help of chartpaper.
- Slips with the name of constituent of petroleum.
- Slips with the use of one constituent on each.
  - Fuel for home and industry.
  - Motor fuel, aviation fuel, solvent for dry cleaning.
  - Fuel for stoves, lamps and for jet air crafts.
  - Fuel for heavy motor vehicles, electric generators.
  - Lubrication.
  - Ointments, candles, vaseline, etc.
  - Paints, road surfacing.

Fig. 1 [I] '*Stapu*' for team A
[II] Chartpaper strips with the uses written on them
[III] '*Stapu*' for team B

- Seven flat stones will be procured and names of one of the constituents of petroleum will be written on both the sides of each stone as shown in Figure 1.

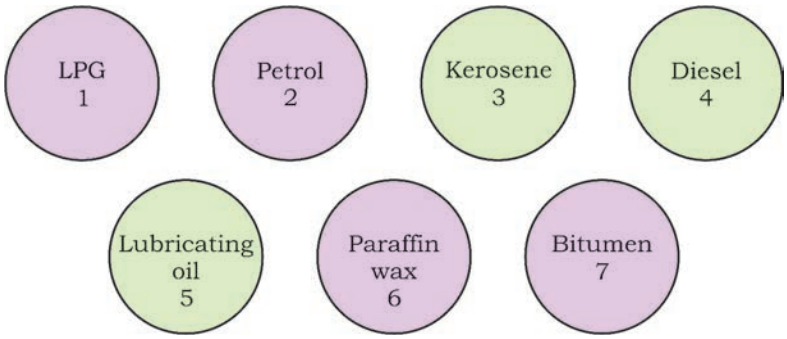



Fig. 1

- Facilitator will ask the players to prepare chart paper strips and write on them the uses of constituents of petroleum. Place these strips on the ground in between the two *stapus* as shown in Figure 2.

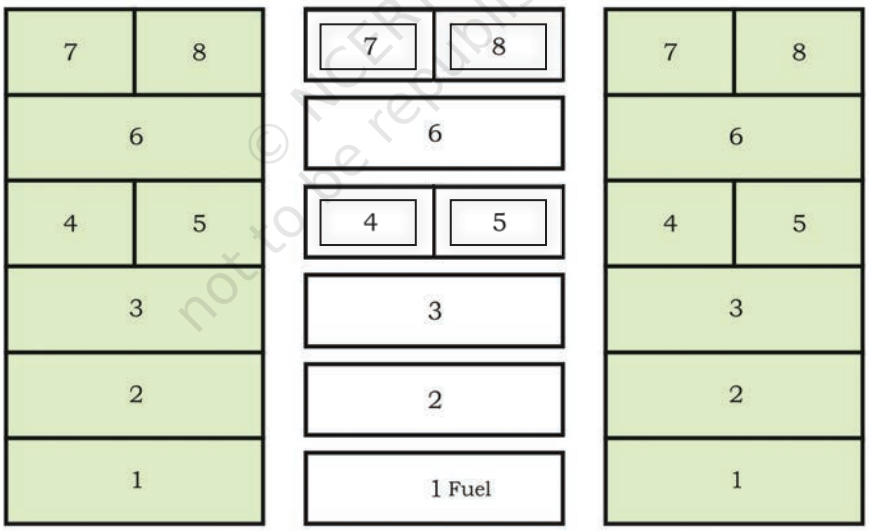



Fig. 2

- Class will be divided into two teams, Team A and Team B. One player from each team will pick up one flat stone placed on the ground upside down, suppose Team A player may pick up flat stone with 'LPG' written on it and Team B player may pick up flat stone with

'Petrol' written on it. The facilitator will ask the players to say aloud the use(es) of their constituents. If they answer correctly, they will be awarded 5 points each.

- Both the players will start the second step of game simultaneously by throwing the flat stone from the start line. Their flat stone should land in the box in which use/ uses of their respective constituent has been written, suppose for Team A the flat stone (LPG) should land on box no.1 and for Team B the flat stone (petrol) should land on box no. 2
- If the flat stone lands in proper box of their respective use, it will fetch the players 5 points again. The player will then hop on one leg on boxes 1, 2, 3 and 6 and can rest both their feet on boxes 5, 6 and 7, 8. They have to skip the box having their flat stone.
- On reaching the box 7, eighth player will turn back and will come back hopping in the same way, pausing and lifting their flat stone on the way back to the start line.
- Both the players will cover the rest of the boxes in the same manner in the allotted time does not permit.
- Now the player will throw the flat stone outside the '*Stapu*' from the start line in such a manner that it should land not very far as the player will be required to lift it with one hand, keeping both their feet in the boxes 7, 8.
- After lifting the flat stone the players will move out of the '*Stapu*' box and will stand facing their back to the '*Stapu*' and will throw the flat stone in the same box in which the player had thrown it initially. On doing so correctly the players will be awarded 10 points as this step requires some skill.
- So, if one player finishes one round correctly he/she can fetch 20 points for her/his team.
- If the player is not able to answer the correct use of the constituents, he/she may be allowed to continue playing and will not be awarded points for that step.
- Likewise all the players of the team will get chance to complete the rounds. The team scoring the maximum points will be declared the winner in the end.



## Science behind the Game

The class will learn the names of the various constituents of the petroleum and their uses.

## Extension of the Game

This game may be used to learn any topic having two variables!

## CWSN (Children With Special Needs)

- The sighted buddy may verbalise the name of the constituents and verbally visually impaired children can tell about the uses of that particular fuel.
- For second step a sighted buddy may throw stones for him and the visually impaired children may then tell the correct use of the constituent only.

# TIC, TAC, TOE
## (THIS GAME IS ON THE LINES OF ZERO-CROSS)

### Number of Participants

Entire class

### Time Required

30 minutes

### Material Required

Chalk and board.

### How to Proceed?

- The facilitator will draw an image like Fig. 1 on the board.
- The facilitator divides the class into two teams.



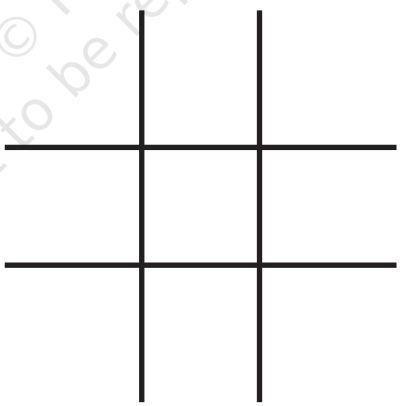


Fig. 1

- The facilitator announces the topic, for example, name of acids and bases.
- The first chance of the team will be decided by toss.
- One member of the starting team will go to the board and write the name of an acid.

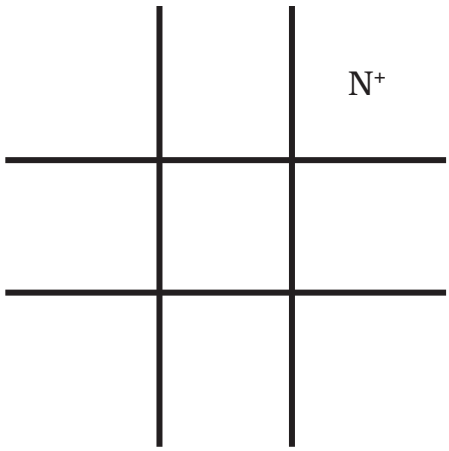



Fig. 2

- Now a member of the other team will go to the board and write the name of a base in one of the remaining boxes.
- The aim of each team is to make a vertical, horizontal or diagonal sequence of three acids or three bases.
- The other team will attempt to prevent the first team from doing so. The facilitator should make sure that entries are correct.
- The team which succeeds first in writing a correct sequence (horizontal, vertical or diagonal) will be declared winners (Fig. 3).



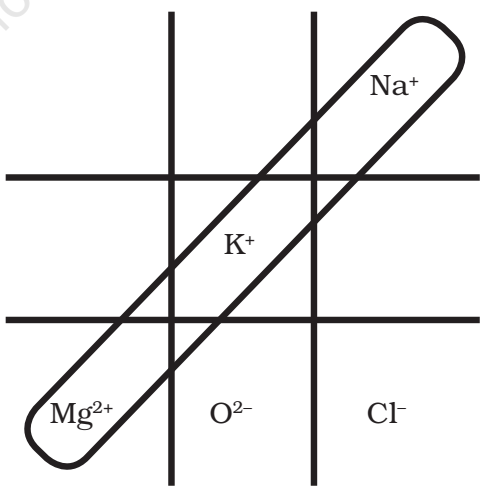



Fig. 3

## Science behind the Game

The game helps students to learn and remember the names of acids and bases.

## Extension of the Game

This game can also be played by using the following combinations—

- Formulae of acids and bases.
- Unicellular and multicellular organisms.
- Names of algae and fungi.
- Name of the diseases caused by bacteria and viruses.

## CWSN (Children With Special Needs)

The sighted buddy may verbalise the name of the acid or base and visually impaired children can tell about the uses of that particular fuel.



# THINK TANK

## Number of Participants

Entire class

## Time Required

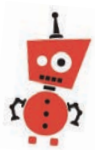
30 minutes

## Material Required

Blackboard, coloured chalks and flashcards to fill the data.

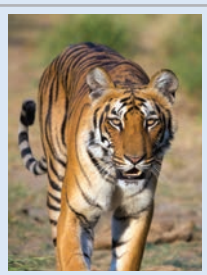
## How to Proceed?

- Ask the class to sit with their eyes closed.
- The facilitator tells the students to 'Just imagine', with their eyes closed, the beautiful landscapes (hills, mountains, deserts, forests and grasslands, streams, rivers, oceans, snow-covered landscapes and so on.



- While the students are engaged the facilitator intervenes to think of the name of a plant or an animal. The facilitator will ask them to think of the habitat to which the plant or animal belongs. She will go on to say that a plant could be a herb, shrub or a tree and that an animal could be a bird, insect, reptile, worm, microorganism or a mammal.
- The facilitator calls the players in batches of three or four and asks them to draw an outline of the plant and animal that they thought of. The players may be encouraged to draw figures on the board. The whole class can participate by helping them. Coloured chalks may be provided for drawing.

- The players may then be asked to write down the main characteristic features of the organism they thought of and prepare the flashcards (an exemplar flash card is given below).

| Flash Card | | | | | |
|---|---|---|---|---|---|
| **Habitat** | **Feature of the Habitat** | **Plant/ Animal** | **Herb/ Shrub/ Tree/ Bird/ Insect/ Reptile/ Mammal etc.** | **Unique Features of the Organism for Identification** | **Picture of Plant/ Animal** |
| Swamps, grasslands, rain forests | Grassland | Animal | Mammal | (1) Black stripes on skin<br>(2) Carnivore<br>(3) Mammal<br>(4) Member of the cat family |  |

Name of the player.....



- Two students may be appointed to develop the two separate lists, one of the plants and another of animals which the players had thought about.

## Point of Discussion

- After the activity, there will be a discussion on the concept of biodiversity.
- By sensitising the students to the beauty of biodiversity, awareness is generated to conserve the same.

## Science behind the Game

- India is rich in biodiversity of plants and animals as well as habitats.
- Student's imagination is translated into the visual art.

## Extension of the Game

Game can be played exclusively for plants or for animals or for a habitat, e.g., aquatic biodiversity, fresh water plants, fresh water animals. Also, where students are asked to draw, their imagination is translated into visual art.

## CWSN (Children With Special Needs)

Visually impaired students may think of the names and habitat of various organisms and they may also describe the salient features to the class or a buddy may be assigned to them for drawing.

# Let's Gang Up!

## Number of Participants

Entire class

## Time Required

30 minutes

## Material Required

Cardboard sheets, plain paper, sketch pen/marker, thread (string), a pair of scissors, and glue/adhesive.

## How to Proceed?

- Facilitator will prepare the list of diseases such as; malaria, tuberculosis, AIDS, sleeping sickness, kala azar, dengue, measles, chickenpox, polio, cholera, typhoid, hepatitis A.
- Facilitator can add/delete diseases in the list as per the requirement.

- Rectangular pieces of 10 cm × 20 cm size will be prepared from stiff cardboard sheets.
- Four kinds of colourful cards may be prepared for each disease (see Fig. 1.a to 1.d):
  - Name of the disease.
  - Mode of transmission and pathogen of the disease.
  - Characteristic symptoms of the disease.
  - Control and prevention of the disease.
- Involvement of differently-abled students must be ensured by preparing cards using embossed sparkle tubes or Braille.
- All the cards will be kept in a big bowl or a box and thoroughly shuffled.
- The facilitator will call students one by one, who will pick one of the cards from the bowl or the box.



# DENGUE

Fig. 1.a

**Female Aedes mosquito transmits virus**

Fig. 1.b

**SYMPTOMS**

**High fever, body rashes, joint pain and low platelet count**

Fig. 1.c

**PREVENTION**

**Don't let water collect / stagnate in surroundings, to prevent mosquito breeding**

Fig. 1.d

- When all the students have picked the cards, the facilitator will start the game and ask the students to form groups of 4, each representing a particular disease.
- Students will be given 10 minutes to form their groups. The team which forms itself correctly in the shortest time will be declared the winner.
- Four students having cards related to one disease will sit together and discuss the disease.
- Now, each group will explain about the disease, they are representing, to the rest of the groups. They can have discussions on the mode of transmission and symptoms other than those written on the cards. The facilitator can also explain the methods of prevention and control.

## Point of Discussion

The issues related to health and diseases may be discussed. During discussion, the students of other groups can raise questions about the disease which should be answered by the group representing that disease. Other students must also be encouraged to reply to the queries. The facilitator can also ask the students about the diseases they or their family members have had. A list can be prepared and students can discuss the possible reasons and preventive methods.



## Science behind the Game

The game helps in comprehending and revising the concepts of health and diseases. The collaborative and fun learning exercise will assist in understanding the symptoms of common diseases and their prevention.

## Extension of the Game

The cards prepared for the game can be used as playing cards. The winner will be the one who first collects the relevant cards of a 'disease'.

### CWSN (Children With Special Needs)

The cards may either be read out to the visually impaired children or written in Braille.

# FIRE...FIRE...NOT THE SAME LET'S KNOW HOW TO TAME

## Number of Participants

Entire class

## Time Required

30 minutes

## Material Required

Chart paper, marker pens, a pair of scissors, 7–8 plastic containers or bowls/cartons and lime powder for marking lanes on the ground.

## How to Proceed?

- To prepare for the game, the facilitator needs to complete the following steps in advance.

1. Prepare FIRE INCIDENT SLIPS such as:
   - fire in a firewood stock
   - fire in a hey stock
   - fire in a forest
   - fire in clothes of a person
   - fire in firecracker shop
   - fire due to short circuit
   - fire in a room/building
   - fire due to overheating of cooking oil in a pan/*kadahi*
   - fire due to petrol/kerosene spread on a surface.
2. Also prepare FIRE EXTINGUISHING SLIPS such as:
   - water



- sand
- carbon dioxide
- extinguishers
- digging a trench to contain fire
- covering the fire with a metallic structure
- a woollen blanket
- rolling on the ground
- large sized sticks/tree branches (or leaves) to beat the fire and so on.

The facilitator shall have to prepare as many sets of these slips as the number of students competing in one round.

3. Divide the class into the teams of equal number of players.
4. On the school playground mark two lines, say 20m apart, with one of them to be used as START/FINISH line, while the other for solving the quiz. The space between these two lines may be divided into as many lanes as the number of teams. (See Figure)



| Station for Solving the Puzzle | | | | |
|---|---|---|---|---|
| B1 | B2 | B3 | B4 | B5 |
| | | | | |

Start/Finish line

- Keep all the slips with the different types of incidence of fire in a container. Mark it as a Container A. Keep the container near the START/FINISH line. Take as many containers as the number of teams and keep a set of slips with names of substances/equipment/technique in each one of them. Let these containers be marked as B1, B2, B3,... as shown in the figure.
- The facilitator now explains the task to all teams as follows:
  - Each team will nominate one player at a time to participate in each round of the game. However, all players would get a chance to participate in the game.
  - The player nominated for the round will be asked to pick up a slip from the Container A near the starting/finish line and read about the incidence of fire that has been written on it. Then take their place at the START line in the lane assigned to them.
  - As soon as the facilitator gives a signal, players have to rush within their lane to the other end where containers B1, B2, B3,..., are kept. Each student has to read all the slips in their respective container and to select all those slips that carry the names of substances/equipment/technique that may be used to douse the incidence of fire written on the slip. Once the player selects appropriate slips, she/he has to run back to the FINISH LINE.
- The following scheme may be adapted to award marks to the players. However, the facilitator may devise her/his own scheme for awarding marks:
  - The player who comes back to the finish first is awarded 6 or 7 points. The players arriving second, third...., at the finish may be awarded 5,4,3...points respectively. It must be ensured that a player is awarded marks only if she/he has made correct selection of substances/equipment/technique.



- The above process is repeated for subsequent rounds for which the facilitator shall collect all the slips and put them in appropriate containers as before. The sum of points earned by all players of a group will determine its overall position

## Science behind the Game

The players will learn the appropriate way of controlling fire in case any accidental fire occurs in their surroundings. This game will create awareness regarding the fire safety and prevention.

## Extension of the Game

The game may be played with more options. The facilitator may add slips of substances which do not extinguish fire, so that players are compelled to think and then decide to pick up correct slip(s).



## CWSN (Children With Special Needs)

- For visually impaired children both the slips have to be Braille labeled.
- For hearing impaired and orthopedically handicapped no modifications required.

# TIPPY TIPPY TAP...WHAT CATEGORY DO YOU WANT?

## Number of Participants

Thirty

## Time Required

30 minutes

## Material Required

A-4 sheets or cardboard sheets, markers, safety pins/ thread and a pair of scissors.

## How to Proceed?

- Prepare 4 placards with the names and drawings of examples from each category of plants. Some examples are suggested below:

| Herbs | Shrubs | Trees | Climbers | Creepers |
|---|---|---|---|---|
| Tomato<br>Coriander<br>Paddy<br>Cabbage | Lemon<br>China Rose<br>Rose Plant<br>Jujube berry (*Ber*) | Jack fruit<br>Eucalyptus<br>Drumstick<br>Tamarind | Pea plant<br>Bitter gourd (*Karela*)<br>Bottle gourd (*Louki*)<br>Money plant | Pumpkin<br>Grass<br>Watermelon (*Tarbooz*)<br>Muskmelon (*Kharbooja*) |

- Divide the class into 3 Teams (A, B and C) of 10 students each. Team A will be spread out randomly in the play area holding placards. The facilitator will ensure that the two placards are given from each category.
- Team B and Team C will stand on either side of the play area.



- Team B will 'Run' and Team C will 'Chase'.
- Team C will decide on two things by consulting with the team members.
  - Which category of plant they will ask Team B to 'tap' on, for example, herbs.
  - Identify three players from their team who will become 'Chasers'.
- When team C is ready with both their decisions, they will shout 'Ready'.
- After that team B will ask in chorus—"Tippy tippy tap, what category do you want?"
- Team C will immediately announce 'herbs', as decided earlier.
- Team B will run and look for appropriate placards of herbs, say 'Tomato' or 'Coriander' and immediately tap the shoulder of either of the player holding these placards.
- Simultaneously, three players of Team C will also enter the play area as chasers. They will chase Team B players and try to make them 'out' by tapping them, before B players can reach the appropriate placard.
- Team B (runners) can be penalised on two counts—
  - Tapping the wrong option, for example, 'Jack fruit' or 'Pumpkin', which are not from the category 'Herbs'.
  - Getting caught by the chasers before being able to 'tap' the correct placard.
- In the next round of the game, Team C will become runners and Team B will become chasers. Roles can also be exchanged with the Team A.

TEAM B (RUNNERS)—"Tippy tippy tap what category do you want?"

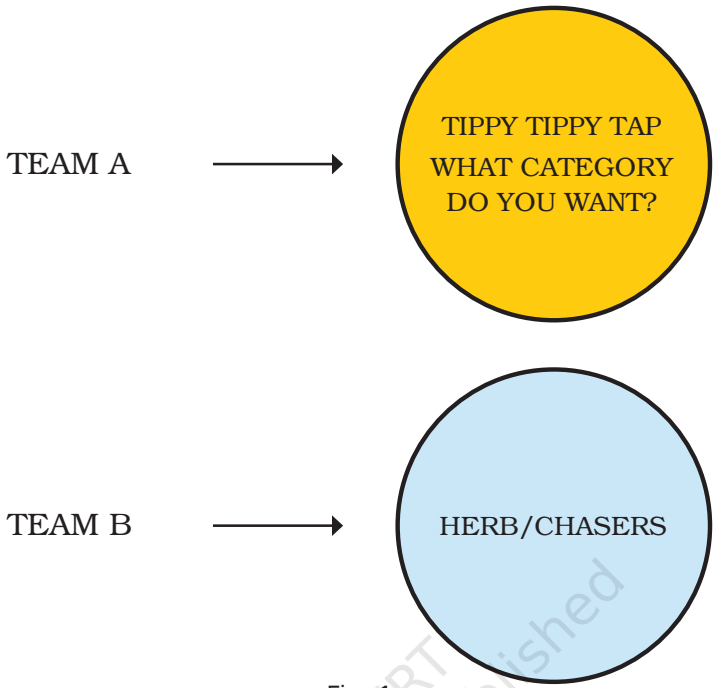



Fig. 1



**Note for the Teacher**

- The students should be involved in the preparation of the material for the game.
- Each and every student must be given equal opportunity.

## Points of Discussion

The teacher can discuss the application and significance of categorisation of plants on the basis of stem, leaves, branches and their height.

## Science behind the Game

The game helps in comprehending and revising the basis of categorisation of plants.

## Extension of the Game

- Make another set of placards in which, instead of examples, only 2–3 characteristics of a category of plants are given or the placards could have only pictures of plants without their names.
- Games may be played for acid, base and salts.

### CWSN (Children With Special Needs)

- Cards must be Braille labelled and for running or chasing a peer may be given to the visually impaired children.
- For hearing impaired and orally handicapped no modifications are required.

# TREASURE HUNT

## Number of Participants

Entire class

## Time Required

30 minutes

## Material Required

Four A4 size sheets of different colours, permanent markers, a beaker or a glass tumbler with water, a bar magnet, a tea strainer, flour sieve, tea leaves, rice grains, iron nails, copper turnings or small balls of aluminium foil, and some sand.

## How to Proceed?

- Following preparations has to be done in advance by the facilitator for this game which will be played in three steps for developing the concept of separation of substances.
  - **Spot 1:** Four riddles have to be written on four different coloured sheets of paper and to be torn into five irregular pieces (like jig-saw puzzle).

    **Spot 2:** Beaker, magnet, tea-strainer and flour sieve have to be carefully hidden in an earmarked area.

    **Spot 3:** Four desks have to be arranged as working stations. Four different mixtures such as that of sand and water, iron nails and copper turnings, tea-leaves and water, rice grains and sand, are placed on these desks.
  - To play the game the class is divided into four teams, each having 10–11 students. Two students from each team will participate in the



first round of treasure hunt, entailing three tasks in accordance with the given clues at each of the three spots.

- Each team will be assigned one colour.
- At first spot, teams will find mixed pieces of coloured sheets. Teams will be asked to pick respective coloured paper pieces, join the pieces together to read the hidden message and decipher it.

**Riddle 1:** First three letters of maggot
Last three letters of internet
Appears very magical
When brought towards iron nail.

The two team members may consult each other and may arrive at the answer 'magnet', and then will run to Spot 2 to search for it which is hidden in the area earmarked.

**Riddle 2:** Pores, pores lots of pores
My body has lots of pores
When you pour tea on me
It flows leaving waste on me!

The team members will guess the right answer 'Tea Strainer' and will then rush to Spot 2 to search for their item.

**Riddle 3:** I am cylindrical, made up of glass
Looks like a tumbler with a beak at the top.

The team members will guess 'beaker' and will go looking for it at Spot 2.

**Riddle 4:** I am circular and have net of pores
Passing down fine particle of flour
Keeping the bigger impurities is my chore!

On guessing the correct answer 'Flour Sieve' the team will rush to Spot 2 to find it.

- If any team fails to guess the correct answer of the riddle, facilitator may give extra clues.
- As and when the teams find their respective items they run up to Spot 3, where different mixtures are kept on four desks. They select the desk where they can separate the mixtures using their items.
- The team will display the components which are separated. The team which completes all these tasks in the shortest time will be declared the winner.

## Science behind the Game

Through this game students get an opportunity to separate the mixtures on the basis of their daily life experiences.

## Extension of the Game

Facilitator may add another spot where mixtures involving different methods of separation may be kept. Examples of such mixture are oil and water, salt and water, roasted peanuts and their skins, etc.



Fig. 1

Fig. 2

## CWSN (Children With Special Needs)

- The students can help in deciphering secret code with the help of sighted peers in reading the secret message.
- No modifications required for the Hearing Impaired children.
- The Visually Impaired children must be given instructions to use other senses to match the given objects.

# VIBGYOR Seven Stones

## Number of Participants

Entire class

## Time Required

One period

## Material Required

Seven small stone pieces, a rubber ball, white and basic colours : red, yellow and green, drawing sheet, water or oil according to the colour nature, and cardboard, discarded CD/DVD.



Fig. 1

## How to Proceed?

- Stone pieces which can be piled on top of each other, will be painted with different VIBGYOR colour, i.e, violet, indigo, blue, green, yellow, orange and red. Orange colour may be made by mixing yellow and red; violet by mixing yellow, green and red; indigo by mixing blue and red.
- The coloured stones will be piled up at random in the centre of play area.
- Students will be divided into teams.
- Toss of a coin decides which team starts the game.
- One student of the first team will begin the game by trying to knock over the pile of stones with the ball from a particular distance. This team gets three chances by three different players to knock over the pile of stones. If they are unable to knock over it in three tries, then it is the turn of the fielding team. But if the fielding team catches the ball after it touches/breaks the pile, the other team will be out. However, if they successfully knock over the stones, the game begins.
- After the first team breaks the pile, the fielding team will get the ball and try to hit out the players by ball when they are trying to rearrange the pile in the VIBGYOR order.
- If the team succeeds in rearranging the pile in proper order it gains point and also gets the chance to hit the pile again. However, if they fail to rearrange the pile properly and all players are out in the process, the fielding team will gain the point. The fielding team will then get the chance to hit the pile of stones.
- When the fielding team tries to hit the opposing team, the player should not move around holding the ball in their hands. However, they can pass the ball to their team mates.

**Note for the Teacher**

- The students must be involved in the preparation of the game.
- Once the pile has been rearranged, it must he checked that the colours are in proper order.
- Each and every student must be given the chance and equal opportunity.

## Points of Discussion

Name the natural phenomenon where you can see colours in the same order as in VIBGYOR.

## Science behind the Game

The game helps in reinforcing the sequence of colours in which the white light gets split.



## Extension of the Game

The students may be asked to make Newton's disc using discarded CDs or pieces of cardboard and observe what happens when it is rotated fast.

Fig. 2

Fig. 3

## CWSN (Children With Special Needs)

The children with special needs may participate in this activity by helping others in arranging the stones which may be given separate textures for easy identification. Prior to the game, they may be familiarised with different textured stones and the colours they have been painted with.

# CHOOSE THE RIGHT PATH

## Number of Participants

Two/Four

## Time Required

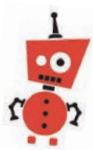
20 minutes

## Material Required

Chart paper or white cardboard, coloured pens, dice, two/four counters (*gotis*).

## How to Proceed?

- Prepare a playing board as shown in the sample. The board has small boxes with clues written on them.
- Stack counters of 2/4 different colours on the box marked 'START'. One player throws a dice, moves to the appropriate box and follows the instructions written in the box.
- Each student will have his/her own turn to throw the dice.
- The student who reaches the 'FINISH' point first will be declared the winner.



## Points of Discussion

The 'clues' contain environmental concerns regarding cleanliness of surroundings, hygiene and social behaviour. The facilitator may initiate discussion on proper disposal of garbage, recycling of paper. Also arrange a debate on the topic, 'Plastic—Boon or a Curse?'

## Science behind the Game

- Environment protection is a matter of great concern and students have to be sensitised towards it.
- Students must be made to realise their responsibility in taking proper care of water sources.
- Adopting proper sanitation practices should be our way of life.

## Extension of the Game

- Arrange discussion on one or more of the following issues:
  - How does air gets polluted?
  - What can be done to reduce air pollution?
  - What are the factors responsible for pollution of rivers and other water bodies?
  - What is the role of the sewage treatment plant?
  - Why should you take care of plants and animals?
  - Why should you not break school's furniture?
  - Why should we be polite to each other?
  - Why should we not jump red light at traffic junctions?
- Another game-board can be prepared based on any topic you wish to teach...such as 'Micro-Organisms: Friend and Foe' or 'Cell—Structure and Functions', etc.



## CWSN (Children With Special Needs)

- A separate game board with tactile markers and Braille labelling must be made for visually impaired children.
- For Hearing Impaired children no adaptation is required.

# STAMPEDE

## Number of Participants

26 players

## Time Required

20 minutes

## Material Required

Cardboard sheets, sketch pen or a marker, safety pins, thread, paper sheets and scissors.

## How to Proceed?

- Facilitator will prepare the following placards in pairs with the names of biotic components such as, lion, peacock, neem tree, rabbit, hawk, green plant and abiotic components such as, soil, heat, rock, earth, air, water written on them. Two sheets with term 'Biotic' and 'abiotic' written on them will also be prepared.

- Students can draw small pictures of these organisms on the cardboards and make it colourful and attractive or they can use face-masks representing the organisms.
- Involvement of differently-abled students must be taken care of. For them, the cards can be prepared by embossing using sparkle tubes and Braille.
- Put 24 chairs in a circle and place two chairs in the middle. Students may be asked to sit on the ground.
- A thread will be tied on both the upper corners of each piece of placard and 24 students will wear placards representing various biotic or abiotic components. Two students will sit on the two chairs marked with 'Biotic' and 'Abiotic'.



- Facilitator will call out name of one biotic or any one abiotic component. For example, if facilitator calls out lion, two lions will rush to interchange places, while the students sitting on 'biotic chair' will try to get to one of the places first.
- If he or she is successful then the lion without the seat will go in the middle 'biotic chair' and the other student becomes the lion and will be handed over the 'lion card'.
- The students who lose the chair will have to mimic the lion before occupying the 'biotic chair'.
- Likewise, teacher will call out names of all the pairs sitting in the circle and each time either the students on the 'biotic chair' or 'abiotic chair' will attempt to occupy the chair in the circle.
- In the end facilitator will call out 'Stampede'. Everyone has to get up and change seats on call of stampede and the two students in the middle attempts to get a seat.

## Science behind the Game

The living thing such as plants and animals in a habitat, are its biotic components. Various non-living things such as, rocks, soil, air and water in the habitat constitute its abiotic components. Sunlight and heat also form abiotic components of the habitat.

The teacher can also discuss the function and significance of different biotic and abiotic components of an ecosystem and further explain about food chains.



## Extension of the Game

This game can be extended for learning of any concept involving pair of substances. For example, pair of various autotrophs, herbivores, carnivores, top carnivores, microorganisms.

## CWSN (Children With Special Needs)

- A separate game board with tactile markers and Braille labelling must be made for Visually Impaired children
- For Hearing Impaired children no adaptation is required.



# TOYS

# INTELLIGENT DUCK

## Number of Participants

Group of 4–5 students

## Time Required

5–6 minutes

## Material Required

One small plastic tub filled with water, one small toy duck (made from plastic or rubber), one rectangular plastic bowl or a paper plate, a few pieces of eatables (e.g., peanuts or biscuits), a few pieces of non-eatables like pebbles, pieces of chalk, etc., two bar magnets, a piece of cardboard, adhesive and adhesive tape.

## How to Proceed?

- Fix a bar magnet inside the rectangular plastic trough along its length at its bottom. Partition the bowl in two by fixing a piece of cardboard vertically in the centre. Fill the part of the trough above south pole with pieces of eatables and that above north pole with pieces of non-eatables. If a paper plate is used instead of a trough, fix the magnet underneath to hide it.

- Select a toy duck that floats on water. Fix a bar magnet at the bottom of a thick piece of thermocol and fix the duck (along its length) in such a manner that the north pole of magnet is towards the beak and the south pole is towards its tail. Float the duck in water of the tub.

Fig. 1

- Divide the class into groups (5–6 students per group).
- Call one group at a time.
- One by one ask each member of the group to feed the duck by bringing eatables close to the beak of the duck. Next, bring the non-eatables near the beak.

## Points of Discussion

- Why does the duck get attracted towards eatables and move away from non-eatables?
- Discuss the reason for the behaviour of the duck once all students have played the game.
- When the duck floats on water, it always rests along north-south direction when no other magnet is near it. This can help in reinforcing the concept that a freely suspended magnet always points to north-south direction.

## Science behind the Toy

Unlike poles of two magnets attract each other, whereas like poles repel each another. When the beak is close to eatables, duck is attracted towards them because North Pole near the duck's beak is attracted towards the South Pole of the magnet fixed on the trough. On the other hand, when the beak is close to non-eatables, duck appears repelled by the like pole of the end of magnet attached with the feeding trough.

Fig. 2

Fig. 3

Fig. 4

## CWSN (Children With Special Needs)

The Visually Impaired student may perform this activity but the movement has to be described by a sighted peer or to further simplify the experiment it can be done using two bar magnets to show how opposite poles attract and like poles repel each other.

# JUMPING DOLL

## Number of Participants

Entire class. Each student to make his/her own toy

## Time Required

30 minutes

## Material Required

Enamelled copper wire (22 SWG) about 2m in length, a light spring 10cm long and about 1cm in diameter (soft rubber band can also be used), a wooden box with open bottom and with attachments as shown in Fig.1, a toy doll about 5cm in length (or a toy monkey), a few iron nails about 2cm long, a holder for two cells, 10cm long iron bolt about 1cm in diameter, a tapping key, (to be made as shown in Fig. 2) and connecting wires.



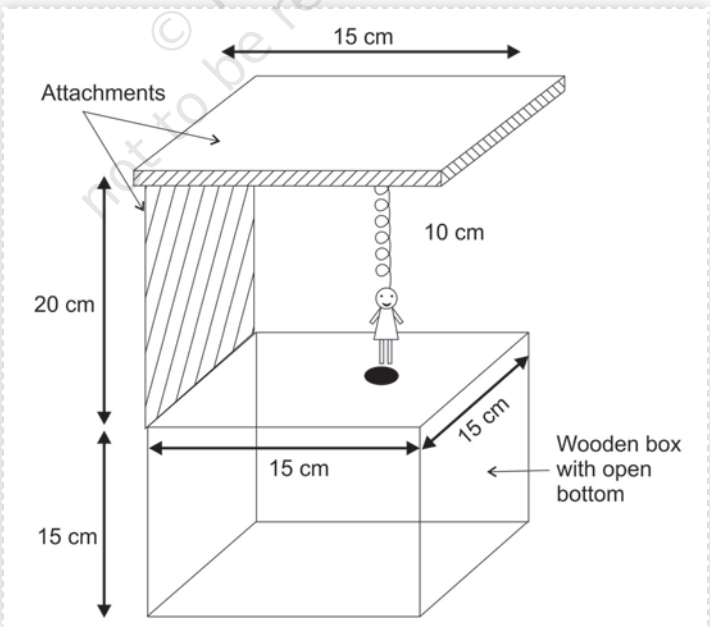



Fig.1

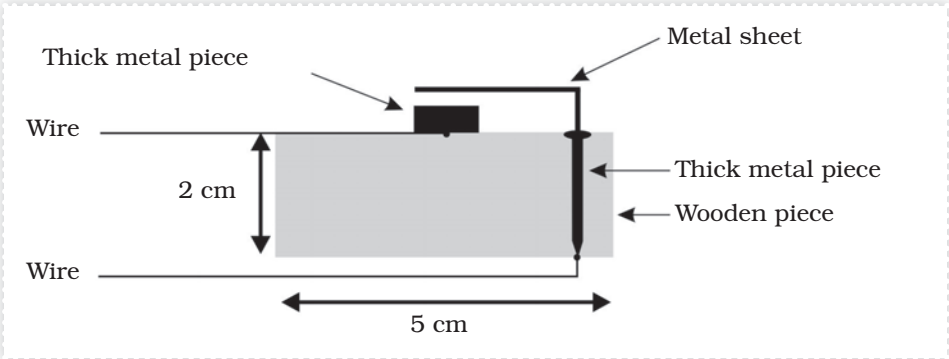



Fig. 2

## How to Proceed?

Wind 50–100 turns of copper wire on the bolt. Make an electric circuit as shown in Fig. 3.

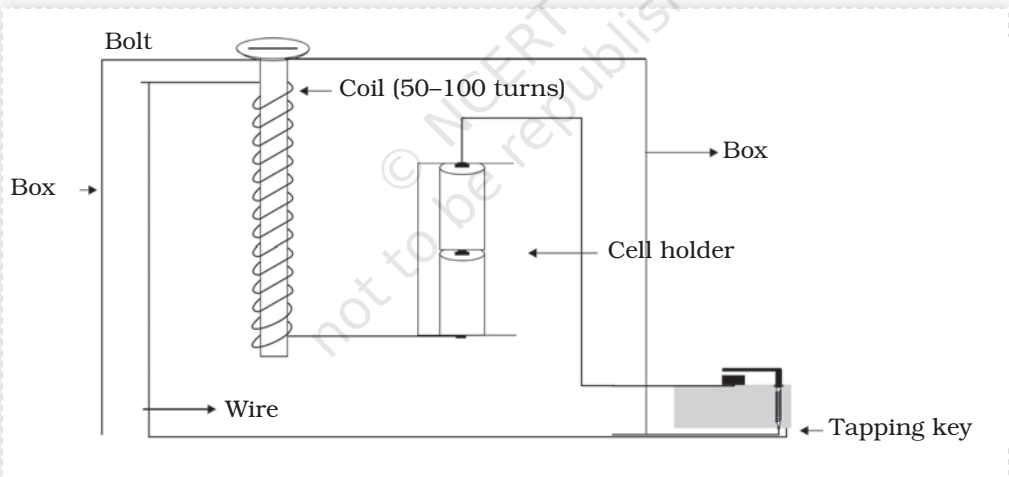





Fig. 3 The circuit

- Place the circuit in the wooden box.
- Only the tapping key should be visible outside the box.
- The head of the bolt should be protruding out of the box through a hole at its top.
- Attach a few iron nails to the feet of the toy doll.

- Suspend the doll with a spring as shown in Fig.1. Make sure that the ends of the nails attached to the doll is directly above the head of the iron bolt with a gap of 2–3cm. Place two cells in the cell holder. You are ready to play with the toy.
- Tap the key. The doll comes down. Let the key go. The doll goes up. Tap the key again. The doll come down again. It goes up as soon as you release the key. By tapping the key again and again, you can make the doll dance or jump.

## Science behind the Toy

As soon as the current passes through the coil, it becomes a magnet. The head of the bolt attracts the iron nails fixed to the feet of the doll. When the current is switched off, the attraction between the doll and the head of the bolt vanishes. The doll goes back to the normal position. By tapping the key rapidly, the doll appears to dance/ jump.

The important point to be remember is that the coil acts as a magnet only when the current is flowing through it. When there is no current, there is no magnet.



## Extension of the Toy

Instead of the electromagnet, you can use a bar magnet mounted on a wooden frame and rotate it in a vertical plane just below the feet of the doll (Fig.4). When a pole of the magnet approaches the feet of the doll it gets attracted. When the pole moves away, the doll goes back to normal position. When the other pole of the magnet approaches the doll, it gets attracted again. So, the rotating magnet makes the doll jump up and down.

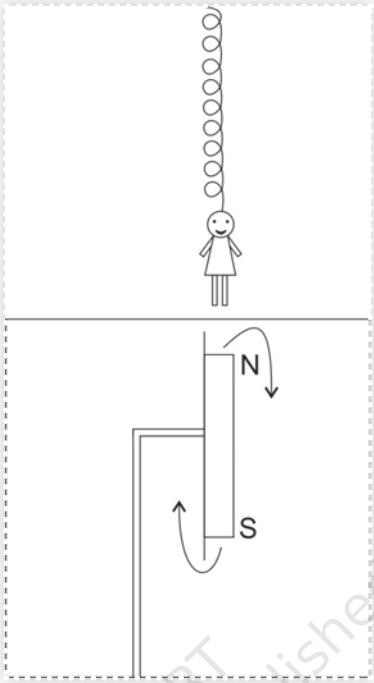



Fig. 4



**Note for the Teacher**

- If you are unable to get hold of a soft spring, you can make one by winding steel or copper wire (26 SWG) on a pencil.
- Similarly, the wooden box can be replaced by a strong cardboard carton such as a shoe box.

## CWSN (Children With Special Needs)

For Visually Impaired children the circuit can be embossed and Braille labelled. The Visually Impaired children can be asked to hold the doll gently and feel the pull between the doll and the electromagnet (head of the bolt) when the current is on or they may place their finger between the feet and the electromagnet to feel the movement. No modification is required for Hearing Impaired children.

# CLIMBING JOKER

## Number of Participants

Group of 4–5 students

## Time Required

5–7 minutes

## Material Required

Two equal pieces of straw (stiff), thread (strong) about 5 m in length, chart paper, a piece of cardboard/mount board (10 cm × 5cm), colour sketch pens, two buttons (about 1.5 cm diameter), sticky-tape, pencil, a pair of scissors (one set of materials for each group).

## How to Proceed?

- Make a colourful joker of about 10cm height and 5 cm width on a chart paper.
- Cut it out and paste it on a piece of cardboard or mount board (10cm × 5cm).
- Fix two pieces of straw of about 4cm length at a distance of about 3cm on the piece of cardboard as shown in Fig.1.

- Take two pieces of thread each of about 1.5m in length. Pass the threads through the pieces of straw and tie a button at one end so that the threads do not slip out of the straws. Instead of buttons, beads could be used.
- Tie the other ends of threads on a pencil as shown in Fig. 1.
- Wind a small piece of thread around the middle of the pencil and make a loop by tying its ends. Your toy is ready.

- Suspend the toy on a nail fixed at a height of about 2m with the help of the loop in the middle of the pencil.
- Now hold the free ends of the threads with your hands.
- Pull down the threads one by one and move them apart while doing so.
- You see the joker climbing up.
- Now bring the two threads close to each other.
- You see the joker sliding down.

## Science behind the Toy

When the thread is loose, it does not touch the straw and the joker can move down without any resistance. When we pull the strings apart, they touch the surface of the straws. Due to friction between the straw and the string, there is a reaction to the force that we apply in pulling the strings apart. It is the upward component of this reaction that pushes the joker upwards.



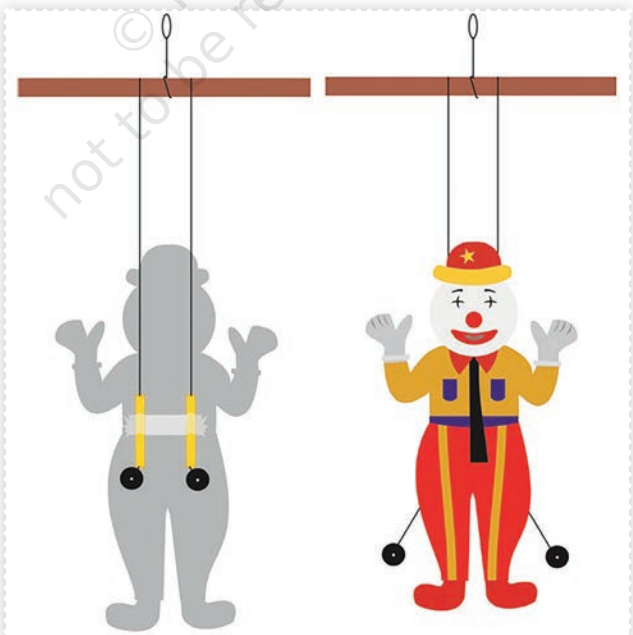


Fig. 1

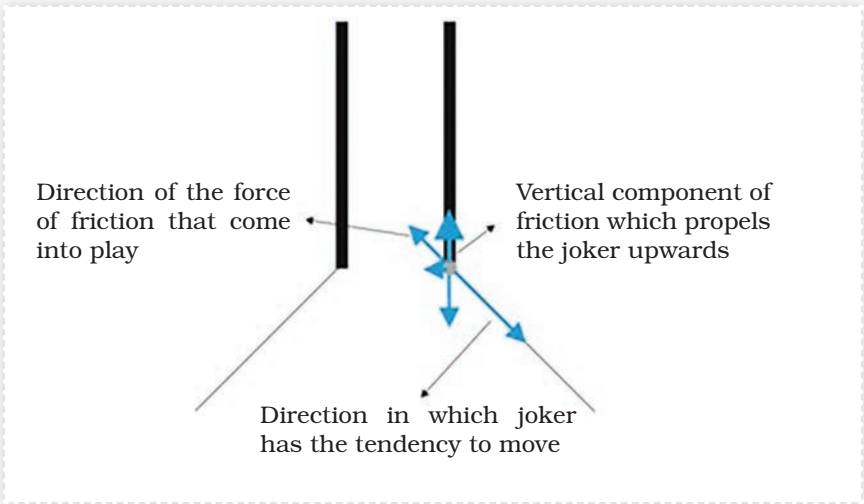



Fig. 2

## CWSN (Children With Special Needs)

The Visually Impaired children may be asked to touch the strings and follow the upward and downward movement by placing a finger between the head of joker and the straw.

# FUNNY BALL

## Number of Participants

Groups of 4–5 students

## Time Required

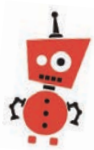
5–7 minutes

## Material Required

One hollow ball made of stiff transparent plastic and of diameter about 10 cm, thermocol balls, small plastic duck, water, adhesive (to join plastics), sharp knife (one such set for each group).

## How to Proceed?

- Divide the class into groups (4–5 students per group). Ask each group to make their own toy.



- Cut a small segment from the hollow ball (be careful, do not hurt yourself). Fill the ball partially with water. Float some thermocol balls and a toy duck on the water. Now fix back the piece that you cut out earlier.
- Each member of the group will rotate the ball one by one. After a few seconds she/he will bring the ball to rest by pressing gently on it and observe the thermocol balls and duck inside the ball.
- Next, rotate the ball again and bring it to rest for a fraction of a second and release it

Fig. 1



by releasing the pressure. Observe what happens. The ball begins to rotate again.

## Science behind the Toy

When the ball is stopped, thermocol balls and duck continue to move due to inertia. Thus, the toy effectively demonstrates the inertia of motion.

## Extension of the Toy

The same idea can be used to distinguish between a raw egg and a boiled egg. The raw egg will behave like the plastic ball.

## CWSN (Children With Special Needs)

Modification for Visually Impaired children is not feasible.

# THE BIRD ON THE BRANCH

## Number of Participants

Groups of 4–5 students.

## Time Required

4–5 minutes

## Material Required

Cardboard or a mount board of about 10cm × 8cm size, chartpaper or a drawing sheet, a bamboo strip of about 1cm width and 40–50 cm length to make a bow, strong thread (string) about 2 m long, a piece of reed (like the one used in *kulfi*) 10 cm long and about 0.5 cm in diameter, empty spool of sewing thread, gum or glue stick, sharp knife, one thin nail 5 cm long, and colour sketch pens.

## How to Proceed?

- Cut two pieces of chart paper of size 10cm × 8cm. On one piece, draw the branch of a tree and on the other draw a bird (Fig. 1 and Fig. 2). Ensure that the placement of the bird is such that it is at the level of the branch of the tree. The branch must be symmetrical in relation to the tree trunk.

- Colour the bird and branch of the tree using sketch pens.
- Paste the picture of the branch on one side of the cardboard and of the bird on the other side.
- Split the reed at one end with a sharp blade or knife so that the cardboard can be inserted in the slit and fix it with the glue (Fig. 5).



- Using a nail, make two holes in the empty spool as shown in Fig. 3. (Make sure that the two holes are opposite to each other.)
- Pass the thread through the two holes in the spool (Fig. 6).
- Make a bow with the help of a bamboo strip using the thread and the empty spool and reed as shown in Fig. 8.
- Pull out the thread of the bow from inside the spool with the help of the reed. Make a loop of thread around the reed as shown in Fig. 5. Insert the reed along with the loop into the spool again.
- Your toy is now ready ( Fig. 9 and Fig. 10).
- Hold the spool and move it to and fro along the string of the bow. Observe the picture of bird and the branch of the tree. You will see the bird sitting on the branch.

## Science behind the Toy

The impression of the image of an object does not vanish immediately from the retina of the eye. It persists there for about 1/16th of a second. So, if the image of the bird and the branch of tree is repeated on the retina at less than 1/20th of a second then it seems as if the bird is sitting on the branch of the tree. This is due to the persistence of vision.

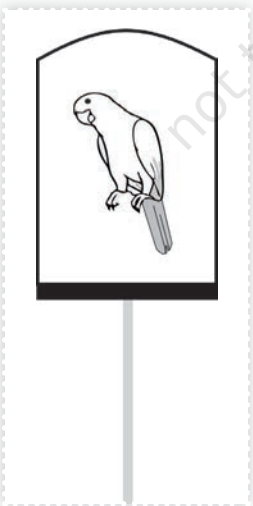


Fig. 1

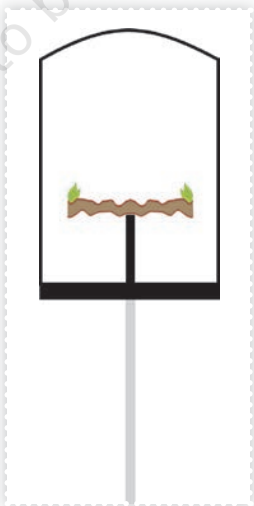


Fig. 2

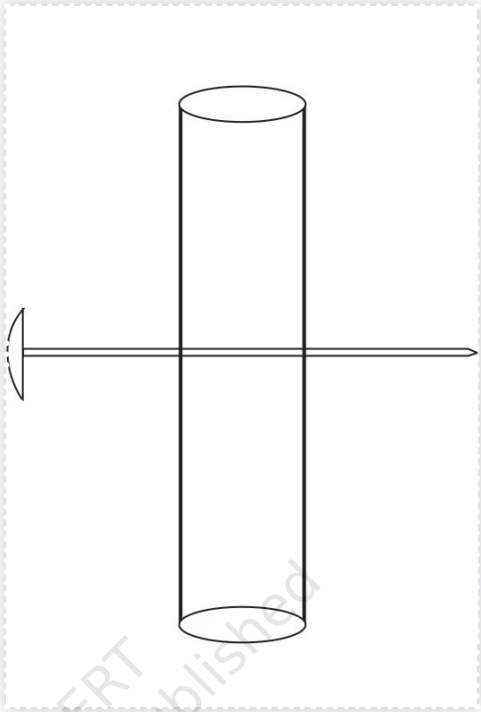


Fig. 3

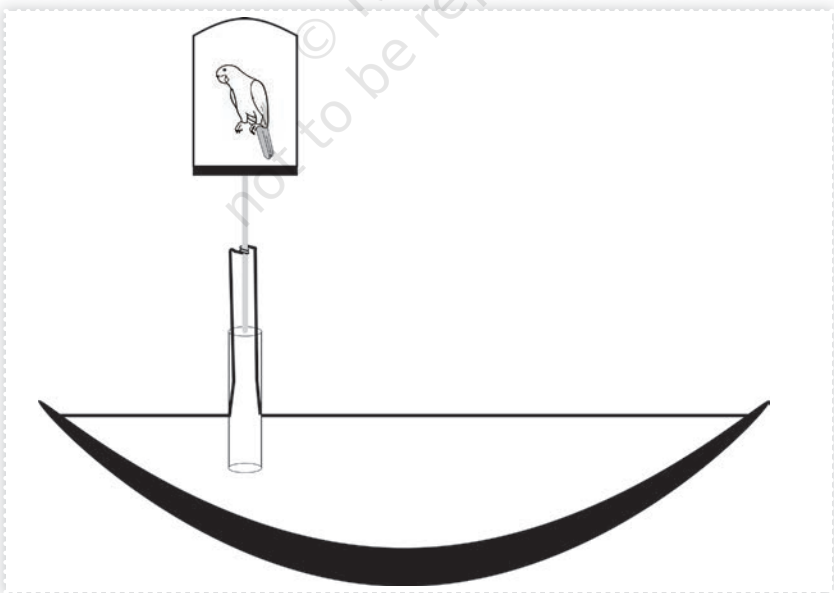


Fig. 4

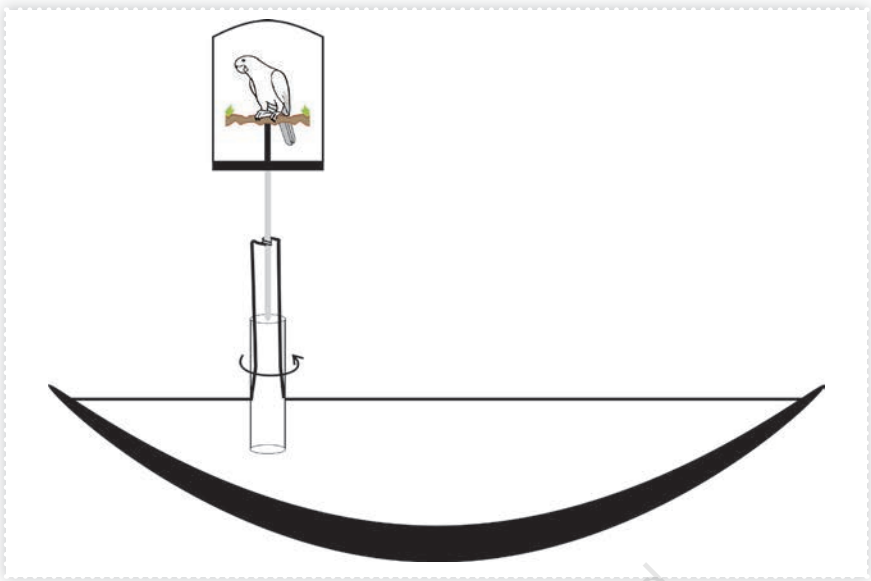


Fig. 5

## Extension of the Toy

Instead of the picture of the bird and the branch of a tree, we can use the picture of a plant (without roots) and a flower pot. Make sure that the sketches of flower pot and the plant are at the level of the soil in the pot.



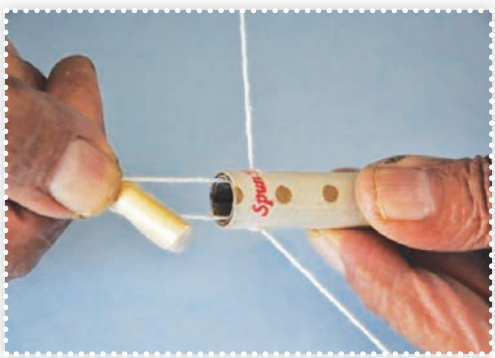


Fig. 6

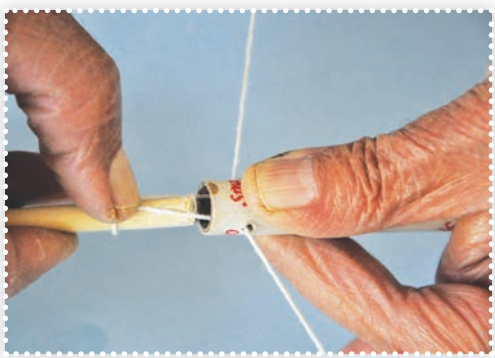


Fig. 7

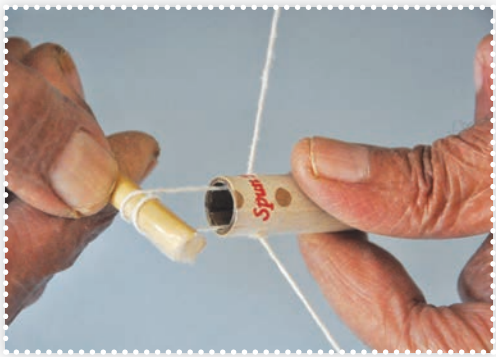


Fig. 8

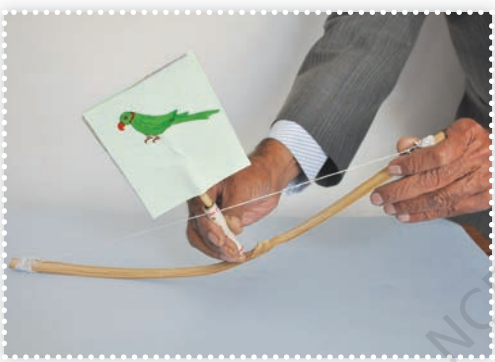


Fig. 9

Fig. 10



## CWSN (Children With Special Needs)

Purely visual activity hence can't be performed by Visually Impaired children. Only embossed diagram can be given to understand the experimental set up and final observation has to be supplemented with audio description by the teacher.

# OBEDIENT TIN CAN

## Number of Participants

A group of 4–5 students.

## Time Required

10 minutes

## Material Required

Tin or plastic can (500 mL) with a lid, large rubber band (about 10 cm long), a pendulum bob or nut 8 cm / (100 g), thin nail 8 to 10 cm long, small hammer, and a pair of scissors.

## How to Proceed?

- Take the tin can. Make two holes on the lid (along the diameter of the lid) and two holes at the bottom (along the diameter) of the can as shown in Fig. 1.
  So, now you have four holes in the can.
- Take a large rubber band and cut it to get a straight string. Insert the rubber string through the holes of the tin can, making a cross. Tie its ends as shown in Fig. 1. Pull the lid away from the can and tie a pendulum bob (or the nut) with a thread at the point where the rubber band crosses (Fig. 1. c).
- Close the lid of the tin can. You can paste two round pieces of chart paper at the two ends of the tin can to hide the rubber band. Your toy is ready.
- Roll the tin can on a smooth surface, such as a table. When you feel that the tin can is about to stop, order it to 'come back'. It obeys your order. The tin can returns almost to the same point from where it started. Try it again.

## Science behind the Game

When the tin can is rolled forward, the rubber string gets twisted due to winding up of the thread holding the bob. Due to twisting of the rubber band, some potential energy gets stored in it. When the tin can stops, the rubber unwinds and the tin can starts rolling back, as the potential energy gets converted into kinetic energy.

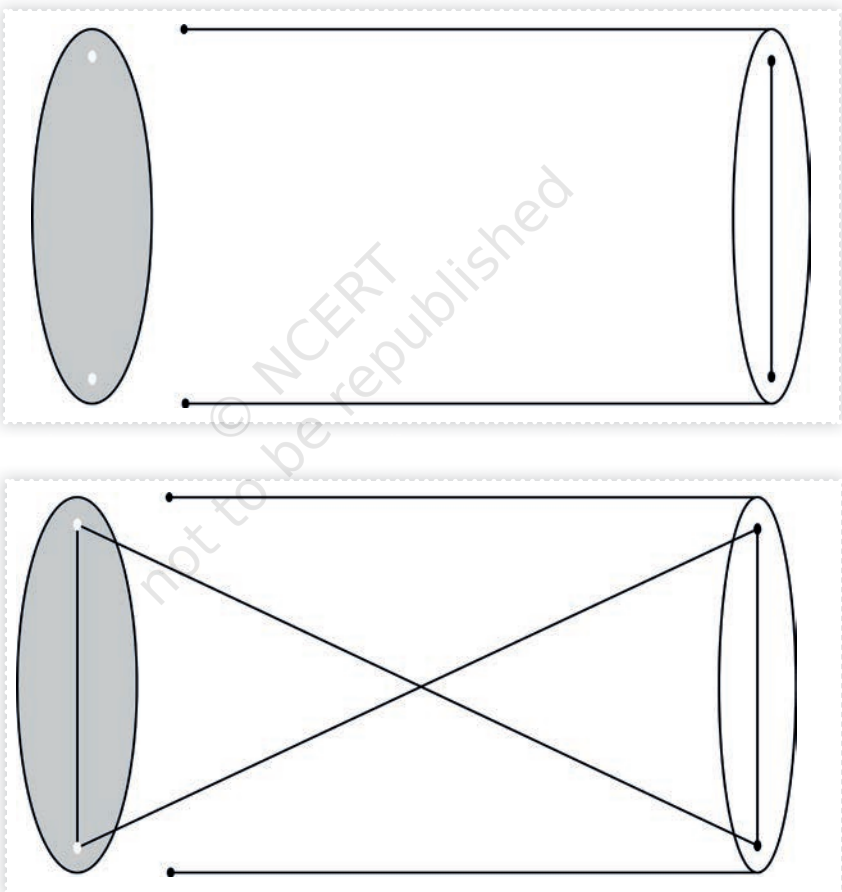
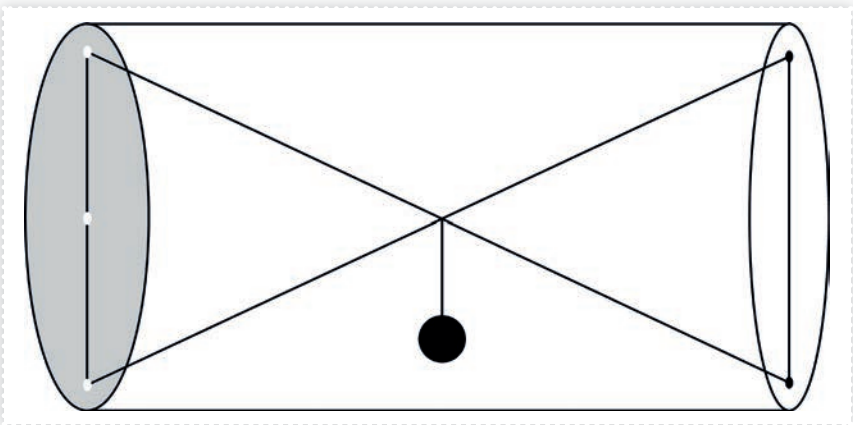



Fig. 1



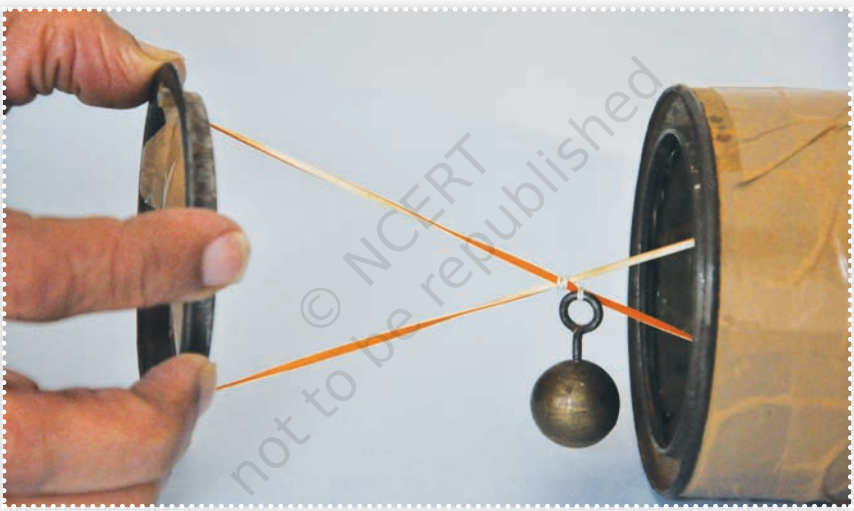




Fig. 2

## CWSN (Children With Special Needs)

Visually Impaired children may be assigned a peer for this experiment. The Visually Impaired children may feel the movement of the can and follow the sound of the can, hence no modification is required.

# SONA *KI PASAND*

## Number of Participants

Entire class

## Time Required

35 minutes

## Material Required

A battery, connecting wires, two LED's, a piece of cardboard, glue, a pair of scissors, paper cutter, tap water, saline water, distilled water, juices of various fruits and vegetables, as many other eatables as possible.

## How to Proceed?

- Draw or paste a face of a girl (named Sona) on a card paper as shown in the Fig.1. Give a horizontal cut between the lips. From this slit, attach a long tongue containing free ends of wires. Make electrical connection at the back of the card as shown in Fig.2.



Fig. 1

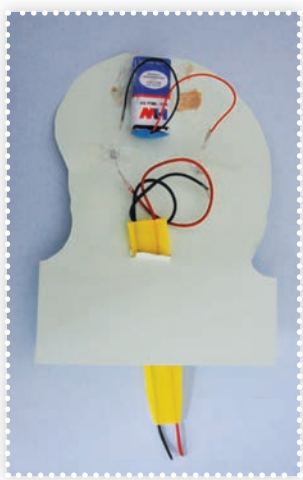


Fig. 2

- Connect the battery and LEDs' with the help of connecting wires. (The LED terminal near the flat spot is usually the negative terminal. It must be connected to the negative terminal of the battery. The other terminal of LED is connected to the positive terminal of the battery.)
- Leave two ends of wire free, coming out from the tongue of Sona.
- These free ends are to be used for tasting the various materials.
- The LEDs' will glow if Sona like the material. The LEDs' will not glow if Sona does not like the material.

Fig. 3

Fig. 4



## Discussion Point

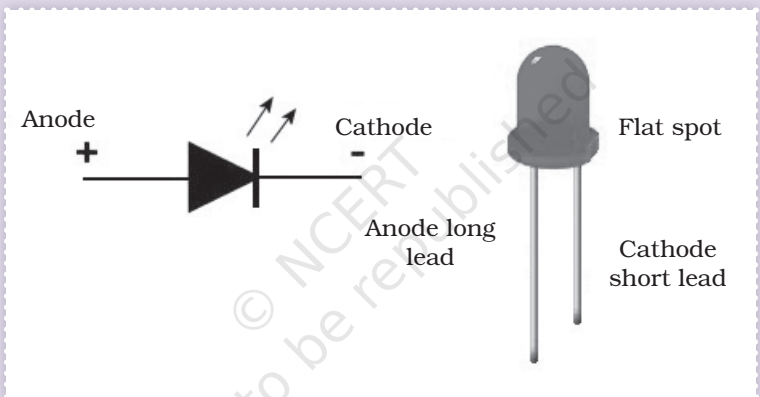
With which eatables, the LED glow? If the LED do not glow with distilled water, why do they glow with tap water?

## Science behind the Toy

This toy helps in finding out whether a given material is conducting or non-conducting. The circuit is completed when the tongue is dipped in certain materials and the LED glow. LED will not glow when in contact with non-conducting materials.

## Extension of the Toy

This game can be played with metallic and non-metallic materials.






## CWSN (Children With Special Needs)

- Visually Impaired children can independently conduct the experiments, if they are provided with light probes to detect light when the LED glows.
- They can also be paired with a sighted peer who can verbally explain when the LED glows.

# MAKE YOUR OWN AIR COOLER

## Number of Participants

To be done individually.

## Time Required

15 minutes

## Material Required

Any size round soft plastic bottle, a pair of scissors, marbles and water.

## How to Proceed?

- Take one empty bottle.
- Divide the bottle in three roughly equal parts and mark them. Cut away the bottom 1/3 part of the bottle with the help of a cutter or a scissor. This part of the bottle will look like a cup.
- Now roughly divide the circumference of the open part of the remaining bottle in six parts and mark them. Cut the bottle along its length at each of the six markings. Each cut should be about 10 cm long.



Fig. 1

Fig. 2

- Now bend the cut portions outwards to shape them like the blades of a fan. Blades of your air cooler fan are ready.
- Place this fan in the cup you had cut from the bottle initially. Place it under any running ceiling fan or at a place where wind is blowing with high speed. What happens to your fan?
- Once the fan has been tested, fill some water in the cup and bring it again under the ceiling fan.

Fig. 3

Fig. 4

Fig. 5



## Discussion Point

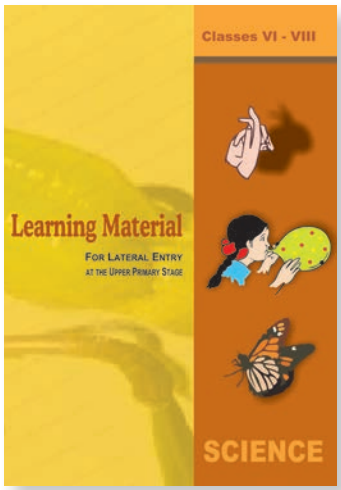
Discuss with children the concept of desert cooler. Compare it with the cooler they have just made. Discuss the role of the grass curtain in the desert cooler.

## Science behind the Toy

The pressure of the air due to the ceiling fan makes the toy fan rotate. When the fan rotates it sucks the moist air above the water in the cup which gives the feeling of coolness.

## CWSN (Children With Special Needs)

- Help will be required while marking and cutting the bottle by Visually Impaired children. The Visually Impaired children can feel the movement of the blades and the movement of the air.
- For Hearing Impaired no modification is required.

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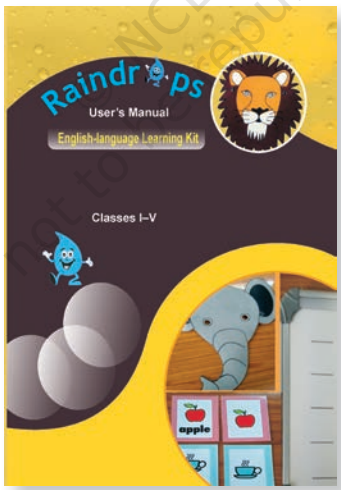


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