

— TEACHERS' MANUAL FOR —

STEM

EDUCATION  N

Part - 2

Teachers' Manual for STEM Education

Part - 2



Introduction:

Science is the study of nature. It is not a subject taught only from books. Science is about discovering relationships between causes and effects in the world around us. Therefore, it is important to develop students' critical thinking and scientific temperament. A lot of information is available to students on the internet; consequently, the ability to apply that information is an essential 21st-century skill.

STEM encompasses the disciplines of Science, Technology, Engineering and Mathematics. These skills are important both for national progress and for individual and career growth. Because these disciplines are interrelated, conceptual understanding requires a learning-by-doing approach.

This STEM hands-on activity manual is designed to make learning engaging by connecting classroom concepts with real-world applications. Hands-on activities help students see how curricular concepts are used in daily life. When students actively participate in these activities, they develop deeper understanding, improve practical skills, and appreciate the connection between school learning and the real world.

The manual includes a variety of activities that allow students to explore science and mathematical concepts through practical experience. For example, students will build a model of the heart's circulation, make parachutes, and create simple machine toys to learn concepts such as force and pressure. They will learn about microorganisms, nutrition, food preservation, and food processing by making curd, pickles, and healthy food items. Agriculture, biology, and environmental science will become more engaging as students perform soil testing to study soil properties and texture, and water testing to examine contamination and microbiological quality. To make mathematics fun, students will create puzzles such as tangrams, build integer models, construct models to understand algebraic expressions and fractions, and learn area and perimeter using geoboards.

Technology is introduced in simple, practical ways. Students will explore solar drying, build electric circuits and solar cars, construct light torches, and learn basic automation using microcontrollers and sensors. Arts-based activities such as dyeing, sewing, crochet, and painting will let students express creativity while reinforcing mathematical concepts like measurement, area, and spacing. Together, these activities make learning multidisciplinary, breaking down barriers between subjects and making education more relevant to everyday life.

In addition to hands-on work, students are encouraged to interact with their local communities to learn about different skills and professions. They will conduct surveys and meet local experts such as gardeners, carpenters, potters, and artisans to understand their work. Field visits to nurseries and workshops will provide practical exposure to various trades and professions. During projects

and activities, students will observe, measure parameters, keep records, analyze gathered data, and reflect on their findings in discussions with teachers, peers, and family members. This process develops problem-solving, critical thinking, communication, and creativity.

Care must be taken to ensure that both boys and girls participate in all types of activities. Societal prejudices that assign certain activities to a particular gender (for example, assuming food processing is for girls or engineering is for boys) should be avoided. Teachers should organize most activities in groups so students can collaborate, share ideas, and learn from each other. It is essential that everyone receives an equal opportunity to participate and develop a range of skills.

Most of the activities suggested in this manual are already included in the “Suggested Activities” section of the science textbook. Here they are presented systematically with full details to support implementation. This will help middle and secondary schools enhance the quality of STEM education.

This STEM Handbook was developed during the implementation of the STEM Learning Program in 100 schools in Murshidabad district. The program is implemented by the Department of Education, Government of West Bengal, UNICEF, and STARS Forum — Vigyan Ashram. By combining hands-on activities with real-world experiences, the program helps students develop both subject knowledge and practical skills, preparing them for higher education and future careers. Activities in the manual were designed in consultation with expert teachers nominated by the State Education Department.

1. Guide to use the handbook

This handbook is an instructional manual for school teachers. It provides ideas for various project-based activities for students. The suggested activities are designed considering students’ age, curricular areas, and learning objectives. Teachers should explain the related textbook concepts after the hands-on activities to help students understand the topics more effectively. Materials used for the activities should not be wasted but reused or repurposed whenever possible.

‘Learning by doing’ is a non-negotiable principle of the program. Therefore, teachers must ensure that every student participates in the activities. It is important for teachers to check the availability of sufficient raw materials before conducting a session.

A teacher must be present at all times while students are performing activities. Safe handling of tools is essential, and students should be regularly reminded of safety instructions.

The activities given in this book are suggestive. Teachers are encouraged to propose new activities based on their classroom needs and local context.

2. The Principles Behind the STEM Program Initiative

2.1) Learning by doing in real-life situations is the natural way of learning

Children learn their mother tongue through learning by doing. Similarly, we learn cooking, swimming, cycling, or operating a computer through practical experience. Learning through doing leaves a deep and lasting impact—what is learned this way is rarely forgotten. This method is effective because students learn without stress or a sense of burden.

2.2) Activities that engage the hands stimulate the intellect

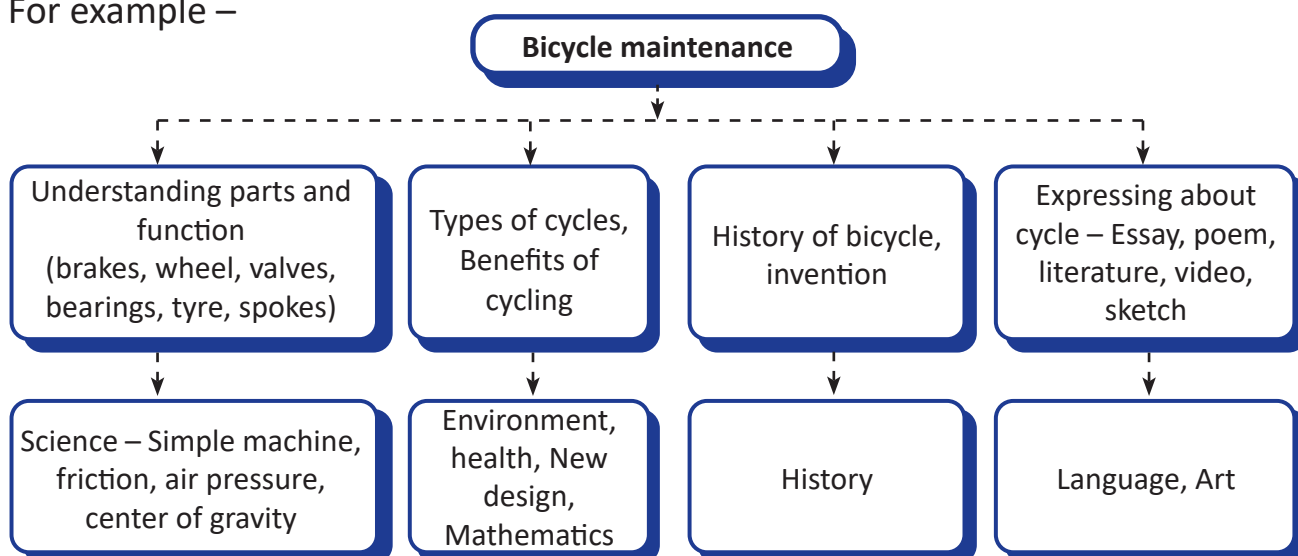
Education is a process of training the head, hand, and heart.

Many great innovators and entrepreneurs—such as Thomas Alva Edison and the Wright Brothers—became pioneers because of the rich variety of experiences they had during childhood. The goal of ‘working by hand’ is not merely to provide skill training for livelihood; it is to broaden a child’s experiential horizon and nurture creativity and problem-solving abilities.

2.3) STEM education is best delivered through project-based learning

Project work requires knowledge from different curricular areas and naturally integrates multiple disciplines. For example, a project on bicycle maintenance can help students learn concepts from science, environmental studies, and mathematics. This interdisciplinary approach makes learning more meaningful and connected to real life.

For example –



3. Conducting the activities

The lesson plans in this manual explain the steps to be followed while conducting each activity. While carrying out activities, the following points are non-negotiable:

3.1) Safety precautions must be followed at all times, and it is the responsibility of the teacher or instructor to ensure this.

- 3.2) Activities should be selected based on the availability of raw materials and the needs of the school.
- 3.3) All required materials must be arranged before the class begins. There should be enough materials so that every student can participate actively.
- 3.4) Many activities—such as agriculture-related tasks and arts & crafts—can be conducted with students of any class. Teachers must guide students on proper documentation, record-keeping, calculations, and using internet searches to gather additional knowledge.
- 3.5) After each activity, the teacher and students must sit together and reflect on the work done. Students should be encouraged to ask questions such as “Why?”, “What?”, “How?”, “When?”, and “Where?” in relation to the activity. These discussions help develop understanding and build connections with curricular concepts. This reflection process is a non-negotiable part of every activity.
- 3.6) Students must document the project or activity after the hands-on work. The project or activity report format is provided in the annexure. Writing notes, calculating costs, keeping records, and documenting measurements are essential and non-negotiable components of the activity.

4. Consumables and Materials Management

- 4.1) Certain types of consumables—such as glue, wires, soldering materials, plywood, cardboard, rubbers, pins, nails, screws, adhesive tapes, PVC pipes and fittings, etc.—should be stocked in the school.
- 4.2) Perishable items such as paints and seeds need to be purchased in a planned manner. Instructors must ensure the seasonal availability of perishable goods and plan their activities accordingly.
- 4.3) A scrap bank should be created in the school. It should include broken appliances, old bearings, plastic bottles, empty cans, carton boxes, and other scrap materials. These items should be properly sorted and stored, as they serve as useful raw materials for various projects.
- 4.4) Project materials should always be used purposefully. Do not allow materials to remain unused or gather dust in the school. If models or toys are created, they should be used by students—either for classroom activities or to take home.

Registers to be Maintained

1. Inventory Register: Record all materials purchased and used, along with their quantities and value.
2. Activity Register: Record daily activities conducted, the number of students participating, the purpose or use of each activity, and details of costs incurred and sales amounts (if applicable).

Important Instruction- One or more QR codes are given at the end of most activities. Scan these given QR codes through your smart phone. Through these QR codes, you will get audio-visual material and additional information related to the activity for studying-teaching purpose.

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Mathematics



Activity Name



42. Making 3D Objects

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 24 - Perspective of solid objects

Concept/Principle: Characteristics of geometric solids, basic geometry

Materials and tools required:

Paper, scale, pencil, eraser, sharpener, scissor, glue, cardboard, push pin, foam sheets, graph paper, rubber bands

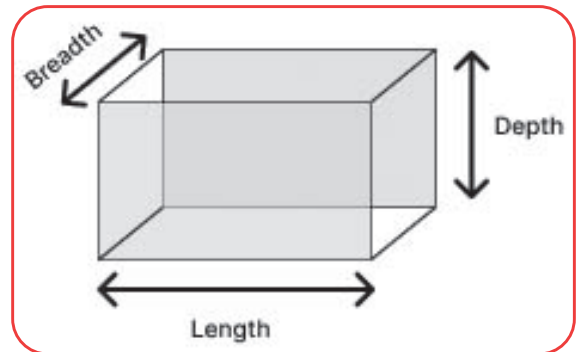
Time required: 60 minutes

Objectives:

1. Students will make three- dimensional solids by folding and sticking paper.
2. Students will learn about the properties of various 3- dimensional geometrical solids

Introduction:

1. Initiate specific geometrical vocabulary like – shapes, solids, unit, edges, vertices, surfaces etc.
2. Discuss the length, width, depth/height and properties of geometric solids.

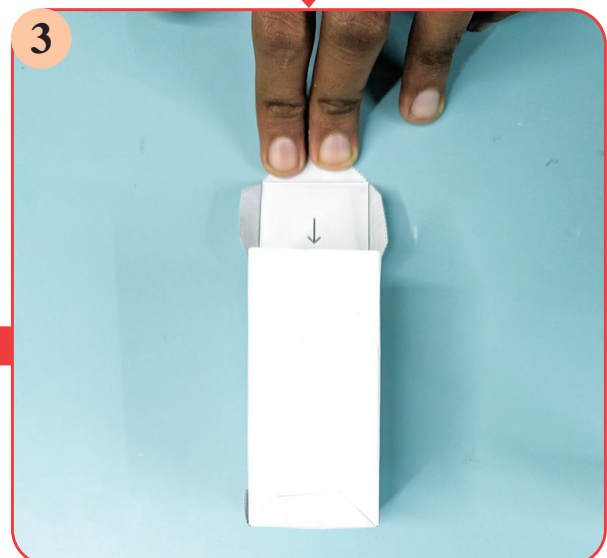
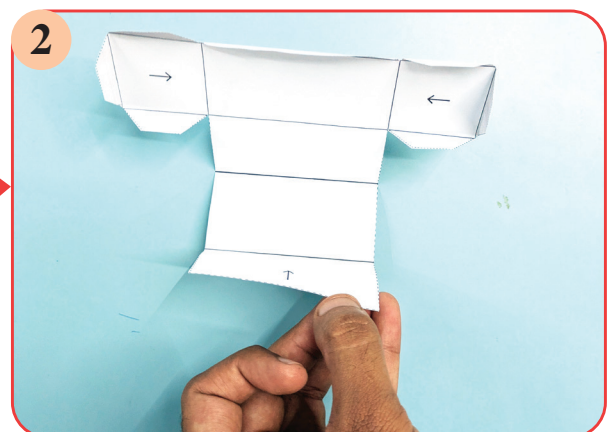
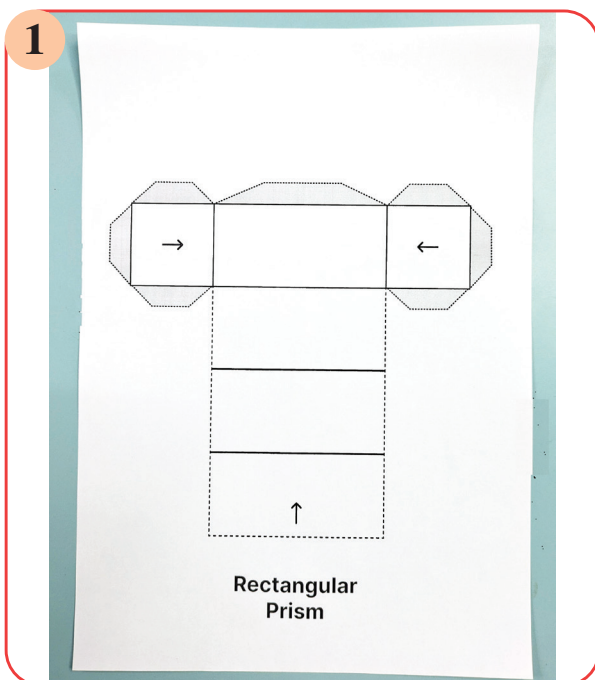


Hands-on activity:

1. Start by scanning the QR code and printing the PDF you receive
2. Paper Model – Create paper models using given PDF formats.



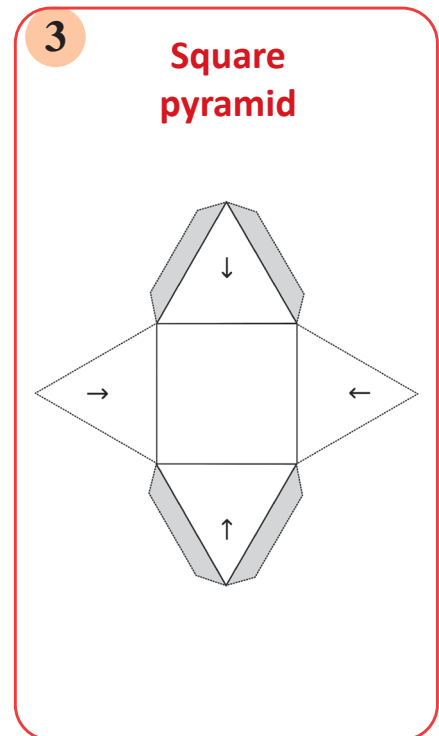
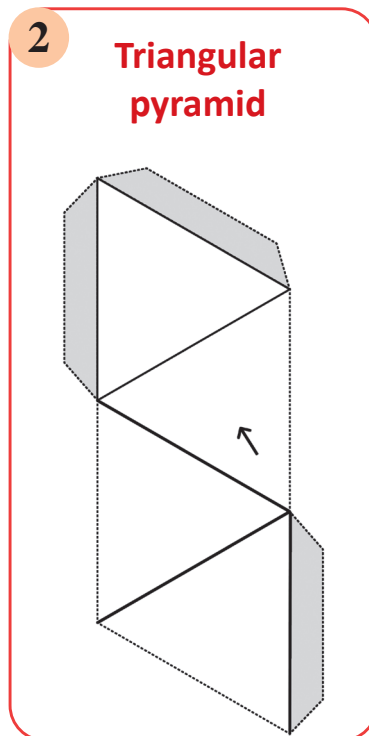
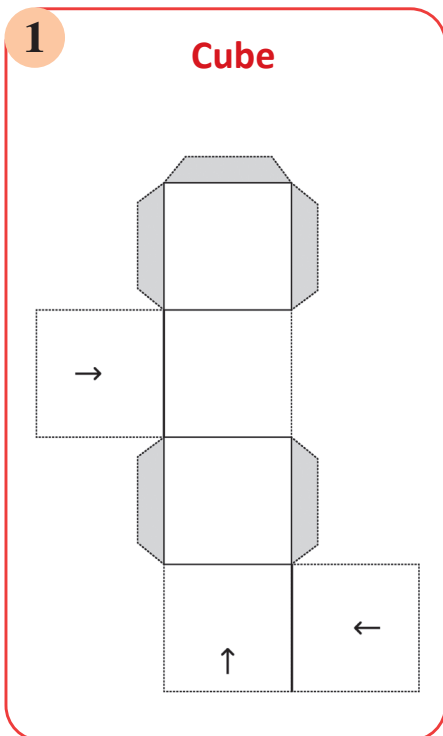
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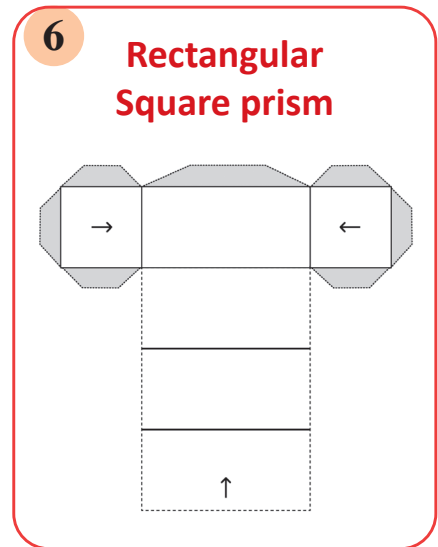
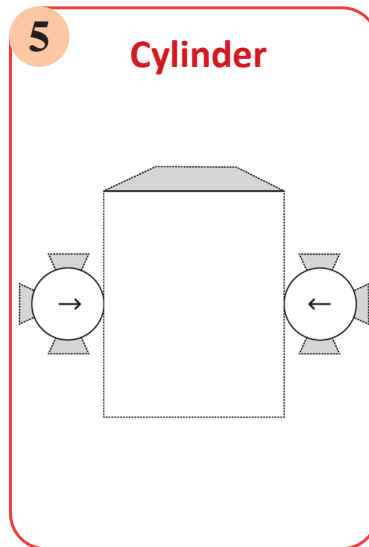
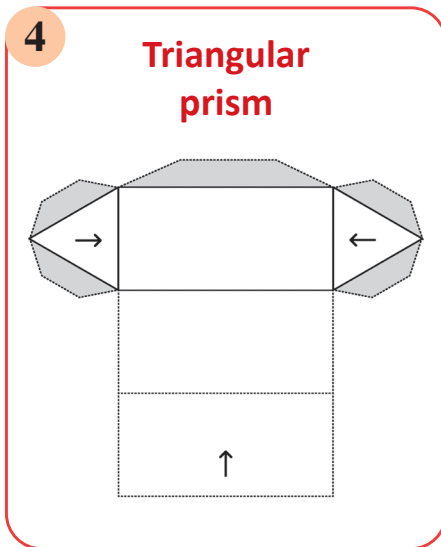


3. Observe all the shapes one by one and fill in the following table (properties of geometric solid).

S.No.	Geometric solids	No. of faces	No. of vertices	No. of edges	Shape of the face
1	Cube				
2	Triangular pyramid				
3	Square pyramid				
4	Triangular prism				
5	Rectangular prism				
6	Cylinder				

picture





Teacher Guidelines:

1. Students can work individually or in groups (4 students in a group)
2. Ensure that students handle scissors carefully under supervision.



Discussion with students:

1. What is the difference between a square and a rectangle?
2. How many sides does a pentagon have?
3. What is the shape of a pizza slice?
4. What do you call a shape with six sides?
5. Is a circle a polygon? Why or why not?
6. What is the difference between 2D and 3D shapes?
7. What is the shape of an ice cream cone?
8. What is the difference between a cube and a cuboid?
9. Which 3D shape has a circular base and a pointed top?



Resources:

- You can search on Google using the search words -
1. Make solids or 3D models from 2D shapes + YouTube
 2. Properties of geometrical shapes/solids





Activity Name



43. Parts of a Circle

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 20 - Concepts about Circle

Concept/Principle: Different parts of a circle and their properties.

Materials and tools required:

Pins (around 40), cardboard/foam, PDF stencil print, white paper
rubber band/thread, scissors.

Time required: 30 minutes

Objectives:

Students will learn about different parts of a circle through visual and hands-on activities.

Introduction:

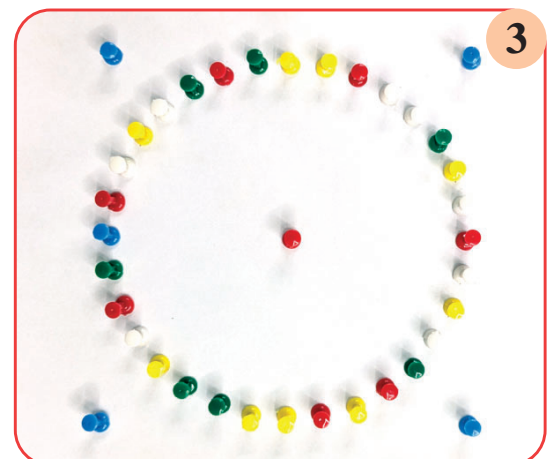
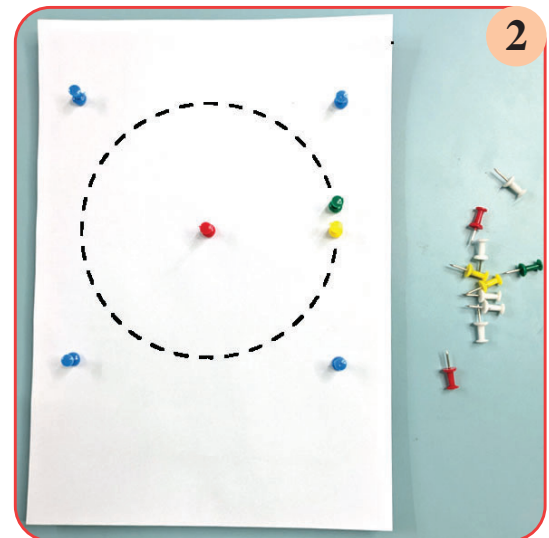
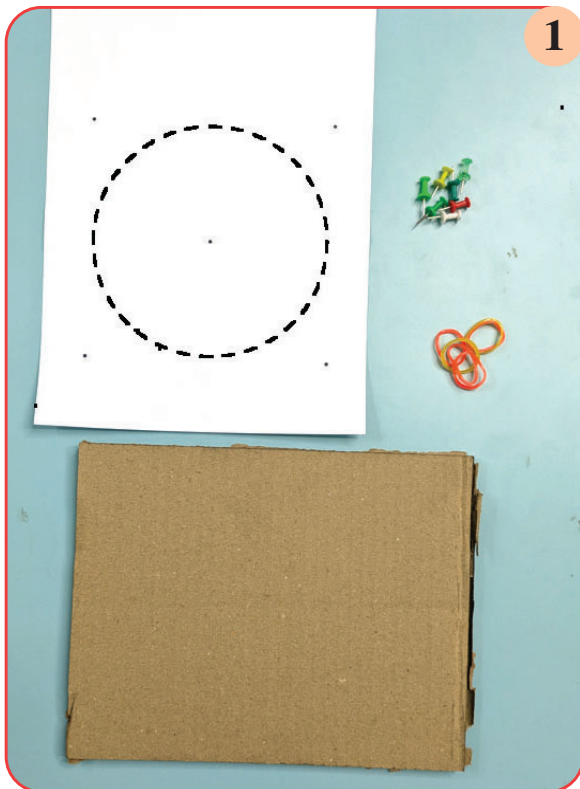
- A Circle is a perfectly round 2- dimensional shape. The middle point is called the center. A line from the center to the edge is the radius. A line that goes all the way across the circle through the center is the diameter. The edge of the circle is called the circumference. A line joining any two points on the circle is a chord.
- A part of the edge is called an arc, and the space inside the circle is its area. A tangent is a line that just touches the circle at one point.

Hands-on activity:

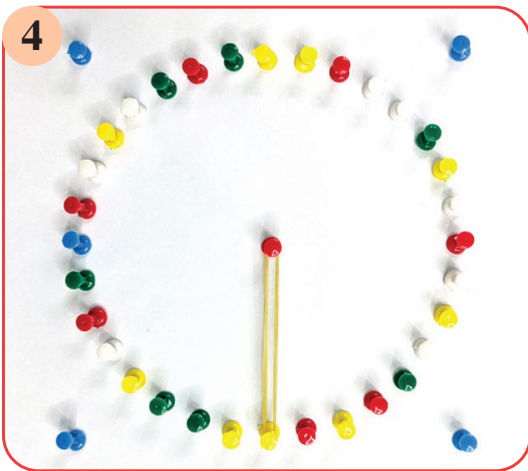
1. Start by printing the PDF you will receive after scanning the QR code.
2. Paste the paper on a cardboard and start placing pins on the dots.



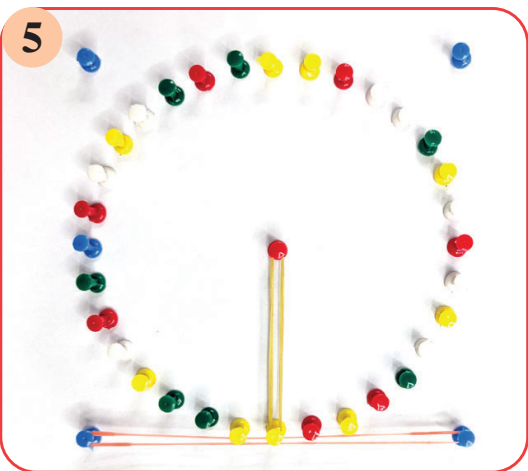
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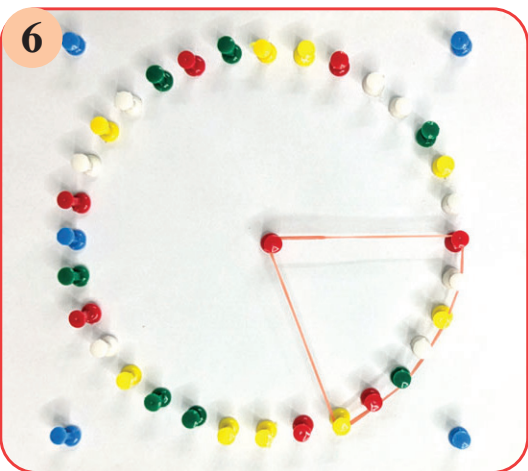
3. Once all the points are pinned, you can use the rubber band to understand the parts of the circle.



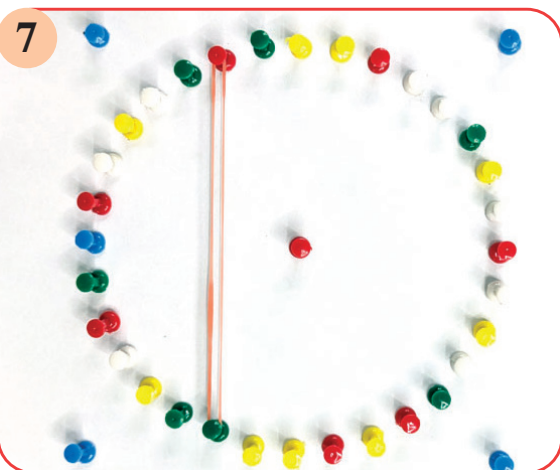
4. A TANGENT can be drawn by connecting a rubber band between two points outside the circle but touching a single point on the circumference of the circle (intersecting circle exactly at one single point).



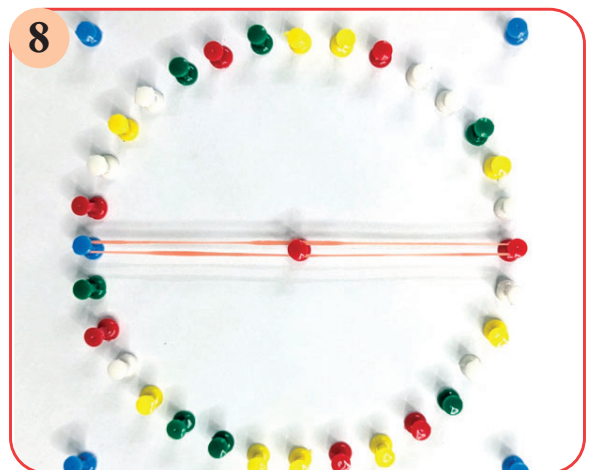
5. If we stretch a rubber band from the center of the circle to the intersecting point of tangent, the line is perpendicular to the tangent. This proves that radius drawn from the intersecting point of tangent is perpendicular to the tangent.



6. Sectors and arcs can be shown by stretching a rubber band (one each) from two pins on the circumference of the circle to the center of the circle. The area covered by the rubber band is the SECTOR, and the line on the circumference between two pins form an ARC.



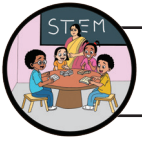
7. A CHORD can be created by stretching a rubber band over any two pins on the circumference of the circle. The area covered by the rubber band is called SEGMENT. The larger covered area is the major segment and the smaller covered area is the minor segment.



8. Other properties such as RADIUS, DIAMETER, CIRCUMFERENCE, etc. can also be included in this activity.

Teacher Guidelines:

1. Help students print and pin the stencil.
2. Help students stay safe while using the scissors and pins.



Discussion with students:

1. What are the different parts of a circle?
2. What is the total angle in a circle?



Resources:

You can search on Google using the search words -

1. Parts of a circle + YouTube
2. Parts of a circle





Activity Name



44. Making Geoboard

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 15 - Determination of Area and Perimeter

Concept/Principle: Calculation of area and perimeter of shapes and figures

Materials and tools required:

Cardboard, push pins, foam sheet, graph paper, rubber bands, fevibond /glue, cutter, ruler/scale, pencil and eraser

Time required: 120 minutes

Objectives:

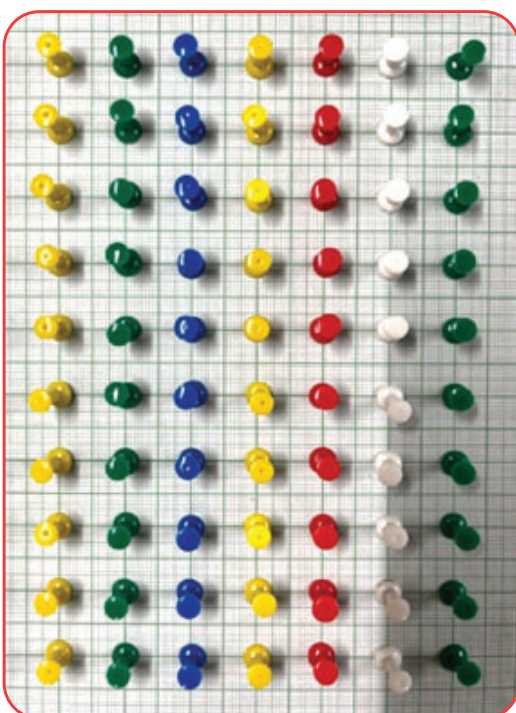
1. Students will learn how to calculate the area and perimeter of different shapes.
2. Students will create and explore various geometric shapes using a Geoboard.

Introduction:

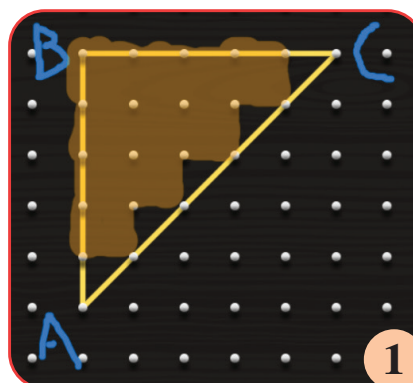
A geoboard is a hands-on mathematical tool consisting of a board with a grid of pegs used to explore geometry. By stretching rubber bands around the pegs, users can create various shapes and patterns to visually learn concepts like area, perimeter, angles, and symmetry.

Hands-on activity:

1. Take a cardboard sheet of 210 mm x 290 mm(A4). Stick the graph paper with the help of fevibond or glue.
2. Then, paste a foam sheet on the backside of the cardboard using glue so that it will become sturdy.
3. Now, take the push pins and fix them on the graph paper at 1 cm distance from each other.
4. Our geoboard is ready to be tried.
5. You can make any geometrical shapes on these boards using rubber bands or any string.

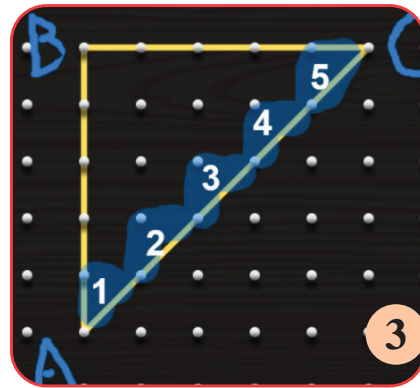
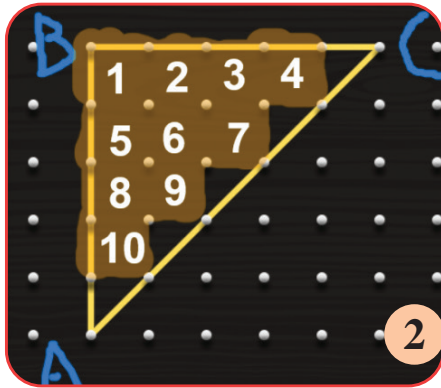


6. Here, we have taken a triangle ABC. It is a right-angled triangle with side $AB = BC$.



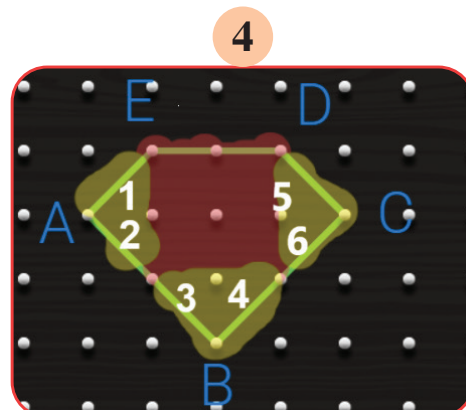
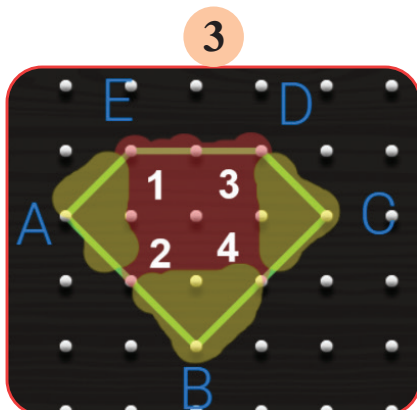
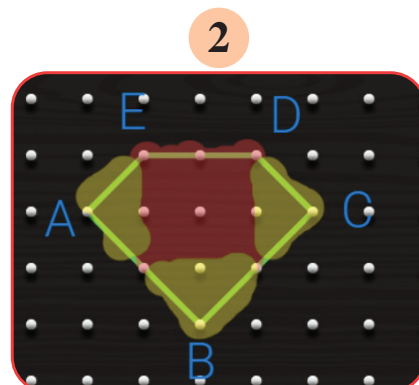
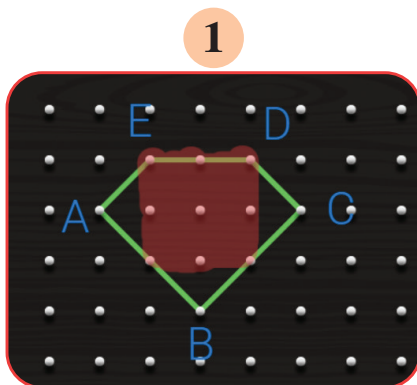
Attempt 1:

7. Let's try to find its area... Area of this Triangle will be the (number of full squares) + ($\frac{1}{2}$ × number of half squares) sq.cm.



8. Area (Triangle ABC) = (Squares highlighted in yellow) + ($\frac{1}{2}$ × No. Of blue highlighted triangles)
 = 10 + ($\frac{1}{2}$ × 5)
 = 12.5 sq.cm.

Attempt 2:



Teacher Guidelines:

1. You can do this activity in a group of 4 - 5 students.
2. Ensure that students wear handgloves when using a blade cutter for the first time.
3. Use of a blade cutter should be done under supervision, and use of cutting mat is necessary as it will avoid cutting the table top.
4. Use of foam sheet is essential here as it provides stiffness to the pins.



Discussion with students:

1. Can you explain the difference between area and perimeter?
2. What are the various geometrical shapes you know?
3. Can you create an irregular shape and calculate its approximate area?
4. Is it possible to make a circle on a geoboard? Why or why not?



Resources:

Website for making geoboard - scan the QR code



QR Code





Activity Name



45. Exploring Shapes with Tangrams

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 17 - Different geometric concepts using different items in the geometry box & Chapter 23 - Symmetry;

Class 7: Chapter 8 - Drawing Triangles; Chapter 14 - Properties of Triangle;
Chapter 9 - Concept of Congruency

Class 8: Chapter 21 - Drawing Triangles

Concept/Principle: Basic geometric figures and their properties, Symmetrical objects, Axis of Symmetry;

Geometric properties of triangles, measuring areas of triangles, rectangles and squares;

Construct various types of triangles with differing properties

Materials and tools required:

Scissors, ruler/scale, pencil, A4 size paper or cardboard

Time Required: 60 minutes

Objectives:

1. Students will learn about different geometrical shapes, congruence, symmetry and similarity and how they fit together by making tangram puzzles.
2. Students will explore different angles like right, acute, and obtuse angle.
3. Students will explore other mathematical concepts like fractions and percentages using tangram pieces.

Introduction:

Tangrams are ancient Chinese puzzles consisting of seven geometric shapes (two large triangles, one medium triangle, two small triangles, one square, and one parallelogram) cut from a single squared paper called "tans" that can be arranged to form various shapes. This activity helps enhance understanding of geometry, shapes and angles.

This activity demonstrates:

- Geometric principles such as congruence (same size and shape), similarity, and symmetry.
- Spatial reasoning by figuring out how pieces fit together.
- Problem-solving by recreating or inventing figures with the given shapes

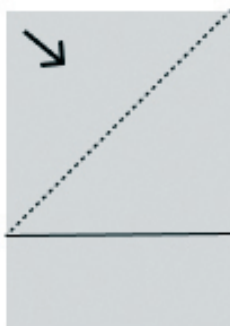
Hands-on activity:

Students will create their own tangram set by cutting a square into seven specific shapes and then using these pieces, they will form different figures, such as animals, objects, or geometric shapes.

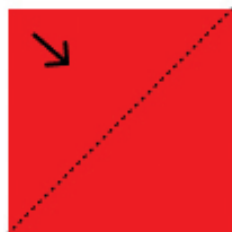
Step-by-Step Procedure:

Instructions for Students-

1. Take a A4 Size Sheet.



2. Make a square



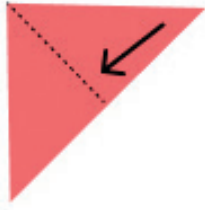
3. Cut through line.



4. You should get 2 triangles.



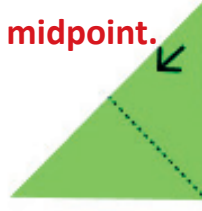
5. Fold one of the triangles.



6. You get 2 distinct, equal triangles.



7. Fold the other triangle, and mark the midpoint.



8. Touch corner to midpoint and fold.



9. Cut through this fold.



10. You should get a small triangle and a trapezium.



11. Cut through the fold.



12. You should get 2 distinct, and equal polygons.



13. Touch corner to right angled corner, and cut through it.



14. You should get a triangle and a square.



15. Fold the right angled corner to opposite corner and cut through it.



16. This will create a small triangle and a parallelogram.



17. Finally we get 7 shapes; 5 triangles, 1 square, 1 parallelogram.

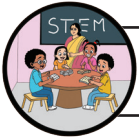


Assemble Shape:

- Challenge yourself to form various shapes using all seven pieces without overlapping them.
- Start with simple shapes like squares or rectangles, then progress to more complex figures like animals or letters.
- Refer to a tangram puzzle from Google for shape ideas or create your own designs.
- Try different shapes.

Teacher Guidelines:

- ➡ Divide class into groups with 4 students in each group.
- ➡ Let students use different colored papers and exchange shapes with each other to get colorful tangram puzzle sets.
- ➡ Handle scissors carefully to avoid injury.



Discussion with students:

1. How many triangles are there in a tangram set? What types of triangles are they?
2. How can you use tangram pieces to demonstrate congruence and similarity?
3. What is the difference between an acute angle, an obtuse angle, and a right angle? Can you find these angles in your tangram set?
4. What is symmetry? Can you find any symmetrical shapes in your tangram set?



Resources:

You can search on Google using the search words –

1. How to make a tangram puzzle
2. DIY tangram puzzle for students
3. How to solve tangram puzzles step by step





Activity Name



46. Pythagoras' Theorem: Models

Syllabus reference:

Standard/Lesson No.: Class 7: Chapter 12 - Algebraic Formulae &
Chapter 14 - Properties of Triangle
Chapter 17 - Area of Rectangle and Square;

Class 8: Chapter 9 - Relation of Two Sides of a Triangle and their Opposite Angles
Chapter 16 - Checking of Relationship between Angles and Sides of Triangles
Chapter 19 - Forming and Solving Equations
Chapter 20 - Geometric Proofs

Concept/Principle: Introduction to Pythagoras' theorem, using geometric concepts to understand and solve algebraic formulas

Materials and tools required:

Cardboard, Pythagoras' theorem template, OHP sheet, mustard seeds, scissors, ruler scale, pencil and eraser, adhesive glue, protractor, blade cutter, glue gun

Time required: 120 minutes

Objectives:

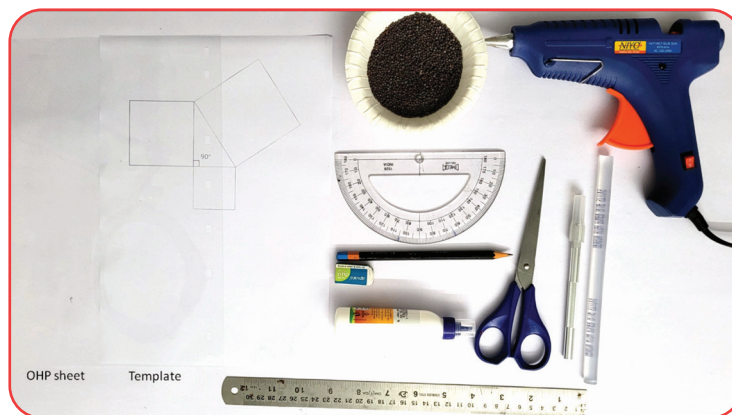
1. Students will understand the Pythagoras' theorem using interesting hands-on activity.
2. Students will make a model for proving the theorem using cardboard.

Introduction:

The Pythagoras' Theorem says that in a right-angled triangle, if you take the shorter two sides, make squares on them, and then add those two square areas together — it will be equal to the square made on the longest side. By making this model, students will see how the areas of squares on the sides of a right triangle relate to each other.

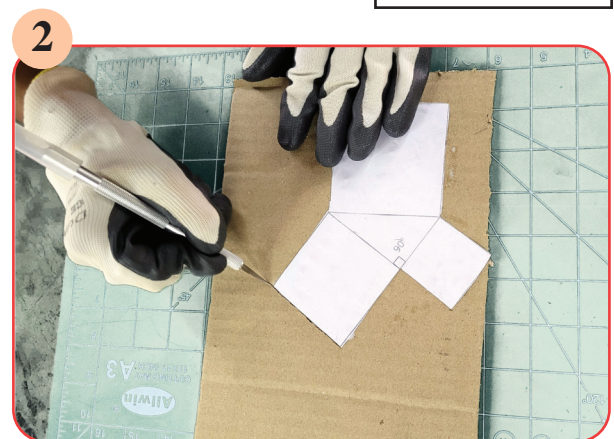
Hands-on activity:

Required materials and tools:



QR Code-1

1. Scan the QR Code-1 to download the Pythagoras' theorem template and print it on A4 size paper. Paste the template on a sheet of cardboard.
2. Cut the cardboard according to the size of the given template.



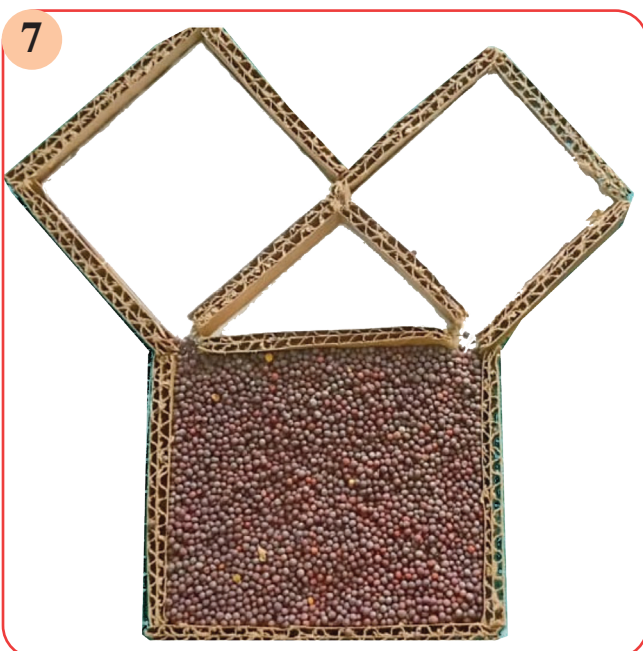
3. Again, draw and cut the 8 rectangles of 1 cm width and length as per the squares in the Pythagoras' template.



4. Now, join all the parts with glue as shown in the image below.



5. Now fill mustard seeds in a large square of this model and cover it with an OHP sheet. Apply the hot glue around the border to join the OHP sheet with the cardboard. Your Pythagoras' model is ready.



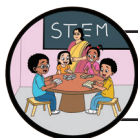
6. As you rotate the model, the mustard seeds from the biggest of the squares (for example, a side of length 'c' cm) will now completely accommodate into the other two squares (one square of side 'a' cm and other of side 'b' cm).

The proof of Pythagoras' theorem via this activity is:

- ➡ Here, two sides of the congruent squares represent two sides and one side of the biggest square represents the hypotenuse of the right-angle triangle.
- ➡ When we rotate the model, mustard seeds from a bigger square fill the other 2 squares.
- ➡ Hence, it proves that the area of the biggest square is equal to the sum of the areas of the other 2 squares.
- ➡ That is, hypotenuse square (C^2) = Sum of squares of the remaining 2 sides (a^2+b^2) In this way, Pythagoras' theorem is proved by this model.

Teacher Guidelines:

1. You can do this activity in a group of 4-5 students.
2. Ensure use of hand gloves while using the glue gun.
3. Help students to use glue guns.
4. Ensure that students do not touch the tip of the glue gun bare-handed as it is very hot.
5. Use of a blade cutter should be done under supervision and use of a cutting mat is compulsory.
6. Ensure the use of hand gloves when blade cutters are being used by students



Discussion with students:

1. What is Pythagoras' theorem?
2. How is Pythagoras' theorem proved in this activity?



Resources:

Video for making Pythagoras' theorem using cardboard model - scan QR code -3:

1. Website for making Geoboard - Scan the QR Code-2.
2. Video for making Pythagoras' theorem using cardboard model. - Scan the QR Code-3.



QR Code-2

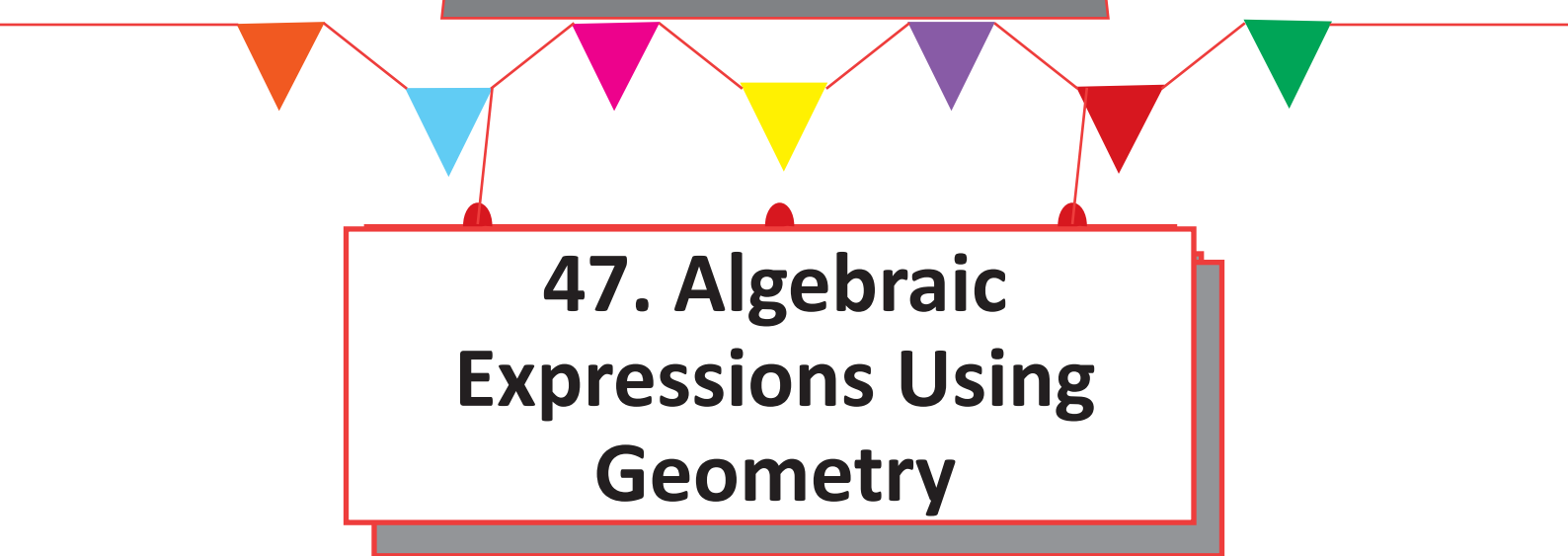


QR Code-3





Activity Name



47. Algebraic Expressions Using Geometry

Syllabus reference:

Standard/Lesson No.: Class 7: Chapter 12 - Algebraic expressions

Concept/Principle: Visualize some basic algebraic formulae.

Materials and tools required:

PDF stencil print, cardboard, scissors, glue.

Time required: 30 minutes

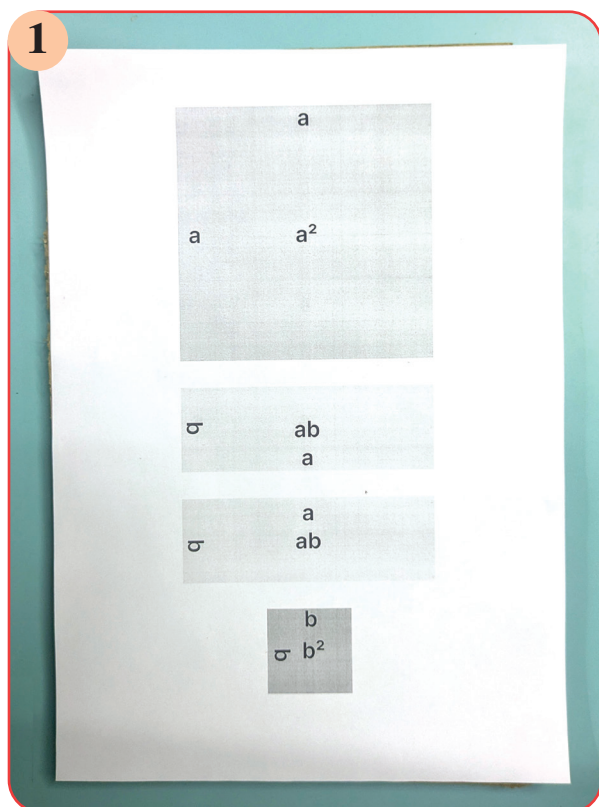
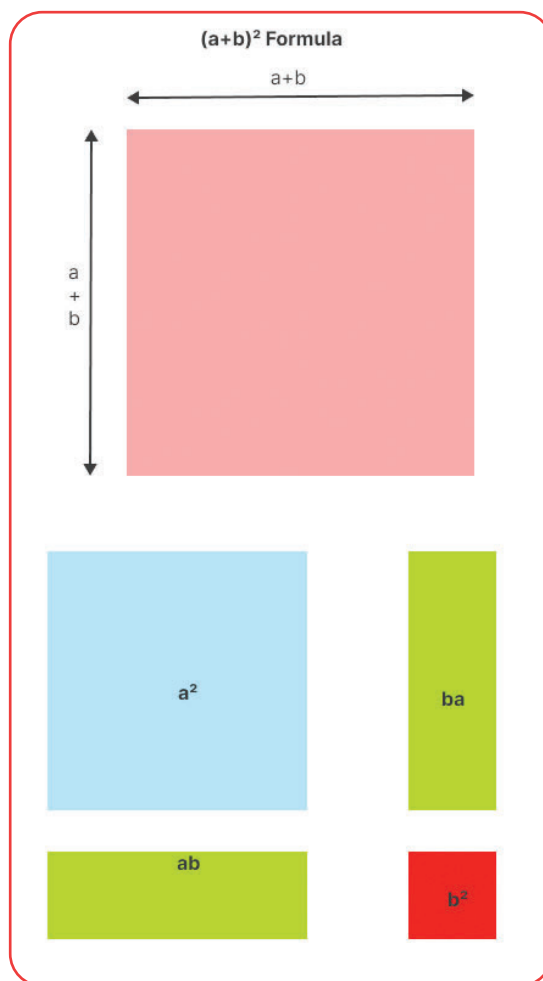
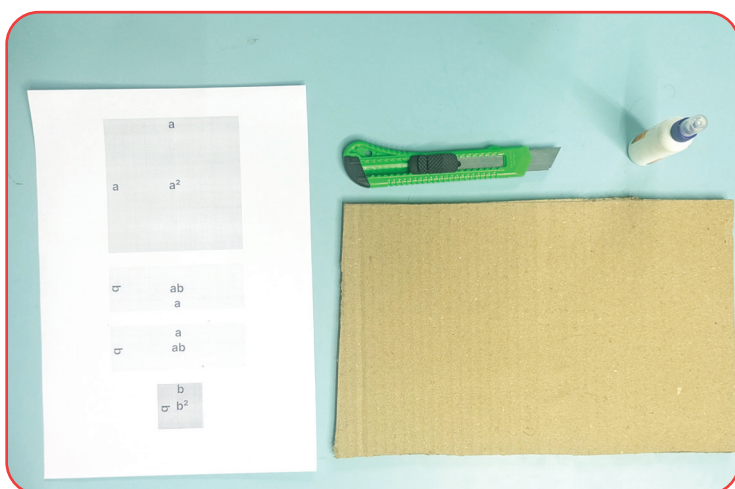
Objectives:

1. Students will learn about algebraic expressions and their relation to geometry.
2. Students will learn formulae and understand their visual representation.

Introduction:

An algebraic formula is a fundamental mathematical rule expressed using algebraic symbols. It is an equation that involves algebraic expressions on both sides. The algebraic formula is a short quick formula to solve complex algebraic calculations.

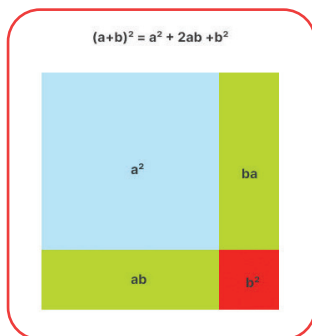
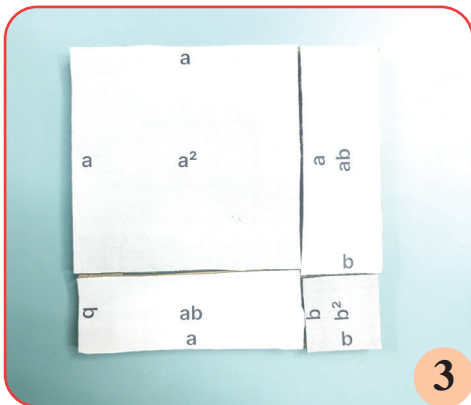
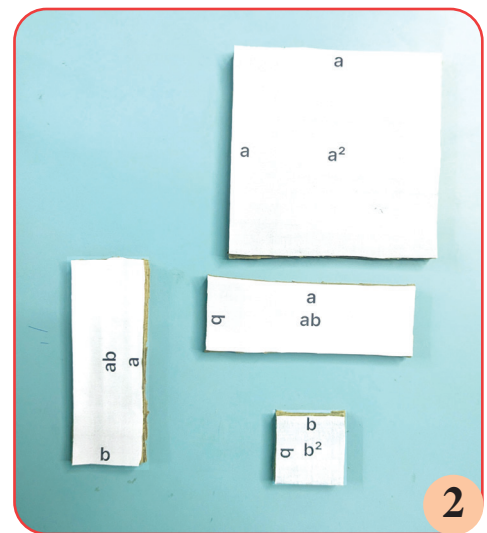
Hands-on activity:



QR Code

1. Scan the QR code and take print of the PDF.

- Paste the PDF on cardboard, and cut the pieces. You will get 4 pieces.



- Once all the pieces are separated, you should be able to move them freely, and place them in different orientations.

- Keeping them in any orientation will show that the total area of the structure is given by the formula

$$(a + b)^2 = a^2 + b^2 + 2ab$$

Teacher Guidelines:

- Help students print, stick and cut the structures.
- Ensure that students stay safe while using the scissors and sharp tools.



Discussion with students:

- What other formulae can you prove using these structures?
- Create more structures and use them to prove formulae.



Resources:

- You can search on Google using the search words -
- Algebraic Formula





Activity Name



48. Angles - Different Types

Syllabus reference:

Standard/Lesson No.: Class 7: Chapter 7 - Drawing angles using compass

Concept/Principle: Learn about different types of angles.

Materials and tools required:

Pin (1 Box), cardboard/softboard, PDF stencil prints, scissors, feviquick

Time required: 30 minutes

Objectives:

1. Students will learn visually, various types of angles.
2. Students will understand the difference between types of angles through hands-on activity.

Introduction:

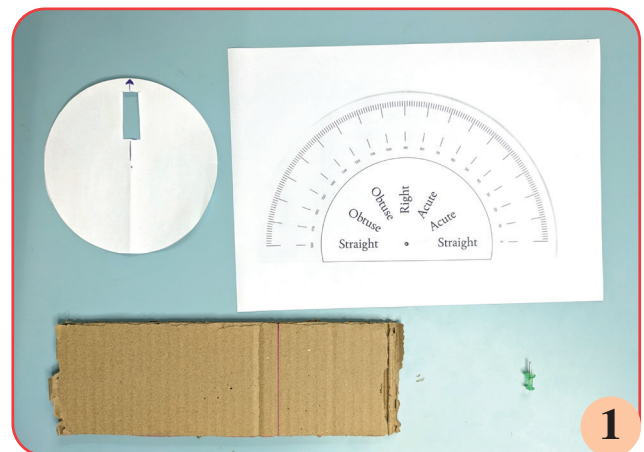
Angles, the fundamental building blocks of geometry. Angles are formed by two rays sharing a common endpoint, known as the vertex. They are measured in degrees, and their classification hinges on the space between the two connecting rays. Acute angles are those which are greater than 0° and less than 90° , while right angles measure exactly 90° . Obtuse angles expand beyond 90° but remain below 180° . Straight angles are precisely 180° , forming a straight line. Again, a reflex angle is greater than 180° and less than 360° .

Hands-on activity:

1. Scan QR code and print the second template.
2. Cut the circle and rectangle as per the given markings.



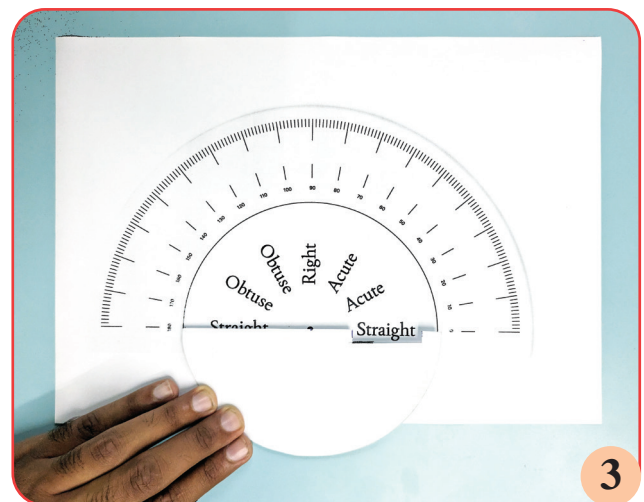
QR Code



1



2



3

3. Stick the rectangle on the cardboard. Take the cut circle, and pin it on the rectangle neatly as shown in the picture, at the black point.
4. You should be able to freely rotate the circle on the protractor.
5. Through the small window of the cut Circle, you can identify various types of angles, like STRAIGHT, ACUTE, RIGHT, OBTUSE, as you rotate the Circle slowly.

Teacher Guidelines:

1. Help students print and cut the stencil.
2. Stay safe while using the scissors.
3. Note that the angles are differentiated keeping Zero degree of the protractor as base.



Discussion with students:

1. What are the different types of angles?
2. What if we keep 180 degrees as base and measure angles from there?



Resources:

You can search on Google using the search words -

1. Types of angles





Activity Name



49. Integers

Syllabus reference:

Standard/Lesson No.: Class 7: Chapter 4 - Addition, Subtraction, Multiplication and Division of Integers

Concept/Principle: Understanding relationship between natural numbers, integers and whole numbers

Materials and tools required:

PDF Template, scissors/cutter

Time required: 30 minutes

Objectives:

1. Students will experience hands- on mathematics.
2. Students will explore mathematical ideas on their own and understand the relationships.

Introduction:

An integer is a number with no decimal or fractional part and it includes negative and positive numbers, including zero.

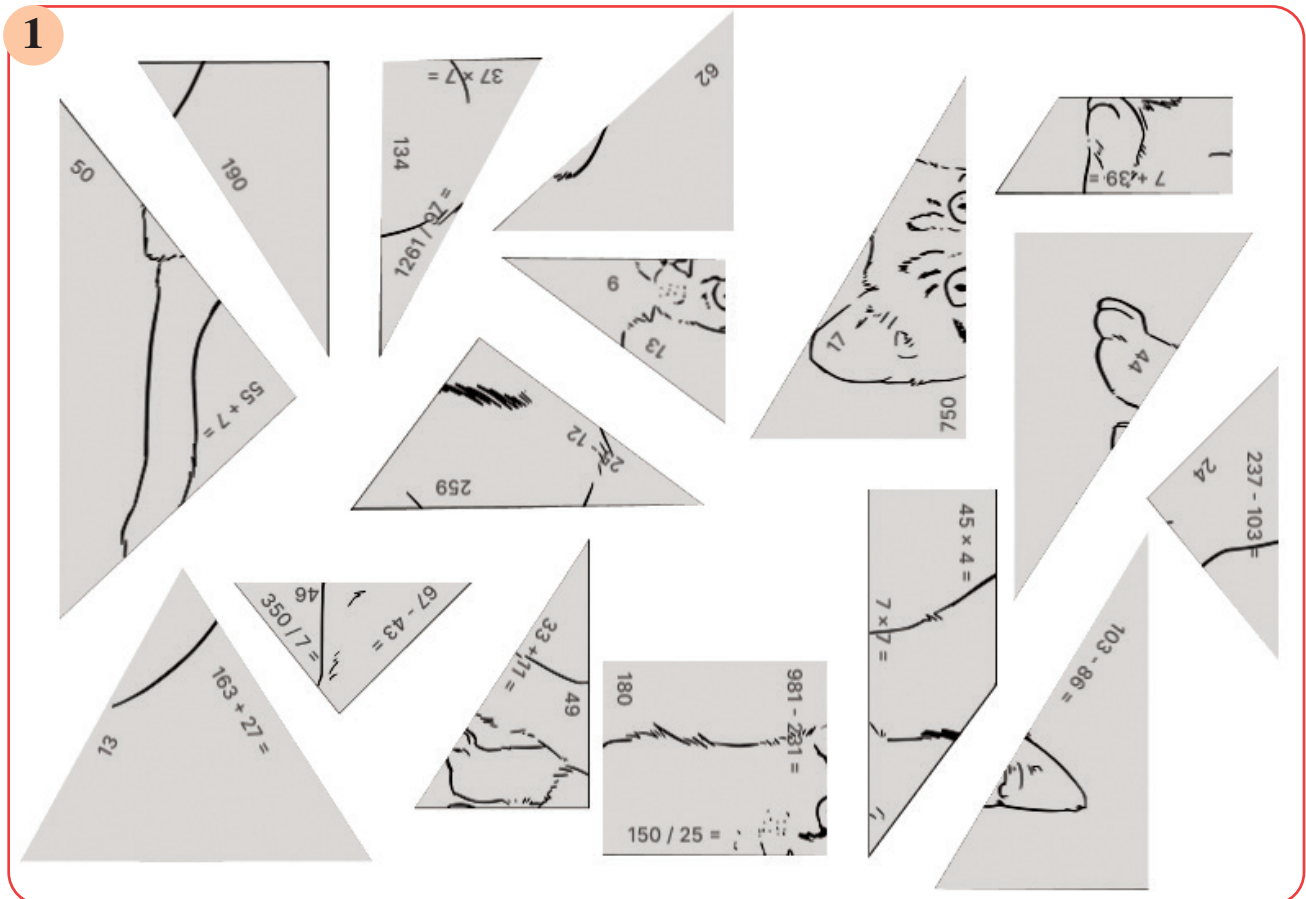
We can perform basic operations on integers like addition, subtraction, division, multiplication, etc.

Hands-on activity:

1. Scan the QR code and take a print of the PDF you receive, which is an A4 stencil.
2. Cut all the pieces given in the sheet carefully using a scissor, there are a total of 16 pieces in the sheet.
3. Each piece has either one or multiple expressions on it; these



QR Code

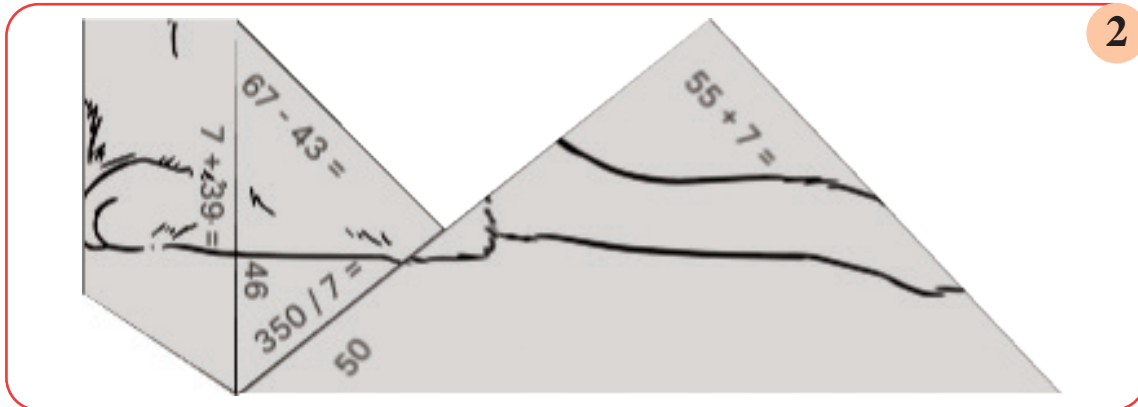


expressions involve either basic sums like ' $45 + 5 =$ ', or integers like ' 24 ', ' 44 ', which are answers to one of the sums on one of the pieces.

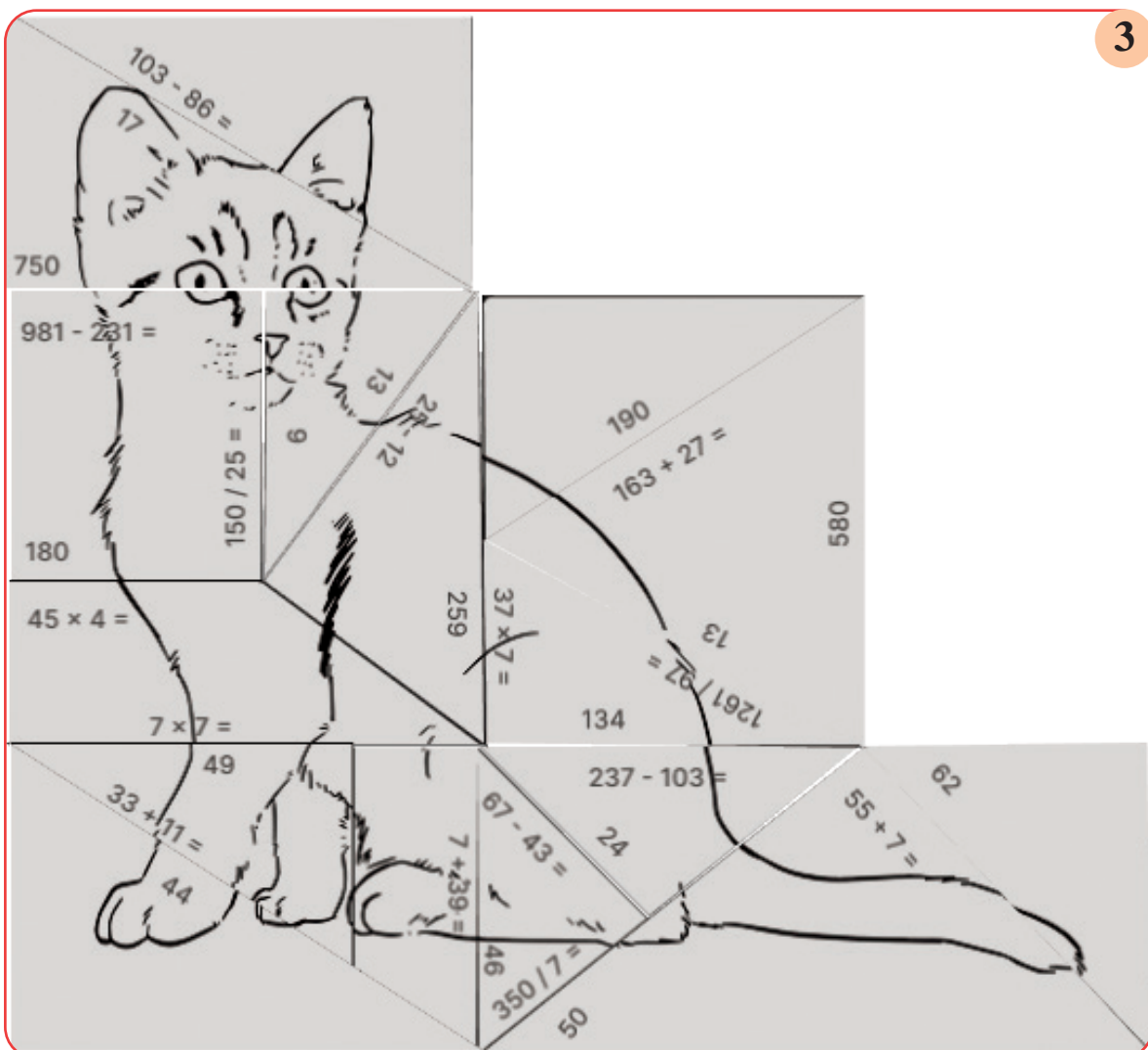
4. Match the pieces based on which piece contains the answer to the expression

given on the piece.

- Like if a piece has the expression ' $7 + 39 =$ ' on one of its sides, then you need to calculate $7 + 39$ orally or on a piece of paper, then find a piece which has the answer to this expression, which is 46, and match the sides together.
- Similarly, find solutions to all the calculations given in the sheet and match the



respective pairs. The final structure will be of a complete image.



Teacher Guidelines:

1. Help students print, and cut the shapes.
2. Help students solve questions and match pieces.



Discussion with students:

1. Where do you use basic mathematics in your day-to-day life?
2. Importance of integers, mental mathematics.



Resources:

You can search on Google using the search words - Integers





Activity Name



50. Congruency of Triangles

Syllabus reference:

Standard/Lesson No.: Class 7: Chapter 9 — Concept of Congruency

Concept/Principle: Conditions for congruence of triangles

Materials and tools required:

PDF Template, cardboard, glue, nut-bolt, scissors/cutter

Time required: 30 minutes

Objectives:

1. Students will make sense of the properties of triangles by engaging in visual and hands-on exploration.

Introduction:

Two triangles are said to be congruent if all three corresponding sides and all three corresponding angles are equal in measure. These triangles look identical even if slid, rotated, flipped and turned.

Conditions for Congruence of Triangles:

1. SSS (Side-Side-Side)
2. SAS (Side-Angle-Side)
3. ASA (Angle-Side-Angle)/AAS (Angle-Angle-Side)
4. RHS (Right Angle-Hypotenuse-Side)

In this activity, students will make a model for proving triangle congruency using different conditions of congruency.

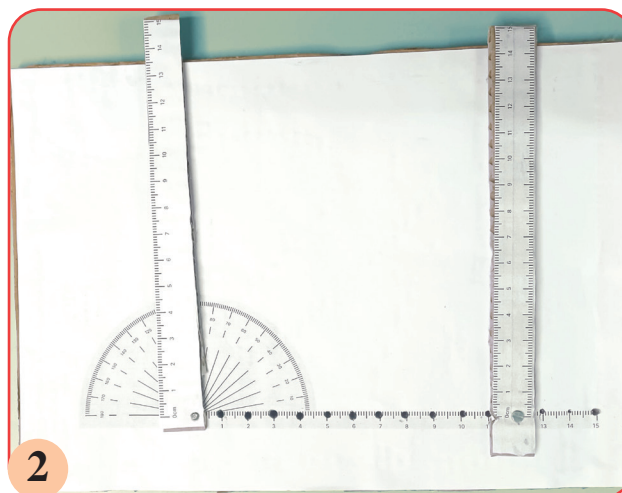
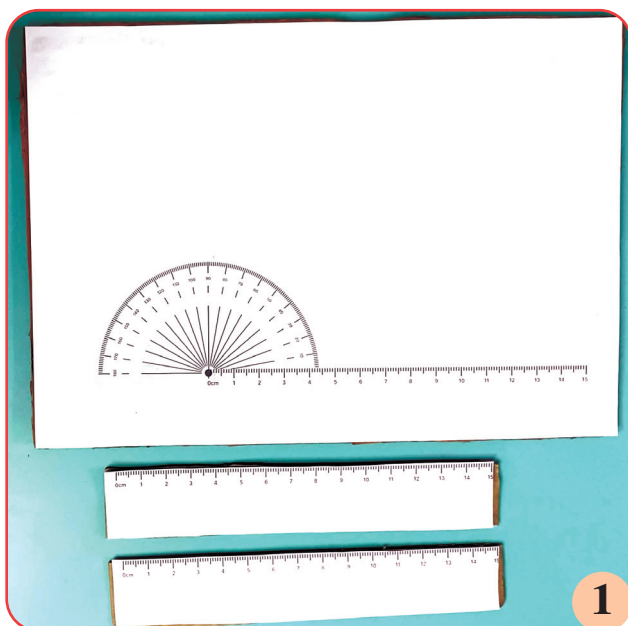
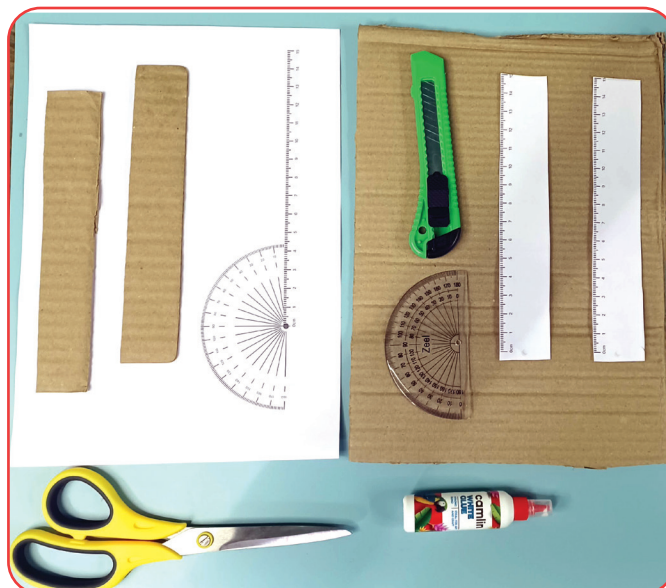
Hands-on activity:

Scan the QR code 1 for templates and print them on paper.

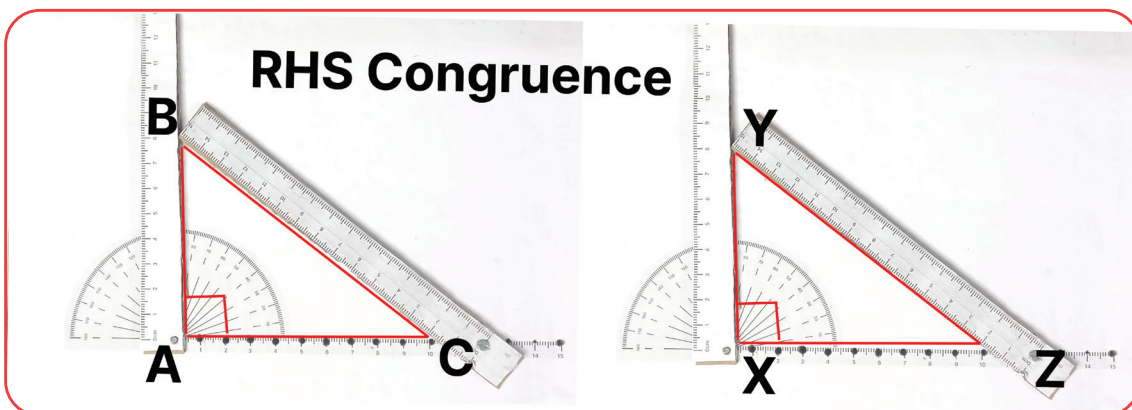
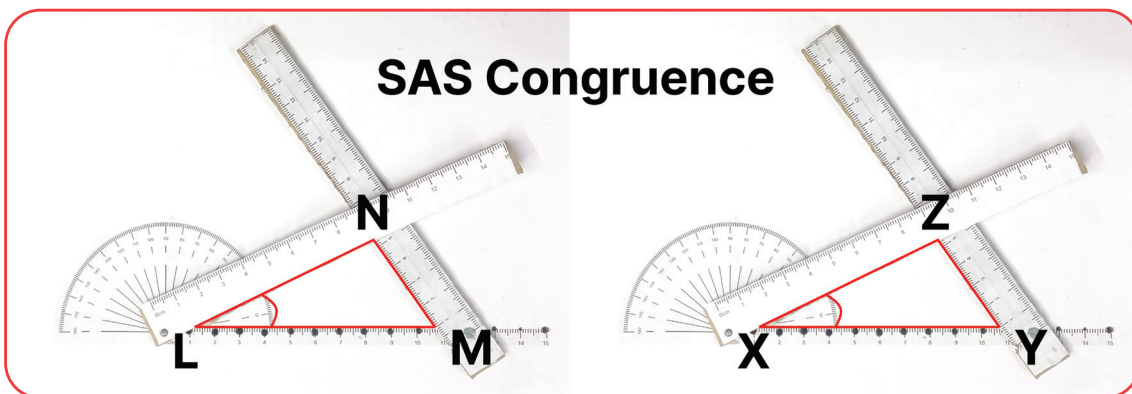
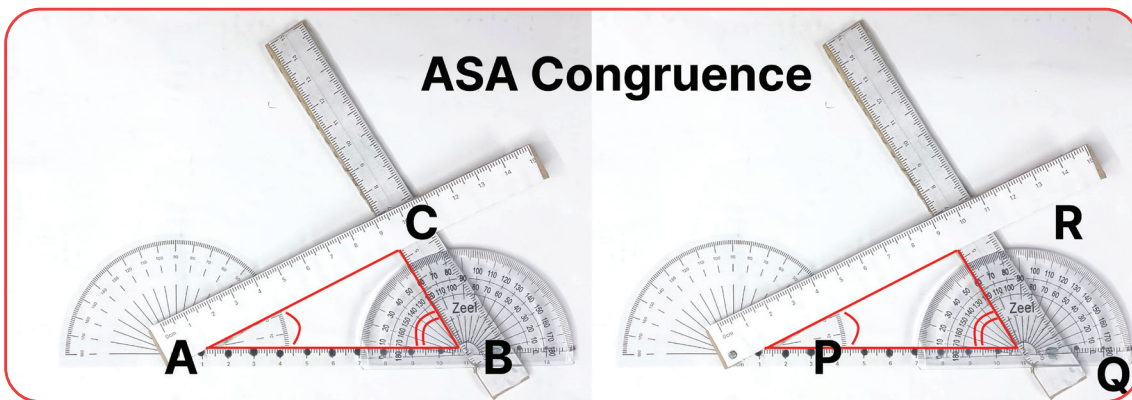
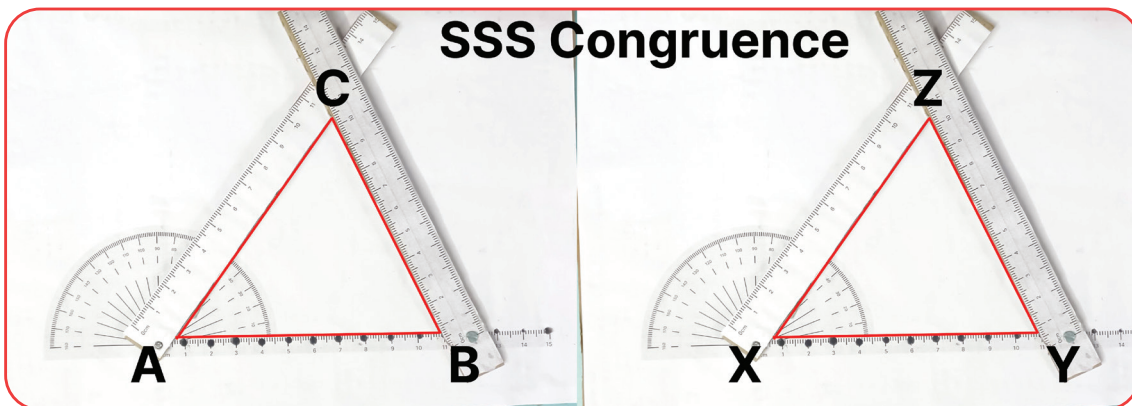
1. Take all the material as shown in the picture.
2. Take sheet 1 and stick it on the cardboard.



QR Code



3. Make 15 holes on sheet 2 (using protractor with scale) at 1cm distance. Fix the two scales with the help of nut-bolt as shown in the picture below.
4. By making two such models, students can understand congruency.



Measure the corresponding sides and angles of triangles ABC and XYZ to prove that they are equal.

Observation table:

Congruency type	Side	Side - cm	Angle	Angle in degree
SSS				
SAS				
ASA				
RHS				

Teacher Guidelines:

1. Help students print and cut the shapes.
2. Help students solve questions and match pieces.



Discussion with students:

1. Two triangles have the same base and height. Are they congruent?
Why or why not?
2. You see two triangular windows of the same shape and size. How can you prove they are congruent?



Resources:

You can search on Google using the search words –

1. Congruency of triangles + YouTube





Activity Name



51. Triangles – Properties & Types – Part 1

Syllabus reference:

Standard/Lesson No.: Class 7: Chapter 14 - Properties of Triangle

Concept/Principle: Study types and properties of different types of triangles.

Materials and tools required:

PDF Stencil, scissors/cutter, nut and bolts

Time required: 30 minutes

Objectives:

1. Students will learn different types of triangles.
2. Students will study properties of these triangles.

Introduction:

A triangle is a polygon with three sides, three angles, and three vertices, one of the basic shapes in geometry. The corners, also called vertices, are zero-dimensional points, while the sides connecting them, also called edges, are one-dimensional line segments.

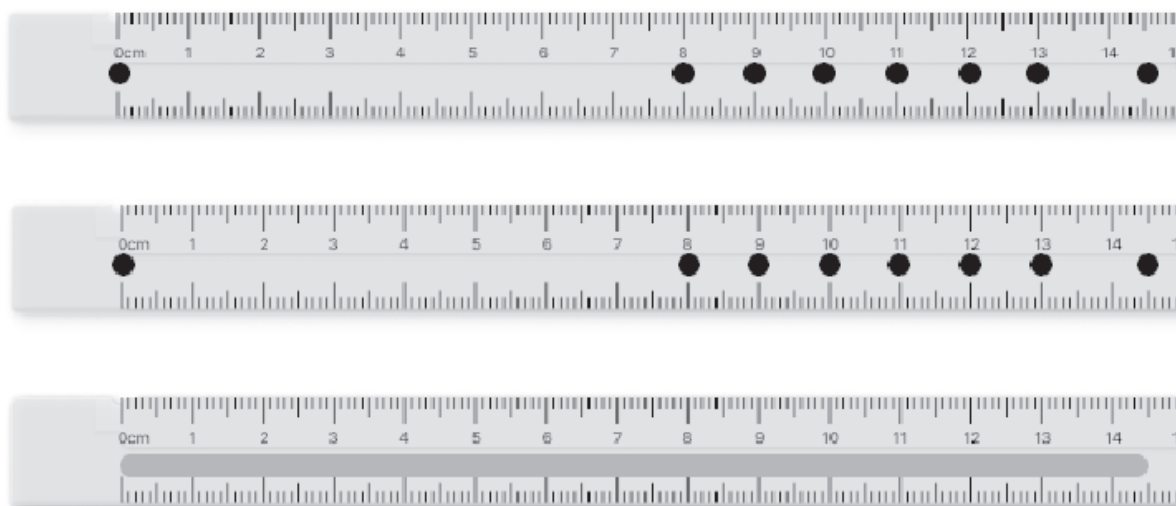
Types of triangles include ISOCELES, SCALENE, RIGHT-ANGLED TRIANGLE, EQUILATERAL TRIANGLE, ACUTE ANGLED TRIANGLE and OBTUSE ANGLED TRIANGLE.

Hands-on activity:

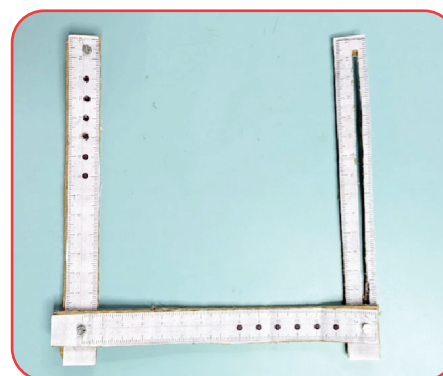
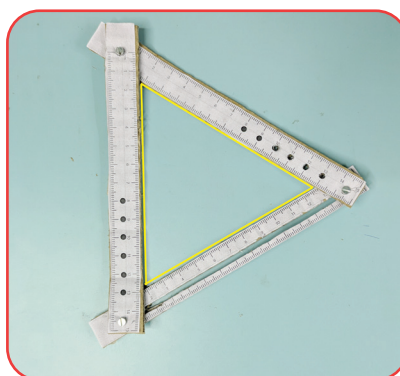
1. Print the PDF stencil that you get by scanning the QR Code.
2. Cut the given Scales or Rulers, 3 (three) in number. You need to cut the slit and holes, which have been darkened in the scales. Use a cutter/scissor to neatly make holes at the correct locations and the slit, clearly marked on only one Scale / Ruler.

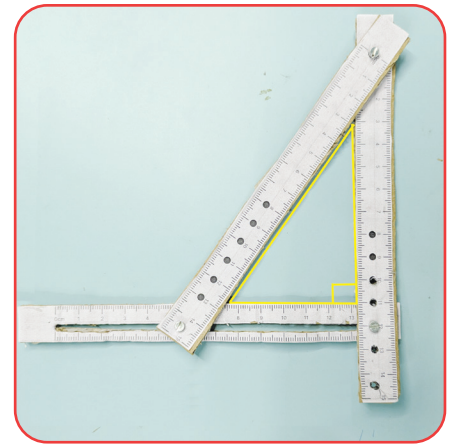
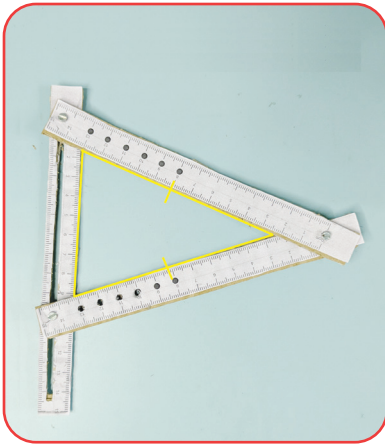


QR Code



3. You should now have 3 separate Scales or Rulers, which can be used to make different types of triangles.





4. Start with an EQUILATERAL TRIANGLE, which can be made by attaching bolts to all the end holes and ends of the slit.
5. Next, we can close the ends in the slip, thus keeping 2 lengths the same, while reducing the length of one side, giving us an ISOSCELES TRIANGLE.
6. For the next triangle, remove the bolt from one end of one of the scales and place it in a closer hole. You can now place this bolt in the slit and slide it somewhere in the center of the slit. This will give 3 sides, all of different lengths, making a SCALENE TRIANGLE.
7. Finally, you can make a RIGHT- ANGLED TRIANGLE by placing the scale with the bolt closer to end perpendicular to the scale with the slit.

Teacher Guidelines:

1. Help students print and cut the structures.
2. Show them different structures and their properties.



Discussion with students:

1. What are the different types of triangles?
2. Find different types of triangles in your surroundings.



Resources:

1. You can search on Google using the search words - Types of Triangles.





Activity Name



51. Triangles – Properties & Types – Part 2

Syllabus reference:

Standard/Lesson No.: Class 8: Chapter 6 - Complementary Angles,
Supplementary Angles and Adjacent Angles

Concept/Principle: Study types and properties of different types of triangles.

Materials and tools required:

PDF Stencil, scissors/cutter, nut and bolts

Time required: 30 minutes

Objectives:

1. Students will learn the relationships between the different angles of a triangle.
2. Students will study and understand the properties of triangles.

Introduction:

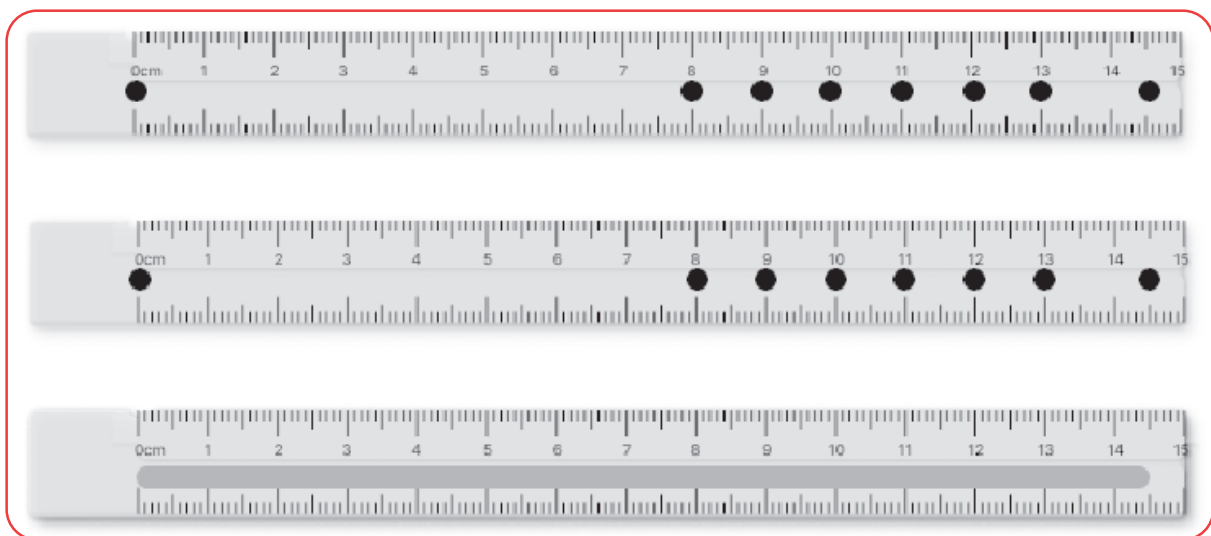
A triangle is a polygon with three sides, three angles, and three vertices, one of the basic shapes in geometry. The sum of the three angles of a triangle is 180 degree. Other than these, if we extend the line segments of each side, triangles create exterior angles, opposite angles, etc., which can be used to understand properties of triangles more clearly.



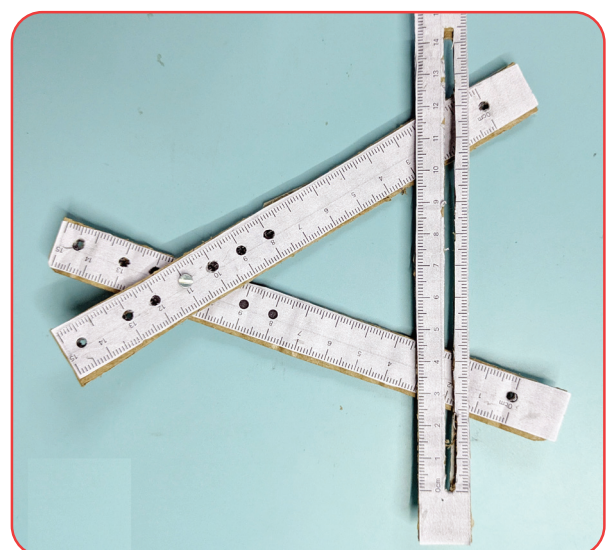
Hands-on activity:

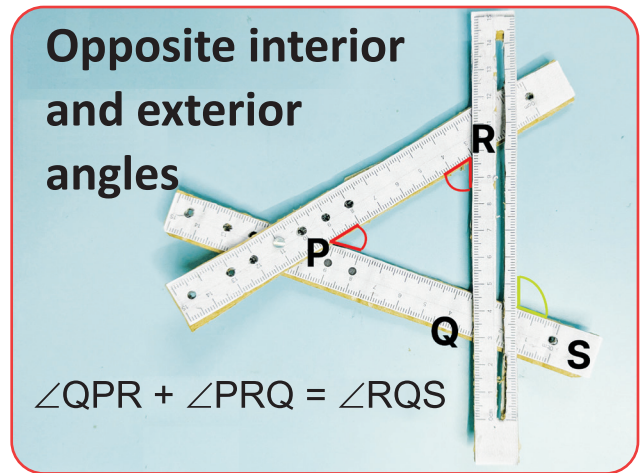
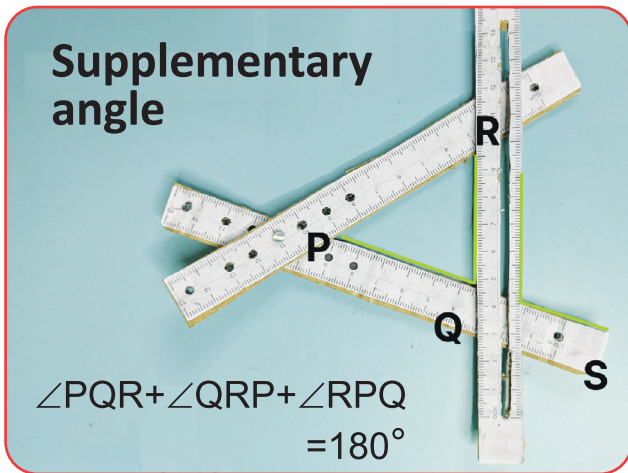
1. Use the cutouts you made for the previous part of this activity and print the PDF worksheet attached.
2. Place them using bolts in such a way that line segments extend across each other.

QR Code

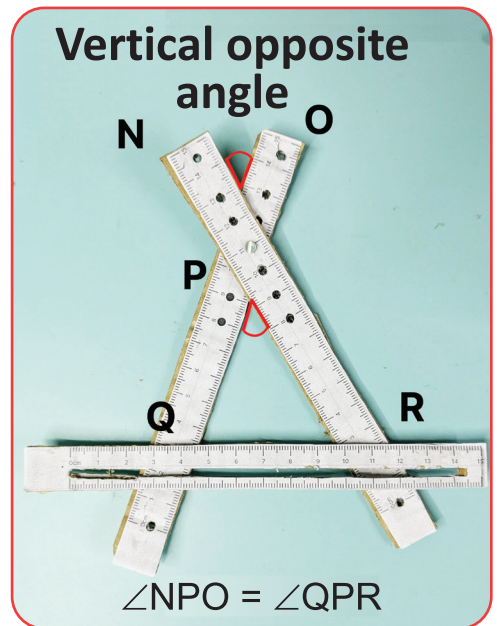


3. Students can name the ends of line segments and vertices of triangle on their own and fill the worksheet stencil attached.



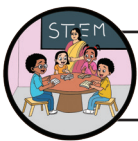


- Students can observe properties like ADJACENT ANGLES that are SUPPLEMENTARY.
- Students can note the sum of any pair of INTERIOR ANGLES and check whether the opposite EXTERIOR ANGLES are of the same measure.
- Students can note any INTERIOR ANGLE and check if its VERTICALLY OPPOSITE ANGLE is of the same measure.
- Ask students to note their observations and fill the worksheet based on that.



Teacher Guidelines:

- Help students print and cut the structures.
- Encourage students to share their observations.



Discussion with students:

- What is the difference between adjacent angles and opposite angles?
- Which types of angles did you see in this activity?



Resources:

You can search on Google using the search words - Properties of Triangles





Activity Name



52. Parallel Lines - Properties

Syllabus reference:

Standard/Lesson No.: Class 7: Chapters 20–21 — Concept of Parallel Lines and Transversal

Concept/Principle: Study types and properties of parallel lines.

Materials and tools required:

PDF stencil, scissors/cutter,
pencil/pen, protractor

Time required: 30 minutes

Objectives:

1. Students will learn what makes lines parallel.
2. Students will understand different properties of parallel lines.

Introduction:

Parallel straight lines are lines that never intersect because they are always the same distance apart.

When lines are parallel, they create many more interesting properties, like:

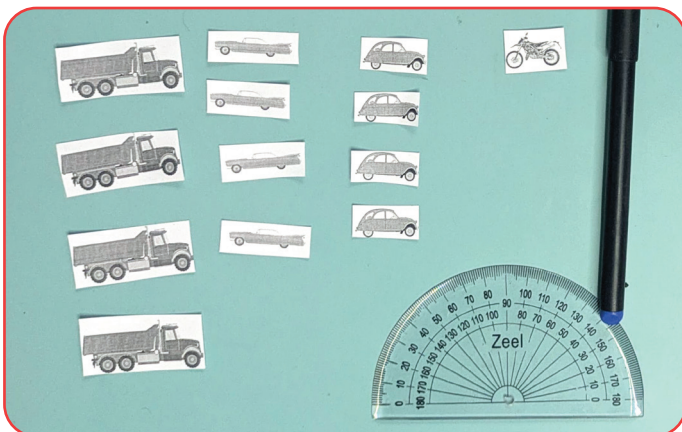
- A transversal line intersects two parallel lines and forms four pairs of identical angles.
- A transversal makes supplementary interior angles on the same side.
- A transversal makes equal corresponding angles and
- A transversal makes equal alternate interior angles.
- The slope of any two parallel lines is always the same.

Hands-on activity:

1. Use the two A4 stencils (Sheet 2 and 4) and print them.



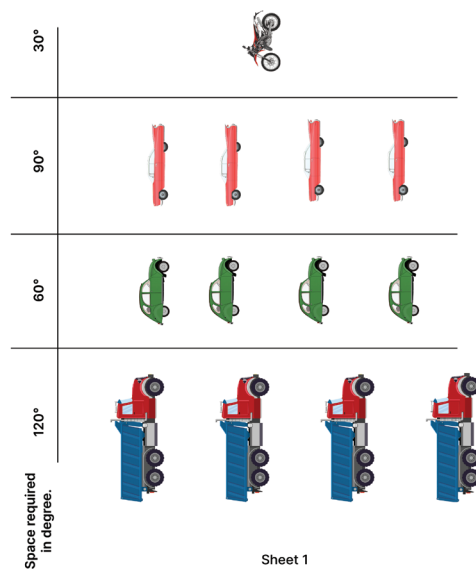
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Sheet 1

Parking Space	Angle
A	_____
B	_____
C	_____
D	_____
E	_____
F	_____
G	_____
H	_____
I	_____
J/K/L/M	_____

In the parking diagram on the sheet 2, lines ___ & ___ are parallel.
 Line 'x' acts as a transversal, making 8 angles on the parallel lines.
 Line ___ intersects line 'z' perpendicularly.
 Angles in spaces E & D as well as ___ & C are supplementary.
 Pairs of corresponding equal angles are 'H-D', 'A-___', 'F-___', '___-___'.
 Lines x and w are not parallel because H & ___ alternate interior angles are not equal; while lines y & z are parallel because their alternate interior angles F and D are equal.



- Cut the vehicles from Sheet 1.
- Use a protractor to measure angles between lines and write them in the worksheet given in Sheet 2.
- Students can then fill in the relation of lines they observe in the top left corner of Sheet 2, example: line x is the transversal.
- Students need to place the vehicles in the appropriate parking places based on the angle they measured of spaces between lines and the angle required by the vehicles. For example,

Sheet 2

line/s	
parallel lines	
transversal	
perpendicular to line z	

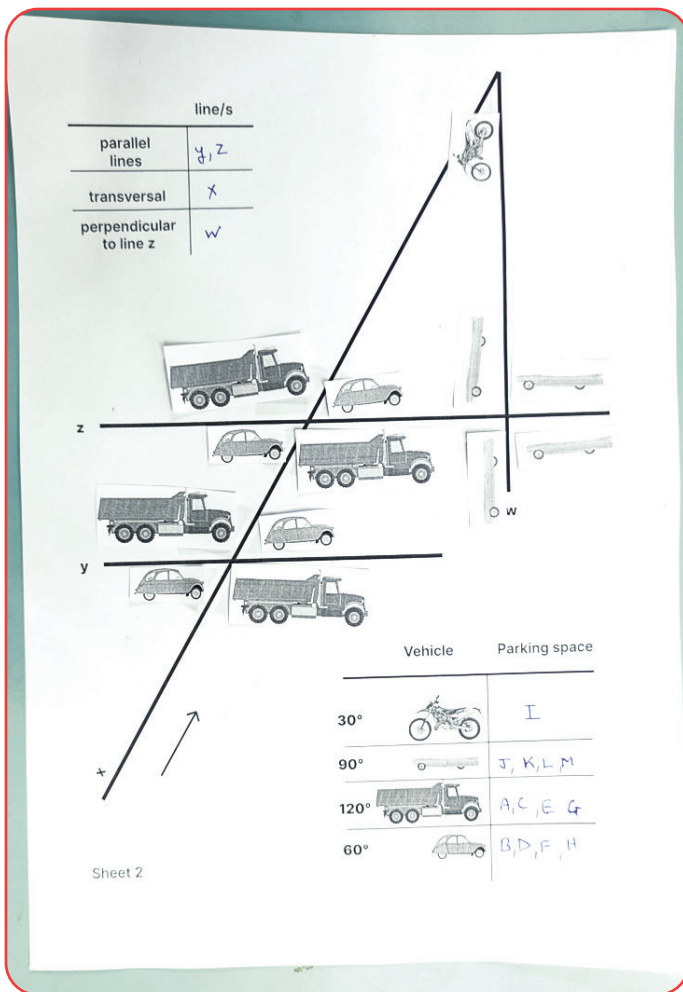
Vehicle	Parking space
30°	
90°	
120°	
60°	

line/s	
parallel lines	y, z
transversal	x
perpendicular to line z	w

angle B is 60° , and a small car requires 60° for parking, then they should place one small car in space B. Similarly, do so for other parking spaces. There are 4 kinds of vehicles. Note that vehicles can be placed vertically as well as horizontally.

- They should fill the parking space where the vehicles are placed, in the bottom right corner of Sheet 2.

Parking Space	Angle
A	120°
B	60°
C	120°
D	60°
E	120°
F	60°
G	120°
H	60°
I	30°
J/K/L/M	90°

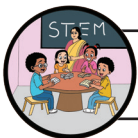


7. Finally, students can fill the worksheet, on Sheet 1, based on their observations and properties of parallel lines.

In the parking diagram on the sheet 2, lines y & z are parallel.
 Line x acts as a transversal, making 8 angles on the parallel lines.
 Line w intersects line z perpendicularly.
 Angles in spaces E & D as well as \underline{E} & C are supplementary.
 Pairs of corresponding equal angles are 'H-D', 'A-E', 'F-B', 'C-G'.
 Lines x and w are not parallel because H & L alternate interior angles are not equal; while lines y & z are parallel because their alternate interior angles F and D are equal.

Teacher Guidelines:

Help students print and cut the structures.



Discussion with students:

1. Explore properties of shape where 2 sets of parallel lines intersect each other. Something like a parallelogram, or rhombus with extended line segments.
2. Explore real world application and use of parallel lines, like parking lots, windows, etc.



Resources:

You can search on Google using the search words -

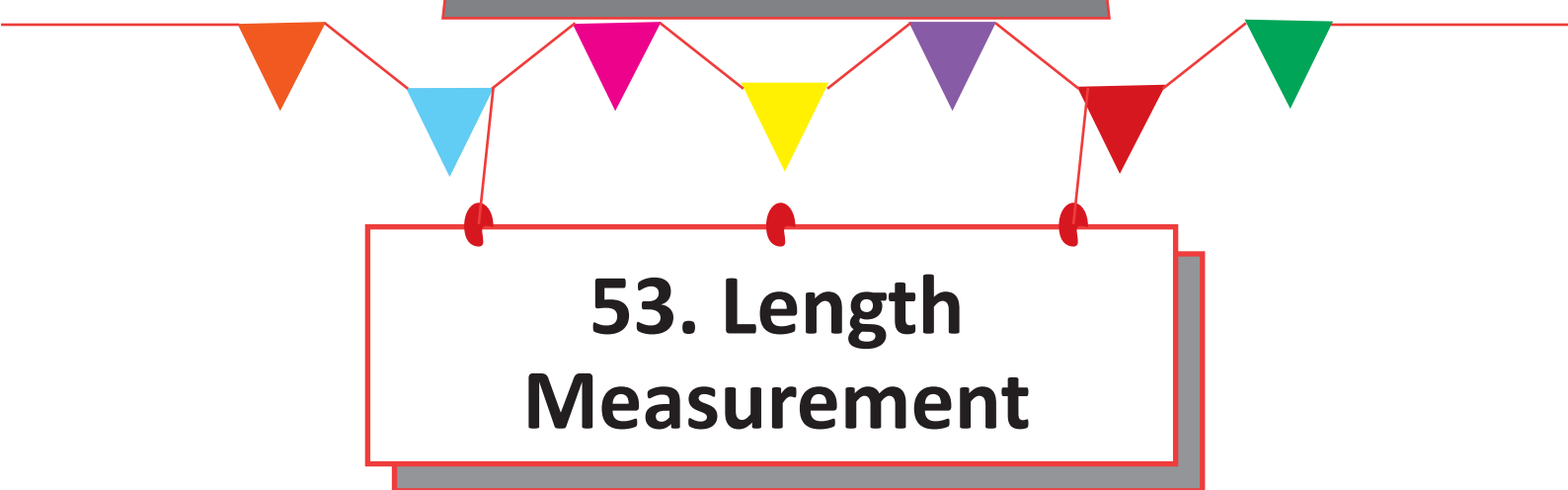
1. Parallel lines and their properties.



Engineering



Activity Name



53. Length Measurement

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 5 - Measurement

Concept/Principle: Measurement requirements and Units of Measurement in daily life, Length measurement

Materials and tools required:

Pen, paper, meter tape, 15 cm and 30 cm scale, rope

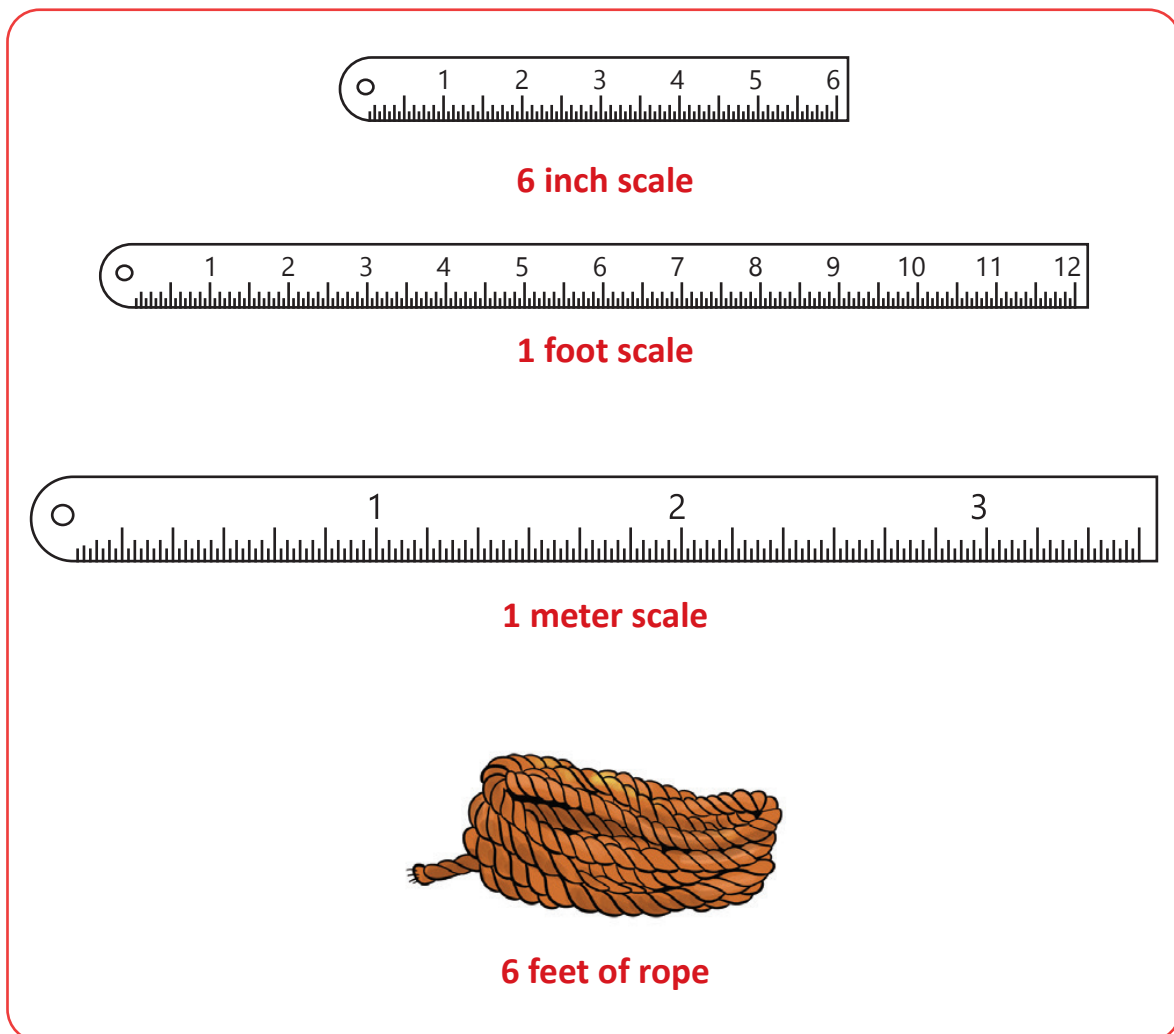
Time required: 60 minutes

Objectives:

- Students will learn to select appropriate tools for measuring length.
- Students will understand how to measure, record, and compare classroom dimensions using different measuring tools.

Introduction:

- We measure many things in our daily lives. In earlier times, things were measured by using body parts like feet, handbreadths, arm-length, etc. However, these methods were not very accurate because the size of body parts differs from person to person. This highlighted the need for standard measurement practices.
- The method of measurement chosen depends on the level of accuracy required. Every measuring tool has a limit to how finely it can measure. This



smallest unit that can be accurately measured using a tool is called its “least count.” For example, the least count of a standard 15 cm scale is 1 millimetre, while a measuring tape commonly has a least count of 5 millimetres.

- Different tools are suitable for different measurement tasks, depending on the level of accuracy needed and the time available.
- See the diagram of various scales you will be using.

Hands-on activity:

1. Make 4 groups of 5 students each and ask them to measure the length and width of the classroom.
2. All groups will measure the length and width of the classroom.
 - Group 1: Use 15 cm scale
 - Group 2: Use 30 cm scale
 - Group 3: Use meter scale
 - Group 4: Use long rope

Observation and recording:

Give 30 minutes to every group to complete the task and note down the readings in the table shared below.

Group	Scale used	Length	Width	Time required to measure
1	6-inch scale			
2	12-inch scale			
3	Meter scale			
4	Rope			

Teacher Guidelines:

1. Make sure that students are taking end-to-end measurements and avoid common measurement errors, such as zero error, parallax error, etc. (search for these on the internet).



Discussion with students:

1. How can you reduce errors from the readings that you have taken?
2. What are the advantages and disadvantages of each method?

3. Is the rope convenient to measure large distances? Can we always measure with the rope to reduce the overall time required to measure the distance?
4. Can you measure the curved path by using any of these tools? Which measuring tool is best for measuring a curved path?



Resources:

You can search on Google with the search words –

▣▣▣▣ Measurement tools and their usage





Activity Name



54. Simple Machine

Syllabus reference:

Standard/ Lesson No.: Class 6: Chapter 6 - Basic concept of Force and Energy & Chapter 9 - General Machines

Concept / Principle: Simple machines and their types – lever, wheel & axle

Materials and tools required:

Cardboard, paper, ice-cream sticks, plastic spoon, trash like plastic bottles and their caps, rubber bands, glue/cellotape /duct tape, scissors, scale, cutter

Time required: 90 minutes

Objectives:

1. Students will make scientific toys to explore the principles of simple machines.
2. Students will understand about various simple machines and their working.
3. Students will be able to identify/recognize simple machines in everyday objects/ life (objects, tools, machinery).

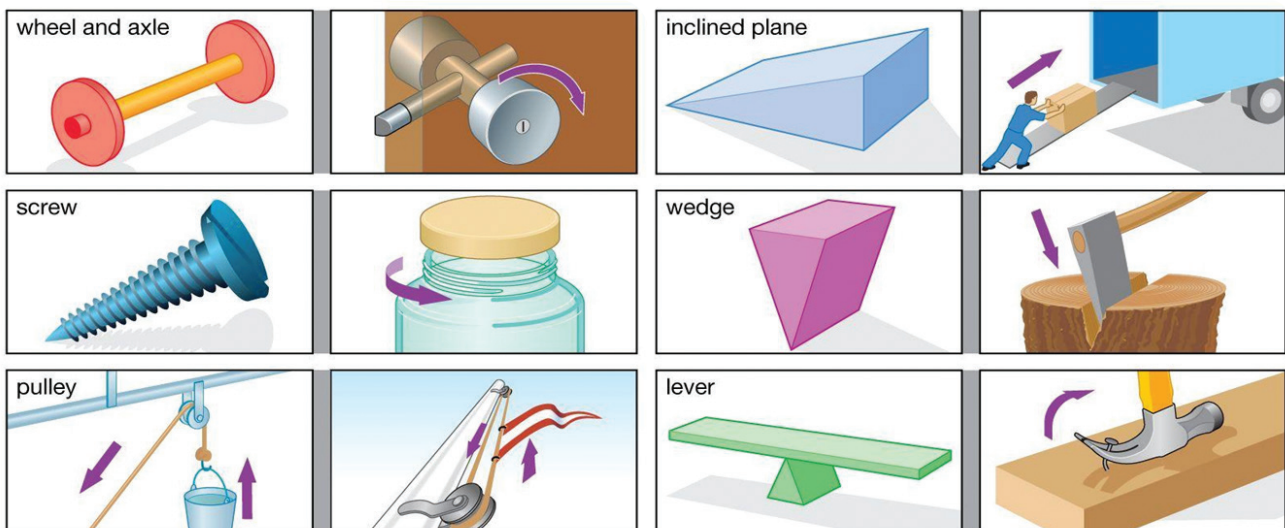
Introduction:

Simple machines are basic devices that make work easier by changing the direction or amount of force needed to do a task. They have very few or no moving parts but are used in many tools and objects around us.

Some common types of simple machines are:

- ➡ Lever
- ➡ Wheel and axle
- ➡ Pulley
- ➡ Inclined plane
- ➡ Wedge
- ➡ Screw

For example, a lever is a bar that turns around (pivots) a fixed point called a fulcrum and helps us lift or move loads with less effort.



Hands-on activity:

Students will make different scientific toys out of easily available material.

Below are some examples of simple machines that can be made:

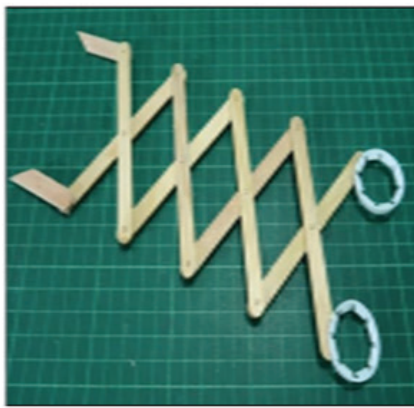
1. Catapult
2. Lazy tongs, or Robotic arm
3. Balloon car

1. Catapult:

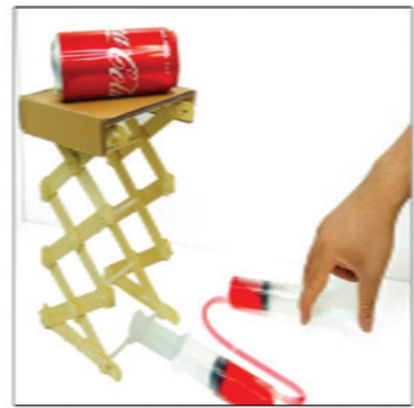
- ➔ A catapult uses the power of stored energy in a stretched material to launch things into the air.
- ➔ It's like pulling back a rubber band on a larger scale to make things bounce at some distance.



Catapult



Robotic arm scissors



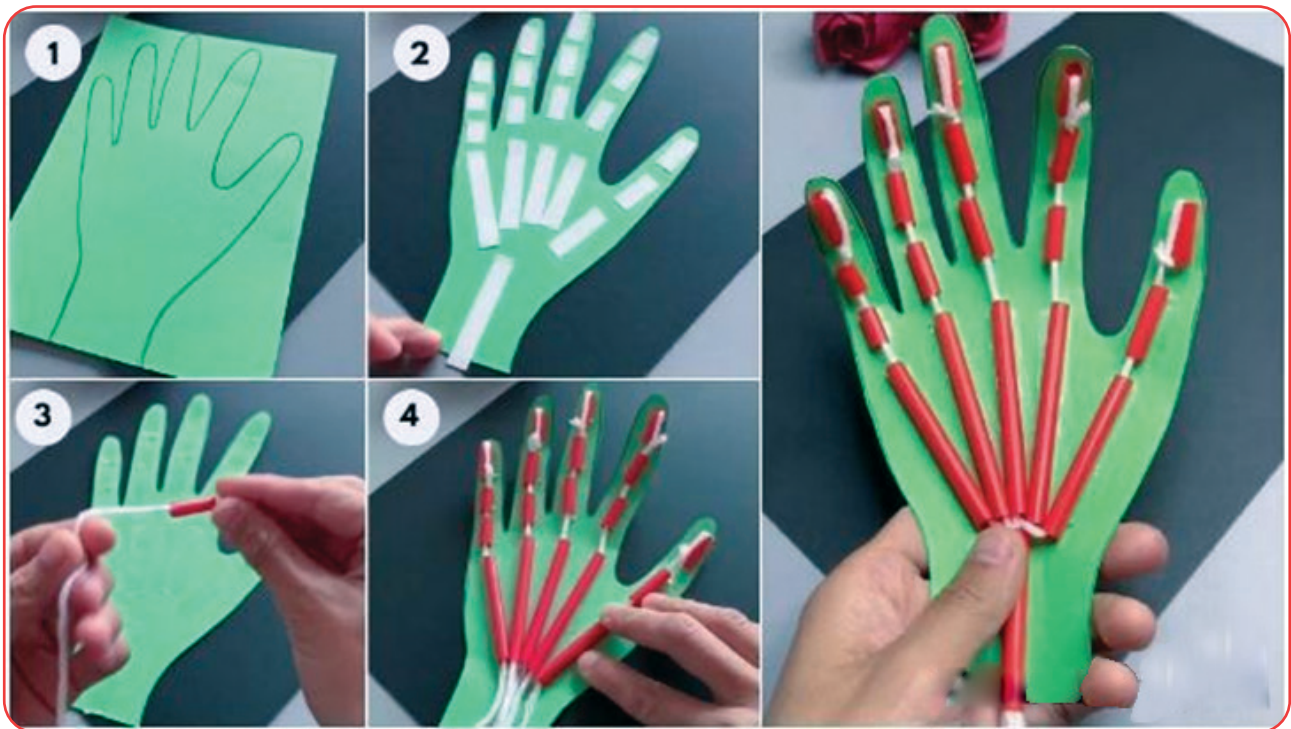
Hydraulic lifting jack

A. Steps to make a catapult:

1. Stack 5 ice cream sticks together and secure both ends tightly with rubber bands.
2. Take 2 additional sticks and bind them together at one end with a rubber band, forming a V-shape.
3. Insert the stack of 5 sticks between V shaped sticks, positioning it close to the bound end.
4. Secure the plastic spoon to the free end of the top stick in the V-shape using a rubber band, ensuring the spoon's bowl faces upward.
5. Place a small paper ball in the spoon. Hold the base steady, push the spoon downward, and release to launch.

B. Robotic arm or lazy tongs

1. A lazy tong uses a combination of bending sections and pulling cables to help reach and grab things without having to stretch or bend too much.
2. Lever: Robotic arm can rotate freely around the fulcrum



Steps to create:

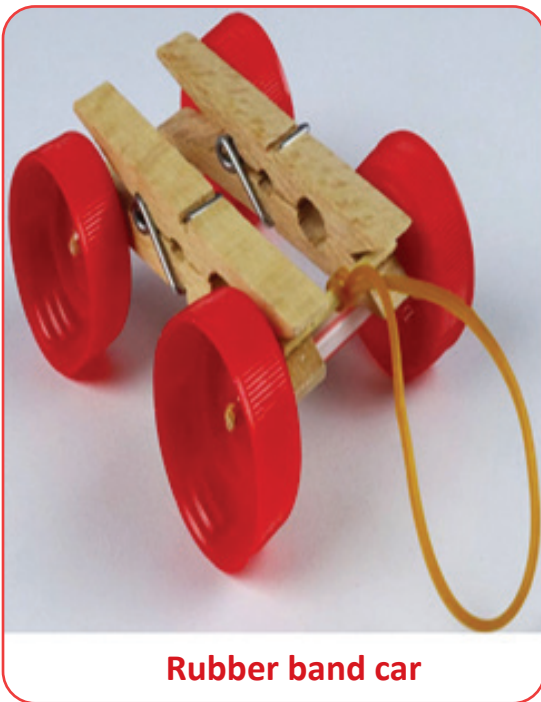
1. Trace your hand on a piece of paper or cardboard and cut it out.
2. Draw lines on each finger to mark the joints and fold the fingers along the lines.
3. Cut plastic straws into small pieces and glue them onto the finger segments, leaving gaps at the joints.
4. Thread a string through the straw pieces on each finger and secure the end at the fingertip.
5. Gather all the strings at the base of the hand and thread them through another straw piece to organize them.
6. Pull the strings to move the fingers and make the robotic hand work.



Air balloon car

C. Balloon car:

1. A balloon car is a vehicle that uses the simple machine “wheel and axle” to reduce friction and allow motion. As air flows out of the balloon, its energy is converted into kinetic energy, the energy of motion



Rubber band car



Steps to Make a Plastic Bottle Balloon Car:

1. Take an empty plastic bottle and place it horizontally.
2. Stick two straws below the bottle—one in front and one at the back.
3. Insert wooden skewers through both straws to make axles.
4. Make holes in four bottle caps and fix them onto the ends of the skewers to form wheels.
5. Insert a straw into a balloon and tape tightly so that there are no air leaks.

6. Fix this balloon–straw assembly on top of the bottle, pointing the straw towards the back.
7. Blow air into the balloon through the straw and pinch the straw end.
8. Place the car on a smooth surface and release the straw.
9. The air coming out of the balloon pushes the car forward.

Teacher Guidelines:

1. Divide the class into 6 or 8 groups, each having not more than 4 students.
2. Make sure students will use scissors or cutters under your supervision.
3. Supervise students when they are using glue guns.



Discussion with students:

1. What new things did you learn about simple machines through this project?
2. Which simple machine did you find the most interesting? Why?
3. How would you improve the toys you created?
4. What real-life examples can you think of that use the simple machines we learned about today?
5. What was your favorite part of the activity and why?
6. Did you find any challenges while making your toys? How did you overcome them?



Resources:

You can search on Google using the search words –

1. How to make catapult
2. How to make a Simple Robotic Arm
3. How to make a Robotic Scissor Arm from Popsicle Sticks
4. How to make a balloon car





Activity Name



55. Bicycle and Its Maintenance

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 6 - Basic Concept of Force and Energy, Chapter 9 - General Machines; Class 7: Chapter 2 - Time and Motion

Concept / Principle: Concept of Force and its Unit, Effect of Force, Concept of Energy, Energy Conversion, Frictional forces in everyday life, &, Concept of Machine, Maintenance of Machines, Concept of Motion, Inertia in our daily life, Power and Work

Materials and tools required:

Bicycle, machine oil, oil can, cloth piece, screw, spanners, nut bolts, cycle pump, gloves

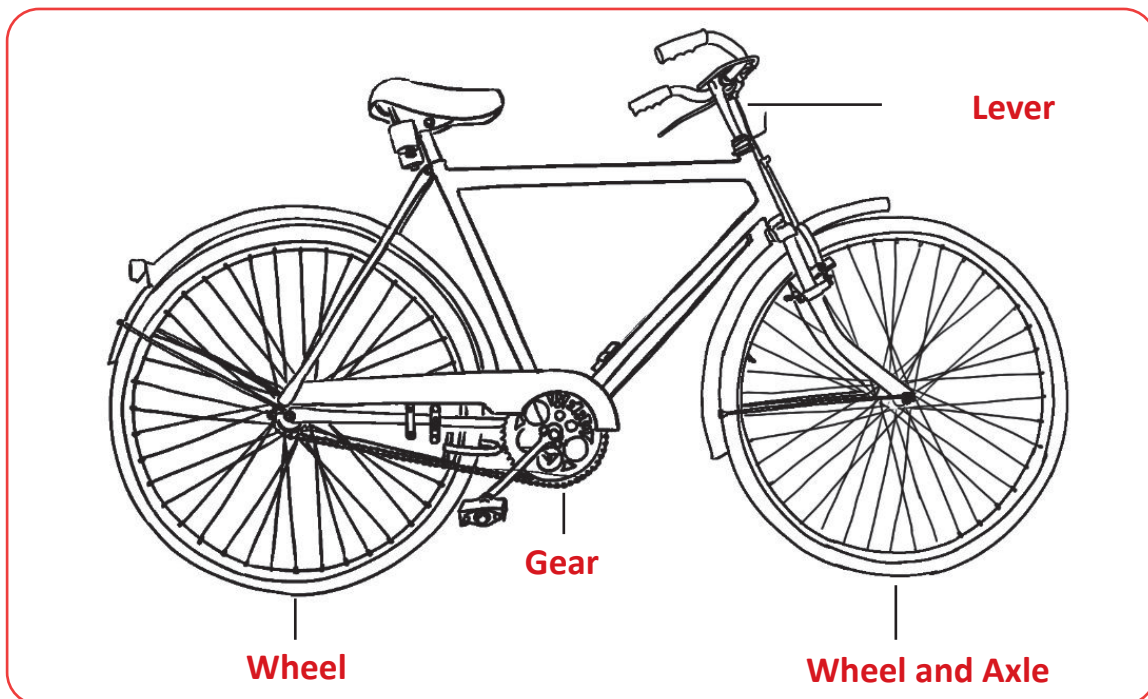
Time required: 60 minutes

Objective:

1. Students will understand basic bicycle mechanics as a compound machine (machine made from two or more simple machines)
2. Students will learn regular bicycle maintenance tasks like checking tire pressure, chain lubrication, and brake adjustment.
3. Students will develop skills to troubleshoot common bicycle issues independently.

Introduction:

A bicycle is a wonderful example of a compound or complex machine that we use in our daily lives. It consists of many parts, each serving a specific purpose to make riding easier and more enjoyable.



- ➡ The wheels and axles help us move forward by reducing the effort needed to pedal.
- ➡ Gears and chains work together to allow us to change speed and tackle different terrains smoothly.
- ➡ When we turn the handlebars, it helps us steer in the direction we want to go, while the saddle provides a comfortable place to sit and balance.

In this activity, students will learn about different parts of bicycles, and their functions and also learn to do basic maintenance of the bicycles.

Some common bicycle parts along with their names and daily maintenance tips:

Part Name	Function	Maintenance
Frame	Main structure of the bicycle is usually made of metal or carbon fiber	Wipe it regularly to remove dirt and moisture, and inspect for any cracks or damage.
Wheels	Consists of the tyre, rim, spokes, and hub	Check tyre pressure regularly and inflate as needed. Inspect the wheels for any loose spokes or damaged rims.
Brakes	Essential for stopping the bicycle	Adjust the brake cables if necessary to maintain proper braking performance.
Chain	Transfers power from the pedals to the rear wheel	Clean and lubricate the chain regularly to prevent rust and ensure smooth operation.
Saddle	The seat where the rider sits	Adjust the saddle height and angle for comfort and proper riding position.
Handlebars	rider grips the bicycle for steering	Ensure handlebar grips are secure and replace them if they become worn out.
Bell	Attach to one of the handlebars of a bicycle. When rider presses the lever, a ringing sound is produced.	Periodically check its mounting hardware for tightness and ensure the bell mechanism is clean and lubricated for proper function

Part Name	Function	Maintenance
Gears	By changing gears, riders can make it easier to go uphill or faster on flat ground.	Regular cleaning, lubricating, and adjusting to ensure smooth shifting and optimal performance.

Hands-on activity:

Part 1:

Take the bicycle of any teacher /student. The students will observe the bicycle and list its different parts. They will discuss the function of each part.

Students will observe and complete the table after the discussion.

Part of Cycle	Sub-parts	Purpose and function of each part	Any other purpose/ observation / special things about the part
Bicycle wheel	Consists of a rim, spokes, hub, valve, tube, tire		
Pedal	Chain, sprocket, pedal, chain cover		
Handle	Brake, handle, bell, light		
Seat	Spring, seat, cover, carrier		
Cycle main frame			
Stand and other accessories			
Air Pump			

Part 2:

Observe all movable parts of a bicycle, and check their condition.

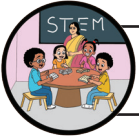
- ▣ Clean the cycle for any dirt, rust, etc.
- ▣ Use different spanners to fix any loose parts.
- ▣ Use lubricant (oil) to reduce friction.

Make the list of movable parts and note your observations in the table below.

Part name	Condition	Action taken
Brake		
Wheel, bearings		
Sprocket and Chain		
Stand		
Handle		
Bell		
Air pump		

Teacher Guidelines:

1. Divide the class into 6 or 8 groups, each having not more than 4 students.
2. Teachers must attract the attention of students and discuss important principles like simple machines, friction, lubrication, pressure, area, balancing, environment & health benefits, etc. with them.
3. Be ready with the required material for the activity.
4. Make sure all the tools you need are working properly.
5. Take a quick look at the activity beforehand. If you want to try them out before showing the students, that would help you understand them better.
6. Wear gloves and a mask while working.
7. Whenever the cycle chain and wheel are moving do not put your hand/fingers in between them.



Discussion with students:

1. What will happen if you suddenly apply the brakes of the cycle? Why should we apply brakes gradually?
2. Why does the air not come out of the tube automatically?
3. What will happen if you rotate the pedal in reverse direction?
4. Why do cycle rides become heavy when the tires are flat?
5. How do we use mathematics in maintaining and riding a bicycle?



Resources:

You can search on Google using these search words -

1. Simple machine concepts in bicycle design
2. How to take care of your bike at home
3. Understanding bicycle parts and maintenance





Activity Name



56. Rain Gauge

Syllabus reference:

Standard/ Lesson No.: Class 8: Chapter 1 (3) - Heat

Concept / Principle: Rainfall, rain gauge, evaporation, condensation

Materials and tools required:

Old plastic bottle, cutter, scale, cellotape, plaster of paris, water,
permanent marker

Time required: 120 minutes

Objective:

Students will learn how to make a rain gauge and measure the daily rainfall, using it at home or school

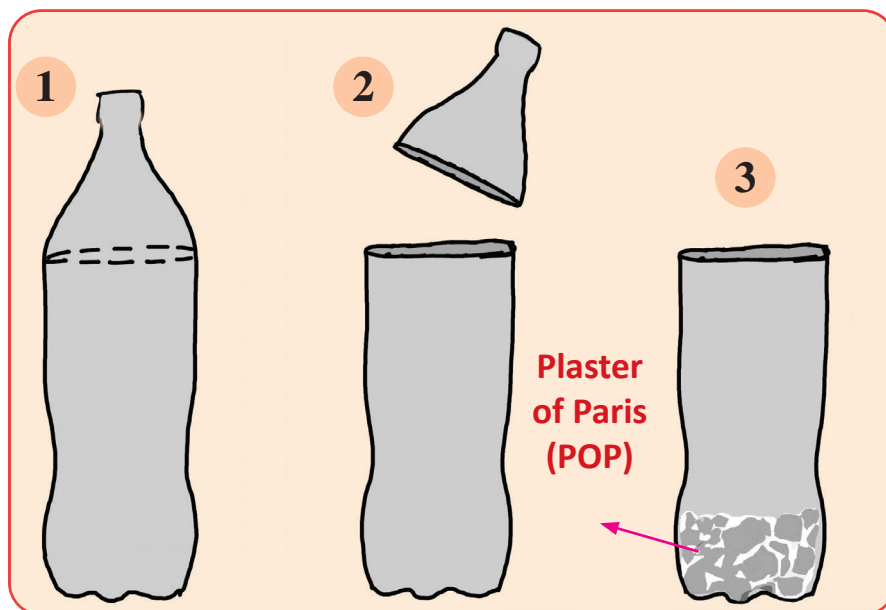
Introduction:

- A rain gauge is a tool used to measure the amount of rainfall in a specific area.
- Students will understand how scientists collect weather data and why measuring rainfall is important.
- This will help students explore weather patterns, record rainfall.

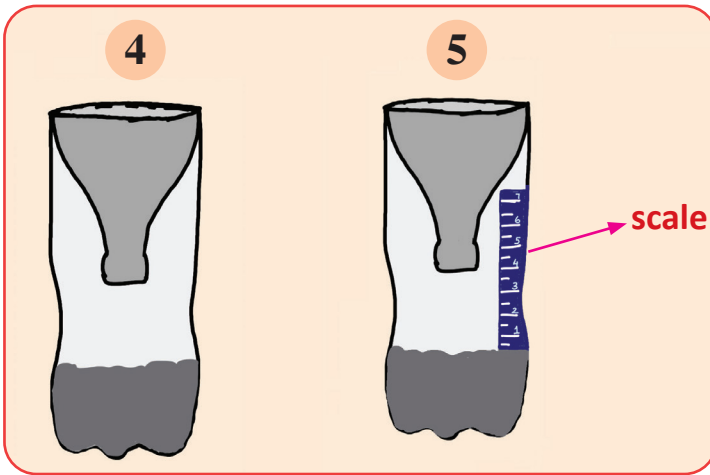
Hands-on activity:

Make your rain gauge:

1. Carefully cut off the top portion of the plastic bottle (about one-fourth from the top). Keep the top part, as it will be used later.
2. Mix Plaster of Paris (POP) with water to make a mixture. Fill the bottom portion of the bottle with a small amount of POP mixture and tap the bottle so that the POP settles evenly at the bottom. Keep the bottle in the sun to dry.
3. Once dry, take a ruler and stick it on the outer side of the bottle just above the POP level. This is the starting point for measuring the collected rainwater.
4. Take the top part of the bottle that you cut off, turn it upside down, and place it inside the bottom part like a funnel. Secure it with tape to prevent it from falling.



5. Your rain gauge is now ready.
6. Place the rain gauge in an open area so that it can collect rain water without any obstruction (away from buildings or trees).



- After rainfall, check the water level against the marked scale. Record the amount of rainfall and empty the gauge for the next measurement reading.

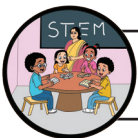
Observation and record:

Measure day-wise rainfall. Draw a graph of week or month and analyze the data.

Date	Rainfall in mm

Teacher Guidelines:

- Divide the class into 6 or 8 groups, each having not more than 4 students.
- Conduct the rain gauge making activity before monsoon season so that students are able to measure the rain during monsoon.
- Make sure all students follow safety precautions.
- Ensure use of a cutter to cut the mouth of the bottle under supervision of the teacher.
- Ensure use of hand gloves to make a mixture of POP.



Discussion with students:

- Why is it necessary to level the surface of the bottle?
- What happens if we keep the bottle as it is? (without cut the mouth)
- Why is it important to measure rainfall, and how does a rain gauge help in collecting weather data?
- Why is it important to place the rain gauge in an open area, away from buildings and trees?



Resources:

You can search on Google using the search words –

1. How to measure rainfall + YouTube
2. Make DIY Rain Gauge
3. How to build a rain Gauge





Activity Name



57. Musical Instruments

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 7 - State and Motion of Liquids and Gases;

Class 8: Chapter 1 (1) - Force and Pressure

Concept / Principle: Concept of Pressure/Stress, Effect of Pressure/Stress;
Air pressure

Materials and tools required:

Rubber band, thick straw/small tube, balloons, empty plastic bottle, scissors or cutters

Time required: 60 minutes

Objectives:

1. Students will learn how to make musical instruments using simple materials like balloons, straws, and plastic bottles.
2. Students will learn about sounds, vibrations, pressure and air movement.

Introduction:

- Sound is a form of energy that consists of vibrations and travels as mechanical waves through a medium like air, water, or solids. It is produced when an object vibrates.
- If the object vibrates with a greater speed, frequency increases (number of vibrations per second is called frequency). The greater the frequency, the higher is the pitch of sound and vice versa.
- If the object vibrates with great force, it produces a louder sound because force also causes objects to vibrate, and these vibrations create the pressure waves that we hear as sound.

Hands-on activity:

BALLOON WHISTLE

1. Take a bottle, and cut it in the middle. We will use the upper cut portion for the experiment.
2. Take a balloon and cut it. Take the upper part of the cut part of the balloon and attach it to the bottle as shown in Picture-1. The balloon should be tight and snug over the mouth of the bottle.



Picture-1

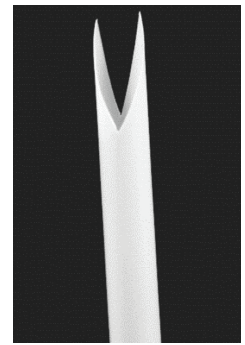


Picture-2

3. Take a small piece of tube/straw and tie it tightly to the mouth of the balloon with the help of a rubber band. The prepared instrument is shown in Picture -1.
4. Now hold the bottle as shown in Picture 2. While blowing through this musical instrument, move your hand such that sometimes it will stretch the balloon, sometimes it will loosen the balloon and see the variation of generated sound.
5. Try with different heights of cut bottles and observe the change in generated sound.

STRAW FLUTE

1. Take a straw. Cut one end of it in a 'V' shape as shown in picture 3. Press the cut end with your fingers.
2. Hold the 'V' shaped end as per picture-4 in your mouth in such a way that the two flaps rest between your lips.
3. Blow into the straw by pressing it lightly. This straw will make a sound like a whistle. If no sound comes out of the straw, adjust the pressure of the lips.
4. Make small holes on the straw, like a flute and try to play it.
5. OR while blowing through the straw, gradually cut the other end of the straw and enjoy variations of the different sounds produced.



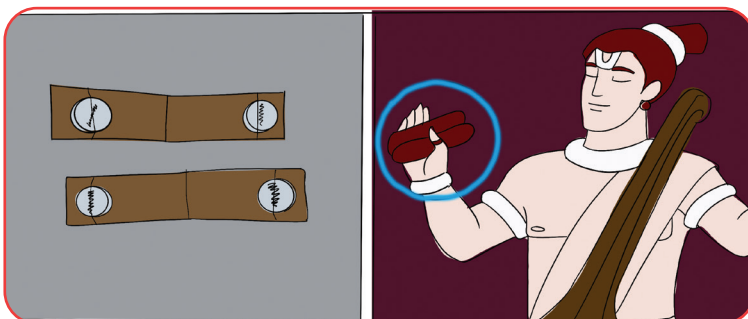
Picture-3



Picture-4

Here are some more ideas for making musical instruments:

1. Kartal/Chipalya:

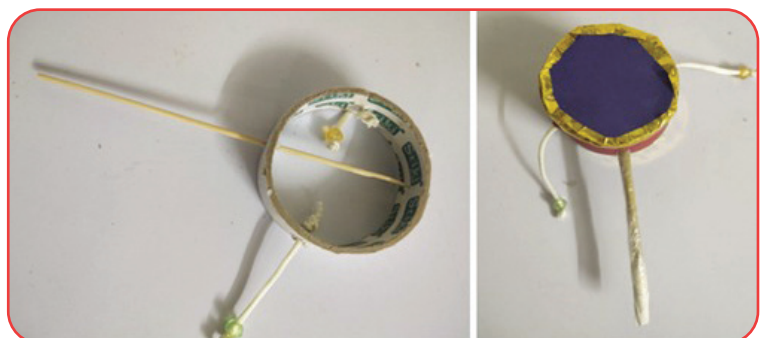


Picture-5

Take the cardboard strips and attach bottle caps as shown in picture-5. Tighten the lid with the help of a rubber band. Your instrument is ready.

2. Damru:

Take a piece of cardboard roll from a tissue paper roll or use the empty ring of a used cello tape. Drill two holes on opposite sides to insert the strings with beads.



Picture-6

Take two pieces of strings and thread a bead (one bigger in size) in each of them. Insert the strings through each hole and tie a knot on the inside so that they will not slip out of the ring. Take a stick, and insert it into the ring as shown in picture

6. Stick the paper discs on both sides of the rings with the help of glue. Place the stick firmly between your palms and move your hands back and forth. Your musical instrument 'Damru' is ready.



Picture-7

3. Drums:

Take a plastic cup, and tighten the balloon on it as per picture 7. Now take two wooden sticks and start playing the drum.

4. Ektaara:

Take two 15 cm long wooden sticks and join them at one end with the help of glue. Attach the other two ends of the sticks to a plastic cup as shown in picture 8. Make a hole in the bottom of the plastic cup and pass a cut rubber band through it. Tie the two ends of the rubber band tightly to the sticks as shown in the picture. Pull the rubber band and release it. Your Ektara is ready.



Picture-8

Teacher Guidelines:

1. Divide the class into 6 or 8 groups, each having not more than 4 students.
2. Make groups, distribute material, and give instructions to students.
3. Ask students to change various parameters and check their effect on the sound.
4. Make sure students use scissors or cutter carefully.



Discussion with students:

1. What is the role of vibrations in the production of sound?
2. Why does the sound change when various straw holes are shut and open?

3. If the rubber/ straw vibrates faster, will the pitch of sound increase or decrease?
4. What are the units in which loudness and pitch of sound are measured?
5. What are various types of musical instruments? List a few instruments.



Resources:

You can search on Google using the search words -

1. DIY + musical instruments using available material
2. DIY straw flute + YouTube
3. How to Make Musical Instruments with Recycled Materials





Activity Name



58. School Weather Station

Syllabus reference:

Standard/ Lesson No.: Class 6: Chapter 2 - Phenomena around Us;
Class 7 and 8: Chapter 1 - Heat;

Concept / Principle: Social science - Environment, Change and Power,
Measurement of accepted or released heat,
Measurement and Unit of Heat, Evaporation, Condensation

Materials and tools required:

Dry – Wet thermometer, funnel/rain gauge made by students

Time required: 30 minutes

Objectives:

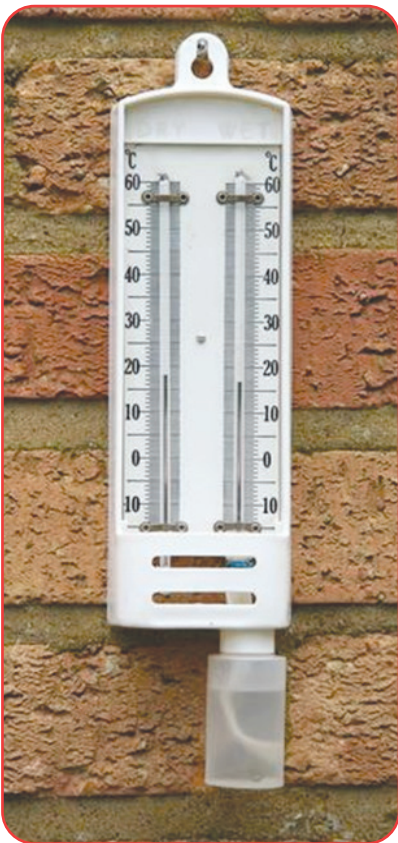
1. Students will learn to measure the temperature, humidity and rainfall.
2. Students will learn to keep records and analyze the weather data.

Introduction:

Rainfall is an important part of our environment. It fills our rivers, lakes, and wells, helps plants grow, and provides water for animals and humans. In some places, it rains a lot, while in others it rains very little.

To understand how much rain has fallen in a particular place, we need a tool that can measure it. A rain gauge is a simple instrument used to collect and measure rainfall. It helps us know how much rain has fallen over a specific period of time.

Hands-on activity:



Dry – Wet thermometer

In the school, students will make a place for a weather station where they will place dry-wet bulb thermometers and rain gauges.

Part 1: MEASURING TEMPERATURE AND RELATIVE HUMIDITY

1. Observe and note down dry bulb and wet bulb temperature 3-times a day.
2. Subtract wet bulb temperature from dry bulb temperature.
3. Refer to the relative humidity chart given. Find the point where the dry bulb temperature and

difference between dry and wet bulb temperature intersects each other in the given chart. This will give you relative humidity.

4. Keep records in your notebook.

Relative Humidity (%)																			
Dry-Bulb Temp., °C	Dry-Bulb Temperature Minus Wet-Bulb Temperature (Dry-Bulb Depression), °C																		
	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20				
2	84	68	52	37	22	8													
4	85	71	57	43	29	16	3												
6	86	73	60	48	35	24	11												
8	87	75	63	51	40	29	19	8											
10	88	77	66	55	44	34	24	15	6										
12	89	78	68	58	48	39	29	21	12										
14	90	79	70	60	51	42	34	26	18	10									
16	90	81	71	63	54	46	38	30	23	15									
18	91	82	73	65	57	49	41	34	27	20	7								
20	91	83	74	66	59	51	44	37	31	24	12								
22	92	83	76	68	61	54	47	40	34	28	17	6							
24	92	84	77	69	62	56	49	43	37	31	20	10							
26	92	85	78	71	64	58	51	46	40	34	24	14	5						
28	93	85	78	72	65	59	53	48	42	37	27	18	9						
30	93	86	79	73	67	61	55	50	44	39	30	21	13	5					
32	93	86	80	74	68	62	57	51	46	41	32	24	16	9					
34	93	87	81	75	69	63	58	53	48	43	35	26	19	12	5				
36	94	87	81	75	70	64	59	54	50	45	37	29	21	15	8				
38	94	88	82	76	71	66	61	56	51	47	39	31	24	17	11				
40	94	88	82	77	72	67	62	57	53	48	40	33	26	20	14				
42	94	88	83	77	72	67	63	58	54	50	42	34	28	21	16				
44	94	89	83	78	73	68	64	59	55	51	43	36	29	23	18				

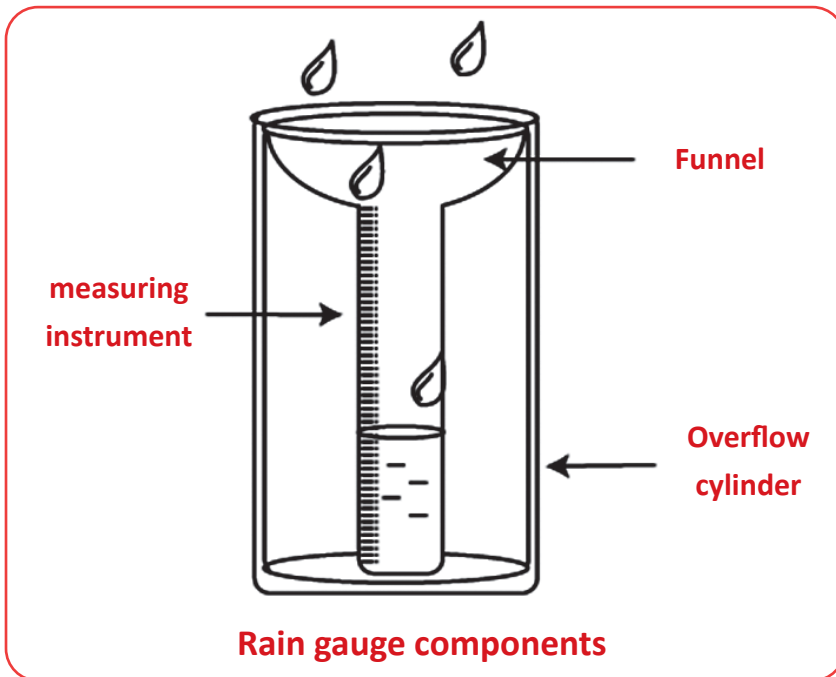
Observations and Records:

Date	Time	Dry temperature (°C)	Wet temperature (°C)	Difference (°C)	Calculate relative humidity (%)
DDMMYYYY		24	17	7	49%

Part 2: MEASURING THE RAINFALL

To measure the rainfall, we need a rain gauge. We can make DIY rain gauges or you can use funnels and measuring cylinders as shown in fig. This device collects the rain drops and we can measure the collected water using a measuring cylinder.

1. Place a DIY rain gauge in an open area where rainfall will not be blocked by any obstacles.



2. After 24 hours, measure collected rainwater using a measuring cylinder.
3. Take measurements every day at the same time (after 24 hours).
4. Check how much water has been collected in the measuring cylinder. Note it every time in milliliters (ml).
5. Calculate the area of the funnel. For this activity, measure the radius of funnel and use the formula for calculating the area of circle i.e. Area of circle = πr^2
6. Let us calculate rainfall using formula:

$$\text{Rainfall (mm)} = \frac{\text{Collected water in (ml)}}{\text{Area of funnel}} = 10$$

7. Record the rainfall in table

Location					
Date					
Rainfall (mm)					

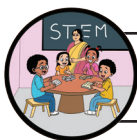
Observation Table:

Prepare a weather station and record the temperature, humidity and rain fall in your school daily. And note it in the register daily.

Date	Temperature		Humidity %	Total rain falls
	Dry	Wet		
1.4.24	24	25	92%	14.11
2.4.24	23	23	96%	41.44

Teacher Guidelines:

1. Divide the class into 6 or 8 groups, each having not more than 4 students .
2. Set up a weather station in the school premises.
3. Make sure students take the daily readings and analyze the collected data.
4. Keep all the weather apparatus in one designated place.
5. Place the rain gauge in an open area where rain water can flow into it freely without any obstruction.
6. Ensure that the bulb of dry wet thermometer always remains moist.



Discussion with students:

1. How does relative humidity affect human beings?
2. Why is it important to monitor weather conditions?
3. How can we predict the weather?
4. At what level does humidity become dangerous for us? What should we do when it is too hot or humid?



Resources:

You can search on google using the search words –

1. How to measure rain
2. How to measure relative humidity
3. Make weather station at school





Activity Name



59. Automata Toys

Syllabus reference:

Standard/ Lesson No.: Class 6: Chapter 6 - Basic concept of Force and Energy;
Class 7: Chapter 2 - Time and Motion

Concept / Principle: Concepts of Position, Motion and Force

Materials and tools required:

Cardboard box, paper straws, paper tape, white papers, scrap pen body,
cutting plier, cutter, scissors

Time required: 180 minutes

Objective:

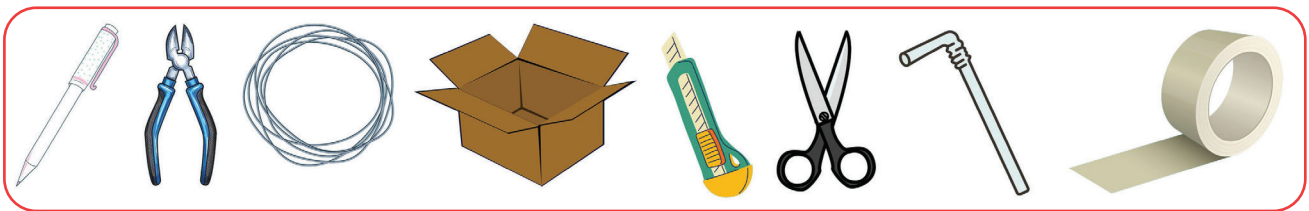
Students will understand the basic concepts of force and motion by making simple automata toys.

Introduction:

The concept of cams and simple mechanisms can be introduced through a hands-on activity in which students create their own Fluttering Bird Automata using cardboard, paper, and other materials. Through this activity, they can learn about how different parts of a mechanism interact to create motion.

Hands-on activity:

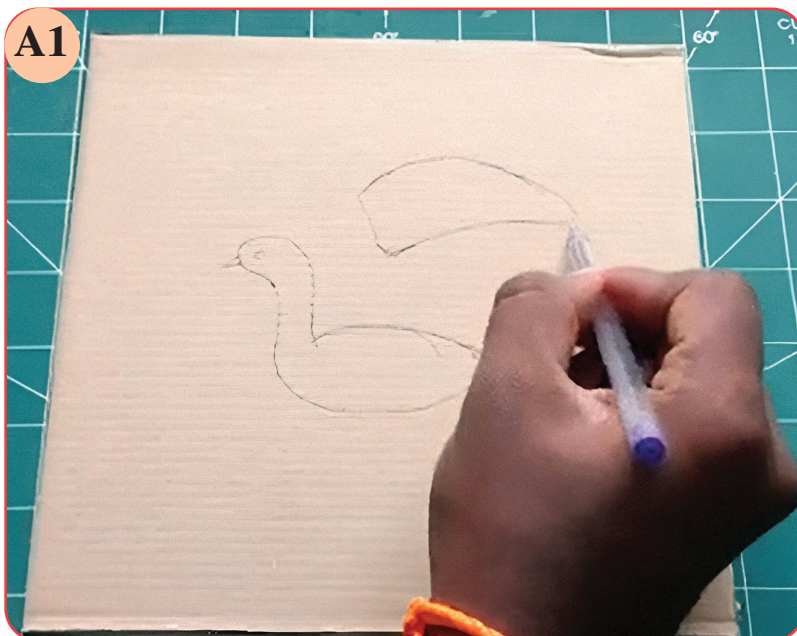
Automata Fluttering Bird



Required tools and materials:

Step 1: Create the bird shape

➡ Draw the shape of a bird on cardboard and cut it out.



➡ You can find bird templates online or draw your own design.

Step 2: Prepare the wings

➡ Cut out two wing shapes from paper. Attach a small piece of straw to the bottom of each wing using paper tape.

Step 3: Attach wings to the bird

➡ Cut a piece of binding wire, three times the width of the wings. Pass the wire through straw. Create bends on the wire as per instructions and attach it to the bird's body. Repeat for both the wings.

Step 4: Stabilize the wings

- Attach two pieces of straw to both sides of the bird's wings
- using paper tape so that the wings remain stable.

Step 5: Create a follower for the cam mechanism

- Cut a straw of desired length to make a follower for the bird's body. Attach it to the lower part of the body using paper tape.

Step 6: Prepare the base

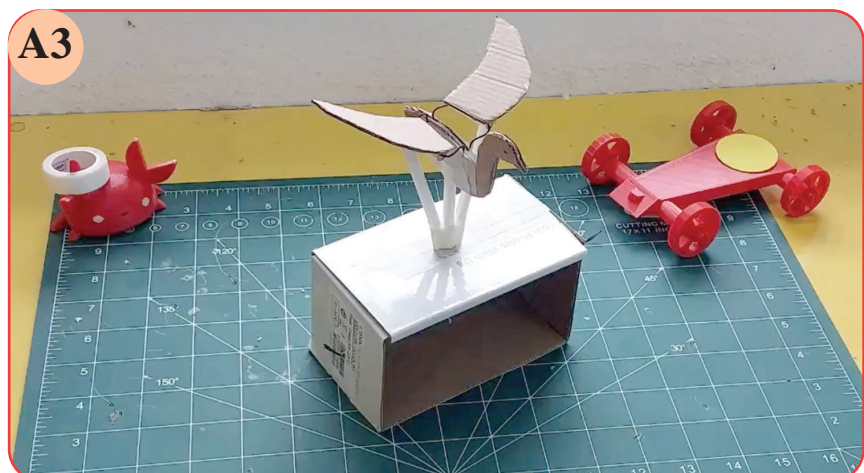
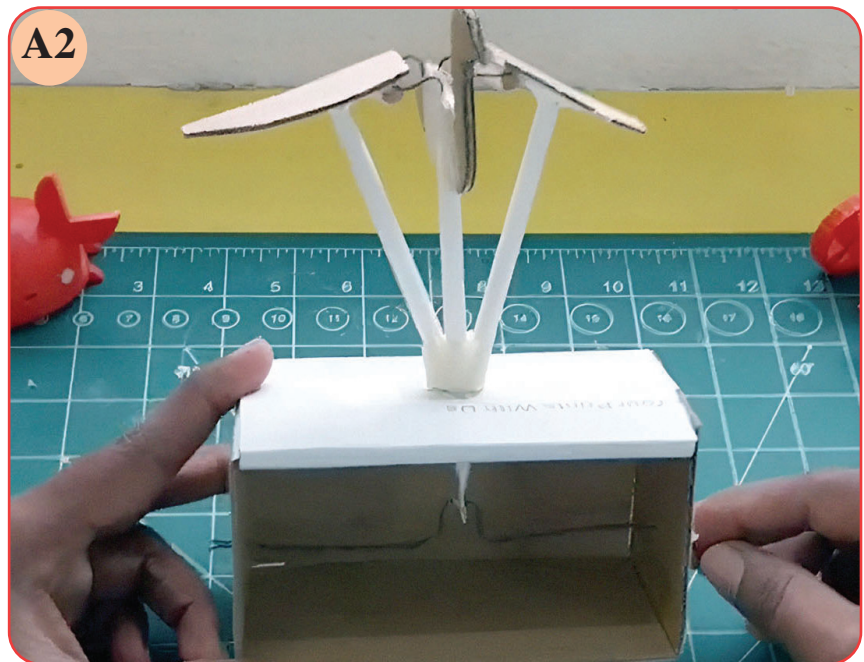
- Take a cardboard box and cut it to the size you need for the base.

Step 7: Prepare the rotational power source (cam)

- Cut a binding wire slightly longer than the base and attach one end to the side of the base. Create a U-bend in the middle of the wire to which the follower will be attached.
- Make a hole in the follower (straw attached to the body) and pass the wire through it.

Step 8: Test the Fluttering Motion:

1. When the U-bend rotates, it acts as a cam, causing the bird's wings to move up and down. Hold the cardboard base and rotate the U-bend gently. Observe the fluttering motion of the wings as the cam lifts and lowers the straw follower.



Step 9: Adjust and Decorate:

- ➔ Make any adjustments in the mechanism if needed. Decorate the bird and the cardboard base using markers or paint. Once you're satisfied with the fluttering motion, share your creation and enjoy your DIY automata fluttering bird.

2. Automata Octopus

Step 1: Make a frame



1. Take a square cardboard piece of approx. 20 cm x 20 cm

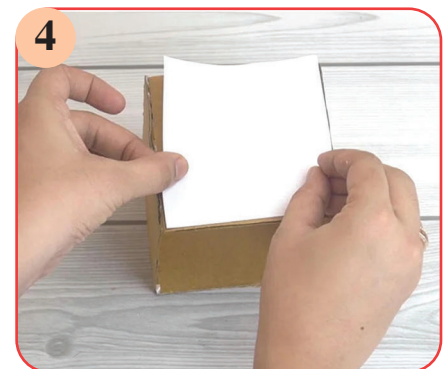


2. Cut four squares of 10 cm x 10 cm as shown.



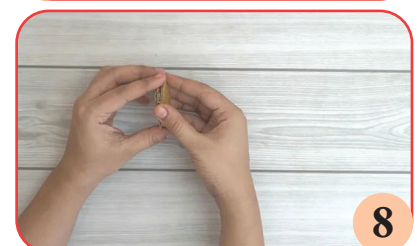
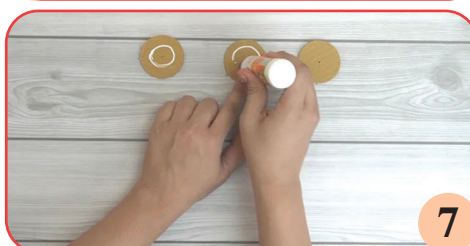
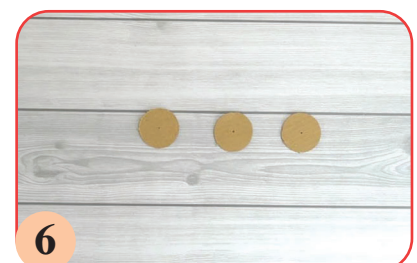
3. Make a square box or a frame for automata by joining all four squares using glue.

4. Cover one side of frame with a white sheet of 10 cm x 10 cm.



Step 2: Make cam and follower

1. Using a circle cutter, cut 6 circles of diameter 5 cm each. Glue 3 circles together to form one cam and three circles together to form one follower.



Step 3: Make holes on three sides of the frame

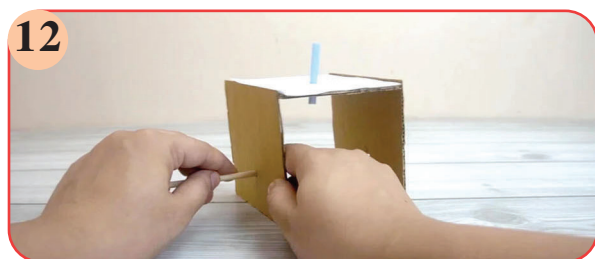
1. Make one hole on top of the frame covered with white sheet. You can use a skewer or tip of pencil to poke the hole.



2. Insert a piece of straw through the top hole.



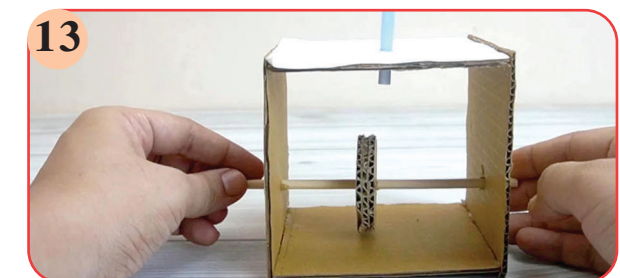
3. Now make holes on two opposite sides of the frame. Holes should be made slightly below the center point.



Step 4: Insert a cam and a cam follower

1. Use a bamboo skewer as a lever (axle) and insert it through one of the side holes in the frame. Once inside the frame, insert the cam on the axle, ensuring it is positioned at its center. You can glue the cam to stabilize it.

2. Insert a half skewer from the top hole in the frame and attach the follower to it at its centre. You can glue the follower on the skewer to stabilize it.



3. Test the motion by rotating the lever (axle).

Step 5: Make the Sculpture

1. You can make any sculpture that you wish to rotate. In this example, we are making an octopus to be placed on the top of the vertical skewer. To make the octopus:

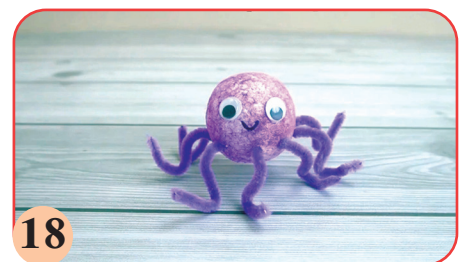


2. Take a thermocol ball and color it.



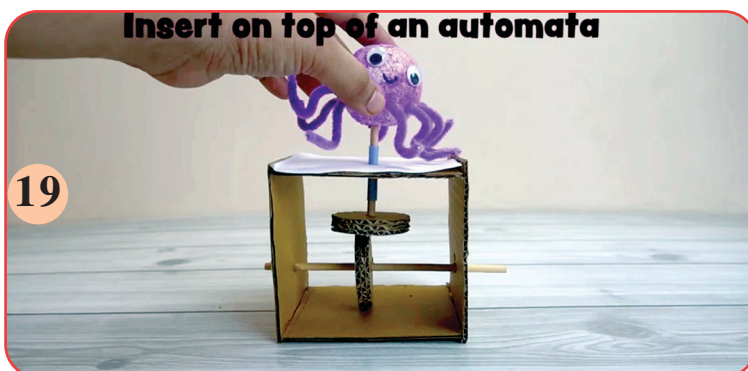
3. Cut pipe-cleaners and bend them to form the octopus legs.

4. Paste googly eyes or draw them, and make a hole at the bottom of the thermocol ball.

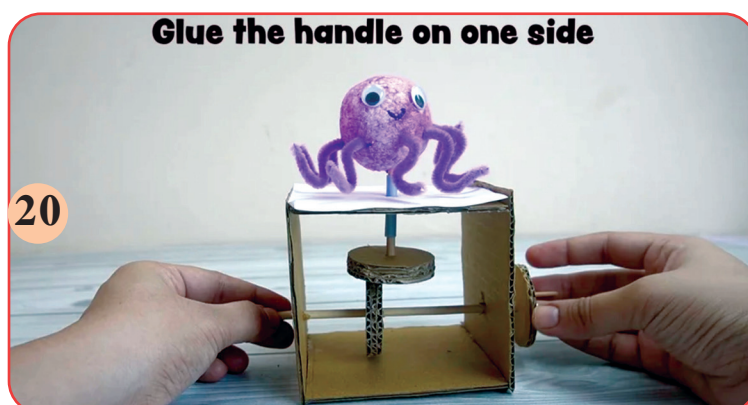


Step 6: Attach the Sculpture and Handle to the toy

1. Glue the octopus on top of the vertical skewer by inserting the skewer into the hole made in the thermocol ball.



2. Make a handle - cut another circular disc from cardboard and attach it at the end of the axle through its center. Glue it in place. Cut a small piece of skewer to use it as a handle and insert it off the center of the circular disc attached at the end of the axle. Glue the handle to stabilize it



3. Rotate the axle using the handle and watch the cam-follower move, causing your sculpture to rotate.

Teacher Guidelines:

1. Divide the class into 6 or 8 groups, each having not more than 4 students.
2. Ensure that students handle all materials carefully under teacher supervision.



Discussion with students:

1. What are the different types of mechanisms that we see around us such as gears, cams etc.?
2. What type of mechanism is used in this project?
3. Why is it important to test and adjust the wing movement before finalizing the project?
4. Can you suggest alternative materials to use if a straw is not available?

Scientific Principle:

Automata Fluttering Bird mechanism –

- The mechanism used in the Automata Fluttering Bird typically involves a simple cam mechanism.
- In this mechanism, a rotating cam (often made from cardboard or other materials) is connected to the bird's wings.
- As the cam rotates, it creates an up-and-down motion in the wings, mimicking the flapping motion of a real bird.

Automata Octopus mechanism –

- The mechanism used in an Automata Octopus made from cardboard typically involves a combination of cams and linkages.
- In this mechanism, cams are used to create movement in the tentacles of the octopus, while linkages connect the cams to the tentacles converting the rotational motion into a waving or undulating motion.
- In this project, students engage in hands-on exploration of basic engineering principles such as measurement, drawing etc. using cutting techniques.
- They also learn creating mechanisms using binding wire and a straw for the bird wing and using bamboo skewers and cardboard cam and follower for rotating octopus.

QR Code



Resources:

You can search on Google with the search words – Automata toys Video reference for making an automata toy with fluttering bird using cardboard (refer QR Code).



Activity Name

60. Solar-Powered Car

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 6 - Basic concept of Force and Energy; Class 7: Chapter 1 (4) - Electricity & Chapter 1 (5) - Environment-friendly Energy

Concept/ Principle: Source of Energy, Energy Conversion, Concept of Energy Chain, Electric Current, Circuit, Effects of electric current, Transformation of Electrical Energy to Other Forms of Energy, Use of Solar Energy

Materials and tools required:

3.8 Volt Solar Panel, 3 Volt D.C. Motor, On-off switch, 2 straws, 5 plastic water bottle caps, rubber band, small gear, ice cream stick, wood stick, 1 fan blade, solder wire, glue stick blade cutter, wire stripper, soldering iron, glue gun

Time required: 120 minutes

Objectives:

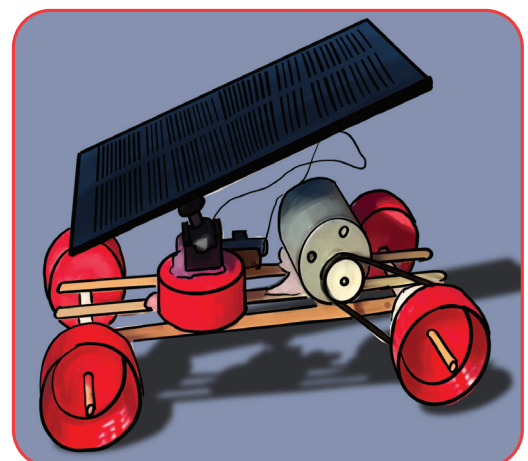
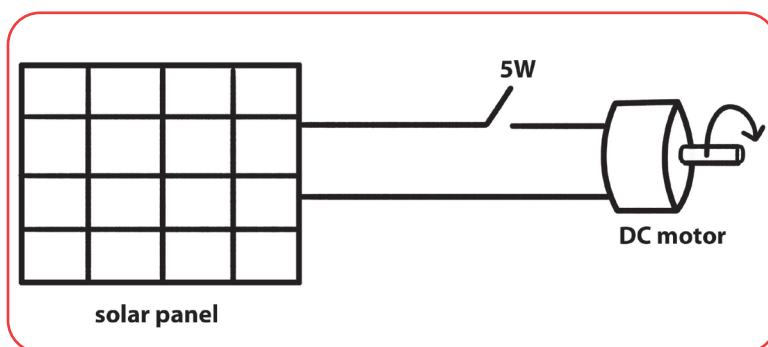
1. Students will learn about electric circuits, basic electronics, power-energy sources and flow of electric current.
2. Students will understand energy conversion through a simple solar based car making activity.

Introduction:

- Solar panels use sunlight to generate electricity, producing DC (direct current) power. When multiple solar cells are connected together, the amount of electricity produced increases. In this activity, the DC motor converts electrical energy from the solar panel into movement (mechanical energy). It works on Fleming's Left-Hand Rule, which explains how electric current creates a magnetic field and produces motion.
- By making a small solar-powered car, students will observe how solar panels generate electricity, how it flows through a circuit, and how electrical energy is converted into motion.

Hands-on activity:

1. Connect a 3.8volt solar panel with (DC) motor.
2. Place the solar panel in the sun- the motor will start rotating.
3. Connect a switch to the motor, so that the motor can be turned on and off.
4. Refer to the circuit diagram shown below and make the necessary connections.
5. Keep the solar panel in the sun and check whether the D.C. motor works.
6. Now install the solar panel on the upper part of the car as shown in the picture.
7. Install the D.C. motor and connect the car as shown in the picture.
8. To make different types of solar cars, see the YouTube link given in 'Resource Sources'.



Teacher Guidelines:

1. Divide the class into 6 or 8 groups, each having not more than 4 students.
2. Children should do soldering only under teacher supervision.
3. Ensure that children should use knives/cutters safely in the presence of the teacher.



Discussion with students:

1. When will the car stop?
2. At which angle will the motor rotate faster after placing the solar panel in the sunlight?
3. Can your car turn? If not, why?
4. How is power transmitted from the motor to the wheels in a car?



Resources:

You can search on Google using the search words –

1. How to make a solar-powered car at home
2. Step-by-step solar car DIY
3. How to build a small solar car with a motor





Activity Name



61. Telescope

Syllabus reference:

Standard/Lesson No.: Class 7 and 8: Chapter 1 - Light;
Concept/Principle: Refraction of light, Optical Image;

Materials and tools required:

2 cardboard rolls made from chart paper, sticky tape,
2 convex lenses (1 big, 1 small), scissors/ cutter

Time required: 120 minutes

Objectives:

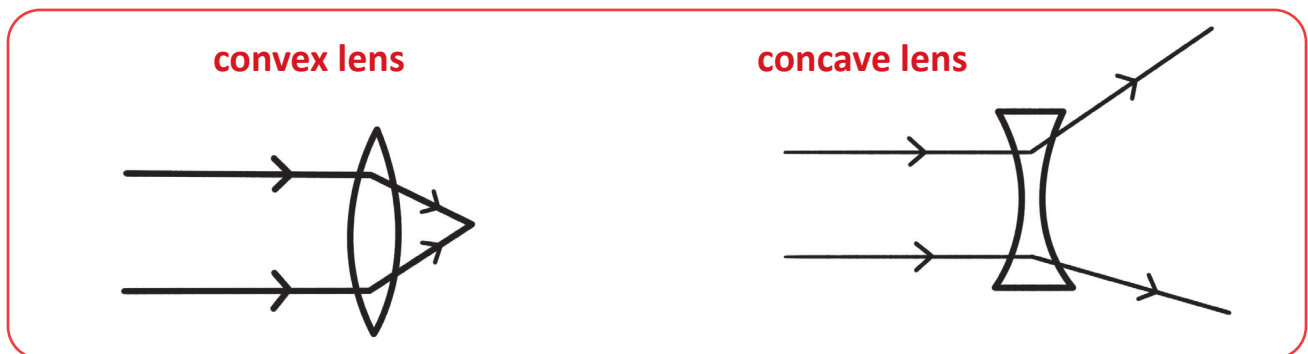
1. Students will learn to make a simple telescope to explore the refraction of light.
2. Students will understand the properties and uses of concave and convex lenses.

Introduction:

- ➡ In this activity, students will make a telescope using chart paper and lenses.
- ➡ Telescopes are tools that help magnify distant objects, making them easier to see. They are commonly used to study stars, planets, and other celestial bodies.

A refracting telescope uses two convex lenses. One convex (objective) lens gathers light from a distant object and focuses it at its focal point to form a real, inverted image. The second convex lens, (eyepiece) lens acts as a magnifier, enlarging the intermediate image to produce a clear, view of the object for the observer.

The size of the image produced by the telescope depends on the curvature of the



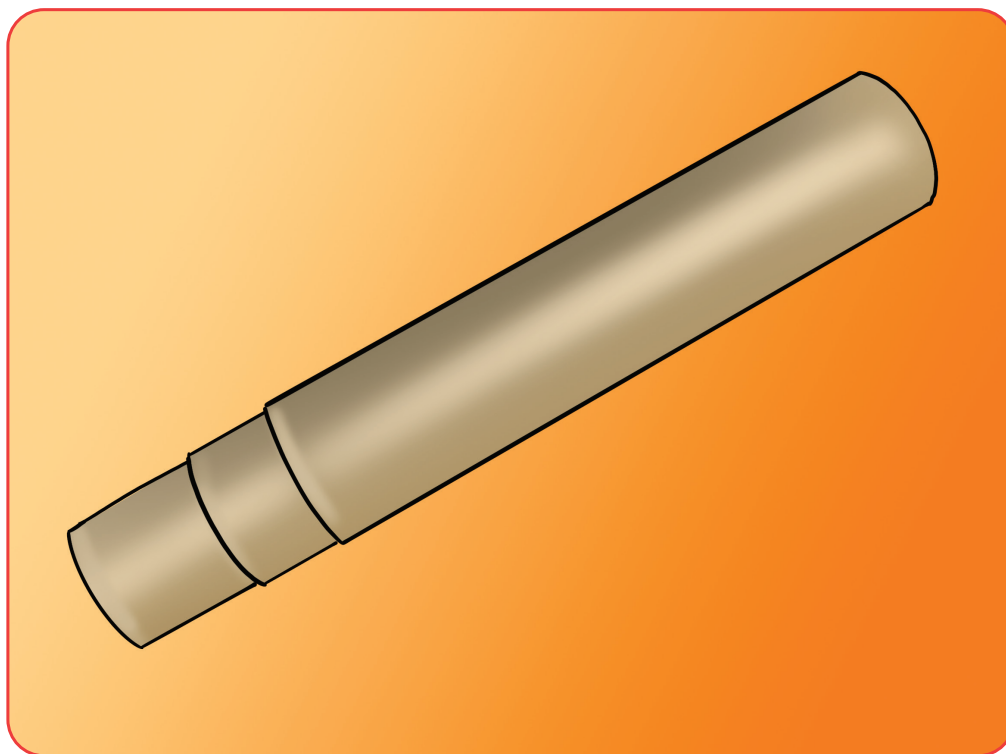
lenses used. We can use lenses with different curvatures to change the magnifying power of our telescope.

Hands-on activity:

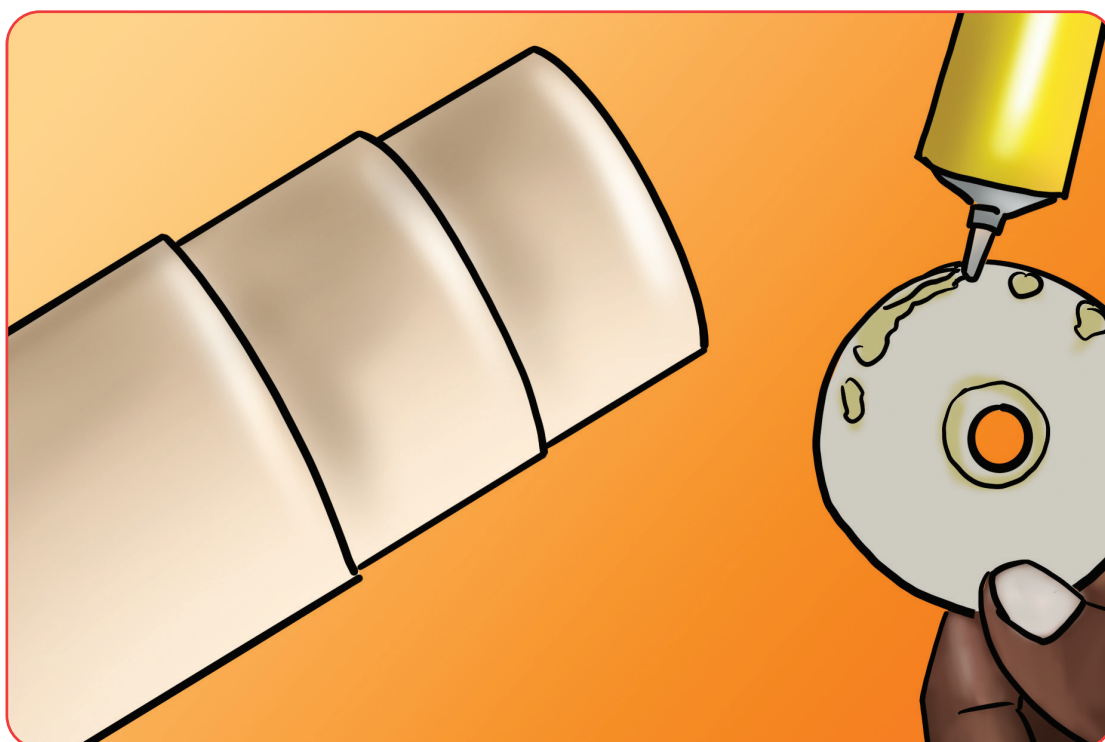
1. Make three nested tubes from chart paper such that the circumference of each tube must be slightly smaller than the previous one so that they fit into each other.



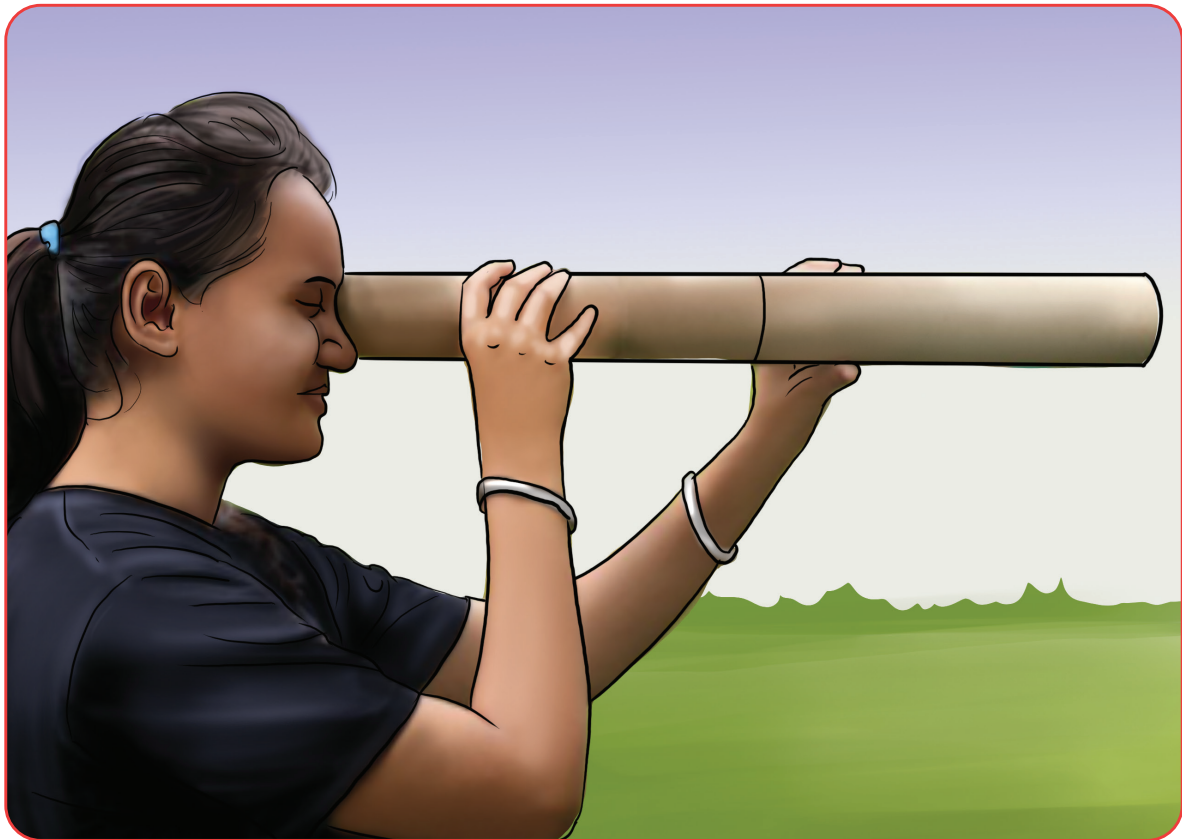
2. Insert the tubes inside one another (small-medium-large). See the image.



3. Just in case the inner tube is not sliding smoothly, roll the inner tube again to make it slightly small in diameter and retry. Make sure the tubes slide smoothly over one another
4. Now use sticky tape to fix a small lens to the outer edge of the inner tube.
5. Fix the big lens to the outer edge of the third tube (outermost tube).



6. Now, look through the lens of the inner tube (eyepiece) and aim your telescope at any object far away from you. Focus the image by sliding the inner tube in and out until the image becomes clear.



Teacher Guidelines:

1. Divide the class into 6 or 8 groups, each having not more than 4 students.
2. First ask students to compare object sizes with and without a telescope.
3. Ensure that students do not look at the sun with the telescope.
4. The students should use a cutter under the teacher's supervision.



Discussion with students:

1. What kind of image (real/ virtual) is formed in the telescope?
2. What happens when the distance between the lenses is changed?
3. What can be done to increase the magnifying power of the telescope?



Resources:

You can search on Google using the search words –

1. How to build a telescope + YouTube
2. Make a simple telescope
3. DIY telescope at home using card sheet/cardboard



Activity Name

62. Hydraulic toys Using Syringes and Pipes

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 7 - State and Motion of Liquids and Gases; Class 8: Chapter 1 (1) - Force and Pressure

Concept / Principle: Concept of Pressure, Effect of Pressure; Liquid pressure, Air pressure

A. Hydraulic scissor lift

B. Hydraulic press

C. Hydraulic crane

Objectives:

1. Students will understand the principles of fluid pressure and basic hydraulics.
2. Students will design and construct simple hydraulic toys to see how force is transmitted through liquids.

Introduction:

- ▣ Students have already learnt about states of matter- solid, liquid and gases and what happens when we apply force on them. This activity applies those concepts to real-life applications of hydraulics.
- ▣ In these activities, students will explore how fluids can transmit force by making hydraulic scissor lifts, hydraulic presses and hydraulic cranes.
- ▣ By using syringes and pipes, students will see how fluid pressure can raise or lower platforms, lift objects, and operate mechanisms. These hands-on activities provide a practical understanding of hydraulic systems like scissor lifts, hydraulic presses, and cranes.



Activity Name



62 A. Hydraulic Scissor Lift

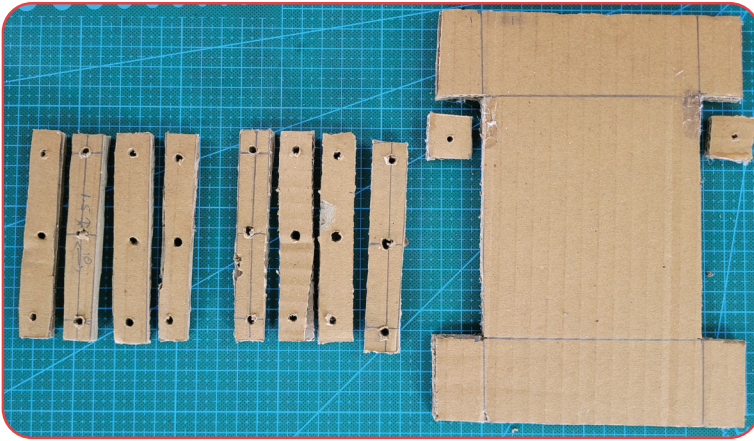
Materials and tools required:

Cardboard, 2 syringes - 10 mL, 1 pipe, 3 chopsticks - 4 mm and 2 chopsticks - 5 mm, hand gloves, battery-operated drill machine with 3 mm and 4 mm drill bit, glue gun, pencil, scale ruler, scissor, utility cutter/ paper cutter, cutting mat wire stripper.

Time required: 120 minutes

Hands-on activity:

1. Take a piece of cardboard and cut it into 8 rectangular plates, each measuring 1.5 cm width and 10 cm length, using a paper cutter. Mark three points on each plate: one at the center and two at 1 cm from each of the two ends of the plate.



Picture-1

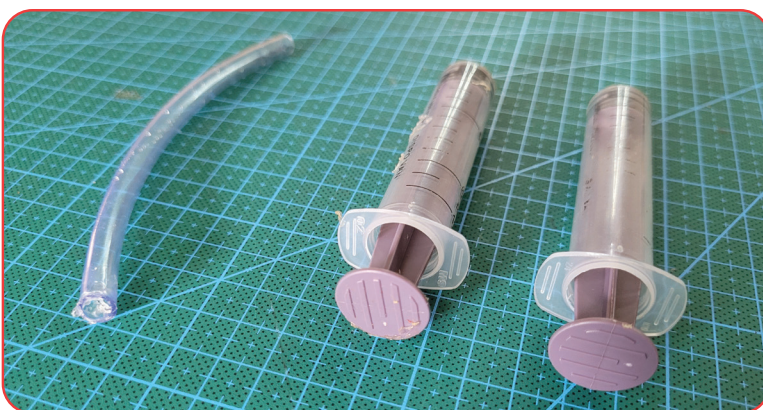
2. Make a hole of 4 mm diameter at each marked point.
3. Cut a base plate for the scissor lift from cardboard, 15 cm width and 25 cm length. Now, cut a rectangular slot of 1.5 cm width and 17 cm length on the longer side of the base plate leaving exactly 3 cm margin from top and bottom edges of the plate

and 1.5cm from the side of the plate. (Refer to the image)

4. Scan this QR code and follow the steps to cut the rest of the parts as suggested in the reference video.
5. To make a master slave cylinder- take a syringe and fix a pipe of 15 cm in length on one side using hot glue. Take another syringe, fill it with water and then connect it to the other end of the pipe using hot glue.



QR Code



Picture-2

6. Connect the piston of the slave cylinder to the bottom stick of the assembly. Apply hot glue around the piston so that it sticks properly on the bottom stick. Fix the syringe to the base plate with hot glue.
7. Make a small cardboard tray and fix it on the top of the scissor lift mechanism.

8. Now, test it by placing different loads in the tray.

Scan above QR code for additional details and guidance whenever needed





Activity Name



62 B. Hydraulic Press

Materials and tools required:

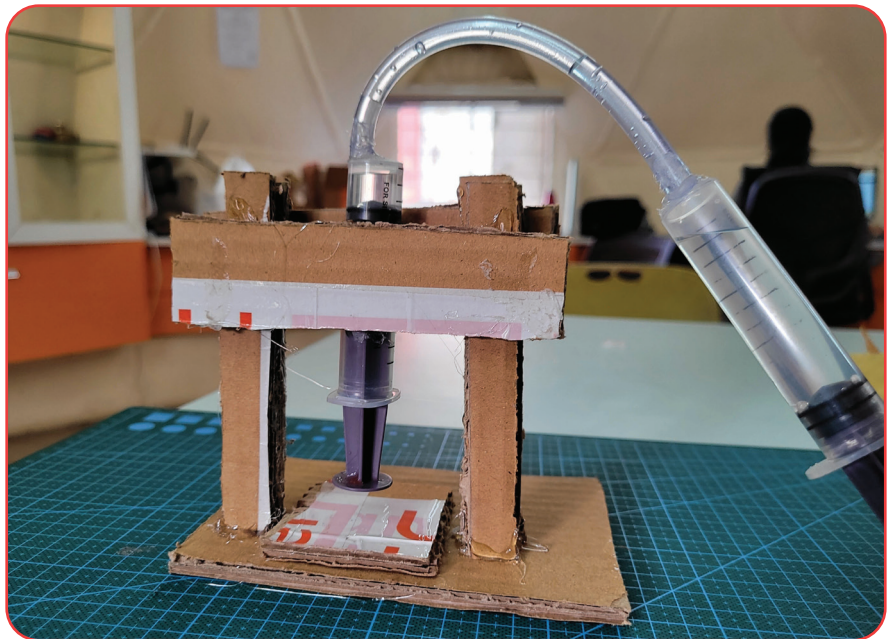
Cardboard, 2 syringes - 10 ml, 1 pipe, 3 chopsticks - 4 mm and 2 chopsticks - 5 mm, hand gloves, glue gun, pencil, scale ruler, scissor, utility cutter/ paper cutter, wire stripper.

Time required: 90 minutes

Hands-on activity:

1. Take a 5 mm thick cardboard sheet and cut it according to the given dimensions
 - * One 14 cm x 10 cm rectangular plate - base plate of the hydraulic press.
 - * One 5.5 cm x 5.5 cm square plate. - central base between pillars
 - * Two 12 cm x 3 cm rectangular plates - support plates for syringe assembly.
 - * Six 12 cm x 1.5 cm rectangular plates - pillars for hydraulic press.
2. Join three plates (each - 12 cm x 1.5 cm) together with hot glue. Do the same for the remaining three sticks for making two separate pillar columns.
3. Fix these two pillar columns on either side of the base plate of the hydraulic press, leaving at least 6 cm between them.
4. Fix the square plate (5.5 cm x 5.5 cm) between 2 pillars.

5. Now, connect one of the two rectangular plates (12 cm x 3 cm) on the upper side of the pillar to support the syringe assembly.
6. Make a syringe assembly as mentioned in the scissor lift activity. Glue it vertically as mentioned in the



video. Then glue the second rectangular plate (12 cm x 3 cm) on the other side of the syringe to fix the assembly.

7. Our hydraulic press is now ready. To demonstrate its actual application, place a tomato under the slave piston on the base plate, press the master piston and crush the tomato.



QR Code





Activity Name



62 (C) Hydraulic Crane

Materials and tools required:

Plywood plate, 2 syringes - 20 mL, 1 pipe, 2 chopsticks - 4 mm, nut and bolt of 5 mm diameter. hand gloves, glue gun, drill machine with 5 mm drill bit, pencil, scale ruler, scissors, utility cutter/ paper cutter, wire stripper.

Time required: 90 minutes

Hands-on activity:

Scan this QR code and follow the steps to cut the rest of the parts as suggested in the reference video



QR Code

1. Take a 30 cm x 30 cm plywood piece of 3.5 mm thickness and . Cut the plywood in the following pieces:
 - * One 25 cm x 15 cm - Base plate
 - * Two 12 cm x 1.5 cm - Pillar plates
 - * One 20 cm x 1.5 cm - Support plate
 - * One 5 cm x 5 cm square plate – Tray
2. Drill a hole on one side of each pillar plate and support plate. Make another hole at the other end of the support plate.
3. Join these plates to each other using 5 mm nuts and bolts. Fix the pillar plates onto the base plate at the appropriate locations.
4. Make a tray with the square plate and chopsticks as shown in the image. Connect this tray to the other free end of the support plate.
5. Attach the syringe assembly as shown and now our hydraulic crane is ready. Operate the crane by pressing the master cylinder piston and releasing it back to its original position.



Teacher Guidelines:

Divide the class into 6 or 8 groups, each having not more than 4 students. Ensure that the students -

1. Use hand gloves and safety goggles when using the glue gun, utility knife and drill machine.
2. Use drill machines, stripper, utility knife and glue guns only under teacher supervision
3. Do not touch the glue gun's hot tip bare-handed.



Discussion with students:

1. What is the working principle behind this experiment?
2. What is hydraulics?
3. What are the different hydraulics applications around you?



Resources:

You can search on Google using these search words - DIY + hydraulics scissors, hydraulic crane, hydraulics press

1. Video reference for making hydraulic scissor lift and hydraulic press.



QR Code#1



Activity Name

63. Electrical Quiz Board Game

Syllabus reference:

Standard/Lesson No.: Class 7: Chapter 1 (4)- Electricity,
Chapter 8 - Environment and Public Health

Concept/Principle: Electric Current, Circuit, Effects of electric current, Electric current results in light emission, Nature of health (Physical, Mental), Infectious Diseases and their treatment.

Materials and tools required:

12 nuts & bolts, 4 pieces of foam, 1 extra piece of foam, 11 pieces of thin electrical wire, 1 piece of cardboard, 2 electrical cells, 1 holder, 1 buzzer, surgical tape, 4 clips, 1 LED light, screw driver, scissors, pencil, digital multimeter.

Time required: 60 minutes

Objectives:

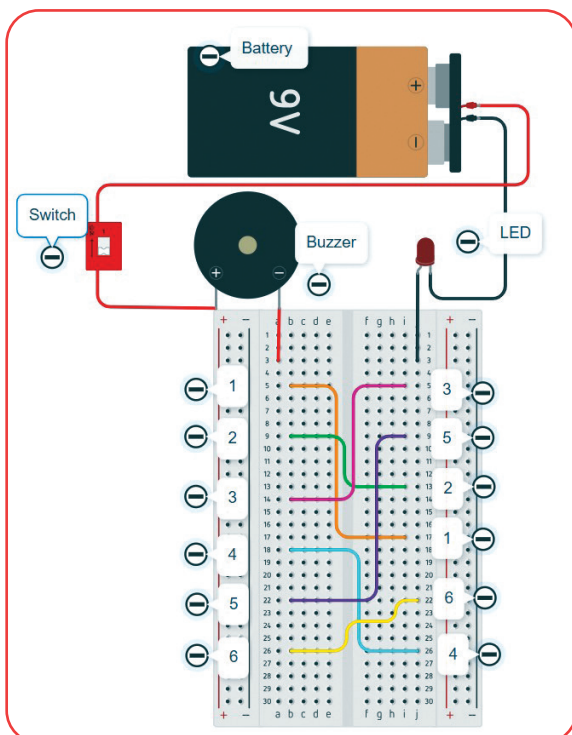
1. Students will make simple quiz board games to make learning enjoyable.
2. Students will learn how to design electric circuits and understand how electric current flows through them.

Introduction:

- In this hands-on activity students will make an electrical quiz board game using some basic components.
- This electrical quiz board can be designed to match or pair up a wide variety of topics related to education, sports, environment, history and geography. For example - animals and habitats (tiger - forest, fish - water, polar bear - Arctic, penguin - Antarctic, camel - desert, etc.), city and country (Pune - India, Guangzhou - China, Brisbane - Australia, Montreal - Canada, etc.), bird and food (parrot - fruit, kingfisher - fish, eagle - small mammal, etc.) and so on.

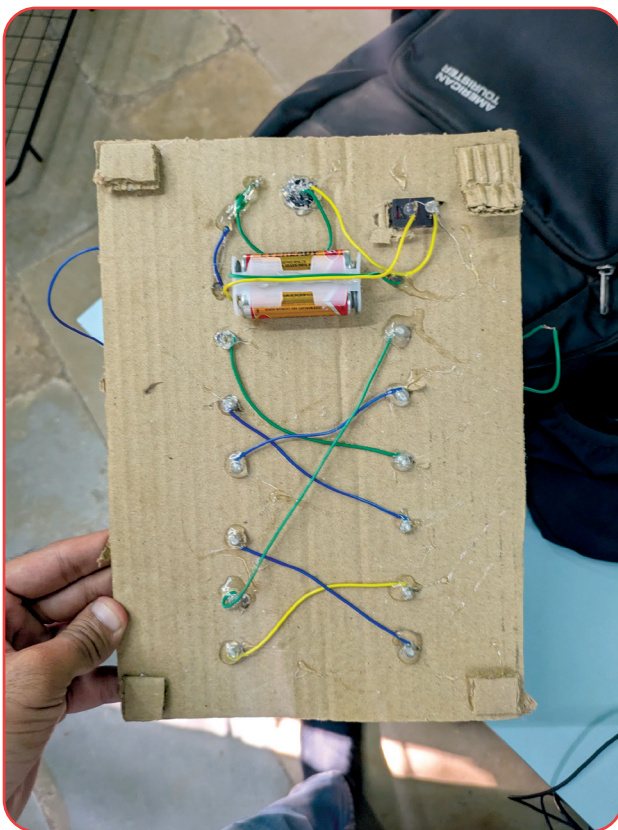
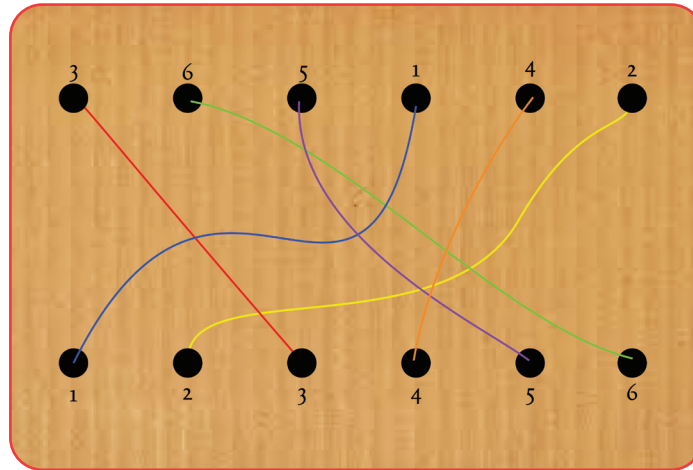
Hands-on activity:

1. Refer to the diagrams provided below.
2. Take the cardboard piece and stick the 4 pieces of foam on its 4 corners.

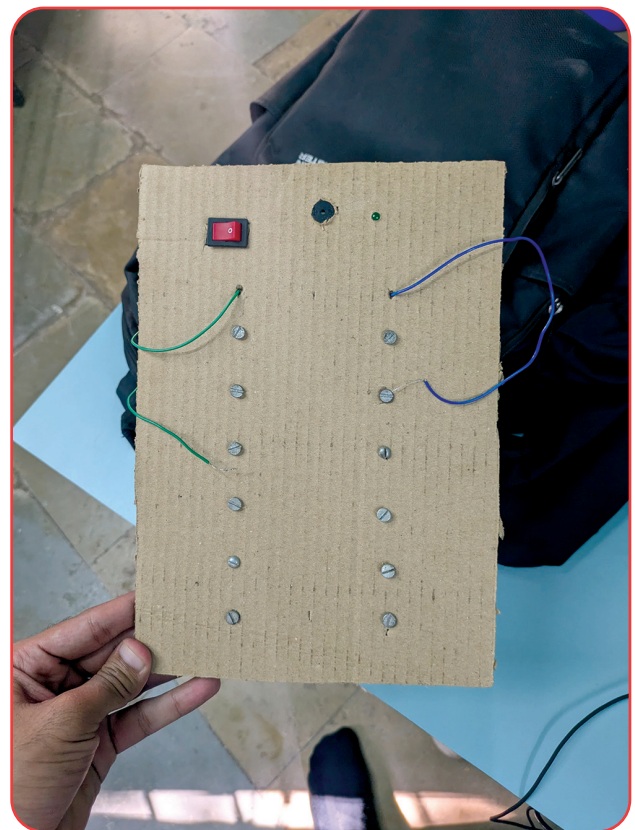


3. Divide the board schematically into two vertical halves. Place/draw questions on the left side of the board and answers on the right side of the board.
4. Make a hole along the side of every question and answer. Make sure the holes are made at equal distances and that the holes on both halves are aligned with each other.
5. Insert a nut and a bolt in each hole.
6. Attach the cell holder, buzzer and LED light to the board.
7. Place the positive terminal (longer terminal) of the LED light next to the buzzer.
8. Connect the red wire of the buzzer to the red wire of the cell holder. Connect the black wire of the buzzer to the positive terminal (longer terminal) of the LED light.

9. Connect the red wire of the buzzer to the black wire coming from the negative terminal (shorter terminal) of the LED light. Finally, connect the other free wire to the black wire coming from the negative terminal of the cell holder.



Back view of the Quiz Board



Front view of Quiz Board

Teacher Guidelines:

1. Divide the class into 6 or 8 groups, each having not more than 4 students .
2. Make sure that there is one multimeter for every two working groups to help the students check whether they have designed their circuits properly.
3. Remind students to handle all materials carefully, especially items like scissors, electrical wires, LED lights.
4. Check the circuits once the students have designed them, before allowing them to start the experiment.
5. Check that the electrical cells, buzzers and LED lights are all working properly before beginning.



Resources:

You can search on Google using the search words –

1. Step-by step guide for making electrical quiz board
2. Make electrical quiz board + YouTube
3. Match it right Quiz Board Game



Activity Name

64. Gyroscope Using a Toy Motor

Syllabus reference:

Standard/Lesson No: Class 7: Chapter 2 - Time and Motion

Concept/Principle: Concept of Motion, Motion in Circular Path, Mixture of Rotational and Rectilinear motion, Curved Motion, Rotational Speed

Materials and tools required:

Old CDs, 6V motor, small battery holder (for 6V battery), 9V battery with connector, straw or refill, hot glue gun or super glue, electrical tape or clips, on-off switches, rubber frame, scissors

Time required: 60 minutes

Objectives:

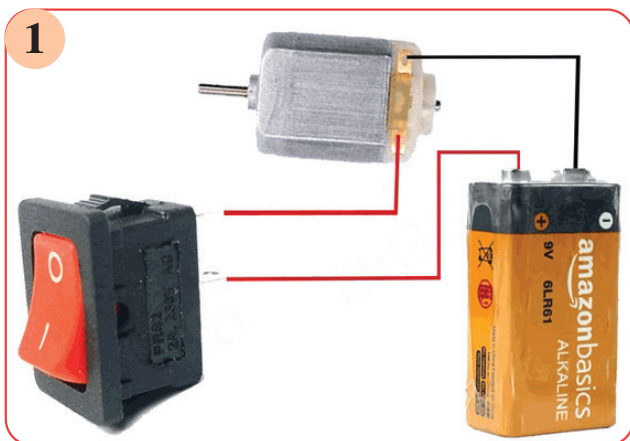
1. Students will make their own gyroscope using simple materials.
2. Students will observe how spinning objects stay stable and resist falling over.

Introduction:

A gyroscope is a device that maintains its orientation while spinning at high speed. In this activity, students will use a 6V motor and a CD to create a gyroscope. The motor will make the CD spin, and students will be able to observe how spinning objects stay stable and resist tipping over. This project will demonstrate the principles of angular momentum and gyroscopic motion. By making the gyroscope, students will learn how spinning helps keep things balanced and how this principle is used in real-world devices like radio-controlled aircraft and drones, in phones, cars for navigation and so on.

Hands-on activity:

1. Take a CD and attach it to the DC toy motor as shown in the image below.
2. Use hot glue to fix it in place. Make sure the CD is centered on the motor's shaft so it spins smoothly.
3. Now, we need to add a counterweight. For this, take 3-4 CDs (or any symmetrical wheels) and cut them into circles of the same size (8 cm in diameter).
4. Glue the cut CDs (or wheels) together using super glue to make a stacked piece.
5. Attach this counterweight to the motor's shaft using hot glue to keep it firmly in place.
6. Finally, connect the wires as shown in the image.
7. Turn on the switch to test your gyroscope. The motor should spin the smaller CD, and the larger CD should rotate around it.



Teacher Guidelines:

1. Divide the class into 6 or 8 groups, each having not more than 4 students (Max. 15 in a batch).
2. Ensure that students wear gloves while working with a glue gun.
3. Supervise students so that they handle tools, especially scissors and glue guns carefully.



Discussion with students:

1. How does the gyroscope resist tipping over when it's spinning?
2. What happens if you slow down the speed of the motor?
3. Can you feel any forces trying to push the gyroscope in different directions as it spins?
4. How do you think this gyroscope could be used in real-world technology?
5. Why do you think spinning objects are so stable and difficult to tip over?



Resources:

You can search on Google using the search words -

1. How to make gyroscope using CD
2. Simple CD gyroscope – toys from trash



Activity Name

65. RC Paper Robot

Syllabus reference:

Standard/Lesson No.: Class 7: Chapter 1 (4) - Electricity

Concept/Principle: Electric Current, Circuit, Concept of battery, Good Conductor and Bad Conductor of Electricity, Effects of electric current, Transformation of electrical energy to other forms of energy, conductor insulator

Materials and tools required:

100 RPM L shaped BO (Battery operated) motors- 2 Qty, 9V battery, battery clip, 3 wires of length 1.25 m each, cardboard, copper tape, A4 paper for printing the template, paper glue, stripper, scale, paper cutter/utility knife, soldering gun, soldering metal, glue gun with glue sticks

Time required: 90 minutes

Objectives:

1. Students will learn about basic electronic circuits and components like battery-operated motors, conductive and non-conductive materials, etc.
2. Students will make a remote-controlled paper robot.

Introduction:

In this activity, students will make a remote-controlled robot using simple materials like cardboard, a DC motor, and a 9V battery. They will use conductive copper tape to create circuits and understand how a DC motor converts electrical energy into motion based on Fleming's left-hand rule (interaction of the magnetic field and current produces the force that causes motion). Students will use a multimeter to check if the circuit is working properly.

Hands-on activity:

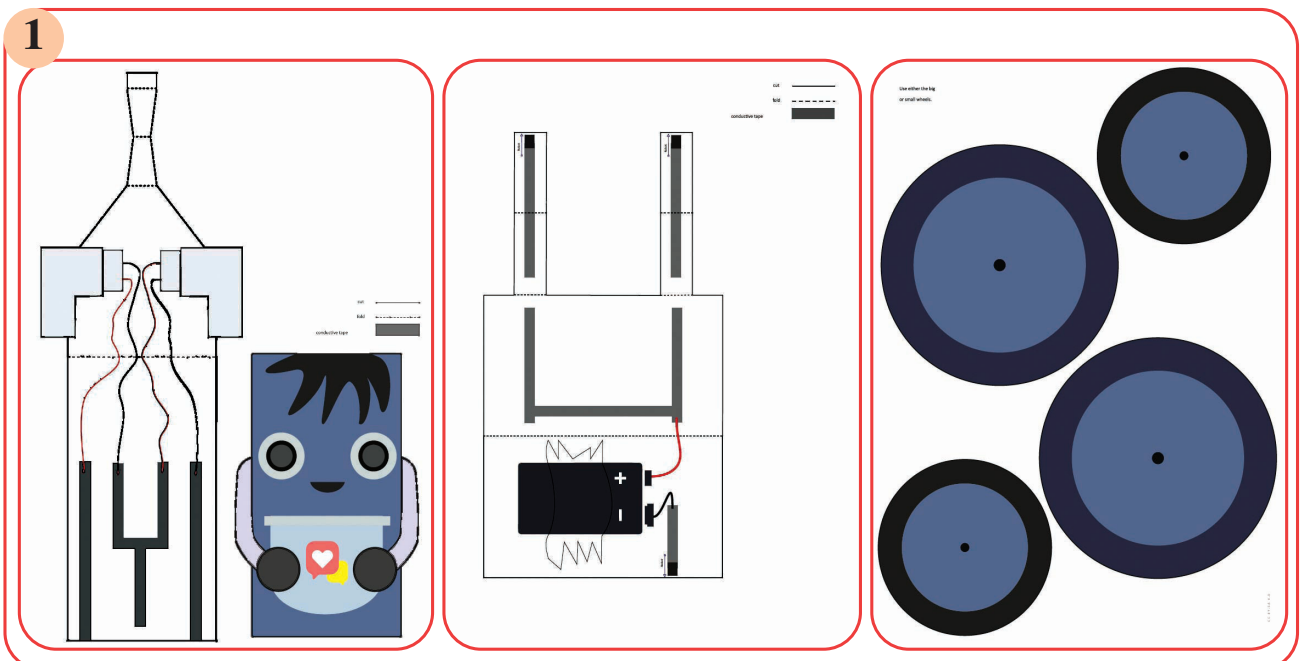
1. Scan this QR code to refer to the step-by-step instructions.
2. Take printouts of the given template on A4 sheets.
Scan this QR code to download the template to print.

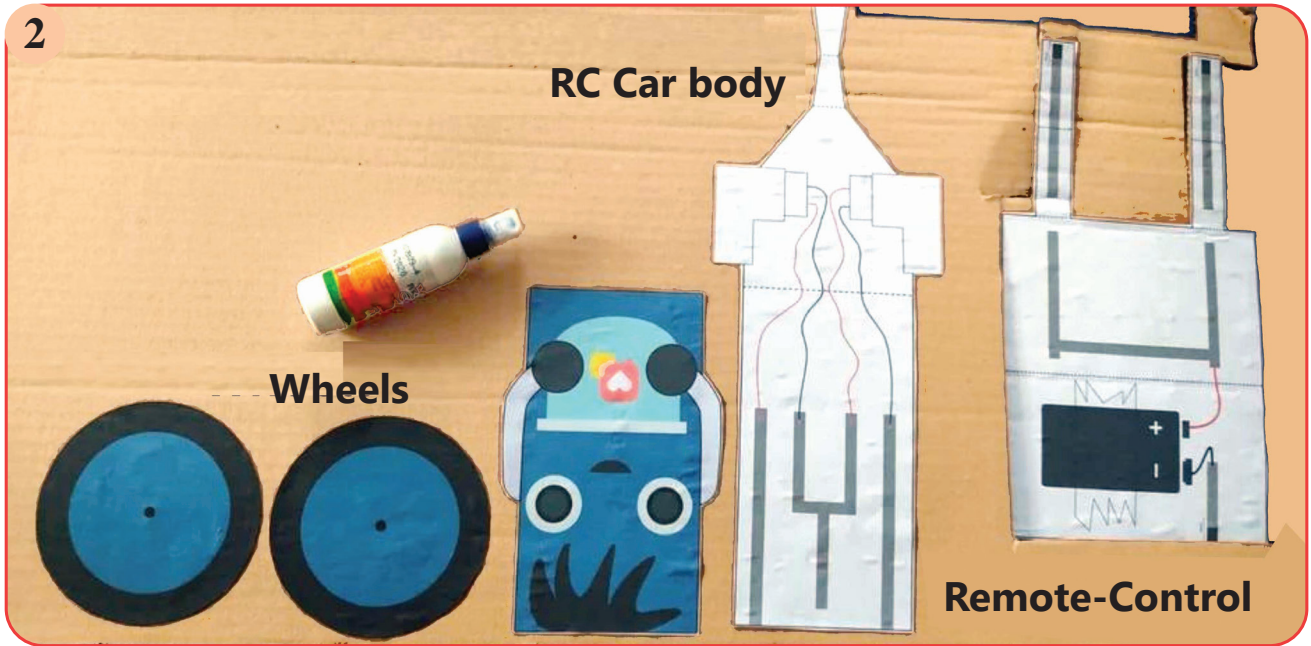
QR Code-A



3. Cut the printed template and paste it on a cardboard sheet using glue (refer to the images below).

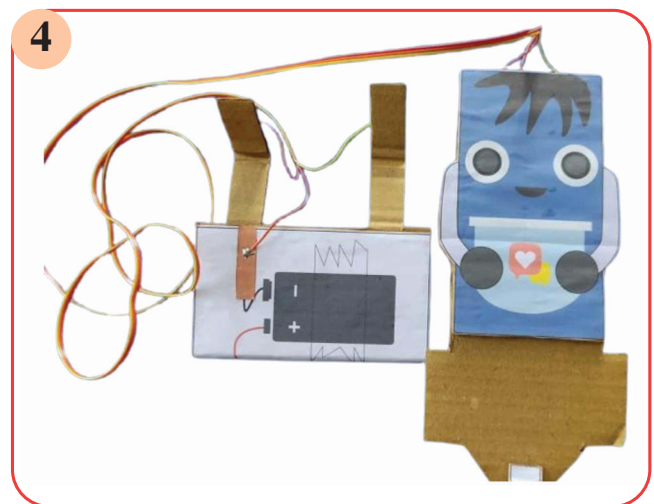
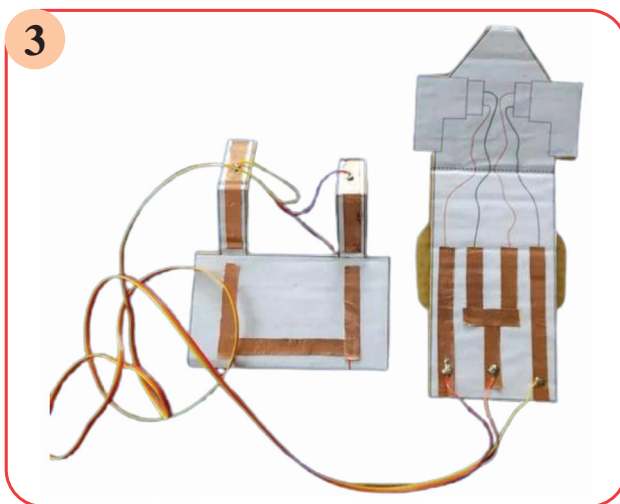
QR Code-B





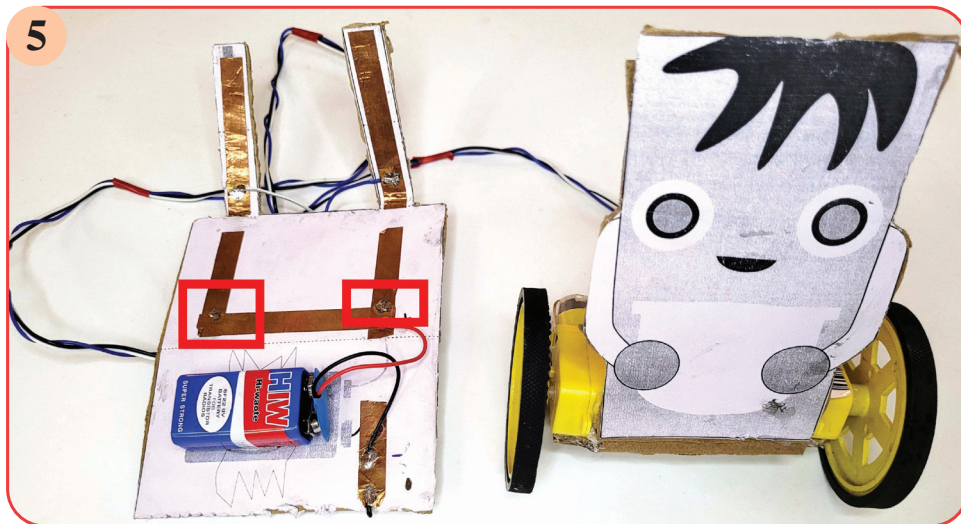
4. Cut out the designs from the cardboard sheet.
5. Stick the conductive copper tape following the dark markings on the design. Connect the RC car body to the remote-control part using 3 ribbon wires of 1.25 m each as per the instructions given in the reference video. This task needs soldering. To understand how soldering needs to be done, scan this QR code to watch the reference video.

QR Code-C



6. Fold the design as per the markings and glue BO (battery operated) motor using silicon hot glue. Solder motor wires as per the instructions in the video. If the motor spins backward then change the wire orientation and resolder it again. Attach the battery in the given place on the remote.

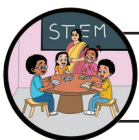
7. After checking the rotation of the motor, glue both the wheels on the motor shaft. In the video, we have used other types of robot wheels. These can be used or else use cardboard wheels.
8. Test run the robot to see if it is working well.
9. If the circuit is not working, check all soldering joints. You can use a multimeter to check the current continuity in the circuit. You can also put soldering joint, where there is intersection of two copper tapes as shown in the image below (highlighted these joints using rectangles)



RC PAPER ROBOT CAR USING CARDBOARD- FINAL ASSEMBLY

Teacher Guidelines:

1. Divide the Class into 6 or 8 groups, each having not more than 4 students.
2. Soldering guns, glue guns, strippers or utility knives should be handled only under teacher supervision.
3. Ensure that the battery clips are not connected to the battery until all soldering work is complete.



Discussion with students:

1. How can you check the circuit continuity?
2. When should motor wires be soldered to the copper tape pasted on the RC car body?
3. How can the speed of the car be increased or decreased?
4. What will you do if the cardboard wheels do not rotate even if the motor is working fine?



Resources:

Video reference to understand the assembly and soldering of joints- Scan this QR code.

<https://youtu.be/MQtPXR2fg9U?si=KhWKZNYvMwDIEmwT>



QR Code-D



Activity Name

66. Skiing Robot

Syllabus reference:

Standard/Lesson No.: Class 7: Chapter 1 (4) - Electricity

Concept/ Principle: Electric Current, Circuit, Concept of battery, Transformation of Electrical Energy to Other Forms of Energy

Materials and tools required:

100 RPM BO (Battery operated) double shaft motor, 1.5V AA battery, 2 wires, switch, ice-cream sticks, earbuds, small plastic ball, marker, pencil, stripper, 6-inch scale, paper cutter/ utility knife, soldering gun, soldering metal, glue gun with glue sticks

Time required: 90 minutes

Objectives:

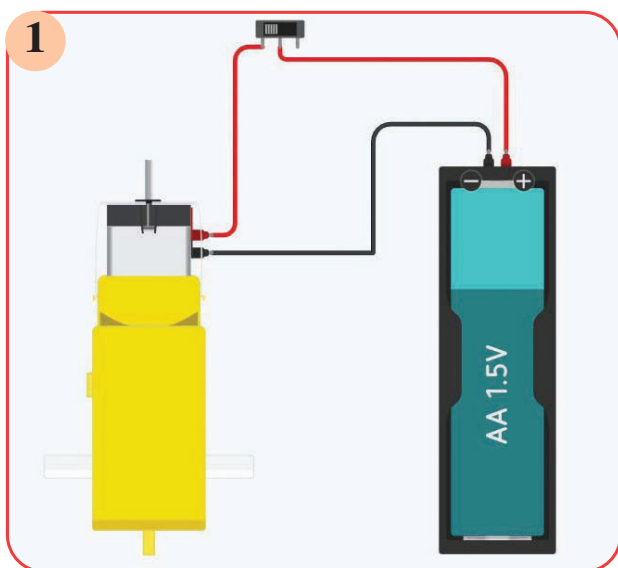
1. Students will make a skiing robot using a motor.
2. Students will learn about basic electronic circuits and components like battery operated motors and switches.

Introduction:

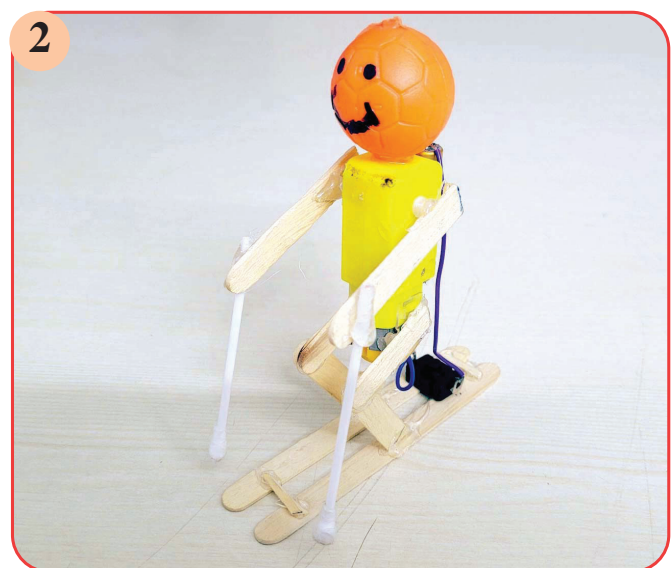
- ➔ In this activity, students will learn how to make a simple circuit using a motor, switch, battery, and wires. A geared DC motor (battery-operated) will be used to convert electrical energy into mechanical energy. The DC motor will work based on Fleming's Left-Hand Rule, which states that when an electric current flows through a wire in a magnetic field, it creates a force that makes the motor move.
- ➔ Students will apply this concept to build a toy, like a skiing robot. When the battery - operated DC motor applies force through ear-buds, motion will be created and the robot will jump.

Hands-on activity:

1. Connect a dual shaft BO motor to a 1.5V AA battery and a switch as per the circuit diagram. Make sure the motor shaft rotates in such a way that after connecting the ice-cream sticks, they make the robot move forward.
2. You can use AA battery without the battery holder. That way, it will reduce the weight the robot will be carrying while working. You can glue the battery directly behind the BO motor using a glue gun.
3. Cut the ice-cream sticks as per the dimensions suggested in the reference video given at the end of the lesson and assemble all the parts as per the instructions in the video.



Circuit diagram of the skiing robot



Skiing robot

Teacher Guidelines:

1. Divide the Class into 6 or 8 groups, each having not more than 4 students .
2. Soldering rods, glue guns, strippers or utility knives should be handled under teacher supervision.



Discussion with students:

1. What should be the length of the earbud so that the robot can jump?
2. Why do we need to join the two ice cream sticks at the bottom with small pieces?
3. What is required to make the robot remain stable when it is not switched on?



Resources:

Video reference for making skiing robot using BO motor



QR Code#1



QR Code#2





Activity Name



67. Multipurpose PVC Pipes

Syllabus reference:

Standard/ Lesson No.: Class 8: Chapter 2 - Element, Compound and Chemical Reaction

Concept/Principle: Properties of material, making models, metal, non-metals

Materials and tools required:

PVC pipes (various diameters and lengths), PVC pipe connectors (elbows, tees, crosses, couplings, caps), measuring tape, ruler, markers, hack saw, safety goggles, glue (PVC pipe adhesive)

Time required: 120 minutes

Objectives:

1. Students will learn to make useful articles using PVC pipes.
2. Students will understand about different types of PVC joints.
3. Students will learn measurement, and design.

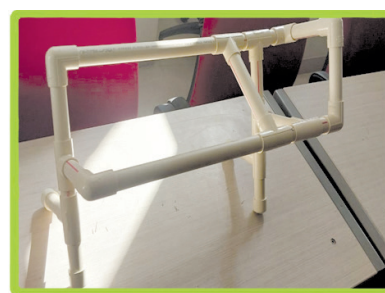
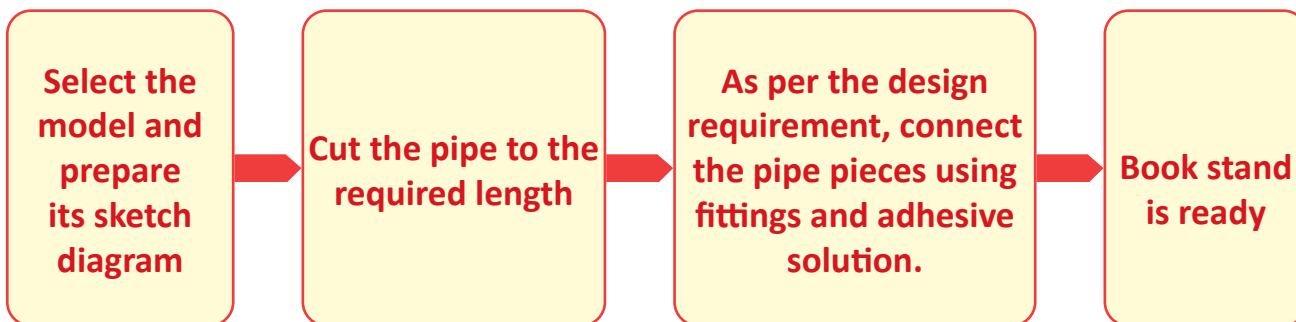
Introduction:

PVC or POLYVINYL CHLORIDE is one of the most commonly used terms in the construction industry. It is a special type of plastic that is used in construction and various industries. Many useful items such as book stands, clothes hangar, mobile stand, laptop stand, clothes drying stand etc.can be made using different PVC pipes, connectors and joints.

Hands-on activity:

Making a book stand:

1. Check all the necessary tools and materials.
2. Draw a paper sketch to get an idea about how the final object will look after completion. This will help reduce wastage of pipe.
3. Measure the PVC pipe with a measuring tape and cut it into small pieces of the required lengths using a hacksaw.
4. Assemble the book stand according to the required height by connecting the pipes to the elbows and T-joints.
5. Put caps on the bottom of the legs of the stand to balance it properly.
6. Finally, fix all the joints with glue.



Costing:

Use the table below to calculate the cost

Calculation table:

S.No.	Particular	Quantity	Rate	Amount
1	PVC pipe			
2	T joint			
3	Elbow			
4	End cap			
		Total Amount =		

Teacher Guidelines:

- Divide the class into 6 or 8 groups, each having not more than 4 students.
- Ensure that all students follow safety precautions such as wearing masks, gloves, etc.



Discussion with students:

1. What is the full form of PVC?
2. Can the book stand be made using just PVC pipes? What else can a book stand be made from?
3. Apart from the book stand, what other things can we make using PVC pipes?
4. What is the use of a book stand?
5. In which other industries is PVC used?



Resources:

You can search on Google using the search words -

1. How to make useful articles or products using PVC pipes
2. DIY book stand using PVC pipes
3. What is PVC ?Learn to make models using PVC pipes at home





Activity Name



68. Solar Dryer

Syllabus reference:

Standard/ Lesson No.: Class 7: Chapter 1 (5) - Environment-friendly Energy;
Class 8: chapter 1(1.3) – Heat, heat flow

Concept/Principle: Solar Energy and its applications,
Heat Transfer: Conduction, Convection and Radiation

Materials and tools required:

Bamboo, black plastic paper/film, wire mesh, velcro, metal wire,
cutter, wire cutter

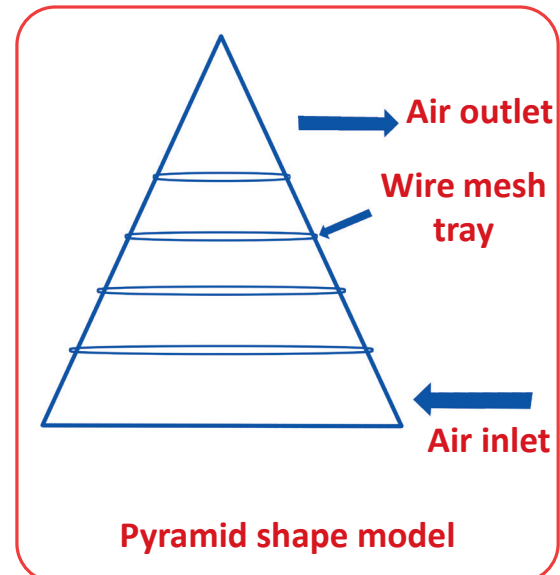
Time required: 120 minutes

Objectives:

1. Students will learn to build a simple solar dryer using easily available materials.
2. Students will understand the principles behind solar drying.
3. Students will dry different vegetables in a solar dryer to learn how it can be used for preserving different food items.

Introduction:

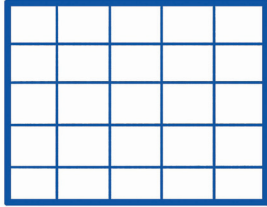
- ▶ Through this activity students understand the importance of solar energy. They will make a solar dryer and use it to preserve vegetables.
- ▶ Drying vegetables in the sun is a traditional method of preservation. But the solar dryer uses sunlight to dry vegetables without exposing them directly to the sun. This helps keep their color, smell, and cleanliness intact compared to traditional sun drying, which has issues like dust, insects, and color changes.
- ▶ Hot air is lighter than cold air and it moves in an upward direction. Therefore, the exhaust vent of the dryer is at the top of the dryer. This principle helps to remove the moisture content of vegetables. In solar dryers, since vegetables are not directly exposed to sunlight the color of vegetables remains the same. Black paper is used because it absorbs the sunlight and helps maintain the internal temperature of the dryer.



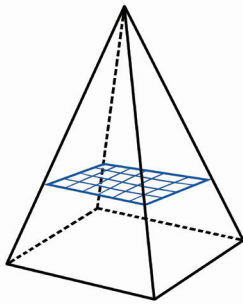
Hands-on activity:

Part 1: Making a simple ARTI solar dryer

This dryer design is made by ARTI institute and hence it is called ARTI solar dryer. This is a four-sided pyramid made out of bamboo.



**MARK AND FIX
WIRE MESH
FRAME FIRMLY**



Steps to make ARTI dryer:

1. Take four bamboos of 160cm each and form a pyramid structure.
2. Make bamboo frames of the following sizes
 - ➡ 100 x 100 cm
 - ➡ 50 x 50 cm
 - ➡ 30 x 30 cm
3. Insert wire mesh into the frame and secure it using metal wire.
4. Keep a small vent at the top of the dryer while wrapping plastic so that hot air can escape outside.

5. This simple pyramid dryer can be easily dismantled when not in use.



Part 2: Using ARTI dryer for drying leafy vegetables

Materials required:

Clean, chopped leafy vegetables.

Steps to dry the vegetables:

1. Clean the vegetables. Remove the stem and other non-edible portions. Chop the vegetables properly.
2. Keep the dryer under sunlight
3. Spread the chopped leafy vegetables uniformly on the wire mesh trays.

4. Wrap the dryer with a black sheet.
5. Allow a few hours for the vegetables to dry completely.
6. Use dried vegetables in the kitchen for use in mid-day meals. Students can also cook the dried vegetables and taste it

Observation Table:

The time when drying starts	Weight before drying	The time when drying is complete	Weight after drying

Time taken for drying = Time when drying is complete – Time when drying was started

Time takes for drying = _____

Loss of moisture during drying = Weight before drying – Weight after drying

Loss of moisture = _____

Note: You can check the temperature inside and outside the dryer 3–4 times a day.

Teacher Guidelines:

1. Divide the Class into 6 or 8 groups, each having not more than 4 students .
2. When to do the activity with students: in the summer
3. Make sure all students follow safety precautions.
4. Make different groups of students to dry different vegetables.



Discussion with students:

1. Why is it good to dry vegetables?
2. How does the solar dryer work?
3. When can we use a solar dryer?
4. What happens if some moisture remains in the vegetable after drying?

5. Why do we use a black sheet in the solar dryer?
6. What is the purpose of the vent at the top of the dryer?
7. Why is it important to spread the vegetables evenly on the mesh?
8. What are some other ways to preserve vegetables besides drying?
9. How can solar energy be used for other purposes in daily life?
10. What types of vegetables can be dried in a dryer?



Resources:

ARTI Solar Dryer

vadic.vigyanashram.blog/2019/03/08/arti-dryer/



QR Code





Activity Name



69. Amazing Products from Bamboo

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 1 - Interdependence of Environment and Biodiversity, Class 8: Chapter 11 - Environment and Flora Around Us

Concept/Principle: Humans and animals depend on trees, e.g. to build houses; Bamboo is one the most versatile and important trees in the environment

Materials and tools required:

Bamboo, glue, marking pen, sickle, hack saw, measuring tape or scale, multipurpose knife, small knife, saw, bench vice, drill machine, sandpaper pad, drill bit, chisel, and wood rasps

Time required: 120 minutes

Objectives:

1. Students will learn to make useful products from bamboo.
2. Students will learn about the versatility of bamboo as a sustainable resource material.

(NOTE: A local resource person, such as a carpenter or bamboo artist, is recommended for guiding this activity.)

Hands-on activity:

Tools/ Materials	Function
Hack saw	To cut internodes from a length of bamboo
Table vice	To hold the bamboo length securely
Sandpaper	To smooth the surface
Sickle /Saw	To cut bamboo
Chisel	To make holes in the bamboo surface
Wood rasps	For rough finishing and smoothening nodal areas
Drill machine	For drilling holes
Measuring tape/scale	To measure length
Knife	For scraping the bamboo surface

Process Chart:

1. Harvest bamboo – Cut the bamboo from the main plant using a sickle or wood saw.
2. Cutting of bamboo – Cut the bamboo into required sizes (length) using a hacksaw.
3. Filing - Clean and smoothen the bamboo surface of the bamboo using files, and wood rasps.
4. De-skinning – Peel off the skin of the bamboo slowly with a sharp knife.
5. Sanding – Smoothen the bamboo surface using sandpaper for a good finish.
6. Finishing - Apply a protective layer of paint and polish on its smooth surface.



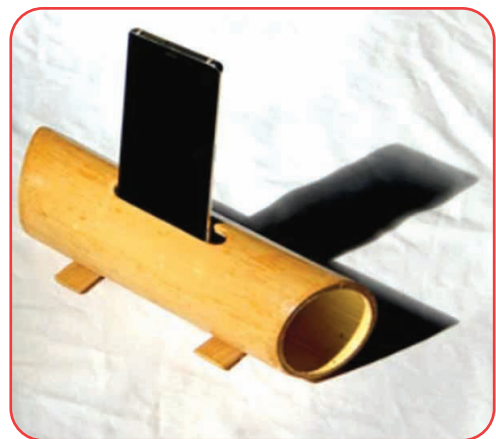
PEN STAND



BASKETS



BAMBOO PLANTER



**BAMBOO MOBILE
AMPLIFIER**

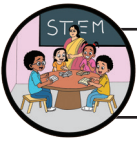
Steps for making a **BAMBOO PEN STAND** -

1. Find a bamboo piece at least 8 inches long and about 3 inches wide.
2. Make sure the bamboo is treated and has walls about 1/8 to 1/4 inch thick.
3. Cut a piece of bamboo with nodes at both ends.
4. Use a tape and pencil to mark the middle of the bamboo piece, then draw a line around it.
5. Carefully cut along the line with a hacksaw to split the bamboo into two equal parts.
6. Each part with a node at the bottom becomes a container.
7. Put the bamboo container on a board with the node end down.

8. Use a file to smooth the bottom of the container so it sits nicely.
9. Peel off the outer skin of the container with a small knife.
10. Finally, you can polish, paint, or add a colored finish to your bamboo stand.

Teacher Guidelines:

1. Divide the class into 6 or 8 groups, each having not more than 4 students .
2. Make sure all students follow safety precautions – masks, gloves, etc.
3. Make sure that all students handle all materials carefully under teacher supervision.



Discussion with students:

1. What are the various products that can be made from bamboo?
2. How can the production of bamboo products positively impact local communities?
3. What are some innovative design ideas for bamboo products?



Resources:

You can search on Google using the search words –

1. How to make pen stand using bamboo + YouTube
2. How to make bamboo products



Activity Name

70. Repair Equipment

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 5 – Measurement

Chapter 6 - Basic concept of Force and Energy

Chapter 9 - General Machines

Class 7: Chapter 1 (4) - Electricity

Concept/Principle: Understanding measurement, force, motion, friction, and simple machines, and applying basic electrical concepts to identify, repair, and reuse parts of household devices.

Materials and tools required:

Old cloth, old equipment in not-working condition, wrench set, allen keys set, screw driver, meter tape, digital multimeter, cutter, stripper, WD-40 liquid spray or petroleum jelly, grease, machine oil

Time required: 180 minutes

Objectives:

1. Students will learn about re-assembling and repairing household gadgets.
2. Students will be able to understand the workings of various equipment.
3. Students will reuse parts like DC fans, motors, cables, etc. for other science projects

Introduction:

Through 'Tod-Fod-Jod' (Disassemble, Reassemble, Repair, Re-purpose, and Create) activities, children learn how mechanical, electronic, and electrical systems work together in various devices and equipment to make every day human activities easier. Through this activity, students learn how to assemble/connect various parts and components of equipment by understanding their working principle, the scientific concepts behind these equipment and objects.

'Tod-Fod-Jod'

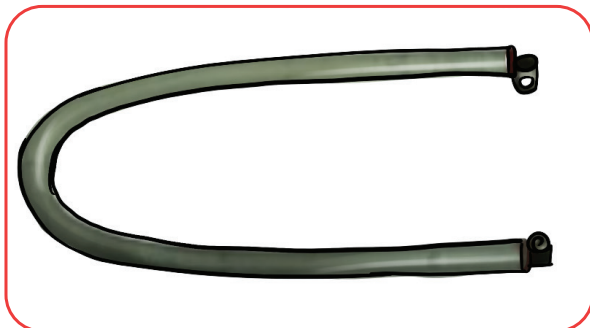
(Disassemble, Reassemble, Repair, Re-purpose, and Create):

1. Collect unused household appliances.
2. Open these unused appliances using appropriate tools.
3. List the different parts and components while separating them.
4. Keep the removed parts properly and neatly. You will need these parts while reconstructing the device again.
5. Use trays, boxes to keep smaller parts like screws, nuts, washers, etc.
6. Study the mechanism and function of the parts/components.
7. To know the function, structure, and mechanism of each part look up the internet, Google, YouTube, etc.
8. Reassemble the device after repairing it.

Hands-on activity:

Example: A device for ironing clothes (press) (see picture.)

The different parts of an iron (press) and their function can be noted down as follows:



S.No.	Name of the part	Function of the part
1	Thermostat	Bimetallic (made of two metals) strips are used in the thermostat to keep the press heated to the desired temperature level.
2	Heating coil	Converts electrical energy into thermal energy. This plate removes wrinkles from clothes.

In the table below, a few equipment and their major parts are described:

Recommended Equipment	Parts to study about
Ironing press	Coil, Base Plate, Thermostat
Computer	Hard Disk, Mother Board, RAM, Mouse, Keyboard
Speaker	Magnet, diaphragm
Fan	Motor, capacitor
Mixer and grinder	Motor, blade
Electric motor	Stator, rotor, binding

Teacher Guidelines:

1. Divide the class into 6 or 8 groups, each having not more than 4 students.
2. Collect old electric appliances.
3. Provide appropriate tools and equipment to open and re-assemble the devices including trays, boxes, old cloth, etc.

4. Let children open the appliance by themselves and write down their understanding in the tabular formats given above.
5. Ensure that students do not connect faulty equipment to the power supply.
6. The instructor/teacher should be personally present during the entire activity.
7. Label the wire so that the wire does not get interchanged.
8. Keep the removed parts properly and neatly. These parts will be used for reconstructing the device again.



Discussion with students:

1. How do these devices work?
2. Write down each part of the equipment
3. On which principle does the device work?



Resources:

You can search on Google using the search words –

1. How to repair a defunct ceiling fan at home + YouTube
2. Assembling a ceiling fan + YouTube
3. Working of electric iron + YouTube
4. Repairing the faults and assembling an automatic electric iron + YouTube





Activity Name

71. Soak Pit

Syllabus reference:

Standard/Lesson No.: Class 7: Environment and Public Health
Concept/Principle: Health and Hygiene, Wastewater Treatment

Materials and tools required:

Broken bricks, coarse sand, meter tape, digging tools - hoe, pan, digging bar

Time required: 180 minutes

Objectives:

1. Students will build a soak-pit at school
2. Students will understand about wastewater and diseases spread via. stagnant water.

Introduction:

A soak pit is a simple structure used to safely absorb runoff water or greywater. It helps keep areas around washing and drainage points clean and dry. When wastewater from houses is left to spread on the ground, it can create puddles or stagnant water. This leads to bad smells and becomes a breeding ground for germs, which can cause diseases. A soak pit solves this problem by allowing the water to slowly seep into the ground.

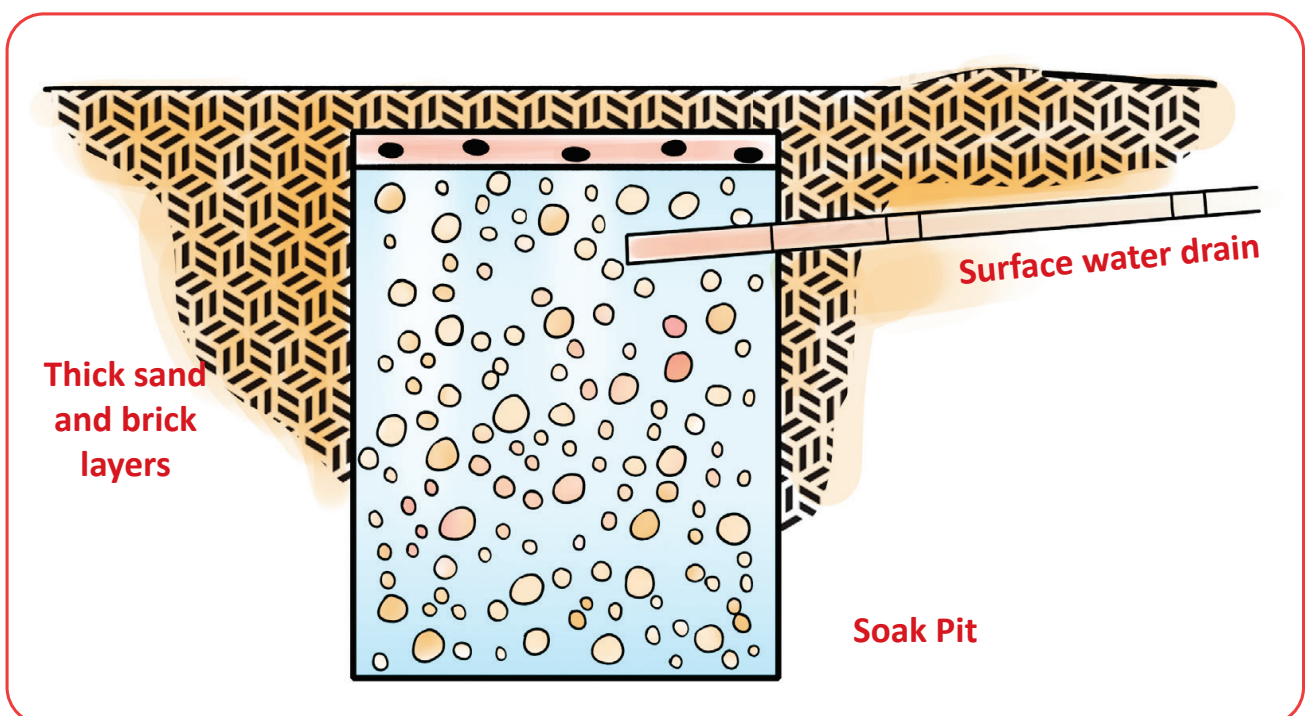
Location:

A soak pit is to be made where waste water usually gets accumulated, for example near handpumps, washing area, bathroom drainage point, utensil cleaning area. Soak pit should be made at least 5 meters away from borewell or well and the house

Hands-on activity:

Follow the following steps to make a soak pit:

1. Dig a 1m x 1m x 1m pit where waste water is to be released
2. Make 20 cm alternate layers of sand and brick
3. Add a 10cm thick layer of sand on top
4. Connect the sewage water flow to soak pit



Advantages of Soak pit:

1. Prevents contamination of groundwater sources from wastewater seepage
2. Prevents mosquitos and bacteria
3. Removes the odor from wastewater accumulated in open ground
4. Soak pit can be made at low cost

Teacher Guidelines:

1. Divide the class into 6 or 8 groups, each having not more than 4 students.
2. Make sure that students are careful while using tools and equipment so that they do not get injured.



Discussion with students:

1. Why coarse sand and broken bricks are used in the soak kit?
2. Can we grow plants using grey or wasted water?



Resources:

You can search on Google using the search words –

1. How to build a soak pit at home/school
2. Soak pit for greywater
3. Soak pit construction guide



Technology



Activity Name



72. Paper Electronics

Syllabus reference:

Standard/Lesson No.: Class 7: Chapter 1 (4) - Electricity

Concept/Principle: Electric Current, Flow of Electric Current – Electric Circuit, Good Conductor and Bad Conductor of Electricity, Battery

Materials and tools required:

Drawing paper, copper adhesive tape, 5mm LEDs, 3-Volt lithium button battery or coin cell, pen, pencil, crayons, sketch pens, scissors/paper cutter, soldering iron

Time required: 120 minutes

Objectives:

1. Students will make paper circuits using copper tape and batteries (coin cells) to understand the basic components of electronics such as OPEN/CLOSED circuits.

Introduction:

- Students will make an electrical circuit using basic components like copper tape, paper, batteries (coin cells) and basic components like LED's to understand how these electronic components work in a hands-on way. Normally copper wires are used in making electric circuits.
- In this activity, copper adhesive tape will be used since it allows safe circuit-making with small current.
- Students can also make greeting cards, and various craft projects using paper electronics.

Hands-on activity:

- Paper circuits are made using a few simple materials—such as batteries, copper tape, LEDs (Light Emitting Diodes), and many other electronic components like resistors, transistors, capacitors, and LDRs (photoresistors).
- Download various paper electronics or “papertronics” circuits from the given links and apply copper tape along the circuit line tracks. Use the LED, buzzer (a type of whistle), resistor, and capacitor as indicated.

Sub Activity 1: Simple circuit without switch

- In this activity, students will make a simple circuit without switch using paper tape, LED and 3.3V coin battery

STEPS:

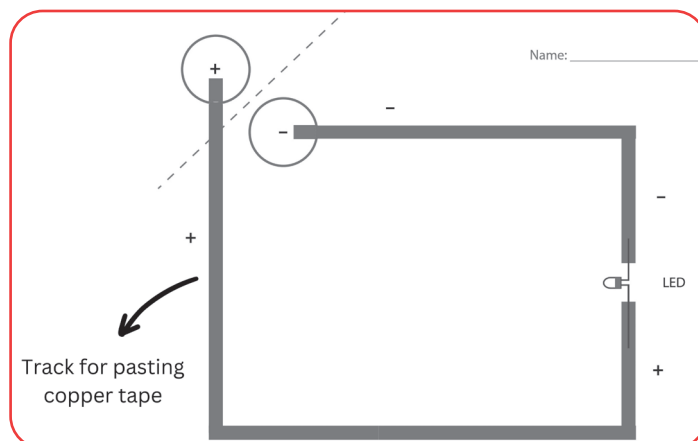


QR Code#1



QR Code#2

- Download template for a ‘simple circuit without switch’ by scanning either QR code#1 or QR code#2 shared below.



- You can also draw the given ‘simple circuit without a switch’ using pen or pencil on drawing paper.

- Remove the paper from the backside and place the adhesive side of the copper tape gently along the drawn circuit track (dark line). This will act as the electricity conducting medium

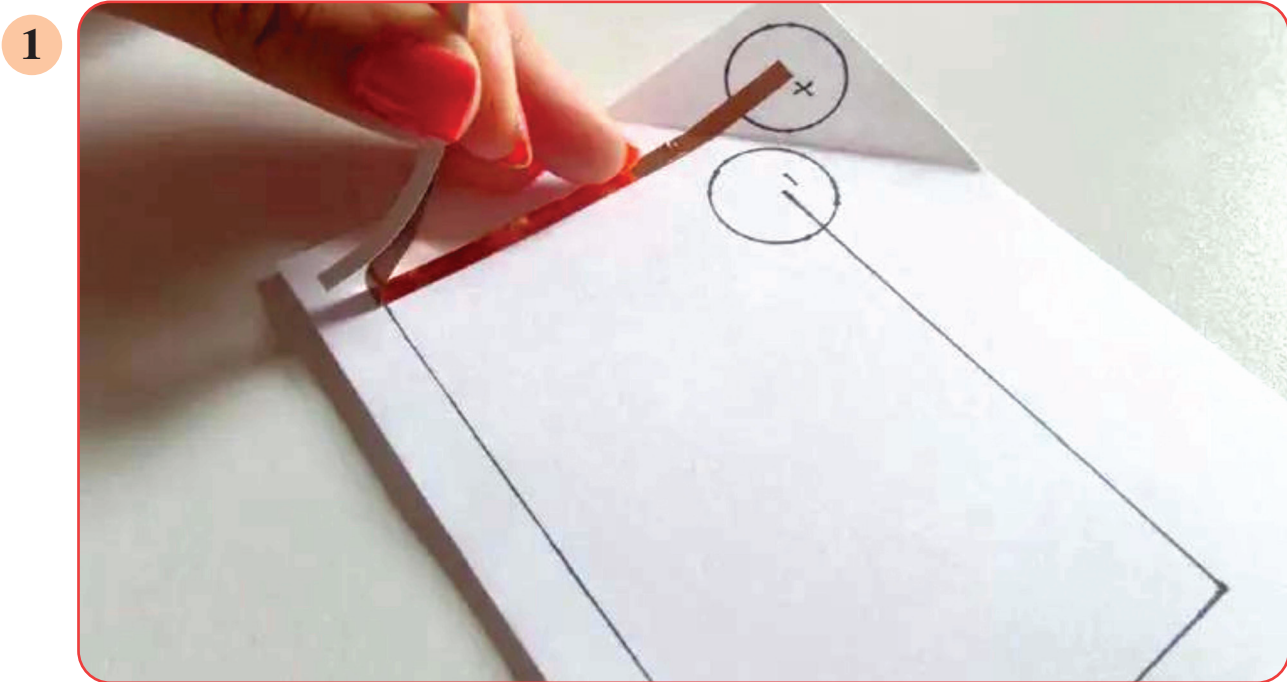
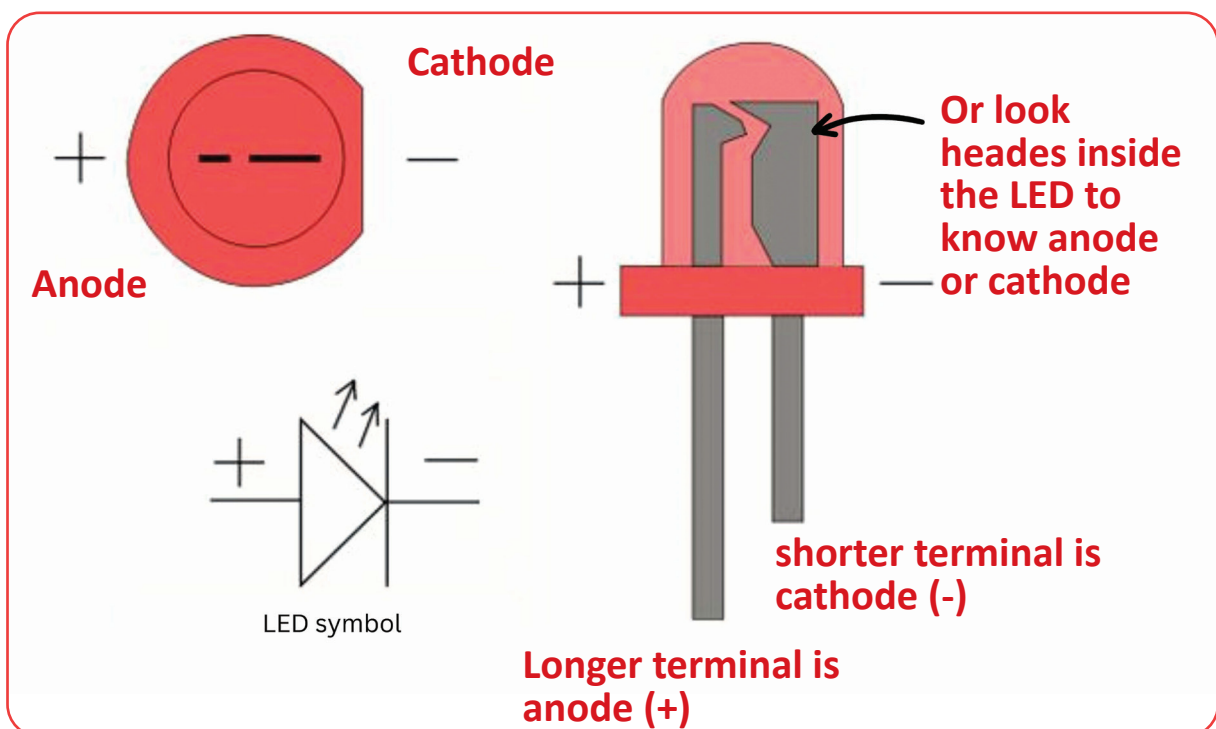


Fig. Simple circuit without switch - circuit diagram

- Check the polarity of the LED (refer to the image below) and then solder its terminals onto the copper adhesive tape as per the polarity. Alternatively, fix both the terminals of the LED with transparent tape as shown in the circuit.
- Place the 3.3V coin battery as per the terminal. Anode of the battery should

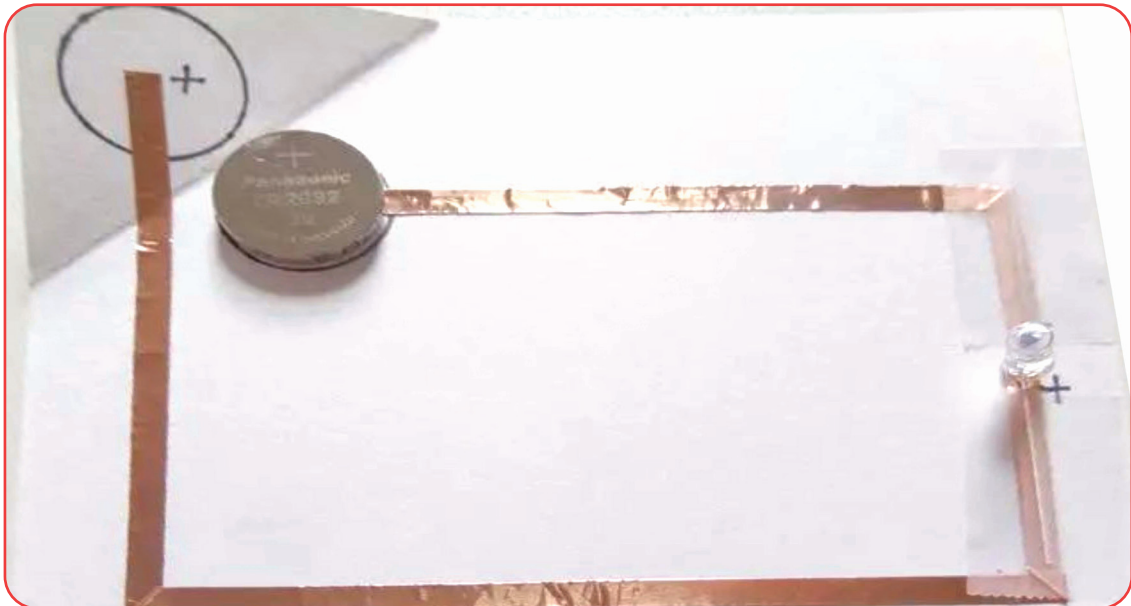


Terminal of LED

be facing upwards. As you fold the top left edge of the paper as shown, the LED will turn ON.

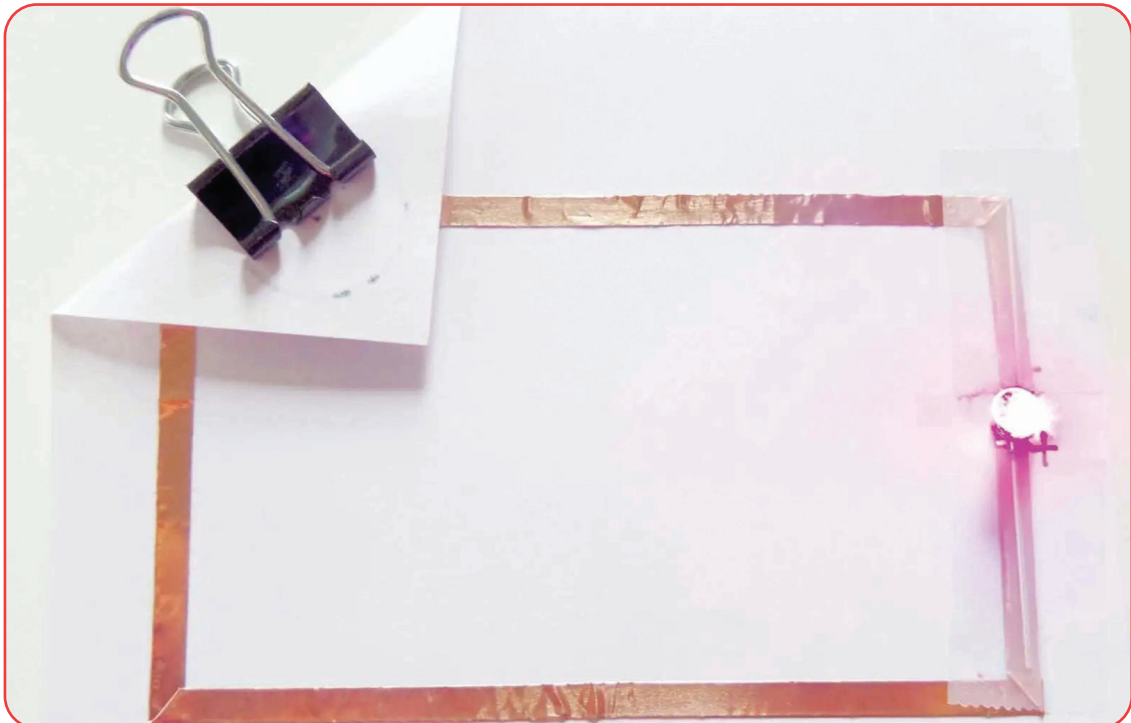
- ➡ You can add a binder clip to hold the battery in place.
- ➡ When the top left corner of the circuit over the battery is not folded, the circuit is called an OPEN CIRCUIT.

2



Simple Circuit Without Switch - Step 2

3



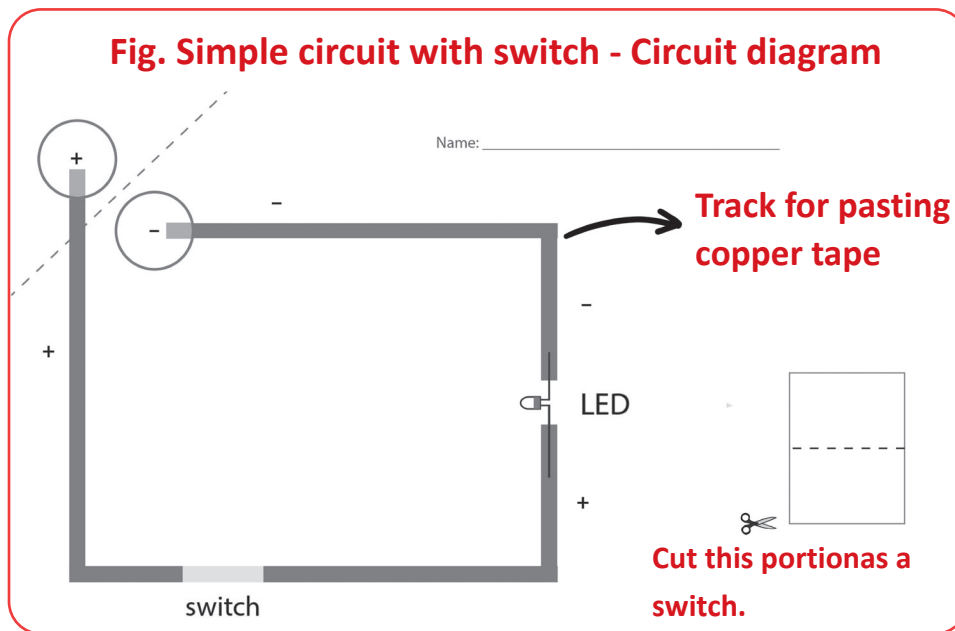
Simple Circuit Without Switch - Step 3

- ➡ When you fold that portion or secure it with a binder clip, the circuit is called a CLOSED CIRCUIT.

Sub Activity 2: Simple circuit with switch

In this activity students will make a simple circuit with switch using paper tape, LED and 3.3V coin battery

- ➡ STEPS: Download the template for 'simple circuit with switch' by scanning QR code#3 given below.
- ➡ You can also draw the given 'simple circuit with switch' using pen or pencil on drawing paper.



QR Code#3



- ➡ Remove the paper from the back side and place the adhesive side of the copper tape gently on the drawn track (dark line). This will act as an electricity conducting medium.

1

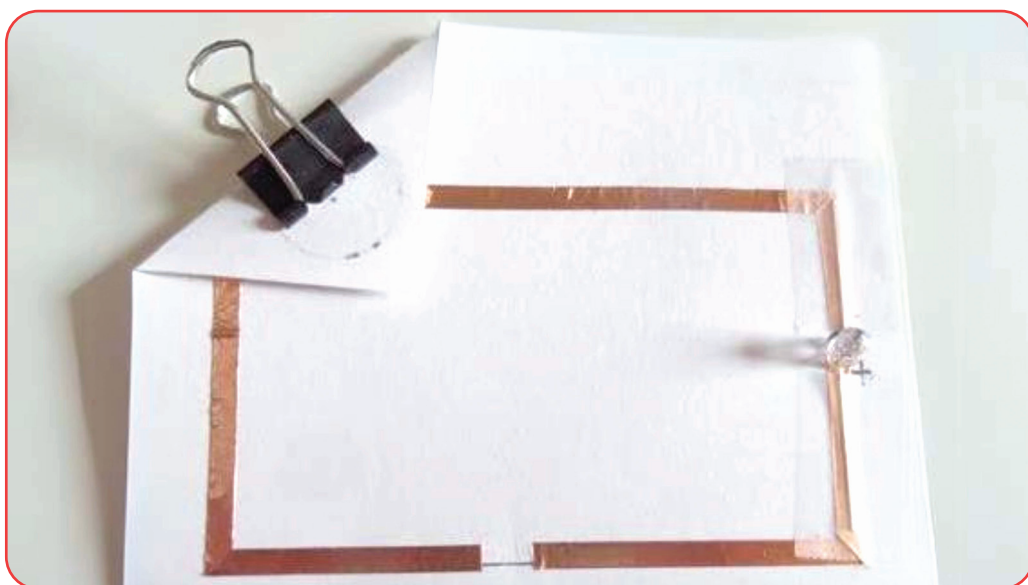


Fig. Simple circuit with switch - Step 1

- Leave space for switch as shown below.
- Cut the switch from the paper template and fold it on the dotted line. Stick one half of the switch on the circuit, keeping the remaining half folded upward over the switch area marked on the circuit. On the second half of the switch, stick a piece of a copper tape facing down, as shown below.
- When you press the switch, the LED will turn ON because the circuit becomes closed, as shown below.

2

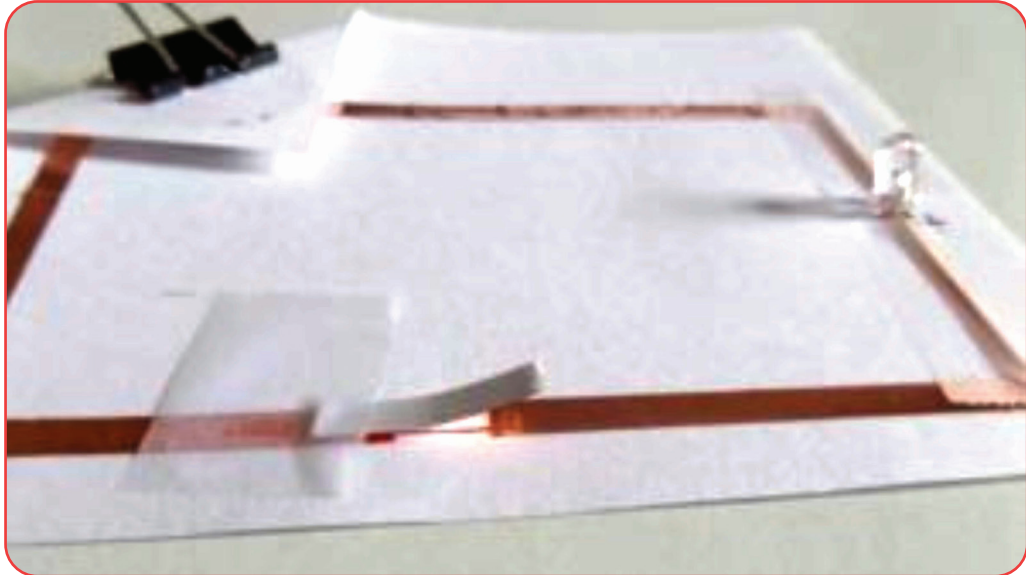


Fig. Simple circuit with switch - Step 2

3

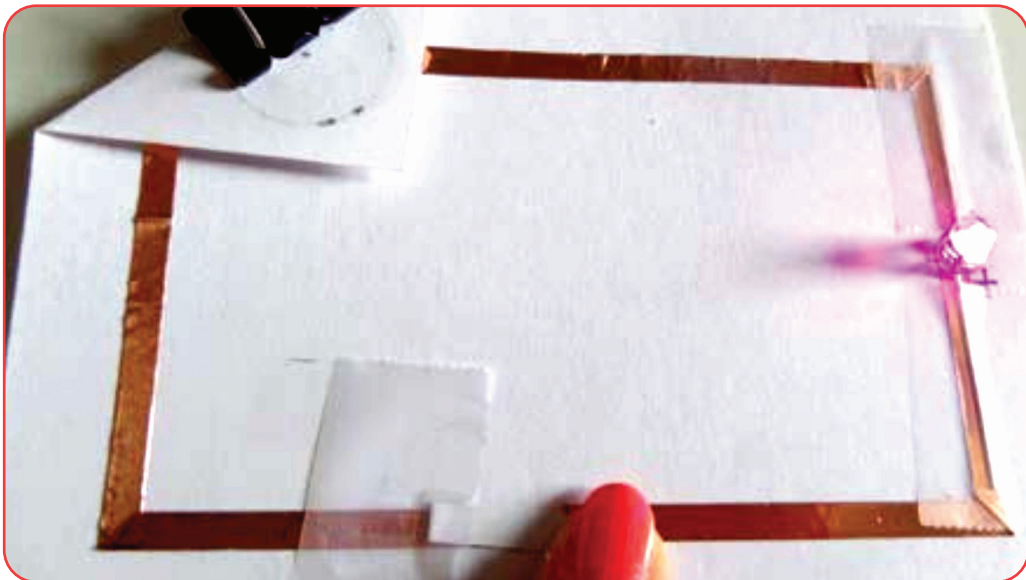


Fig. Simple circuit with switch - Step 3

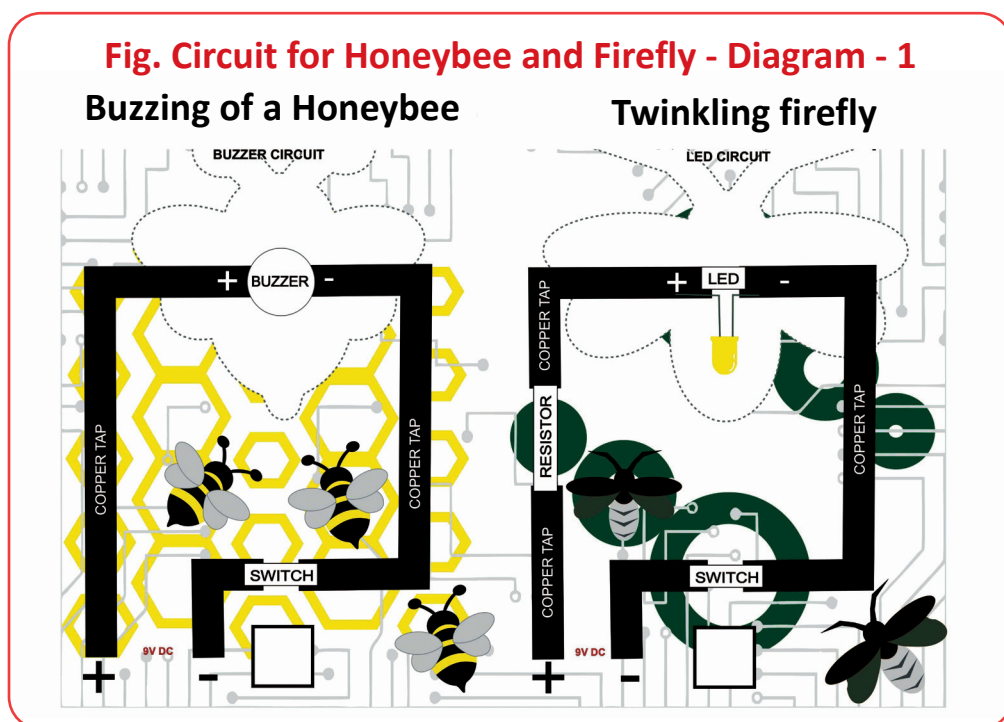
- If the LED does not turn ON, check the continuity of the copper tape. Instead of joining the LED using cello tape, solder the LED terminals directly on the copper tape. Also, add a small amount of solder at the joints of the copper tape.

Sub Activity 3: Buzzing Honeybee and Twinkling Firefly

In this activity, students will make creative and artistic circuits using paper tape, buzzer, LED, resistor and 9V battery to demonstrate the buzzing sound of a honeybee and the twinkling light of a firefly.

STEPS:

- ➡ Download the template for these circuits (buzzing honeybee and twinkling firefly) by scanning the QR code#6. You can also draw a given series circuit using a pen or pencil on drawing paper.

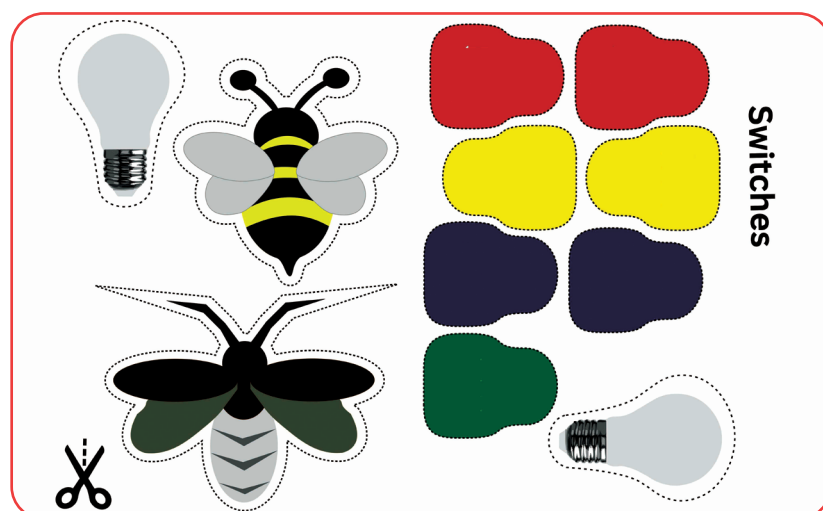


QR Code#4

- ➡ Follow the same steps as earlier to paste the copper tape and fix the LED and Buzzer (after

checking their polarity) on the circuit.

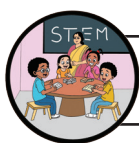
- ➡ Add a switch as instructed in earlier activity. You may cut switches from the colorful template as shown below.



- ➡ For the Firefly circuit, add one resistor of 220 Ohm in the circuit
- ➡ Use a 9V battery with a battery clip to test the circuit and see that the LED and buzzer are turning ON.

Teacher Guidelines:

1. Divide the class into 8 or 10 groups, each having not more than 2 students.
2. Check circuit diagrams, and polarities of components twice before making connections.
3. Teachers must ensure that students take adequate precautions while soldering or while using wire strippers or utility knives.
4. Do not try paper circuits with an AC supply.
5. Students must not rush while doing these circuits.
6. Students should be aware of their surroundings while handling the soldering gun, scissors or paper cutters.



Discussion with students:

1. What is a circuit?
2. What are the different types of circuits?
3. What are the different methods of making a circuit?
4. What materials are used in making a paper circuit, and how are they different from materials used in other types of circuits?
5. In what other ways can paper circuits be used?
6. What will happen if we change the polarities?
7. What will happen when the battery is connected, and the switch is pressed?
8. Why is it important to properly overlap the copper tape strips when pasting them?



Resources:

You can search on Google using the search words –

1. How to make a paper circuit
2. DIY Paper circuits
3. Paper circuit light up card+ step-by-step guide





Activity Name



73. LED (Light Emitting Diode) Torch

Syllabus reference:

Standard/Lesson No.: Class 7: Chapter 1 (4) - Electricity

Concept/Principle: Electric Current and its effects, including the production of light and heat when current flows through a circuit.

Material and tools required:

Hinged transparent lockable plastic box, switch, LED light, 9V battery, 100-ohm resistor, soldering gun 25 w, flux, solder wire, wire stripper, blade cutter, multimeter, nose plier

Time required: 120 minutes

Objectives:

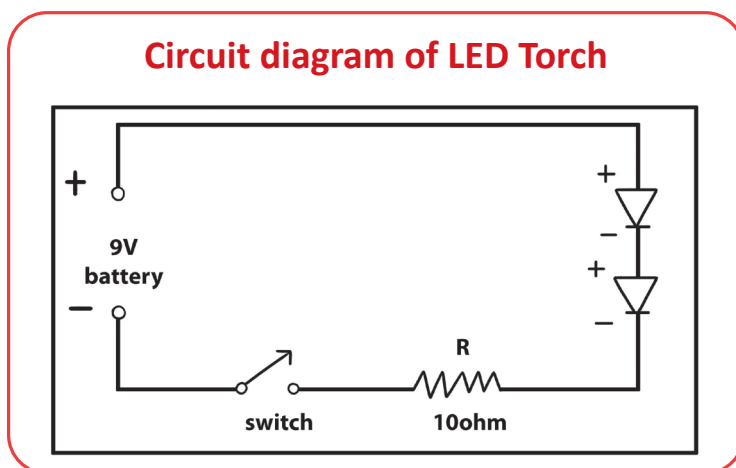
1. Students will make a DIY LED torch
2. Students will learn about current, voltage.

Introduction:

- The torch circuit includes a power source (9V battery), conducting medium (wires) and a load in the form of a Light Emitting Diode (LED).
- When the switch is turned on, the chemical energy stored in the battery is converted into electrical energy causing the current to flow through the circuit.
- The LED then converts this electric energy into light energy.
- A resistor is used in the circuit to limit the current in the circuit.
- A switch is used to control the flow of current in the circuit.

Hands-on activity:

1. Observe and note down the specifications given on different materials such as the battery.
2. Observe and note the color code of the given resistor and calculate the value.
3. Arrange the battery, connector switch, and LED in the plastic box as shown in the figure.



4. Connect and solder the components as shown in the circuit diagram.
5. Torch is now ready, you can easily carry it in your pocket!

Teacher Guidelines:

1. Divide the class into 8 or 10 groups, each having not more than 3 students.
2. The teacher needs to be present when students use soldering iron.



Discussion with students:

1. What is the full form of L.E.D.?
2. How does the battery store energy?
3. Why use resistors?



Resources:

You can Google with the search words:

1. How to make L.E.D (Light emitting diode) torch



QR Code





Activity Name



74. Circuits using Tinkercad

Syllabus reference:

Standard/Lesson No.: Class - 7: Chapter 1 (4) - Electricity

Concept/Principle: Electrical Circuits and their Components, Electric Current and its effects

Material and tools required:

Paper and pencil, computer or laptop with internet access

Time required: 120 minutes

Objectives:

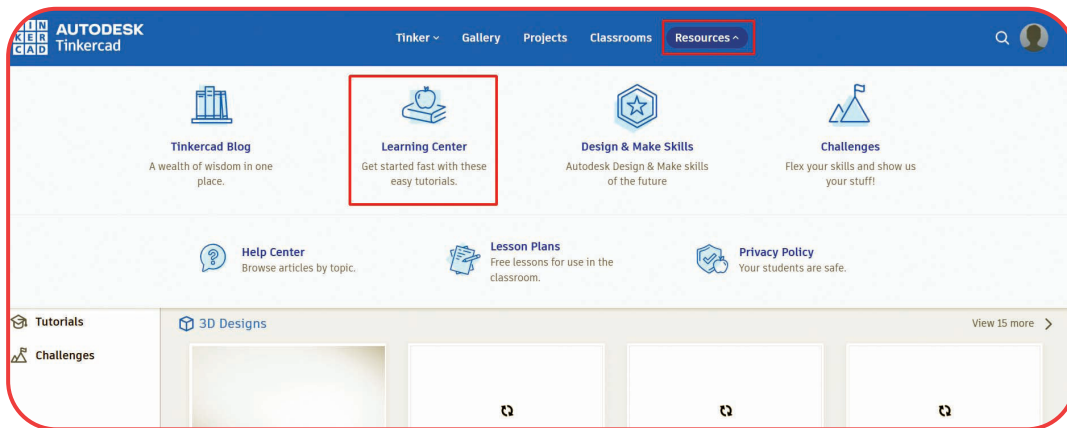
1. Students will explore the concept of electrical circuits and learn to design and simulate circuits virtually using TinkerCAD
2. Students will learn about basic circuit components like resistors, LEDs, batteries, and switches.

Introduction:

- Tinkercad is a browser-based 3D design and modelling program that enables users (beginners to advanced) to create digital projects.
- Tinkercad Circuits is one of the easiest ways to get students started with learning electronics.
- Students can explore, connect, and code virtual projects using the Toolbox-like simulator.

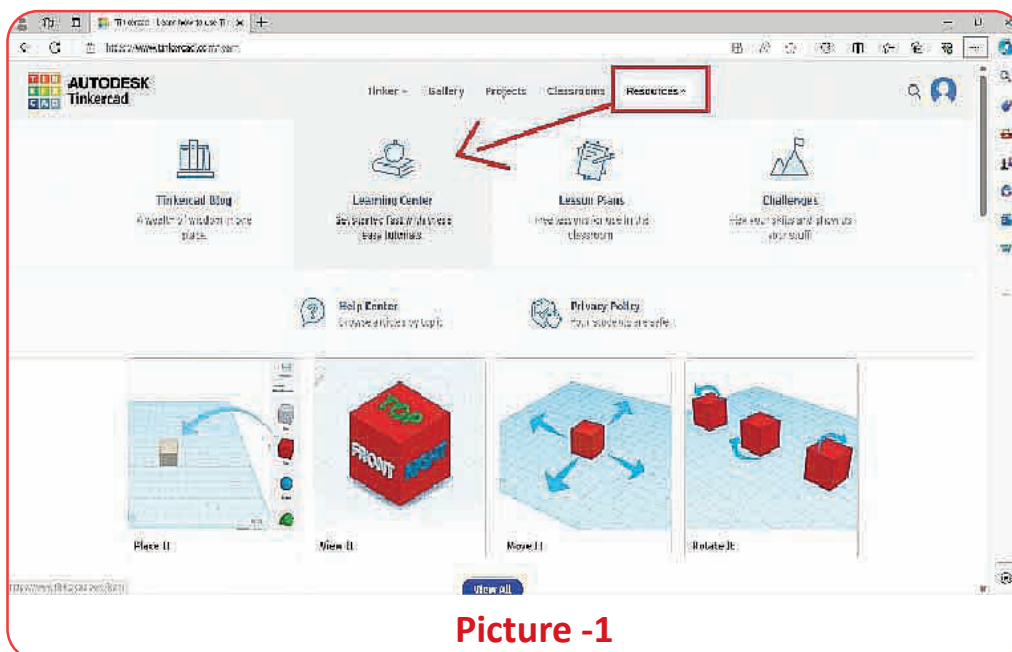
Hands-on activity:

1. Create an account on Tinkercad, or login with an existing email id.



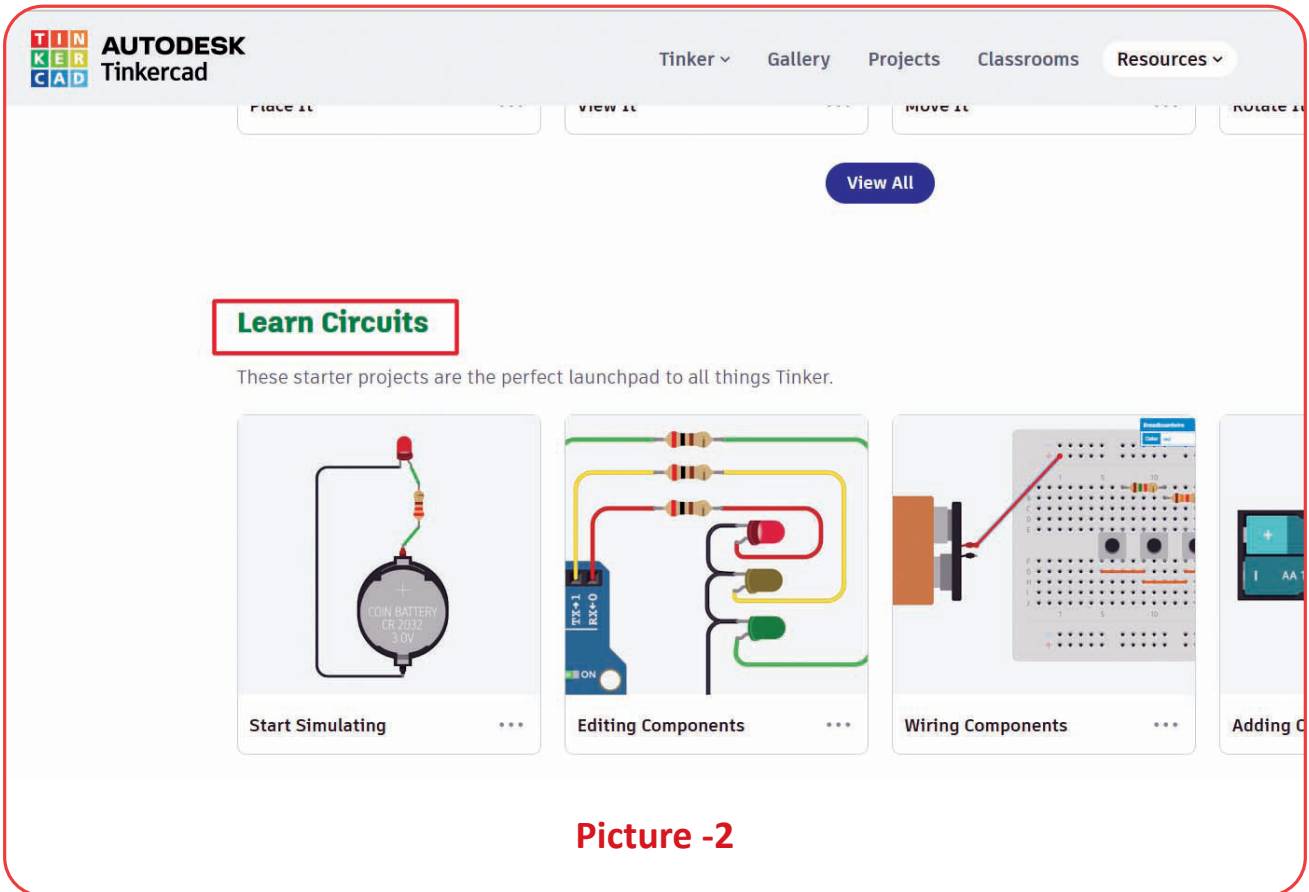
2. Access the website using the link:

<https://www.tinkercad.com/dashboard> or scan the QR code

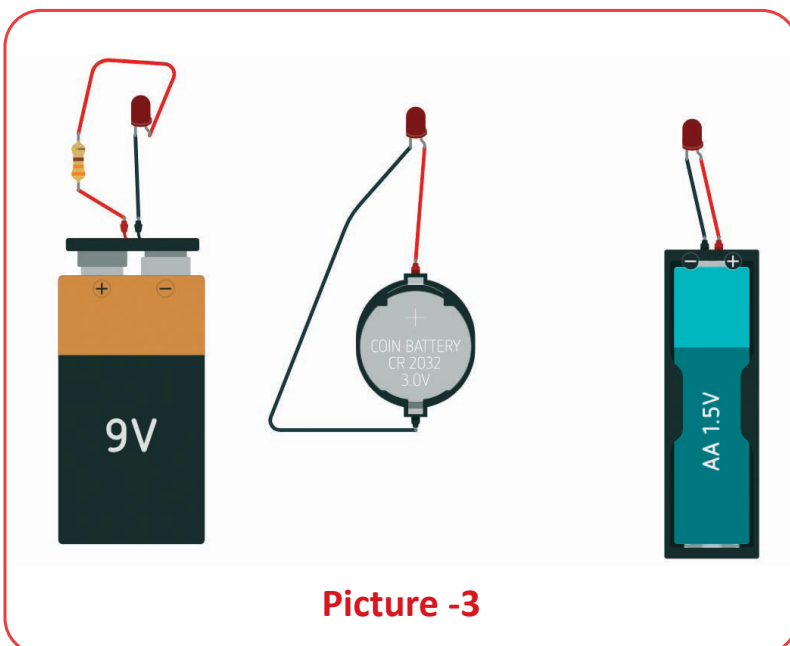


Picture -1

3. After logging into Tinkercad, go to Resources > Learning Center. (See Picture 1)
4. Click on the “Learn Circuits”. (as shown in Picture 2).
5. Find the starter project to get familiar with circuit designing in Tinkercad.



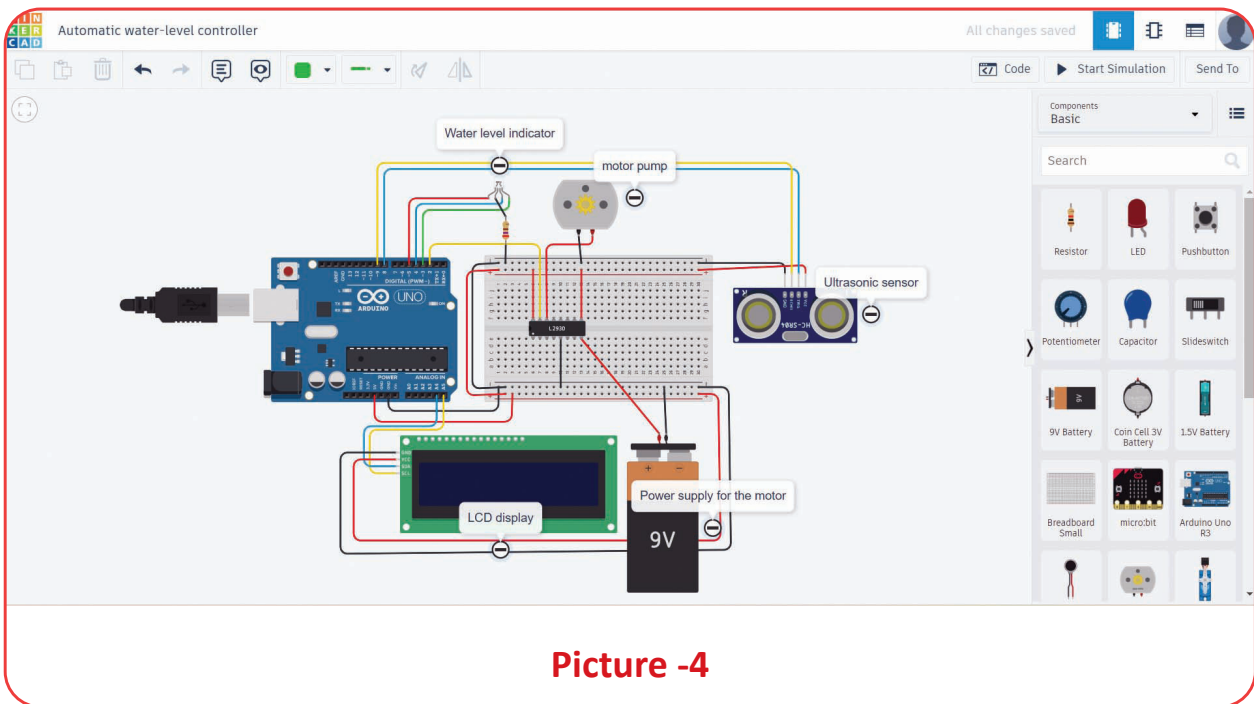
Picture -2



Picture -3

6. Design your electronics circuits in Tinkercad and explain the voltage, current and components of the circuits.

7. Before starting any electronic project, use TinkerCAD to digitally create and test the circuit.
8. First, create a circuit diagram, verify connections, resistor values, battery voltage, and other components.



Teacher Guidelines:

1. Divide the Class into 8 or 10 groups, each having not more than 2 students.
2. Ensure that students do not plug or unplug electrical devices by themselves without teacher supervision



Discussion with students:

1. What happens to the LED in the circuit when we start the simulation?
2. How can we change the brightness of the LED?
3. What happens when the battery is not correctly connected?



Resources:

You can Google with search words - **“TinkerCAD Circuits for Beginners”, “led blinking on tinkerCAD”** etc.





Activity Name



75. Projects using Arduino Uno

Syllabus reference:

Standard/Lesson No.: Class 8 - Technology around us

Concept/Principle: Using the Arduino UNO microcontroller and learning its various applications.

Materials and tools required:

Arduino Uno, breadboard, connecting wires (single stranded), computer/laptop with Arduino IDE software, LEDs and Resistors (220 Ohm), wire nipper, wire stripper (1 setup for 2-3 students), digital multimeter if needed

Time required: 150 minutes

Objectives:

1. Students will learn about basic electronics.
2. Students will learn to use Arduino UNO to build various gadgets.

Introduction:

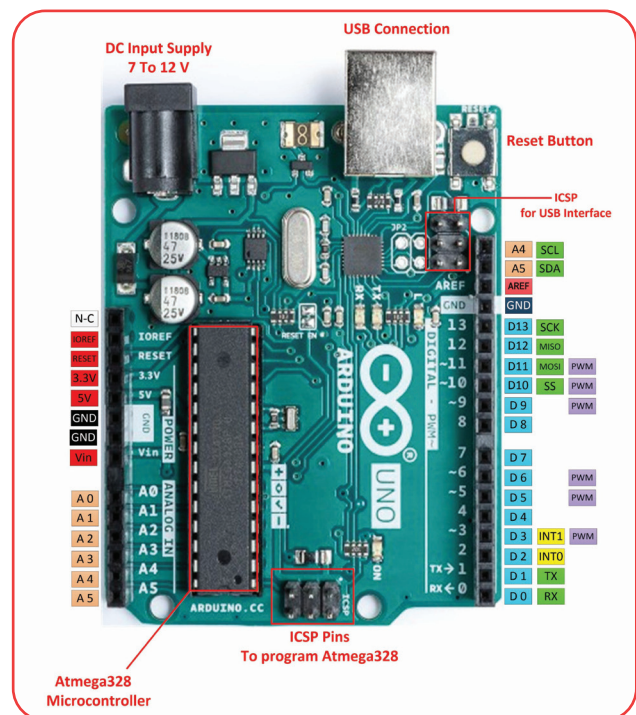
- Arduino is widely used in consumer electronics as well as industrial electronic applications.
- Arduino controllers are easy to learn and use.
- Arduino Uno can be programmed to control sensors, motors, and lights.
- A controller can take inputs from various sensors and process the data to control lights, motors etc.
- Students can use Arduino to create automation in their science projects

Know your Arduino board:

- We will start this activity by studying the pinout diagram of the Arduino and get to know the function of each pin or section.
- Pins on Arduino Board:
 - Power pins: - GND ground & VCC 5V
 - Input pins: - Analog and Digital
 - Output Pins: - Digital and PWM
 - (Pulse Width Modulation, it converts digital signals into analog signals).

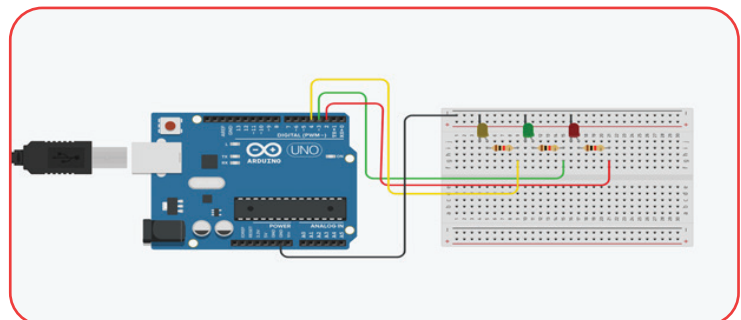
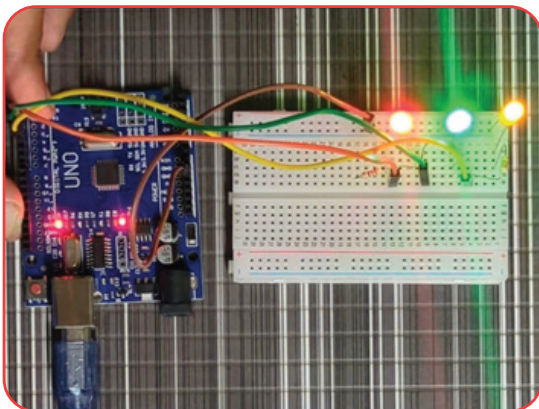
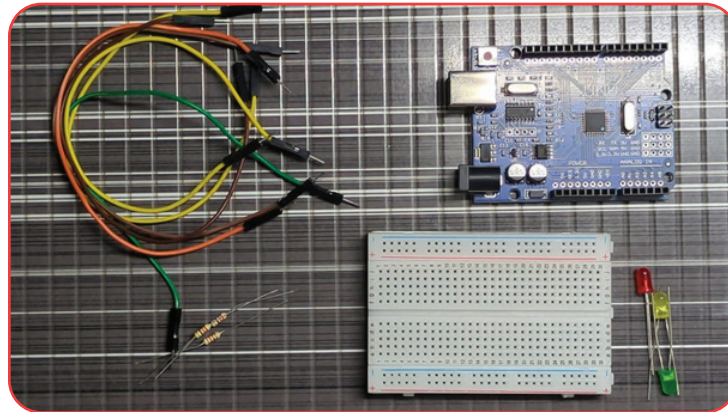
Hands-on activity:

1. We will learn to use Arduino by using it to make a simple application of a blinking LED on the board. . (You may refer to video tutorials available online or learn from the official Arduino website: <https://www.arduino.cc/>).
2. If you are using Arduino for the first time on the computer, download the software and install it from <https://www.arduino.cc/en/software>
3. Start the Arduino IDE program on the computer:



Picture-1

4. Go to: file -> examples -> basics -> blink.
5. This will open a new window with the blink program.
6. Connect the Arduino board to the computer using its cable. Then open the tools menu on the computer and go to port and select Arduino Uno Com ____.
7. We will be using LEDs which have a CATHODE and an ANODE. CATHODE being the negative with shorter leg, while ANODE being the Positive with longer leg.
8. We will start learning and using Arduino UNO by making a simple project, where LEDs blink in a pattern. Arduino can be used to control this pattern.



Circuit

9. Take 3 LEDs, and connect them to the bread board in such a way that their cathodes are all connected to a single bus strip. Connect this strip to GND using a jumper cable. You can refer to the circuit diagram and make the connections accordingly.

Connect the Anodes of the LEDs through resistors to the digital pins using jumper cables.

1. In this activity, the blinking pattern will be like this - first LED for 1 second, then first and second blink together, then all three LEDs blink and then this pattern repeats. You can modify this pattern by adjusting the HIGH and LOW values given in the code below.
2. Once all connections are made, open the Arduino IDE in your computer and type the code given below.

```
const int ledPin1 = 2;
const int ledPin2 = 3;
const int ledPin3 = 4;

void setup(){
  pinMode(ledPin1, OUTPUT);
  pinMode(ledPin2, OUTPUT);
  pinMode(ledPin3, OUTPUT);
}

void loop(){
  digitalWrite(ledPin1, HIGH);
  digitalWrite(ledPin2, LOW);
  digitalWrite(ledPin3, LOW);
  delay(1000);

  digitalWrite(ledPin1, HIGH);
  digitalWrite(ledPin2, HIGH);
  digitalWrite(ledPin3, LOW);
  delay(1000);

  digitalWrite(ledPin1, HIGH);
  digitalWrite(ledPin2, HIGH);
  digitalWrite(ledPin3, HIGH);
  delay(1000);

  digitalWrite(ledPin1, LOW);
  digitalWrite(ledPin2, LOW);
  digitalWrite(ledPin3, LOW);
  delay(1000);
}
```

Teacher Guidelines:

1. Do this activity with a maximum of 10 students in a batch.
2. Ensure that the computer has proper earthing, otherwise Unos will get permanently damaged.

3. Help students connect wires, LEDs and stay safe while using electronic components and electricity.
4. If students are connecting LED pins to different digital pins, please specify the pins in the code.
5. Students should work with multiple programs which are available in the example menu.
6. Students can visit: <https://www.arduino.cc/> to find out more about Arduino, IoT and related projects.



Discussion with students:

1. What would we need if we want to connect more LEDs?
2. How can we adjust the blinking duration of the LEDs?
3. Where can this technology be applied, and where do we see it in our daily lives?




Resources:

- ➡ You can search on Google with the search words -
For Arduino related projects - <https://www.arduino.cc/>
- ➡ Download Arduino IDE from the link given here - <https://www.arduino.cc/en/software>





Activity Name



76. Arduino with DHT11 Sensor

Syllabus reference:

Standard/Lesson No.: Class 8: Technology around us

Concept / Principle: Physical Science and Electronic,
Heat and Temperature, Weather and Climate

Materials and tools required:

Arduino Uno, DHT11 temperature and humidity sensor, jumper cables (Male-Female: 3), breadboard(optional), desktop/laptop to upload the code Arduino IDE

Time required: 30 minutes

Objectives:

1. Students will learn how to connect input devices to an Arduino board.
2. Students will understand how to monitor and read the temperature and humidity data.

Introduction:

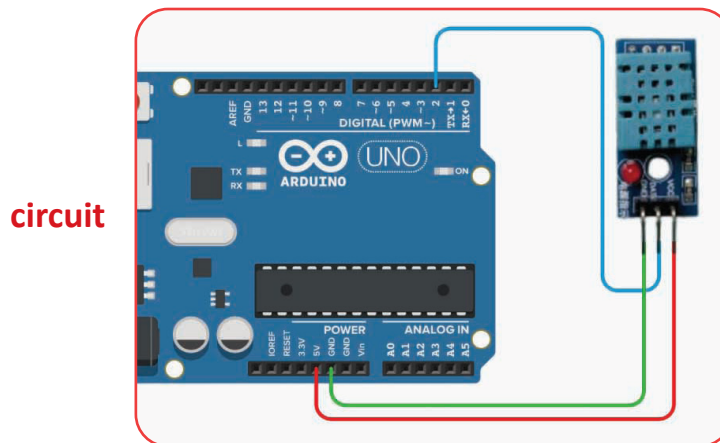
- The DHT11 is a commonly used sensor that measures both temperature and humidity. It uses a thermistor to sense temperature and a humidity-sensing component to detect moisture in the air.
- In this activity students will connect the DHT11 sensor to the Arduino and get the readings of the DT11 sensor on the serial monitor.

Hands-on activity:

Step 1: Gather all required components for the project as mentioned above.

Step 2: Connect the DHT11 Sensor as per the circuit diagram shown below:

1. Connect the positive terminal of the DHT11 sensor to the 5V on the Arduino.
2. Connect the negative terminal of the DHT11 sensor to the GND on the Arduino.
3. Connect the data pin of the DHT11 sensor to any digital pin on the Arduino (like pin 2).



```
sketch_feb14a.ino
1  #include <DHT.h>
2  #include <DHT_U.h>
3
4  #define DHTPIN 2
5  #define DHTTYPE DHT11
6
7  DHT dht(DHTPIN, DHTTYPE);
8
9  void setup() {
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11 }
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```

Output Serial Monitor x

Message (Enter to send message to 'Arduino Uno' on 'COM4')

```
Temperature: 27.10°C | Humidity: 33.00%
Temperature: 27.10°C | Humidity: 32.00%
Temperature: 27.10°C | Humidity: 32.00%
```

Step 3: Write the Code

Open the Arduino IDE software on your computer and write the following code:

1

```
#include "DHT.h"
#define DHTPIN 2
#define DHTTYPE DHT11

DHT dht(DHTPIN, DHTTYPE);

void setup() {
    Serial.begin(9600);
    dht.begin();
}

void loop() {
    delay(2000);
    float h = dht.readHumidity();
```

2

```
float t = dht.readTemperature();
if (isnan(h) || isnan(t)) {

    Serial.println(F("Failed to read
from DHT sensor!"));
    Return;
}

Serial.print(F("Humidity: "));
Serial.print(h);
Serial.print(F("% Temperature:
"));
Serial.print(t);
Serial.println(F("°C "));
}
```

Step 4: Upload the Code

- ➡ Connect Arduino to the computer
- ➡ Write the code into the Arduino software
- ➡ Select the correct board and port
- ➡ Once code is completed then verify it and if no errors are found, then click "Upload" to transfer the code to the Arduino.

Step 5: Test It

- ➡ Once code is uploaded, open the serial monitor from the Tools section and see the Temperature and Humidity readings of the DHT11 Sensor.

Notes:

- ➡ If the code is not uploading, recheck the code.
- ➡ If you get this message "Failed to read from DHT sensor!", check the connections again.
- ➡ Check if DHT sensor library is installed on your device, if not then go to 'Sketch → Include Library → Manage Libraries → DHT Sensor Library'.

Teacher Guidelines:

- ➡ Divide the class into 8-10 groups, each having not more than 4-5 students
- ➡ Help students with connections, coding and uploading.

Make sure students will follow -

1. Wiring diagrams or pinout guides for components to ensure proper connections.
2. Ensure all connections are secured to prevent electrical issues.
3. Do not neglect basic safety practices. Turn off the power while making wiring changes, and avoid exposing electronic components to moisture.
4. Do not allow wires to touch each other unintentionally. Short circuits can damage components and the Arduino board.
5. Do not connect wires to the wrong pins on the Arduino. Double-check pin assignments in the code and ensure they match the physical connection.
6. Explain the connection rules when using a breadboard.



Discussion with students:

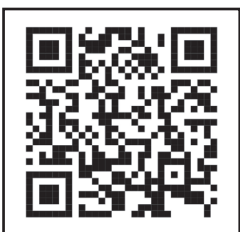
1. How does the DHT11 sensor work?
2. Where can this project be implemented?
3. What is the use of this system?



Resources:

Reference video link QR code:

1. DTH11 with LED YouTube reference QR code



QR Code





Activity Name



77. Temperature and Humidity Monitoring System

Syllabus reference:

Standard/Lesson No.: Class 8: Technology around us

Concept/Principle: Physical Science and Electronic, Heat and Temperature, Weather and Climate.

Materials and tools required:

Arduino Uno, DHT11 temperature and humidity sensor, LCD with I2C - 1 Qty, jumper cables (Male-Female: 7), breadboard(optional), PVC box(optional), desktop/laptop to upload the code, Arduino IDE

Time required: 30 minutes

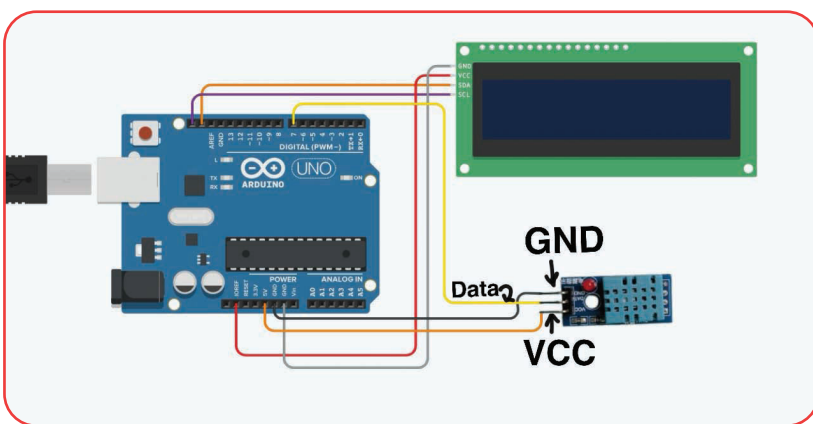
Objectives:

Students will learn how to build a weather station using simple electronic components and install the weather station in their school

Hands-on activity:

- In the earlier activity the DHT 11 sensor readings were collected and viewed.
- In this activity, connect an LCD - I2C display to the same DHT11 sensor and Arduino setup.
- The LCD will display the real-time temperature and humidity levels on the screen.

Step 1::



Circuit

- Take the same DHT11 and Arduino setup as used previously. Now connect the LCD I2C to the Arduino as shown in the circuit diagram. The DHT11 data pin can be connected to any digital pin (e.g. Pin 7)

Step 2: Write the Code

Open the Arduino IDE software on your computer and write the following code:

```
1 #include <DHT.h>
  #include <LiquidCrystal_I2C.h>
  #include <Wire.h>

  #define DHTPIN 7
  #define DHTTYPE DHT11
  #define LCD_ADDRESS 0x27

  DHT dht(DHTPIN, DHTTYPE);
  LiquidCrystal_I2C lcd(LCD_
  ADDRESS, 16, 2);
```

```
2 void setup() {
  Serial.begin(9600);
  dht.begin();
  Wire.begin();

  lcd.init();
  lcd.backlight();
}

void loop() {
  float h = dht.readHumidity();
```

```
3 float t = dht.readTemperature();

  if (isnan(h) || isnan(t)) {
    Serial.println(F("Failed to read
from DHT sensor!"));
    Return;
  }
  lcd.setCursor(0, 0);
  lcd.print("Temp:");
```

```
4 lcd.print(t);
  lcd.print("C");
  lcd.setCursor(0, 1);
  lcd.print("Humidity:");
  lcd.print(h);
  lcd.print("%");

  delay(1000);
}
```

Step 3: Upload the Code

Connect the Arduino to the computer.

- ➡ Write the code into the Arduino software
- ➡ Select the correct board and port, once code is complete, verify it. If no errors are found, then click "Upload" to transfer the code to the Arduino.

Step 4: Test It

- ➡ Once code is uploaded, students should be able the Temperature and Humidity readings of the DHT11 Sensor on the LCD Display.
- ➡ The brightness of the LCD can be adjusted by turning its potentiometer using a screwdriver.
- ➡ Pack the entire setup in a PVC box and place it as a stationary weather station.



Notes:

1. If the code is not uploading, recheck the code for errors.
2. If you get this message “Failed to read from DHT sensor!”,
 - Check the connections again
 - Check if DHT sensor library is installed on the device, if not, go to ‘Sketch→ Include Library→Manage Libraries→DHT Sensor Library’, as well as ‘Sketch→ Include Library→Manage Libraries→Liquid Crystal Library’.
 - If the LCD address is incorrect, you may need to check the correct address.
 - To do this, go to ‘File→ Examples→ Wire→ i2c_scanner’ and upload that code and go to the serial monitor and see the address.
 - Replace the old address with the new one on line 6 of the above program and reupload.

Teacher Guidelines:

1. Divide students into groups and assign different tasks to each group.
2. Help students with connections, coding and uploading.



Discussion with students:

1. How does the LCD work? What is the full form of LCD?
2. Where can this project be implemented?
3. What is the use of this system?



Resources:



QR Code

Reference video link QR code

1. DTH11 with LED YouTube reference QR code





Activity Name



78. Game Design With Scratch (Software)

Syllabus reference:

Standard/Lesson No.: Class 8: Technology around us

Concept/ Principle: Computational thinking and the basics of programming through game design.

Materials and tools required:

Paper, pen/pencil, computer or laptop with internet access and scratch installed (<https://scratch.mit.edu/>)

Time required: 180 minutes

Objectives:

1. Students will install SCRATCH software and understand the fundamentals of game designing and programming
2. Students will make educational or fun games, and animated stories using the SCRATCH program

Introduction:

- SCRATCH is a free programming software and online community where users can create their own interactive stories, games, and animations.
- Students will learn about computational thinking and basic programming concepts through game design using SCRATCH.
- They will understand how to create interactive games and develop problem-solving skills, and creativity in a digital environment.

Two ways to access-

Method 1 – ONLINE

New tab ---> scratch.mit.edu ---> click on start creating

Method 2 – OFFLINE

Download scratch (scratch.mit.edu/download)

Scratch window:

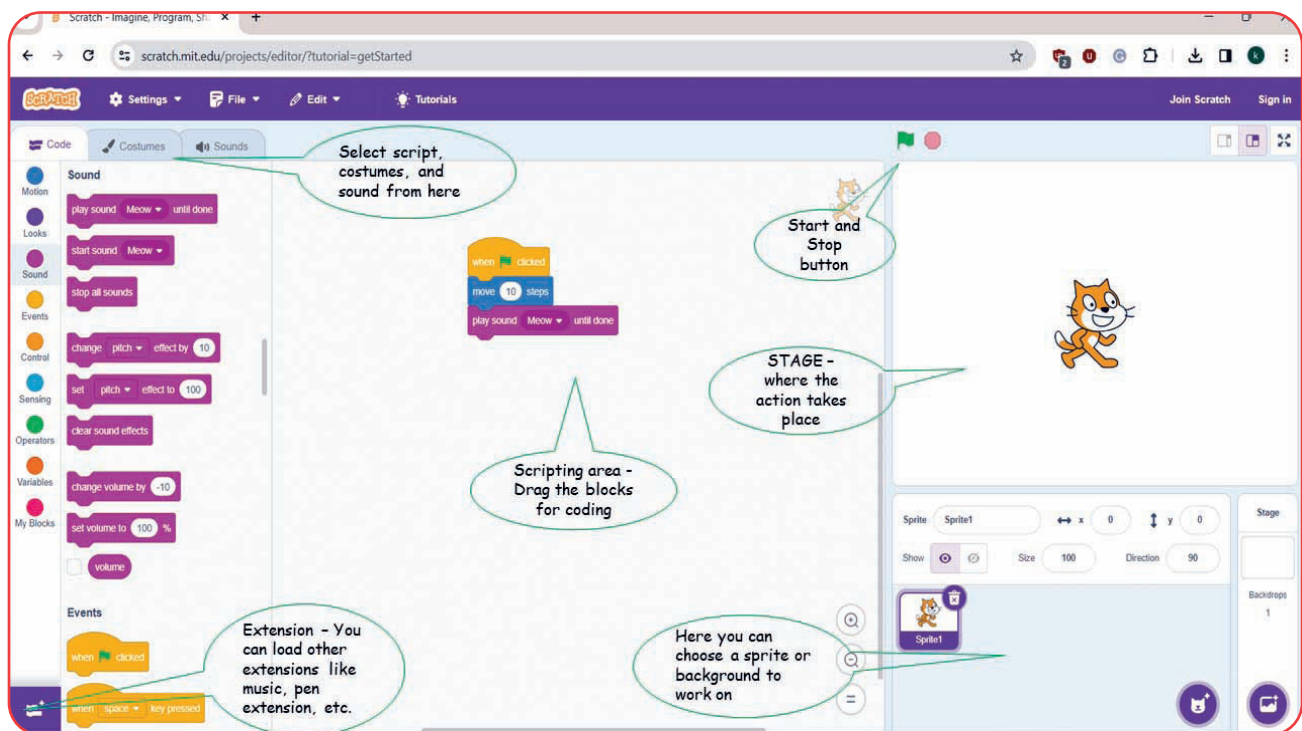
The Scratch interface is divided into three main sections:

1. A stage area,
2. A block palette, and
3. A coding area
 - **Coding/scripting area** – This is where users place and arrange the blocks into scripts that can be run by pressing the green flag or clicking on the code itself. Users may also create their custom code blocks, which will appear in the "My Blocks" section.
 - **The stage area** features the results and thumbnails of all sprites listed at the bottom. The stage uses x and y coordinates, with 0,0 being the stage center.
 - When a sprite is selected from the bottom of the **staging area**, blocks of commands can be applied to it by dragging them from the block palette into the coding area.
 - When creating **sprites and backgrounds**, users can draw their sprite manually, choose a Sprite from the library, or upload an image.
 - **The Costumes tab** allows users to change the look of the sprite to create various effects, including animation.

- The Sounds tab allows users to attach sounds and music to a sprite

Hands-on activity:

Steps to design any game -



1. Plan Your Game:

- Define the concept and theme of your game.
- Think about the game mechanics, objectives, and player interactions.
- Sketch the layout and design of your game, including characters, backgrounds, etc.

2. Create a New Project:

- Go to the Scratch website (scratch.mit.edu) and log in to your account.
- Click on the "Create" button to start a new project.

3. Set Up Your Stage:

- Choose a backdrop for your game's stage or create your own by importing images.
- Add any additional sprites (characters or objects) that you'll need for your game.

4. Code Your Sprites:

- Select a sprite to begin coding.
- Use Scratch's block-based programming interface to add functionality to your sprites.
- Experiment with different code blocks to control movement, interactions, animations, and game logic.

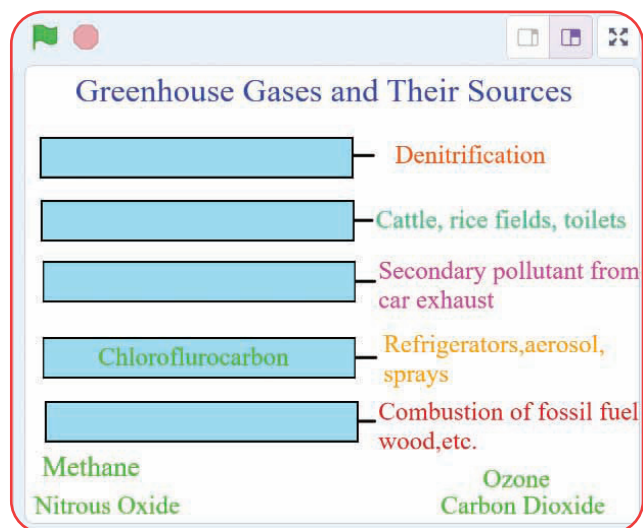
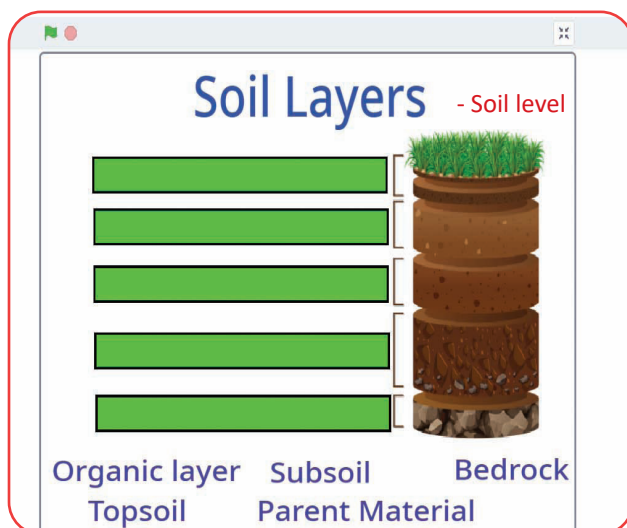
5. Implement Game Mechanics:

- ➔ Program your game mechanics based on your planned design.
- ➔ Use conditionals (if-else statements), loops, variables, and sensing blocks to create interactive gameplay elements.
- ➔ Add scoring, levels, and other features to enhance gameplay.

6. Share Your Game:

- ➔ Once your game is ready, click on the "Share" button in Scratch to publish it.
- ➔ Give your game a title, and description to help others find it.

Game design - There are many games which you can make, here are some examples of games related to science.



Match the pair – fun way to learn soil layers, greenhouse gases

Teacher Guidelines:

1. Divide the class into groups with a maximum of 2 students in each group.
2. Allot a computer or laptop to each group.



Discussion with students:

1. Which theme did you choose to design your game in SCRATCH?
2. Which is your favorite game that you designed using SCRATCH?
3. From where can you find tutorials for game designing?
4. What did you learn about game designing and programming through this activity?
5. How was your experience with SCRATCH?



Resources:

You can search on Google with the search words -

1. Scratch game tutorials for beginners
2. Educational Scratch games for school students
3. Scratch games for practicing math skills
4. Scratch games for teaching history or geography





Activity Name



79. Maze Game with Scratch

Syllabus reference:

Standard/Lesson No.: Class 8: Technology around us

Concept/Principle: Concept of computational thinking and the basics of programming through game design.

Materials and tools required:

Paper, pencil, marker, computer or laptop with internet access and Scratch installed (<https://scratch.mit.edu/>)

Time required: 120 minutes

Objectives:

1. Students will learn to design maze game using SCRATCH
2. Students will understand sensing blocks, variables and operator blocks.

Introduction:

Discuss with the children about the different games they enjoy playing.

Hands-on activity:

Maze Game:

Sensing block:

The sensing block helps the program check conditions that can result in a true or false response. The program can perform different tasks depending on the answer 'True' or 'false'.

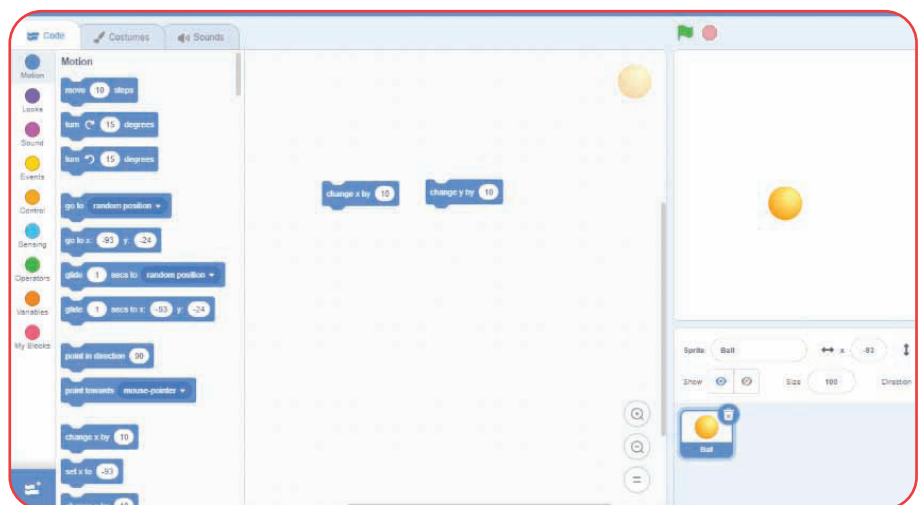
- Children will create a game where a sprite moves around a maze, avoiding certain obstacles.
- Start by creating a background. Click on the stage, click on backgrounds, and then paint. Design a maze using the paint features.
- Add a sprite. Adjust the sprite's size to fit the maze.
- Program the sprite to move up, down, left and right.
- Remember to click on the sprite in the sprite's area before starting the code.

STEP 1: Move x and y direction

1. Go to the 'motion' palette.
2. Drag the 'Change X by 10' block onto the ball sprites script area.

3. Drag the 'Change X by 10' block onto the ball sprites script area.

4. Click on it and watch the ball move in the x and y direction.

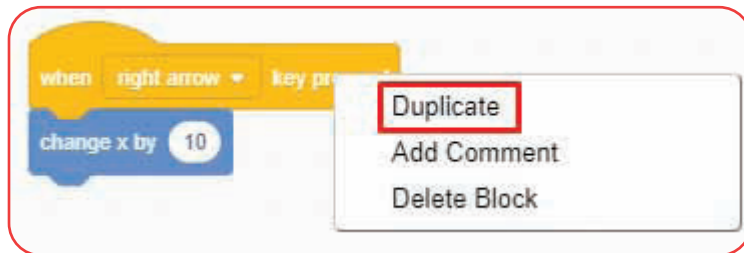


STEP 2: Move with the Arrow Keys

1. Go to the 'event' palette.
2. Drag the 'When space key pressed' block onto the ball sprites script area.
3. Choose the "right arrow" key.
4. Connect the right arrow key to move the block:
5. Press the right arrow key and watch the ball move.



Let's do the same for the left arrow:



Right-click on the block and select "duplicate".

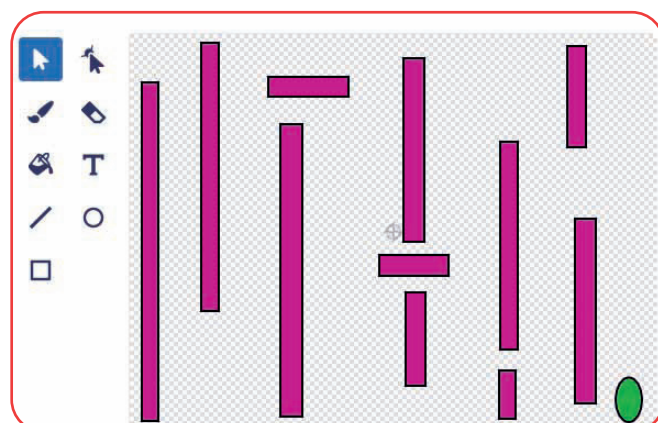
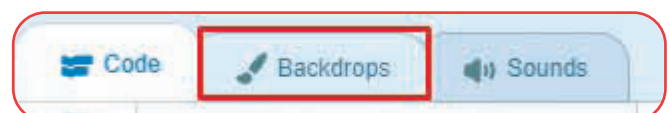
Change the duplicate to "left arrow":



We've easily created another set of scripts

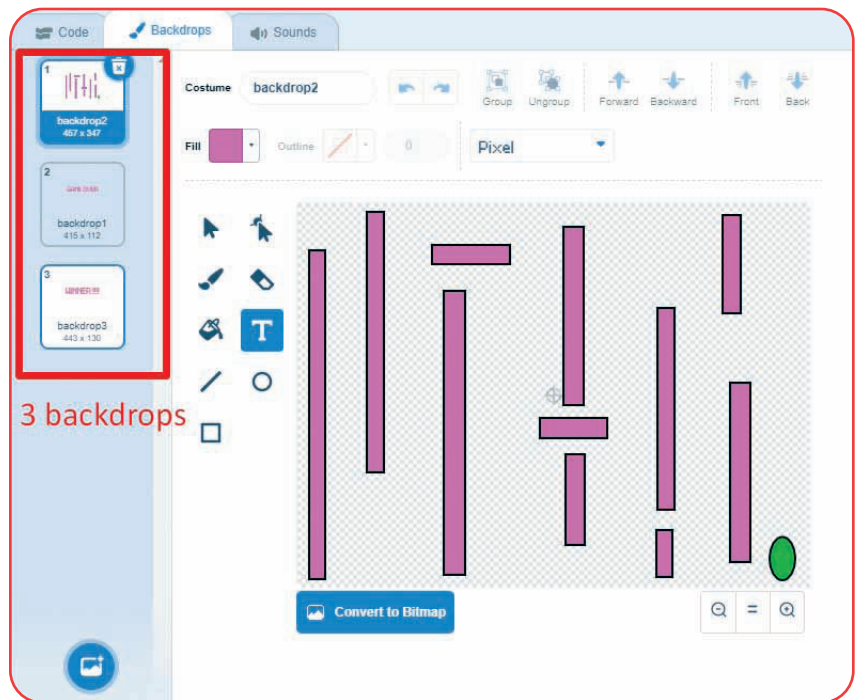
STEP 3: Create Backdrops

1. Click on the backdrop

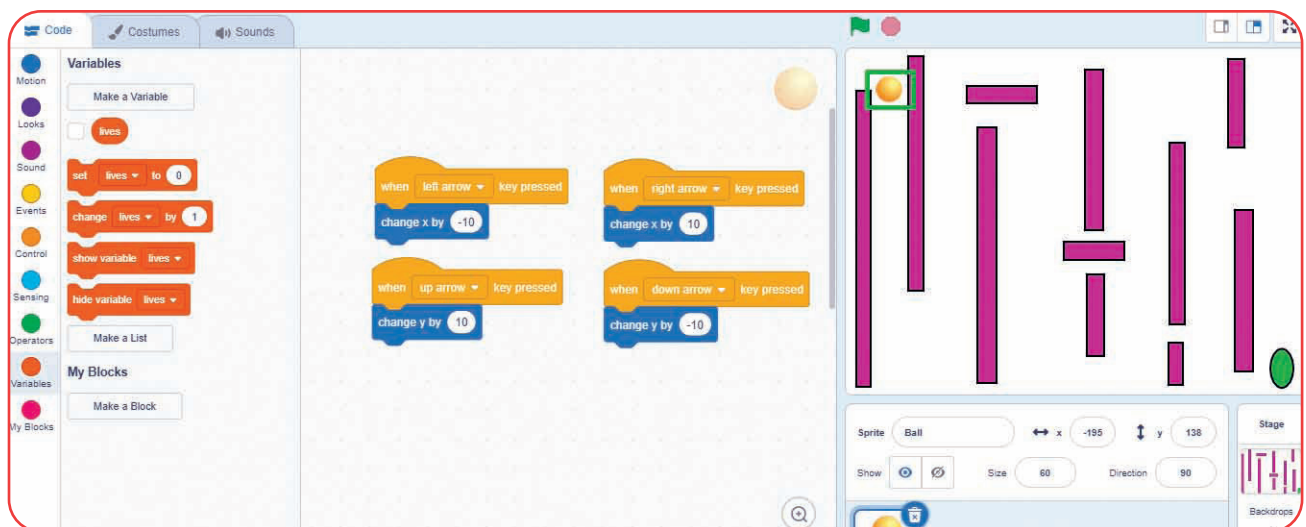


2. Design the first backdrop using shapes and paint features.

3. Create another two backdrops using text feature.



STEP 4: Adjust the size of the ball sprite to fit the maze.



SENSING -

- ➡ If the sprite touches the wall, it should return to the start point. We will use the sensing block to do this. The walls of this maze are different color, hence we will create a script so that if the sprite touches the wall (different colour) it returns to the start point.
- ➡ The sprite will begin with 3 lives. Each time it hits the wall; it will lose a life.

STEP 5: Create Variables

1. Click on my variable and click on the renamed variable.



STEP 6: sensing block



1. We will use this block for the game

Step 7: Complete the code

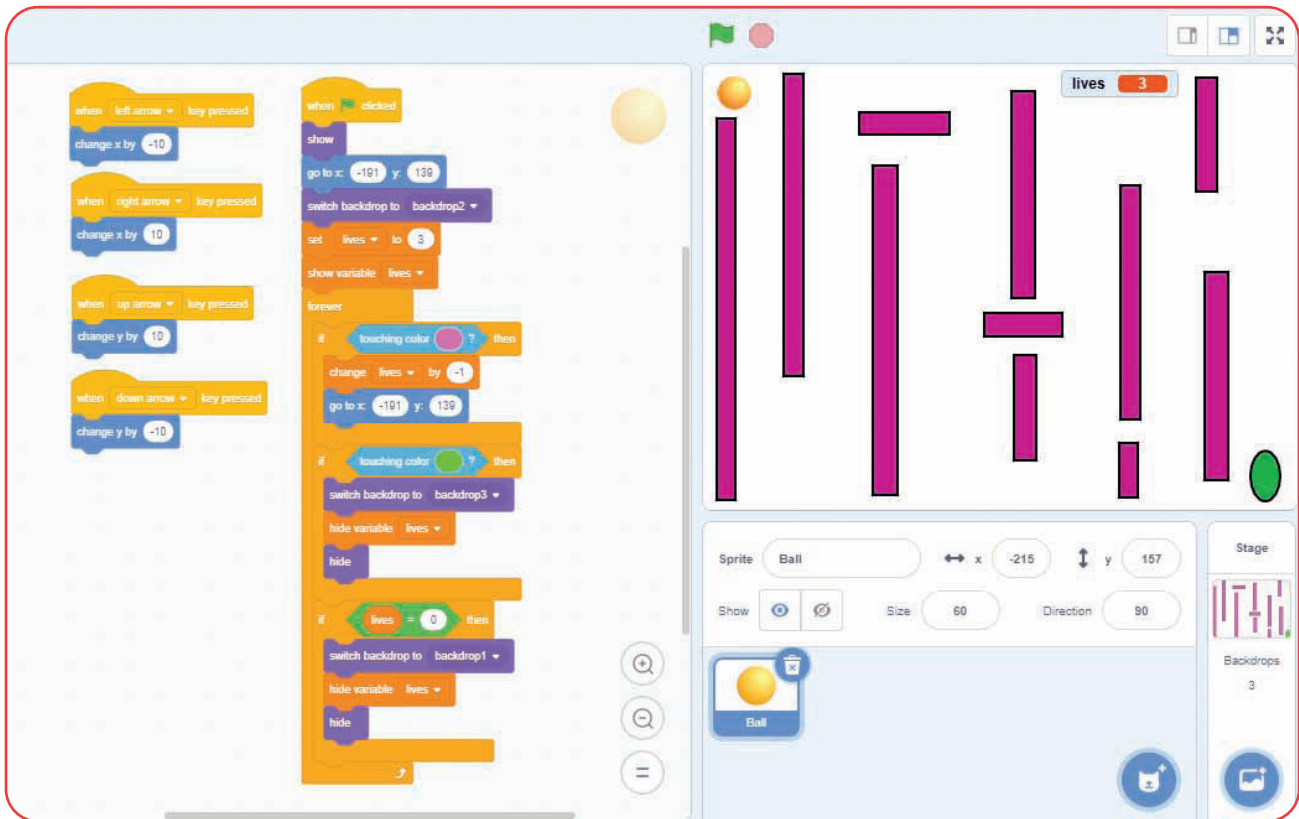
STEP 8: Use operator blocks



1. Go to the 'operators' palette.
2. Drag the block onto the ball sprites script area
3. Complete this step by adding other blocks from different palettes.

STEP 9: Complete the code.

MAZE GAME



Teacher Guidelines:

1. Set up computers or laptops with internet connection.
2. Make student groups with a maximum of 2 students in each group.



Discussion with students:

1. What are the different games you can make where you need to make variables?
2. What does the sensing block do and why do we need this block?



Resources:

You can search on Google using the search words –

➡ Scratch.mit.edu



Activity Name

80. Biodiversity Using Ai Tool – Google Lens, Plantix

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 10 - Biodiversity and its Classification;
Class 7: Chapter 7 - Environmental Crisis, Conservation of Plants and Environment;

Class 8: Chapter 11 - Environment Around Us and Plant Kingdom

Concept/Principle: Use of technology and AI to observe, identify and classify biodiversity, methods to collect plant data, detect plant diseases, importance of preserving biodiversity

Materials and tools required:

Computer with internet access, web browser, camera, google lens, Image Editing Software.

Time required: 120 minutes

Objectives:

1. Students will learn to collect data using both manual and AI assisted methods.
2. Students will learn to collect location-based data through images for computer /mobile vision applications (object detection).
3. Students will understand and learn to use different free AI-mobile apps for plant diagnosis(diseases).

Introduction:

- In this activity, students explore how artificial intelligence can help us study and understand biodiversity. Using tools like Google Lens and the Plantix application, students can identify plants, detect plant diseases, and collect location-based data. These tools allow students to connect technology with environmental learning, making it easier to observe, classify, and understand the variety of plants and trees around us.
- In this activity, students will explore how artificial intelligence

Hands-on activity:

Project: Agro-biodiversity

Make a list of Agro-biodiversity (Plants, Grass, pests, insects, birds) in your village/ town.

A. Data Collection

- There are many methods for data collection like gathering information through surveys or questionnaires, using physical sensors or IoT devices, and many other ways.
- In this project, students will collect the data manually.
- Students will make tables on paper/notebook.

Pests - Insects:

1. List some insects commonly found in your village or town.
2. Describe the unique qualities or behaviors of each insect.
3. Identify/search how these insects interact with local plants/crops.
4. Identify relations → insects to plant/crop/grass.

Table 1 Format: Crop plant

S. No.	Crop	Local name	Scientific name	Variety	Landscape / Habitat	Approx. area under crop	Local status		Cropping season	uses	Diseases
							past	Present			
1.											

Table 2 Format: Fruit plant

S. No.	Crop	Local name	Scientific name	Variety	Landscape / Habitat	Approx. area under crop	Local status		Source of seeds/plants	fruiting season	Special features	uses	Diseases
							past	Present					
1.													

Table 3 Format: Fodder crop

S. No.	Crop	Local name	Scientific name	Variety	Landscape / Habitat	Approx. area under crop	Local status		Source of seeds/plants	Parts used	Other details	Availability season	Diseases
							past	Present					
1.													

Table 4 Format: Weed crop

S. No.	Weed plant	Local name	Scientific name	Affected crop	Impact	Landscape / Habitat	Local status		Uses, if any	Management options	Other details	Diseases
							past	Present				
1.												

Table 5 Format: Pests of crops

S. No.	Hosts	Insects/animal	Local name	Scientific name	Habitat	Time/season of attack	Which crop/plant	Local status		Management options	Other details
								Past	Present		
1.											

Capturing images using AI tool for collecting more information about plants/crops/weeds/pests:

Plants/crops/weeds:

1. What are the scientific names of these identified plants? What are the different diseases of crop/plant?
2. What are different qualities or characteristics of each plant?
3. Can you use AI tools to identify common plants in your village or town?

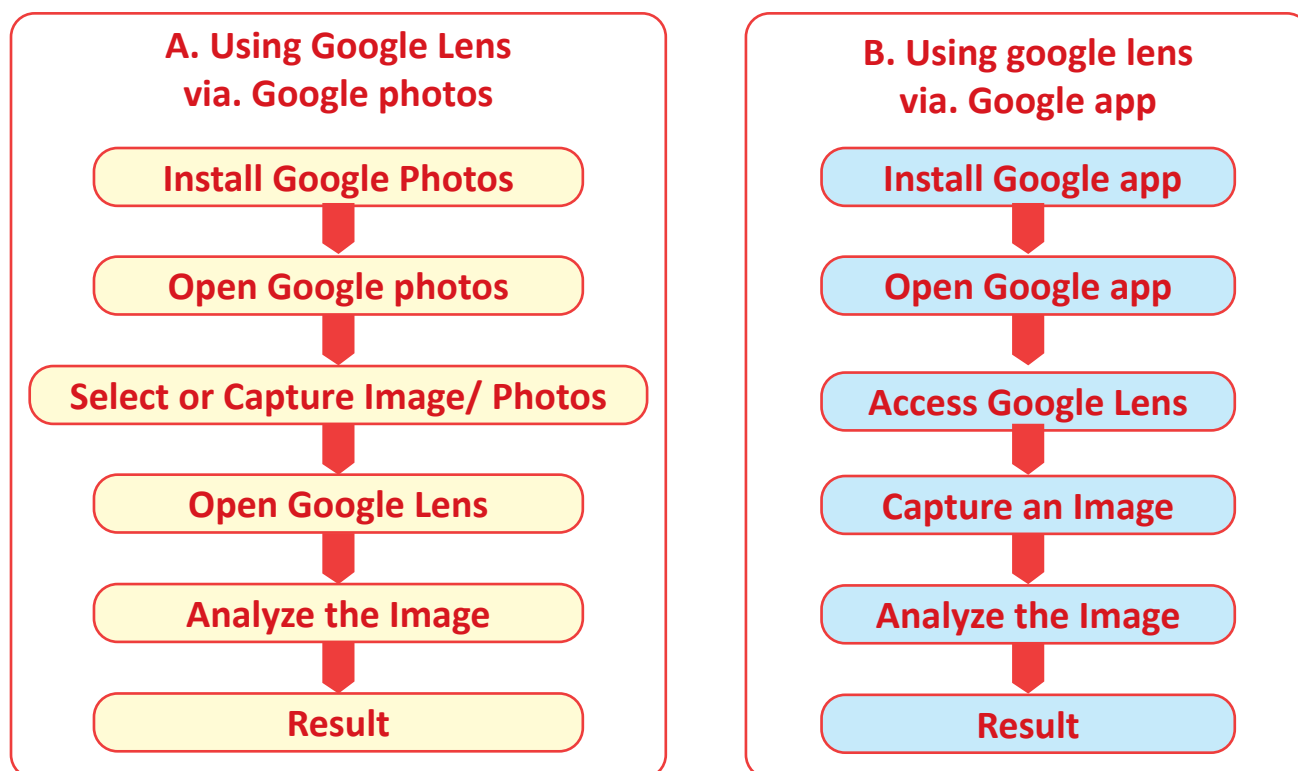
Pests- insects:

1. Can you find the scientific names of these insects?
2. Explore the roles of these insects in the ecosystem and their interactions with plants.
3. Use AI tools to identify common insects in your surroundings.

AI Tool – Google Lens:

- ➡ Google Lens is a visual recognition tool that analyzes images and provides information about them. In this activity, we will use Google Lens to identify scientific names, diseases, and other useful information about plants/crops/weeds, insects, and pests.
- ➡ Using AI tools students will collect data and note it down in a table (notebook/paper).

Steps to use Google Lens for plant, crop, or pest identification:



Use the free mobile AI app for plant diagnosis: Plantix / spicy tech

Download and Install App:

1. Open your device's app store (Google Play Store for Android or Apple App Store for iOS).
2. Search for "Plantix" and download the app.
3. Install the app on your smartphone.
4. Create a new account by providing the required information or login if you already have an account.

Using Plantix:

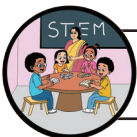
1. Select your preferred language for the Plantix app.
2. Allow the app to access your device location.
3. Select a crop as per your interest.
4. Choose the plant grown in a pot/home garden/field.
5. Explore the home screen options: disease Identification, nutrient, deficiency, recognition/fertilizer calculator.

Plant diagnosis – Capturing and analysing images:

1. Capture Photos: Use the app's camera to capture clear photos of the affected plant parts/insects.
2. Submit Photos for Analysis: Upload the captured photos to the app for analysis.
3. The Plantix app - AI image recognition technology will process the images to identify diseases or pests.
4. View Results and Recommendations: The app will provide information about the identified disease, pest, or nutrient deficiency.
5. Check/read recommendations for treatment or management based on the analysis.

Teacher Guidelines:

1. Divide the class into groups, each group not having more than 4-5 students
2. Ensure students have access to smartphones or tablets with Google Lens and Plantix installed.
3. Provide students with templates for data recording tables (printed or digital).
4. Prepare a brief introduction to AI tools and their uses in biodiversity studies.
5. Assign specific areas or types of plants for each group to explore.
6. Divide students into small groups for collaborative work.
7. Remind students to obtain proper permissions for capturing images and their usage.
8. Educate about copyright laws and ethical considerations when using digital images.



Discussion with students:

1. What did you find most interesting or challenging about this activity?
2. How do you think the skills you have gained from this activity could be applied in real-world scenarios?
3. What challenges did you encounter during the activity, and how did you overcome them?
4. How can technology like AI make it easier to study and protect biodiversity?



Resources:

You can search on Google using the search word –

➡ <https://youtu.be/bDsR1K53Ew0?si=q6mToRidA7M9RSKW>



QR Code





Activity Name



81. Using Bhashini AI Tool

Syllabus reference:

Standard/Lesson No.: Class 8: Technology around us

Concept/Principle.: AI- Regional language translation app

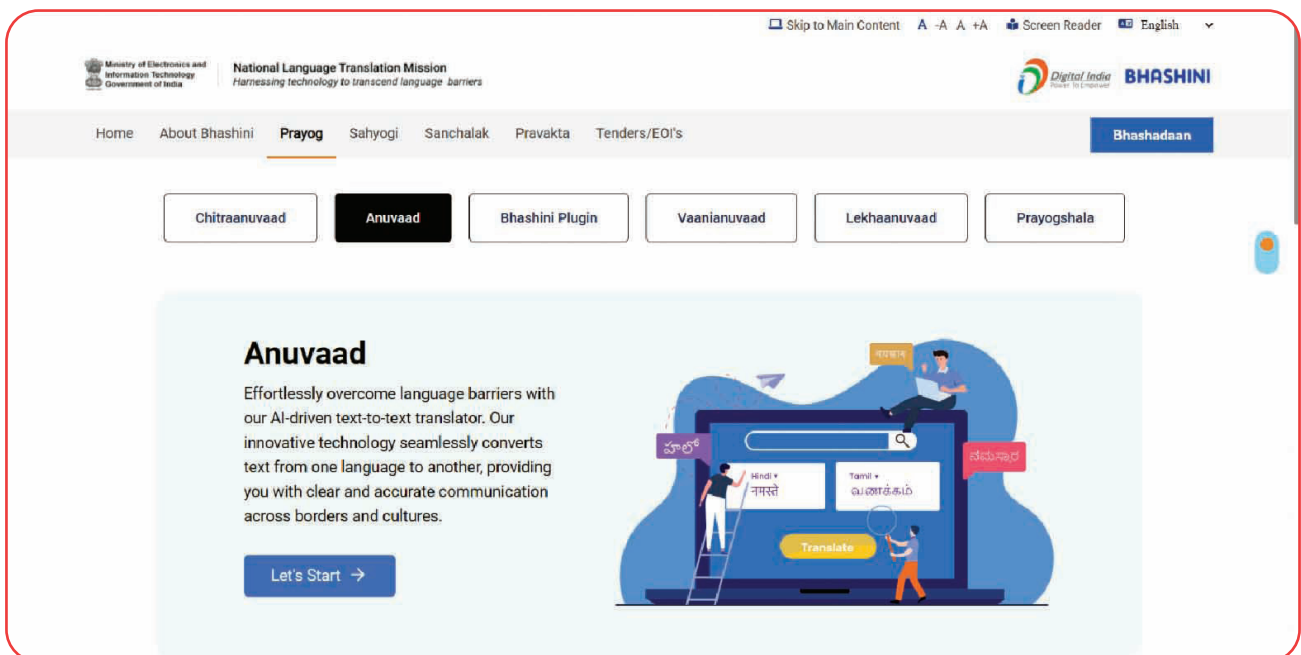
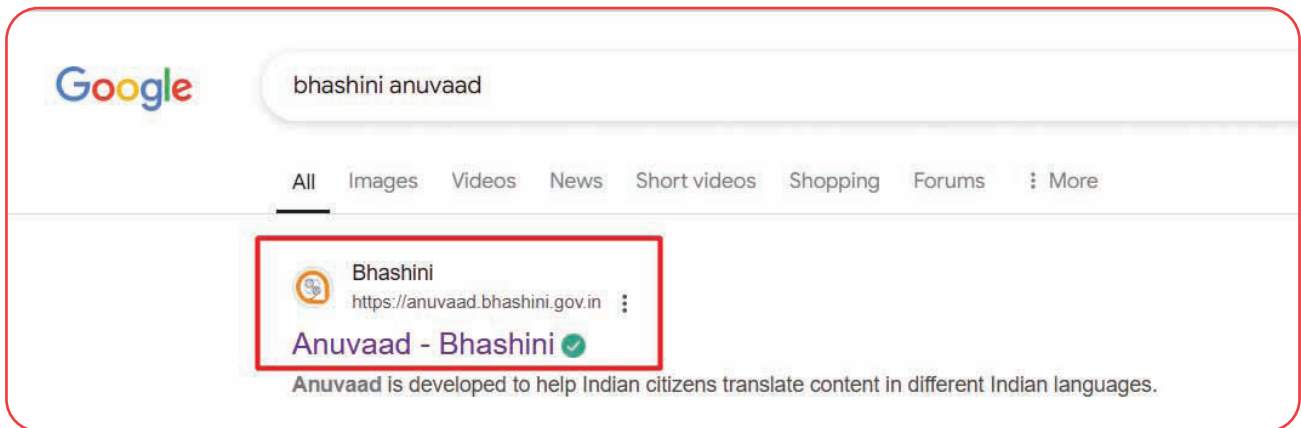
Materials and tools required:

Computer or Mobile device with internet connection, Bhashini AI tool

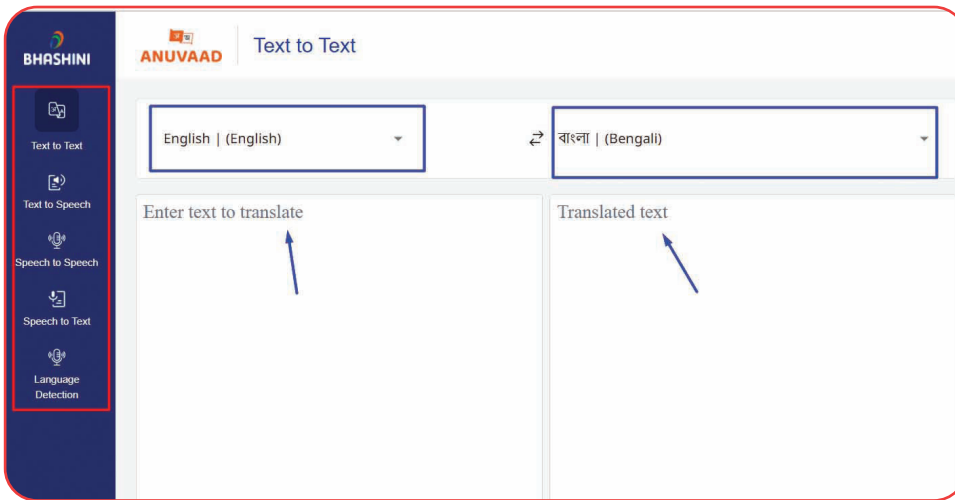
Time required: 60 minutes

Hands-on activities:

1. First, introduce Bhashini AI tools to students. Explain the capabilities and uses of the AI tool.
2. Open a preferred search engine browser on the computer and search for Bhashini AI Tool. Or you can open the given URL: <https://bhashini.gov.in/#mainPage>
3. On the web site navigate to “Prayog” and click on it. You will see the interface as shown in the picture.

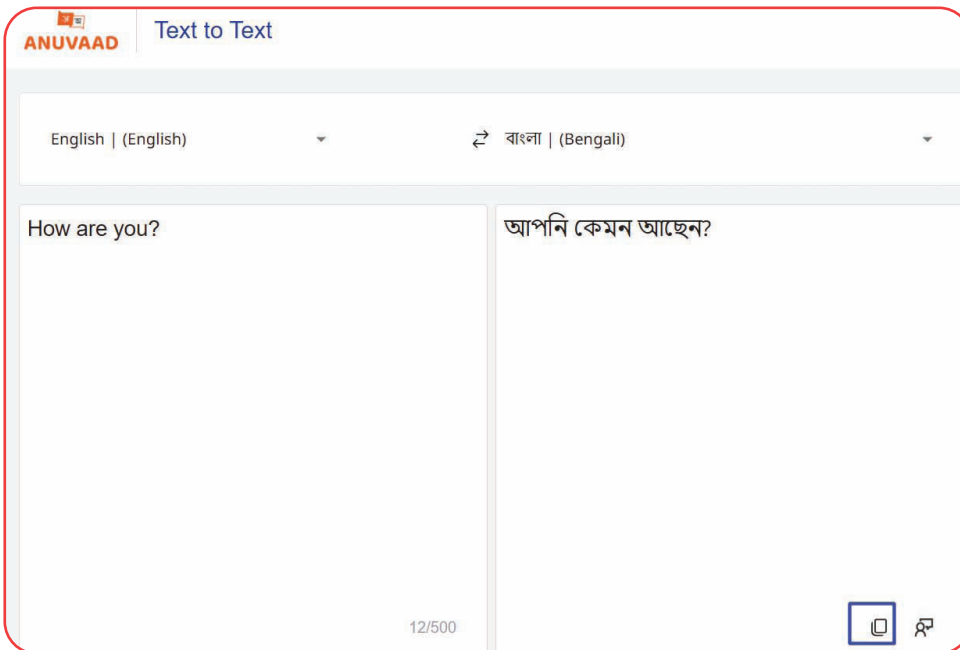


4. Select any tool to use it. For example, click on “Anuvaad” and then click on “Let’s Start” to use the tool.
5. A new window will appear. Refer to the picture as shown below.
6. Here you can see different options such as Source language on the left side and Target language on the right side. You can also choose the voice gender. Source language is the language of the text that you have to translate to the target language.

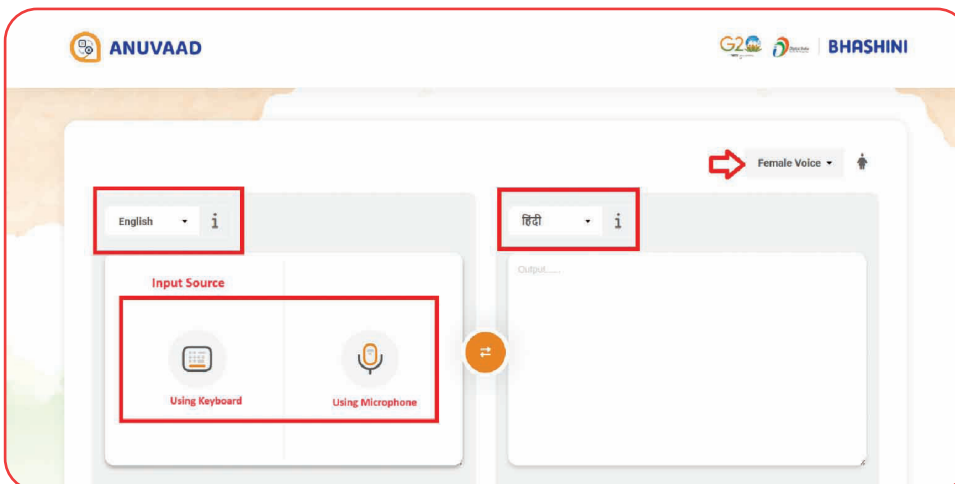


7. You can also select the **input method**—either **keyboard** or **microphone**—to enter the text you want to translate.

8. Also, you can select the input method as a keyboard or microphone to input your text that you want to translate.



9. Select the source language and target language for translation. Enter the text using the keyboard / microphone option, and click on the translate button. The text you entered will be converted to your desired language.



10. Explore different tools on Bhashini website such as “Vanianuvad” -speech to speech translation, “Lekhanuvaad” - Document translation etc.

Projects for students:

1. Read newspapers in a different regional language or from another country, and try to find out their viewpoint on certain topics. Make a presentation of the findings in the class.
2. Try to make a powerpoint presentation of the topic, and give it voice over in another regional language and get it reviewed by a person who speaks that language.
3. Interview a person who speaks a foreign language / regional languages, in their language. Write and publish an interview in the school magazine.

Teacher Guidelines:

1. Divide the class into 6 or 8 groups, each having not more than 4 students .



Discussion with students:

1. What did you find most interesting or difficult about this activity?
2. How do you think the skills acquired from this activity can be applied in real life?
3. What challenges did you face during this activity and how did you overcome them?
4. How can AI technology facilitate biodiversity study and conservation?



Resources:

You can search on Google using the search words –

➡ <https://bhashini.gov.in/#mainPage>



Art & Craft



Activity Name



82. String Art

Syllabus reference:

Standard/ Lesson No.: Class 6: Chapter 14 - Broad concepts of Lines, Line Segments, Rays and Points

Chapter 23 - Symmetry;

Class 8: Chapter 6 - Complementary Angles, Supplementary Angles and Adjacent Angles

Concept/Principle: Fiber to fabric, Intersecting lines, Intersection points, Symmetrical objects, Axis of Symmetry;
Concept of different types of angles

Materials and tools required:

Thick paper (1-2 mm thick), crepe paper, glue, tape, cotton yarn of different colors, wood board and nails (For string art using wood board and nails), scissors, cutting board, ruler, hammer

Time required: 60 minutes

Objectives:

1. Students will learn about string art, geometry and angles.
2. Students create various patterns using their creativity, and explore geometrical principles like symmetry, angles, intersection, etc.

Introduction:

- String art is a creative hands-on activity where designs are made by wrapping thread around nails, pins, or small slots cut on cardboard.
- You first place the nails or pins in a pattern, and then slowly connect them with colourful thread.
- As the thread moves from one point to another, different shapes and curves begin to appear.
- It is an enjoyable way for students to explore lines, angles, and symmetry while making attractive artwork.

Hands-on activity:

Type 1-

- Making a DIY basic string art using a thick paper and few colored strings.

Process:

Step 1: Preparing the base

- Obtain a thick paper of about 1mm thickness and dimensions of 10 x 10 cm (Fig. 1.2).
- Draw a circle of radius 4 cm on this paper (Fig. 1.3).

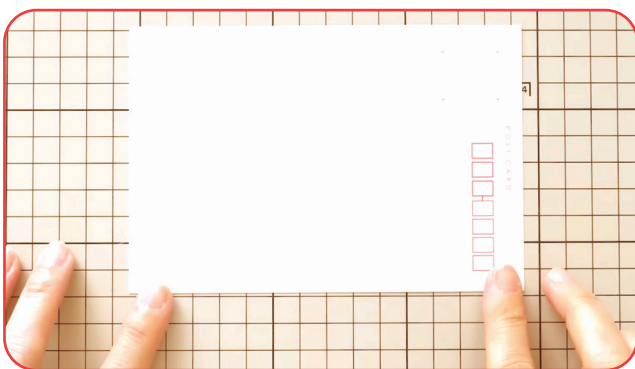


Figure 1.2: Thick Paper of about 1mm.

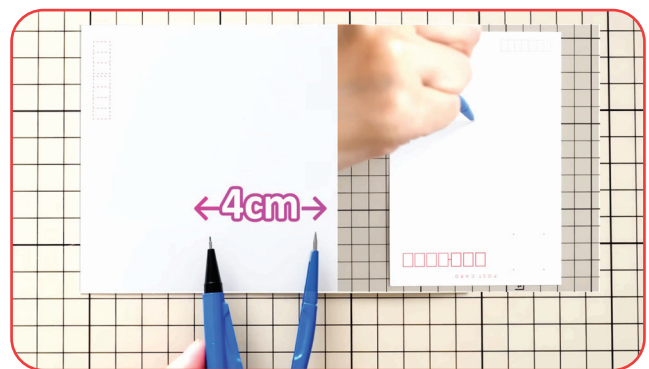


Figure 1.3: Measure and draw a circle of 4cm.



Fig. 1.1: DIY String Art

- With the same center point, draw another circle of radius 3.7 cm (concentric circle) (Fig. 1.4).
- Cut out the larger circle (4 cm radius) from the paper (Fig. 1.5)

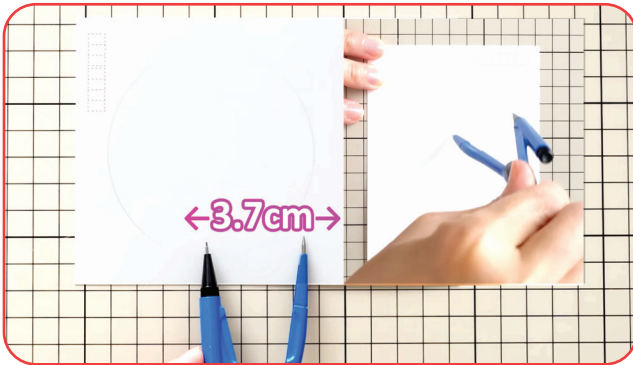


Figure 1.4: Draw another circle of 3.7 cm.

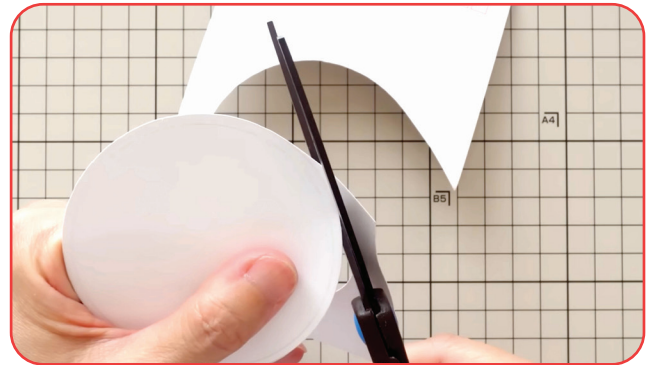


Figure 1.5: Cut out the bigger circle



Step 2: Marking the points and preparing the base for the string art

QR Code:1.1

- Download the template using the QR code given here and print it.
- For the string art, refer to this print to accurately mark the necessary points along the circumference of the circle that you have cut (4 cm radius).
- Affix the cutout on the colored paper using a suitable adhesive.
- Carefully trim any excess-colored paper around the cutout.
- Proceed to make precise cuts along the markings using the reference print as shown in the image.



Fig. 1.6: Marking the points using reference

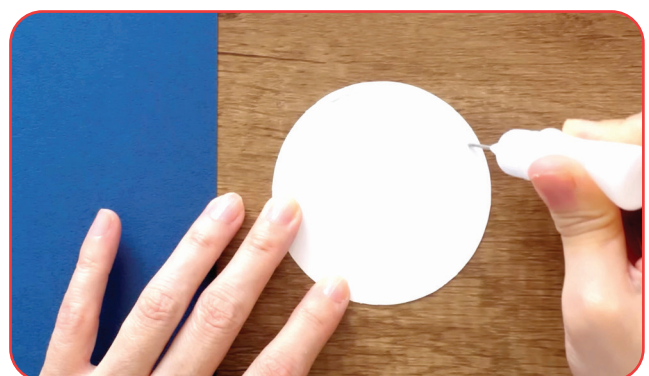


Fig. 1.7: Pasting the Cutout

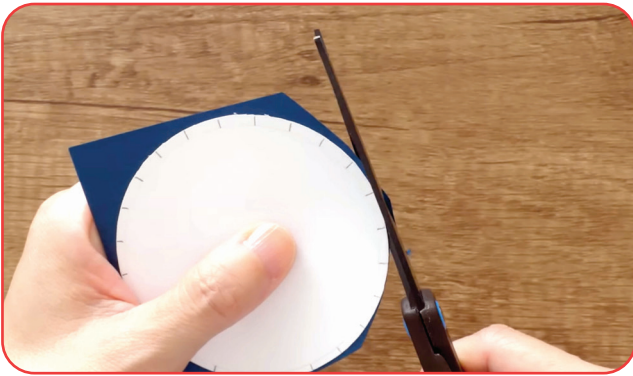


Fig. 1.8: Cutting out the excess part

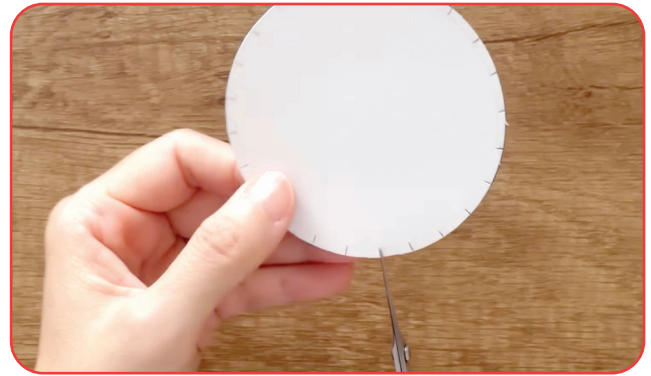


Fig. 1.9: Cutting the markings

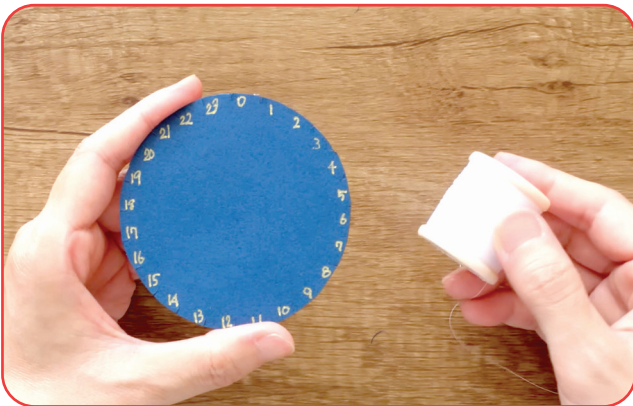


Fig. 1.10: Marking the number for each cut

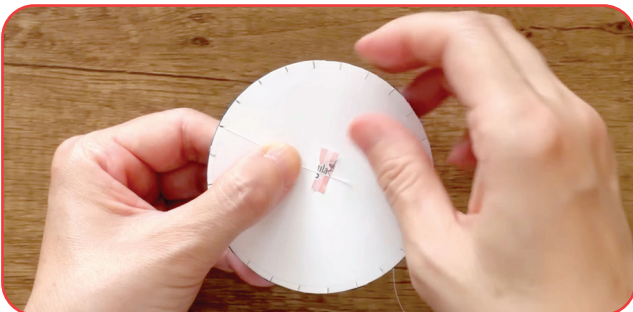


Fig. 1.11: Paste the string behind

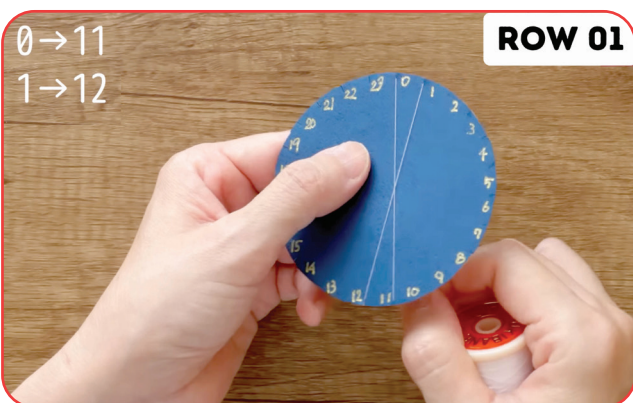


Fig. 1.12: Create one row by following pattern

Step 3: Prepare to create the design

- ▣▣▣▣ Assign a number to each cut for better precision in your design.
- ▣▣▣▣ Choose a colored yarn and begin winding it around the structure to form a visually appealing pattern.

- ▣▣▣▣ To ensure the yarn is securely attached, stick it to the back of the cutout as shown in the image below.

Step 4: Completing the design

- ▣▣▣▣ Initiate the pattern by wrapping the thread from point 0 to 11, then from point 1 to 12, point 2 to 13, point 3 to 14, and so on. Continue this pattern until all points in Row 1 are connected.
- ▣▣▣▣ Upon completion of the first row, affix the end of the thread to the back of the paper using tape.

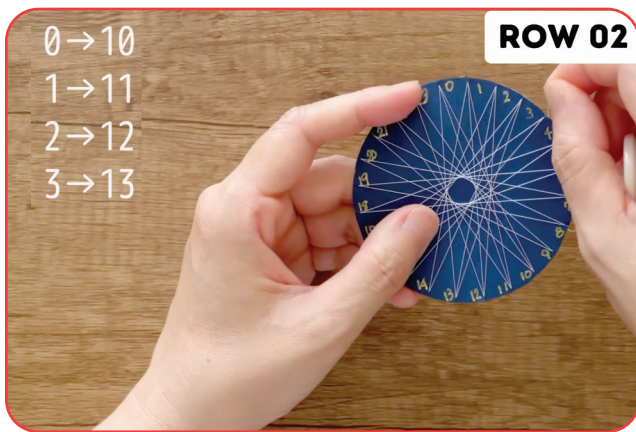


Fig. 1.13: Create another row

provided in Figure 1.14 and 1.15 respectively. Affix the end of the thread for row 3 and 4 also with tape.

➡ Start creating the pattern for Row 2 by wrapping the thread from point 0 to 10, then from point 1 to 11, point 2 to 12, point 3 to 13, and so on. Continue this pattern until all points in Row 2 are connected. Affix the end of the thread with tape.

➡ Similarly create patterns for Row 3 and Row 4 as per the guidelines

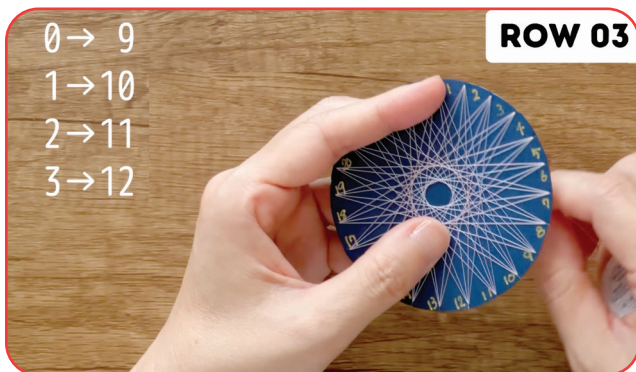


Fig. 1.14: Creating row 3



Fig. 1.15: Creating Row 4

➡ Use different colored yarn for different row to make the design more visible.

Step 5: Finishing the String art

➡ Upon completion of all the rows, paste a piece of paper with the same diameter of the first circle to the back of the string art.

➡ This will conceal any undesired elements and also provide a neat and polished finish to your artwork.

➡ Remember, the final presentation is just as important as the creation process.



Fig. 1.16: Pasting a paper behind

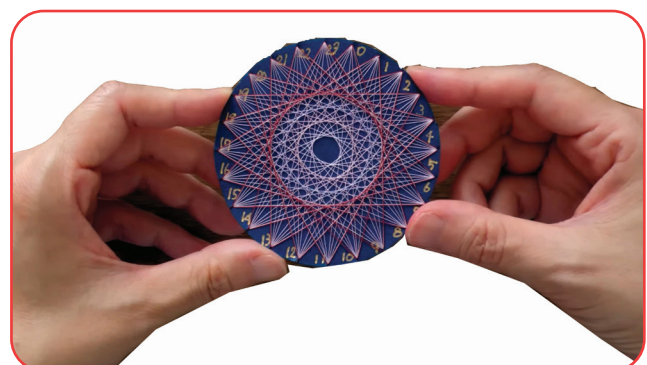


Fig. 1.17: The String art

Teacher Guidelines:

1. Do this activity in a pair or assign it individually.
2. Always use thick paper and sturdy yarn to ensure the string art holds up over time. Avoid using weak adhesive or flimsy materials.
3. Be accurate when marking points and cutting out shapes. Don't rush through the steps as string art requires patience and precision.
4. Ensure the yarn is firmly attached to avoid it coming loose over time. Don't ignore the importance of securing the work properly.
5. Use different colored yarns to make the design more vibrant. Don't limit creativity and let the students feel free to add their own touches to the design.
6. Prioritize safety when using sharp tools and clean up the workspace after completing the string art.
7. Don't neglect these important aspects of any DIY project.



Discussion with students:

1. What material is required for this DIY Basic String Art activity?
2. Can you explain the process of preparing the base for the string art?
3. How do you create the design using the colored yarn?
4. How does using different colored yarn for different rows enhance the visibility of the design?
5. What steps are involved in finishing the string art and why are they important?
6. Can you find some other pattern?
7. How is mathematics related to string art?



Resources:

You can search on Google using the search words –

1. DIY Rainbow Spirograph String Art + YouTube
2. DIY Basic String art + YouTube





Activity Name



83. Preparing Natural Colors

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 2 - Phenomena around Us;
Class 7: Chapter 7 - Environmental Crisis, Conservation of Plants and Environment; Class 8: Chapter 11 - Environment Around us, Plant Kingdom

Concept/Principle: Events - Intended, Unintended, Natural, Man-made;
Climate Change, the role of trees in protecting the environment;
Some important trees in the environment

Materials and tools required:

Various flowers in specific locality like (rose, marigold, hibiscus, palash etc), green vegetables (spinach, coriander), beetroot, turmeric, food color, corn-starch/talcum powder/gram flour, water, gas stove, table spoon, vessel for heating water, knife for cutting vegetables, strainer

Time required: 120 minutes

Objectives:

1. Students will make natural colors and learn about their benefits compared to chemical alternatives.
2. Students will explore the vegetables, fruits, plants etc. that are useful for creating color in the surrounding premises.

Introduction:

Colors have a special impact in our lives. We find out about the situation only by looking at colors. We cannot even imagine our life without colors. In childhood, we recognize objects with the help of colors.

In olden days people used natural colors. As the need for colors increased, chemical colors started being used in various items as well as in festivals. These are very harmful for the skin. Chemical colors can cause water pollution, air pollution, soil pollution. Keeping these issues of pollution in mind, it is necessary to use natural colors instead of chemical colors.

Hands-on activity:

A. Method of preparing PINK COLOR:

1. Take one beetroot to make it pink.
2. Add salt and dissolve it in clean water. Now wash and clean the beetroot with this water, this will clean the soil on the beetroot. After that, dry the beetroot in shade.
3. Cut the beetroot into small pieces with the help of a knife.
4. Put the cut pieces of beetroot in a pan and add two glasses full of water into it. Boil the mixture on gas for 5 minutes. Once the water changes to a pink color, remove it from heat and allow it to cool. Drain the colored water through a strainer.
5. Take two small tablespoons of corn-starch and keep on adding filtered beetroot water to it until its color changes to pink.
6. Keep it in the sun for drying.



B. Method of preparing GREEN COLOR from green leafy vegetables

1. Take green leafy vegetables like spinach or coriander. Cut it into small pieces with a knife and grind it finely.
2. Mix chopped green vegetables in two glasses of water and keep it on the gas to heat for 5 minutes.
3. After the color turns green, keep the hot water in a safe place until it cools down.
4. Press the green vegetables well with boiled water and extract the water.
5. Take two tablespoons of corn starch and add filtered green vegetable water to it. Dissolve corn starch in water until its color turns green.
6. Since the mixture is wet, keep it in the sun for some time to dry.

Try preparing YELLOW COLOR from turmeric powder (which is used at home for cooking) in a similar way.

Teacher Guidelines:

- Divide the class into 6 – 7 groups with each group having not more than 4 students.
- Collect flowers, fruits, vegetables from the school premises or nearby areas or from the students' homes.
- Use of knives should be in presence of a teacher

- ➡ While boiling flowers in water, make the students stand at a distance.
- ➡ Keep some chemical colors in the class to show the students and identify the difference.
- ➡ If you conduct the activity around festivals like Holi, somewhere in February or March, nature also has different colored flowers around us at that time.



Discussion with students:

1. What things are necessary to make color?
2. What is the difference between natural and chemical colors?
3. How many types of colors do you know (names and numbers)?
4. What harm can chemical colors cause to us?
5. What ingredients would you use from your premises to prepare natural colors?



Resources:

You can search on Google using these search words –

1. How to make natural colors at home
2. How to make organic Holi colors at home
3. How to make natural powder colors at home





Activity Name



84. Loom – Bracelet making

Syllabus reference:

Standard/Lesson No.: Class 6: Art and craft

Concept/Principle: Fiber to fabric

Materials and tools required:

Cardboard sheet, wool, beads, gloves, cutter, marker, compass, pencil, ruler (scale)

Time required: 90 minutes

Objectives:

1. Students will make a cardboard loom and use it to weave friendship bands.
2. Students will understand the basic process of weaving and its role in turning fibers into fabric.

Introduction:

In this activity, students will learn how to make a simple cardboard loom to weave friendship bands. Using easily available materials like cardboard, wool, and beads, they will explore the basic concept of weaving and understand how fibers are turned into fabric. Through this hands-on experience, students will design and create their own colorful and creative friendship bands, adding unique patterns and bead decorations for a personal touch.

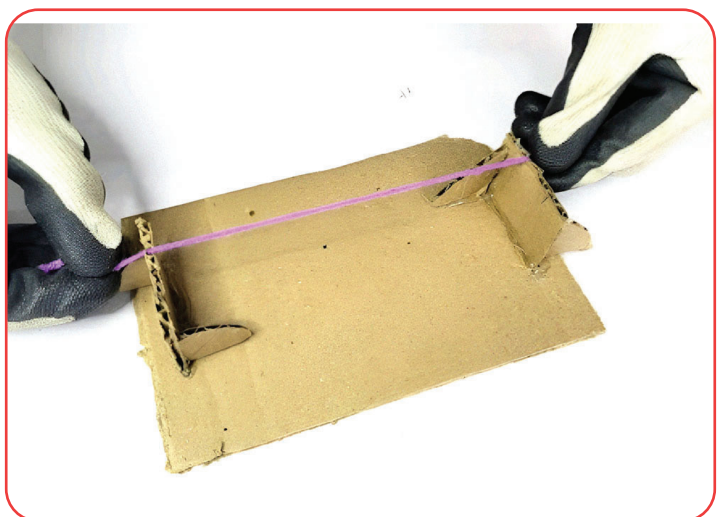
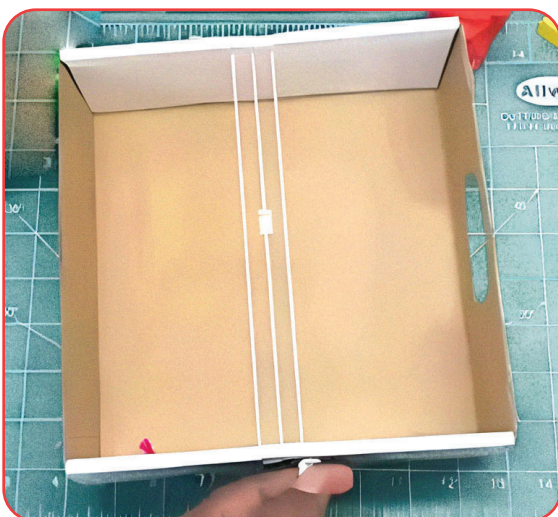
Hands-on activity:



Type1. How to make a cardboard loom using a box for friendship bracelets.

Step 1: Prepare Cardboard Loom

- ➡ Cut a scrap cardboard box into three equal sections to create a simple loom. If you don't have a cardboard box, you can make your own loom structure using the available material as shown in the right-hand side image below.



Step 2: Attach Starting Wool

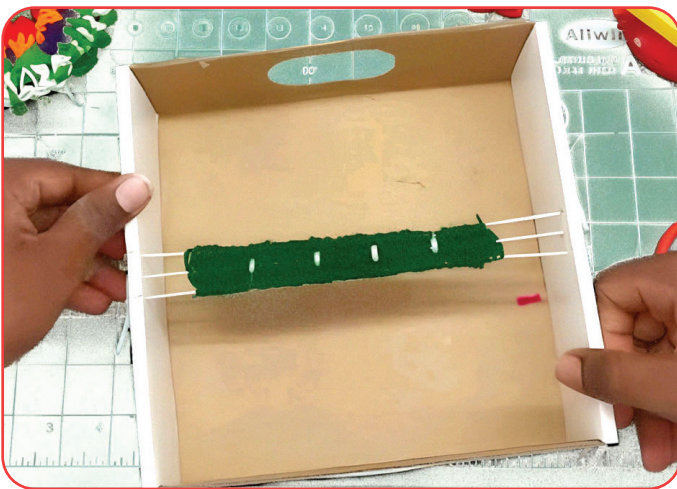
- ➡ Tie a knot at one end of the cardboard loom and secure a length of wool, leaving extra for fringe.

Step 3: Add Beads (Optional)

- ➡ Thread beads onto the wool before passing it through the loom for a decorative touch.

Step 4: Prepare Spool

- ➡ Wind a desired color of wool around an empty spool, securing it with a tight knot at one end.



Step 5: Start Weaving

- ➡ Weave another color of wool through the vertical strands, alternating over and under. Repeat until desired length.

Step 6: Finish Weaving

- ➡ Tie off the wool at the end, leaving extra for fringe. Cut the friendship band from the loom.

Step 7: Trim Excess Wool

- ➡ Cut away any extra wool after the knot for a neat starting point.

Step 8: Tie Fringe

- ➡ Securely tie knots at both ends of the woven band to ensure a strong hold.

Step 9: Repeat on Other Side

- ➡ Mirror the process on the opposite side for symmetry.

Step 10: Add Button (Optional)

- ➡ For a final touch, attach a button to one end for both style and functionality.

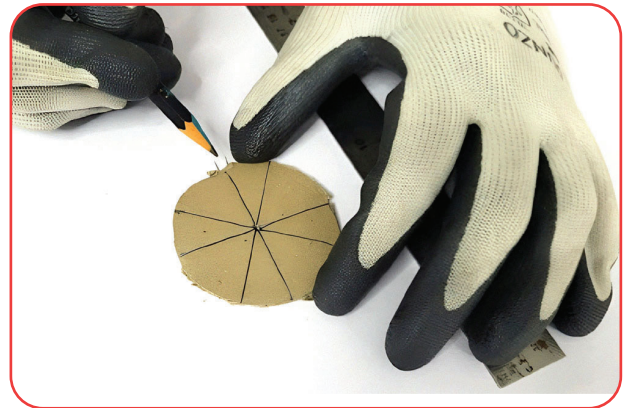
Step 11: Explore Creativity

- ➡ Experiment with different colors, bead placements, and variations to express your creativity.

Type 2. How to make a circular cardboard loom for friendship bracelets.

Step 1: Prepare the Circular Cardboard Loom

1. Take a piece of cardboard sheet and cut it to a circular shape.
2. Draw four lines on the cardboard, dividing it into halves both vertically and horizontally, meeting at the center.

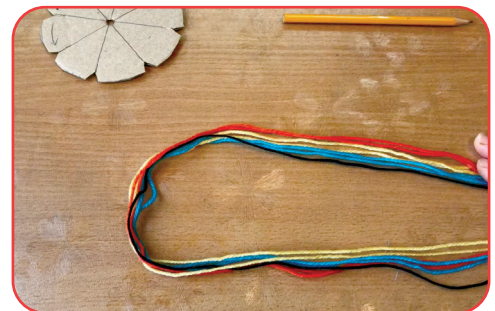


Step 2: Make cuts at the Edges:

- Cut small slits along the edges of the circular cardboard, creating evenly spaced slots for the wool. Use hand-gloves while using paper cutter.

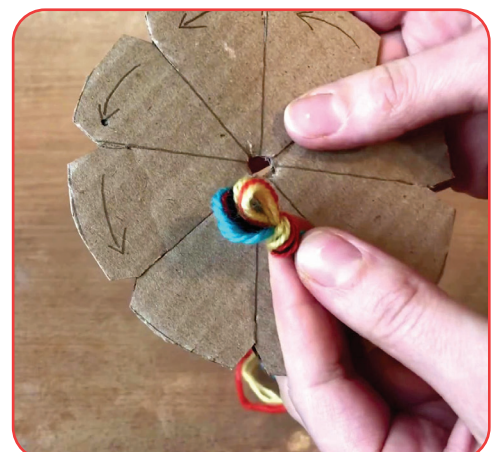
Step 3: Prepare Wool Strands:

- Choose seven different colors of wool, cut them into equal lengths, and thread each strand through a separate slot on the cardboard.



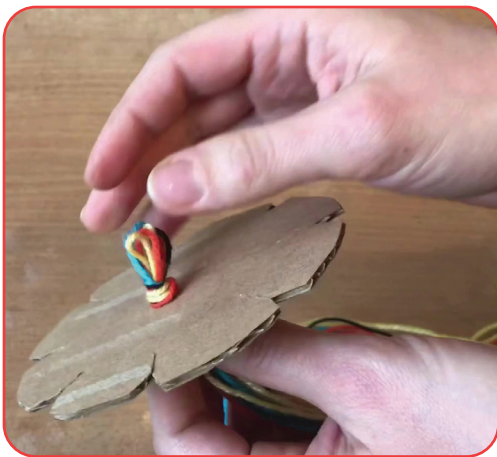
Step 4: Secure the Wool at the Center:

- Bring all the wool strands to the center of the cardboard and make a small hole. Bundle the strands together and tie a knot at the back to secure them in place.



Step 5: Start Weaving:

- Start weaving the wool through the slots in



a desired pattern. You can go over and under the slots, creating a woven design.

Step 6: Repeat Weaving Pattern:

- ➡ Continue weaving until you reach the desired length, repeating your chosen pattern. Ensure that the tension is consistent for a neat finish.

Step 7: Finishing Touches:

- ➡ Once you've completed the weaving, tie off the wool securely and trim any excess. Ensure the knots are tight for durability.

Step 8: Remove from Loom:

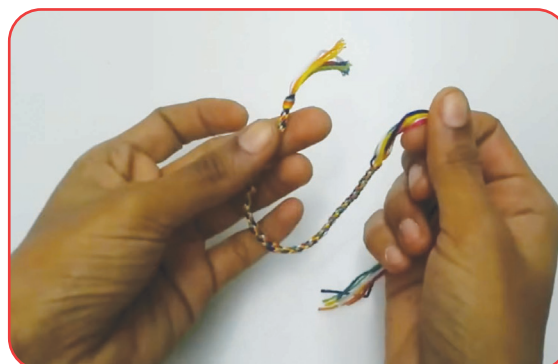
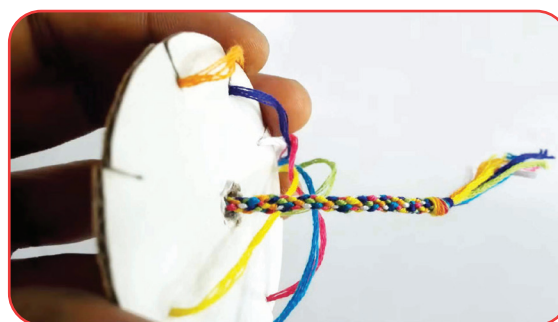
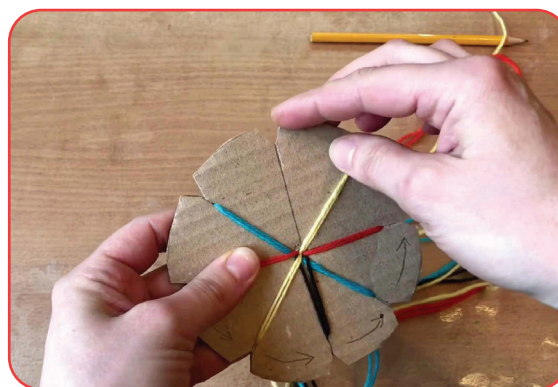
- ➡ Carefully remove the woven piece from the cardboard loom, sliding it off the slots.

Step 9: Optional Embellishments:

- ➡ Add any optional embellishments like beads or extra wool for a aesthetic enhancement.

Step 10: Finalize the Project:

- ➡ Trim any loose threads, and your hand-loomed circular piece is ready! Display it as a decorative item or use it as desired.



Teacher Guidelines:

1. You can do this activity in a group of 3-4 students.
2. Use sharp tools such as scissors, paper cutters very carefully and keep them away from young children.
3. Take breaks to prevent strain or fatigue, especially during long crafting sessions.
4. Avoid rushing through the crafting process, as it can lead to mistakes and potentially unsafe situations.



Discussion with students:

1. How do you secure the wool to the cardboard loom, and why do you leave extra length for the fringe?
2. Describe the weaving process. What pattern do you follow to create the friendship band?
3. Why is it important to tie a tight knot at one end when winding wool around the spool?
4. Why is it necessary to trim away excess wool after tying a knot on the spool?
5. What suggestions are given for customizing the project, and how can creativity be expressed?



Resources:

You can search on Google using these search words –

1. How to make circular cardboard looms for friendship bracelets.
2. Video reference for making cardboard loom for weaving.
3. How to make cardboard loom using a box for friendship bracelets.



QR Code





Activity Name



85. Making Rakhi

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 5 - Measurement

Concept/Principle: Measurement requirements and Units of Measurement in daily life, Length measurement

Materials and tools required:

Glue, scale, scissors, silk strings, stars, beads, colored paper, silk threads, thin sponge, pin, raksha sutra

Time required: 30 minutes

Objectives:

1. Students will make beautiful Rakhis.
2. Students will get to know about different Indian festivals, their significance and how to celebrate them.

Introduction:

In Indian tradition, Raksha Bandhan festival is celebrated with great enthusiasm. Rakhi thread is considered the strongest and most sacred bond, which enhances love and trust among siblings. This activity allows students to explore the festival while applying practical measurement skills. While creating Rakhis, students measure and cut threads, calculate lengths for beads and decorations, and practice precision, linking a cultural activity to real-life applications of measurement.

Hands-on activity:

1. First, check all the necessary equipment and materials.
2. Take the Silk thread.
3. Braid the silk thread like a plait. (As per figure 1)
4. Wrap the thread to close both ends. (As per figure 2)
5. The base of Rakhi is ready, cut a thin layer of sponge

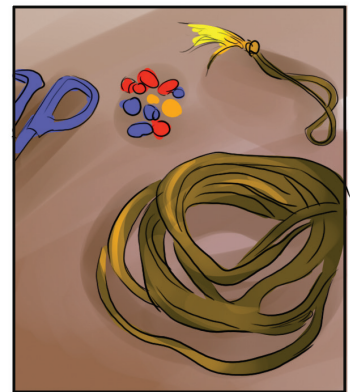


Figure 1



Figure 2



Figure 3

round and stick it on this base. (As per figure 3)

6. Cut a round piece of colored paper similar to the size of the sponge and glue it to the sponge. (As per figure 4)

7. Decorate the top of the paper with stars or beads. (As per figure 5)



Figure 4

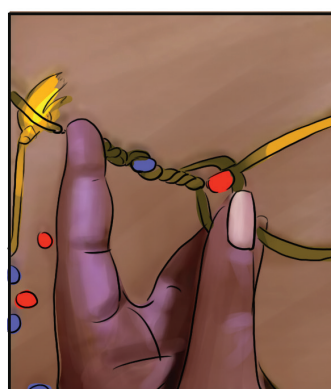


Figure 5

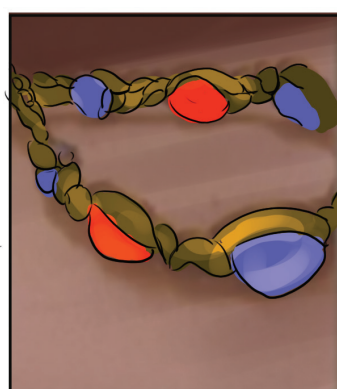


Figure 6

8. Your Rakhi is ready! (Figure - 6)

Teacher Guidelines:

- ➡ Divide the students into groups, with 4-5 students in each group.
- ➡ Rakhi made by teachers and students can be decorated in the school premises.
- ➡ Ensure the use of scissors & blades under teacher supervision.



Discussion with students:

1. Is Rakhi a form of art?
2. What different types of materials can be used to make a Rakhi?
3. Make a cost chart for making Rakhi and figure out the selling price. Ask your teacher for help.
4. What are the stories behind Rakhi? What is the history of this festival?



Resources:

You can search on Google using the search words –

1. How to make Rakhi at home
2. DIY Rakhi using threads step-by step guide





Activity Name



86. Painting of a Wall

Syllabus reference:

Standard/Lesson No.: Class 7: Chapter 4 - Role of Substances in Environment, Synthetic compounds and their impact on the environment - Paints & Dyes

Concept/Principle: Measurement, Finding the area

Materials and tools required:

Paint, water and thinner, polish paper, sandpaper, distemper, putty, water, brushes, bucket, roller

Time required: 180 minutes

Objectives:

Students will learn about the process and advantages of painting and about the different paints available in the market

Introduction:

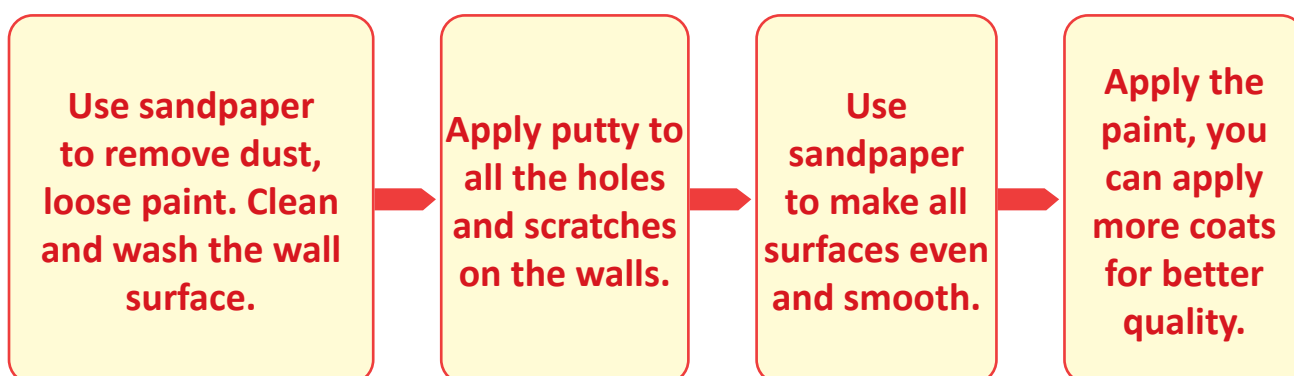
Painting is a process used to color wood, metals, acrylic, walls etc. Painting increases the shine of the surface; it also increases the life of the material. It slows down rusting in metals, keeps bugs away from wood, and increases the durability of the wall.

Today we are going to paint a wall in our school to understand the painting process.

Hands-on activity:

1. Select any wall in the school that needs to be re-painted. Do not select a wall at height or which needs climbing on a ladder.
2. The selection of paint depends on the type of wall. Paint differs in terms of their binder, glaze, and appearance.
3. Whitewash, distemper paint, oil paint, acrylic paint, exterior paints, etc. are some of the types available in the market.
4. To calculate the quantity of paint required, calculate the area of the wall to be painted. Normally paint manufacturers have recommendations for the amount of paint required. But by approximation, a wall of area of 6 m^2 needs approximately 1 liter of paint.
5. For the school wall, we can select distemper paint. Select the appropriate color.
6. Generally, primer is applied before applying paint. Primer ensures better adhesion of paint and increases its durability. However, distemper paint does not require the use of a primer.

Steps in painting:



Select the right choice of brush/roller:

Selection of proper tools ensures a better quality of work. There are different brush/roller sizes and shapes. Please select the appropriate brush.

Following brushes are useful for our purpose:



1. Wall brush: This type spreads the paint over a large surface area.
2. Trim brush: A 2-inch-wide trim brush is ideal for woodwork and for "cutting in" around windows, doors, and corners.
3. Sash brush: A sash brush has an angled bristle end. It is useful for painting around windows.
4. Roller: it is used to evenly paint large and flat surfaces.

Teacher Guidelines:

1. Conduct the activity with a maximum of 20 students in a batch.
2. Paint and water have to be added in proper ratio.
3. The area to be painted should be cleaned with sand paper.
4. The brush used should be clean and free of dust. Ensure use of face masks while re-moving dust while using sand paper.
5. Students should not be asked to paint above their own height.
6. Make sure all students follow safety precautions – masks, gloves, apron, etc.



Discussion with students:

1. What is the composition of the paint?
2. What are the chemical differences in oil bond, distemper, oil paint etc.?
3. How to use the roller for the painting?
4. Why add thinner to the oil paint?
5. When is sandpaper used in painting?



Resources:

You can search on Google using the following search words -

1. How to paint a wall
2. How to use roller /brush in painting + YouTube
3. Wall painting





Activity Name



87. Dyeing Fabrics Naturally

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 2 - Phenomena around Us; Class 7: Chapter 7 - Environmental Crisis, Conservation of Plants and Environment; Class - 8: Chapter 11 - Environment Around Us and Plant Kingdom

Concept/Principle: Extraction of color, dyeing process, Natural, Man-made; Climate Change, the role of trees in protecting the environment

Materials and tools required:

Fabrics (cotton, wool, silk, etc.), natural dye sources (e.g., onion skins, turmeric, beetroot, red rose, hibiscus, tea, etc.), water, vinegar (optional, as a mordant), strainers, stirrers or spoons, pots or containers for dyeing, gas or heating source, heat-resistant gloves (for safety during dyeing), aprons.

Time required: 120 minutes

Objectives:

1. Students will learn the making of natural dyes.
2. Students will learn to color different fabrics using natural dyes.

Introduction:

Natural dyeing is an ancient art that uses plants and other natural materials to color fabrics. In this activity, students will explore how colors can be extracted from hibiscus, onion skins, turmeric, beetroot, and other natural sources. They will observe how different fabrics absorb these dyes in distinct ways, creating a variety of shades and patterns. The process also introduces the role of mordants, which help fix colors to fabrics, and demonstrates how factors like pH levels can subtly change the resulting hues. Through hands-on experimentation, students will experience the transformation of plain fabrics into vibrantly dyed materials, gaining insight into both the science and art of natural coloring.

Hands-on activity:

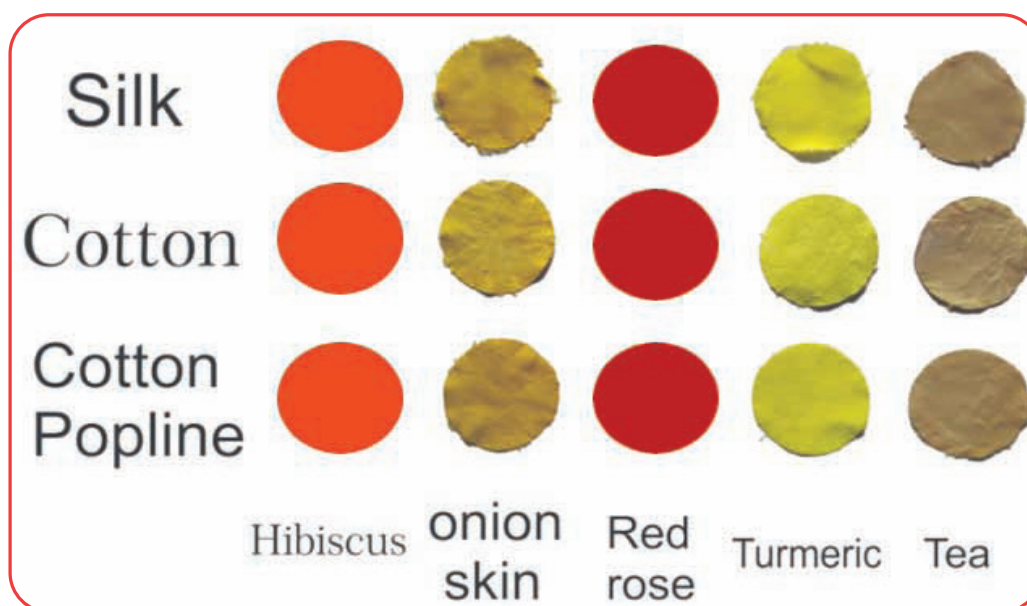
1. Choose natural materials like red rose, hibiscus, onion skins, turmeric, or beetroot for dyeing. You can use fresh or dried plants.
2. Chop or crush the materials to release more color. Boil them in water for 30-60 minutes, then strain to remove any solid pieces.
3. Wash the fabric to remove dirt or chemicals, then wet it well so it absorbs the dye evenly.
4. Use a mordant like alum, vinegar, or salt to help the color stay longer. Soak the fabric in this solution before dyeing.
5. Heat the strained dye liquid and put the wet fabric into it, stirring continuously for an even color. Let it simmer for at least 30 minutes or until you get the desired shade.
6. Rinse the fabric with cool water to remove extra dye, then hang it in a shaded place to dry.
7. Once dry, iron the fabric or let it sit for a few days before washing to set the color properly.

Recipes:

Natural dye	Quantity	Boiled water	Mordant	Heating time	Soaked time in dye	Soaked time in warm water
Turmeric	15 g	200 ml	salt (15 g)	20 minutes	30 minutes	5 minutes
Hibiscus	10 g	200 ml	Alum (1 g)	30 minutes	2 hours	5 minutes

Natural dye	Quantity	Boiled water	Mordant	Heating time	Soaked time in dye	Soaked time in warm water
Red rose	80 g	400 ml	Alum (1g)	35 minutes	2 hours	7 minutes
Tea	11 g	200 ml	salt (1.73g)	20 minutes	2 hours	7 minutes
Onion skin	20 g	300 ml	Alum (0.91g)	25 minutes	1 hour	5 minutes

Results:



Teacher Guidelines:

1. Ensure that students are careful when using stoves or burners and follow safety rules.
2. Ensure that all students wear gloves to protect their hands from heat and possible skin irritation from dyes.
3. Divide 20 students into small groups of 5-6 students each.
4. Give each group a different natural dye and fabric type to experiment with for varied results.
5. Make sure all materials and tools are ready before starting the activity.



Discussion with students:

1. Why do we need to boil the dye materials in water?
2. How does adding vinegar or salt help the dye stay on the fabric?

3. Why do different fabrics absorb dye in different ways?
4. How do natural dyes compare to synthetic dyes in terms of environmental impact?
5. How did people in the past use natural dyes before synthetic dyes were invented?
6. What are some benefits of using natural dyes instead of artificial ones?



Resources:

You can search on Google using the search words –

1. Natural fabric DIY + YouTube
2. Dyeing at home
3. Natural fabric dyeing at home

<https://class.textile-academy.org/2019/harshada.raut/assignments/week04/>



QR Code





Activity Name



88. Making a Cloth Bag

Syllabus reference:

Standard/Lesson No.: Cass 6: Chapter 5 - Measuring or Measurement,
Class 8: 24 - Fun Maths

Concept/Principle: Measurement, Sewing, Fabric Selection, Stitching

Materials and tools required:

Threads, cloth, measuring tape, fabric (various types and colors), chalk,
needles, buttons, scissors

Time required: 120 minutes

Objectives:

1. Students will learn to create a simple cloth bag using hand stitching.
2. Students will learn basic hand sewing skills.

Introduction:

Hand sewing is a skill that combines creativity with practical craftsmanship. In this activity, students will explore different types of stitches and threads, select suitable fabrics, and create a simple cloth bag entirely by hand. As they work, they will practice basic sewing techniques, develop precision and patience, and experience the satisfaction of making something functional. The finished reusable bag can be used for carrying books, groceries, or other items, offering an eco-friendly alternative to plastic and highlighting how simple handmade solutions can contribute to sustainability.

Hands-on activity:

1. Decide the size and shape of your bag.
2. Measure and cut two identical rectangles of fabric for the front and back of the bag.
3. Cut two long fabric strips for the straps.
4. Fold and sew the edges of all fabric pieces to prevent fraying.
5. Fold each strap piece lengthwise, sew along the edge, and turn it right side out.
6. Place the two rectangles together with the right sides facing in and sew along the sides and bottom.
7. Turn the bag right side out.
8. Position the straps at the top edge of the bag and sew them securely in place.
9. Fold and sew the top edge of the bag for a clean finish.



Teacher Guidelines:

1. Keep tools like scissors and needles organized.
2. Ensure that students handle all materials carefully under your supervision.
3. Divide the students into 6-8 groups with not more than 6 students in each group.



Resources: You can search on Google using the search words -

1. How to Make a Simple Cloth Bag
2. How to make simple tote bag + YouTube
3. Easy cloth tote bag





Activity Name



89. Embroidery work

Syllabus reference:

Standard/Lesson No.: Class 6: Chapter 5 - Measuring or Measurement,
Class 8: 24 - Fun Maths

Concept/Principle: Stitches, embroidery

Materials and tools required:

Thread, needle, embroidery thread, embroidery needle, color,
scissors, pencil, ruler

Time required: 60 minutes

Objectives:

1. Students will learn the art of hand embroidery on a pillow cover.
2. Students will learn different embroidery stitches such as straight stitch, back stitch, etc.

Introduction:

Embroidery is the art of decorating fabric or other materials using needle and thread. It involves stitching various designs, patterns, and motifs onto the fabric surface to create decorative embellishments. Common embroidery stitches include satin stitch, backstitch, chain stitch, and French knot, among others.

In this activity, students will learn how to apply these stitches on fabrics. Generally, there are the following 6 types of prevalent embroidery.



Two types of threads commonly used in embroidery are-

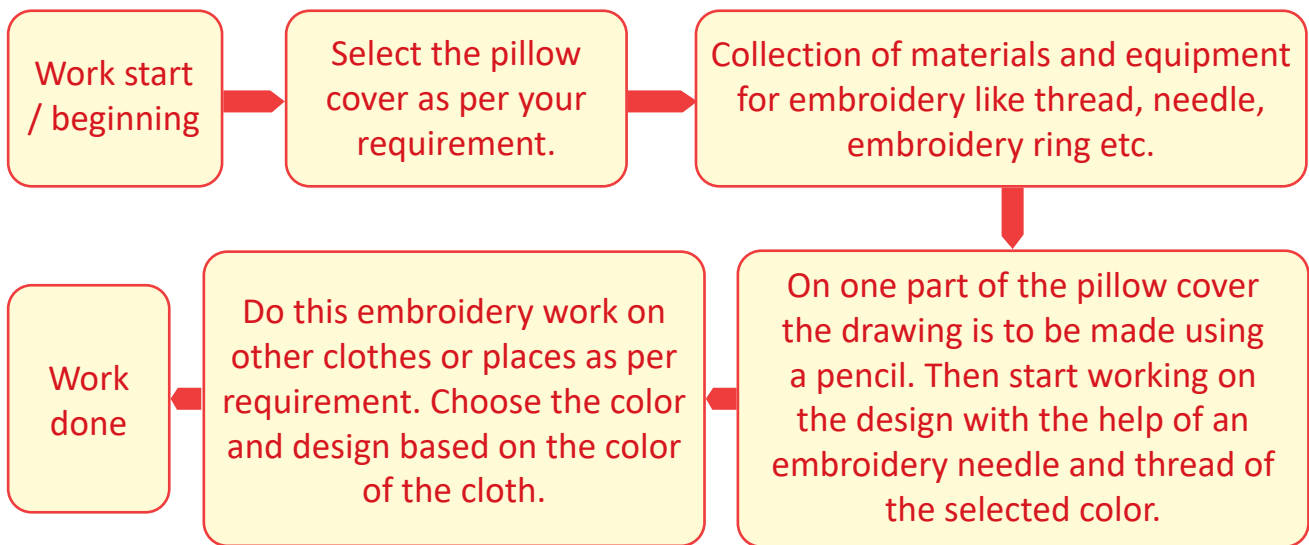
1. Thorn
2. Filament

We can make the following items used in our daily life attractive by doing Chikankari or embroidery work –

1. Handkerchief
2. Scarf
3. Pillow
4. Curtain

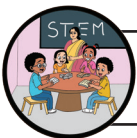
Hands-on activity:

Now, we will learn how to do embroidery work on pillow covers using the following process chart:



Teacher Guidelines:

1. You can take a maximum of 30 students in a batch with each group having 2 or 3 students.
2. Use the needle carefully in embroidery work.
3. Carefully draw the embroidery design on the selected area.
4. Work carefully on the embroidery design only.
5. Ensure that students handle scissors and needles under teacher supervision.



Discussion with students:

1. Where can you use this embroidery work?
2. How to use a jute sack to make an attractive doormat?
3. How can embroidery work be made a means of livelihood?
4. How has the concept of symmetry helped you in this activity?



Resources:

You can search on Google using the search words –

1. Hand embroidery for beginners + YouTube
2. How to embroider flowers





Activity Name



90. Crochet - Friendship Bracelets

Syllabus reference

Standard/Lesson No.: Class 6: Chapter 5 - Measuring or Measurement,
Class 8: 24 - Fun Maths

Concept/Principle: Basic Crochet Stitch (Chain Stitch), Repetition
and Pattern Making

Materials and tools required:

Different color yarn, crochet hooks, scissors

Time required: 90 minutes

Objectives:

1. Students will make friendship bracelets using repeated chain stitches.
2. Students will learn fundamental crochet skills - the chain stitch.

Introduction:

Crochet is a way of making fabric using a crochet hook to loop yarn, thread, or other materials together. In this activity, students will learn to make friendship bracelets using basic crochet techniques. They will practice making a chain stitch, which is a simple repeated movement used in crochet projects.

Hands-on activity:

1. Tie a slip knot to attach the yarn to the crochet hook.
2. Pull some of the yarn and make a loop about 6 inches from the end, leaving a small tail.
3. Make a loop with the long end of the yarn (from the two balls of yarn) over the short tail.

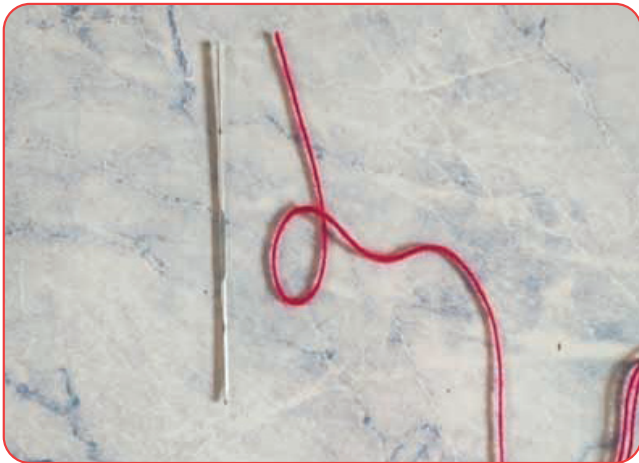


Image 1



Image 2

4. Push the crochet hook into the center of the loop from front to back. Grab the long end of the yarn with the hook and pull it through.
5. Gently pull both ends of the yarn to form a loop around the hook. This completes the slip knot.
6. Now, start crocheting with a chain stitch to form the base of your bracelet.



Image 3

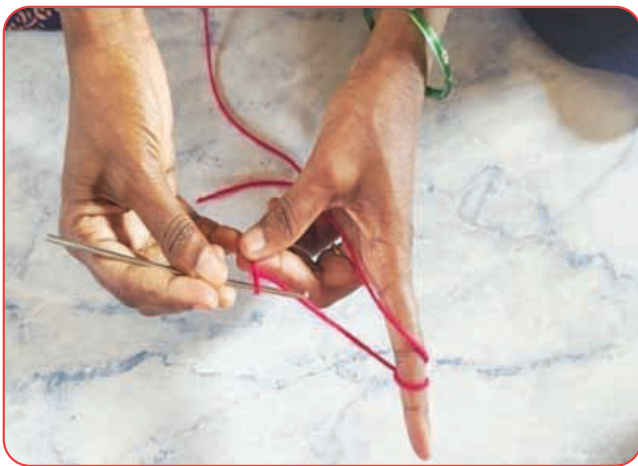


Image 4



Image 5

7. The arrangement (a chain stitch) is created by pulling the yarn through the loop on the hook.
8. Make a new loop by pulling the yarn through the slip knot. This creates your first chain stitch.
9. Repeat step 4 over and over again. Each time you pull the yarn through the loop; you will create another chain.
10. Once the chain is long enough, your friendship bracelet is complete.



Image 6

Teacher Guidelines:

1. Store crochet materials properly after use.
2. Make student groups with a maximum of 2 students in each group.
3. Use hooks with smooth edges to avoid cuts or scrapes.
4. Ensure that students use scissors safely.



Discussion with students:

1. What kind of stitch are we using to make our friendship bracelets?
2. How can we create different patterns?
3. What if we use thicker yarn?



Resources:

You can search on Google using the search words –

1. How to use crochet for making a bracelet
2. Easy crochet - friendship bracelet + YouTube
3. Crochet projects



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