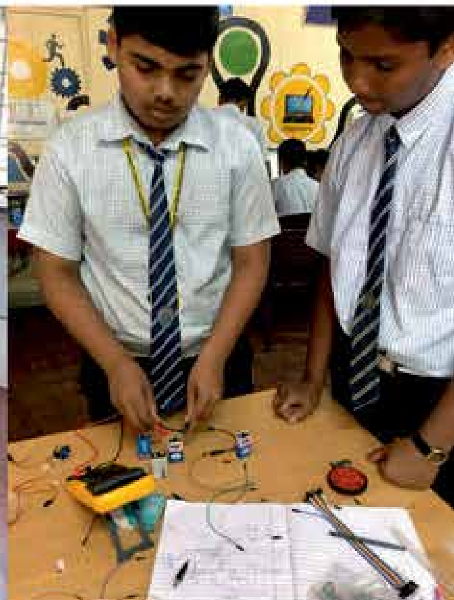
Teacher's Manual

Manual for Makerspace in Secondary Schools



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Makerspace in Secondary Schools

Teacher's Manual

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- This booklet has been developed by **'Vigyan Ashram Technologies Foundation (VATF)'** only for the guidance of trainers/instructors.
- **Different reference sources have been used and referred to in the preparation of this booklet. A lot of content has been designed in-house and some content been taken from the internet for the benefit of the students.**

Introduction:

New Education Policy (NEP) 2020 is aiming to reform the education system in a big way. It emphasizes on giving vocational exposure to students between class VI-VIII. NEP states the importance of 'hands-on' learning (NEP 4.6) as a standard pedagogy within each subject and with explorations of relations among different subjects. It further states (NEP 4.9) that there should be no hard separation among 'curricular', 'extracurricular', or 'co-curricular', among arts, humanities and sciences or between vocational and academic streams

The policy (NEP 4.26) also promotes students engagement in vocational pursuits such as carpentry, electrical work, gardening, pottery, etc., and encourages their participation in a 10-day "bagless period," during which they can intern with vocational experts such as carpenters, gardeners, potters, artists, etc.

NEP 16.3, 16.4 talked about 'Reimagining vocational education'. Beginning with vocational exposure at early ages in middle and secondary school, quality vocational education will be integrated smoothly into higher education.

This booklet serves as a set of guidelines aimed at implementing the recommendations of NEP 2020 in schools across Telangana, Karnataka, and Andhra Pradesh. We anticipate that these efforts will serve as a model for other states across the country.

Derived from the experiences of the 'Strengthening Makerspaces in Andhra Pradesh, Telangana, and Karnataka' initiative, which has been catering to government school students since January 2022, this booklet is a product of collaboration between the Departments of Education of Andhra Pradesh, Telangana, and Karnataka, with support from UNICEF. The 'Makerspaces' program has been operational in 42 schools across these states since December 2023, with Vigyan Ashram serving as the technical agency for the project. With over 30 years of experience in introducing the 'Work-Centered Education Methodology' at the secondary school level, Vigyan Ashram brings valuable expertise to the project. The 'Strengthening Makerspaces' program, initiated in 2022, focused on enhancing the capacity of 84 'Atal Tinkering Labs' in Andhra Pradesh, Telangana, and Karnataka. Presently, 'Makerspaces' have been established in 42 schools within these states, with regular training sessions conducted for lab in-charge teachers. Students from classes VI to IX are also undergoing training in these schools. The 'Work-Centered Methodology' has proven to be highly effective pedagogically in training school children and aligns well with the objectives of the NEP. The primary objective of this booklet is to assist teachers in implementing pedagogical reform activities envisioned by the NEP.

A note for the teacher on this Low Cost Maker Space manual...

In recent times, 'maker spaces' have become an important part of schools, especially at the middle and secondary schools. These learning spaces, provided with both traditional and modern technology resources, promise to provide children and their teachers an experiential learning experience, one which brings the curriculum alive and at the same time, breaks curricular boundaries and enables innovation at the school level. Governments across the world have looked to establish maker spaces to strengthen STEM (Science, Technology, Engineering and Mathematics) based learning in schools.

The Atal Innovation Mission has established 10000+ maker spaces called 'Atal Tinkering Laboratories' (ATLs) in schools across India. The objective of this maker space is to foster curiosity, creativity, and imagination in young minds; and inculcate skills such as design mindset, computational thinking, adaptive learning, physical computing etc.

ATLs are equipped with DIY kits to teach science, electronics, robotics, open-source microcontroller boards, sensors and 3D printers and computers. The cost of capital equipment is Rs. 10 lakhs at the time of lab establishment. This is supported by an annual maintenance grant of Rs. 2 lakhs per year from the Atal Innovation Mission, for a period of five years. It is assumed that the school and the state will find ways of sustaining the ATLs beyond this period.

The ATLs come at a higher cost. UNICEF and Vigyan Ashram which have worked extensively with ATLs in the states of AP, Karnataka and Telangana, have realized that the maker spaces can also be established at a much lower cost. This opens the possibility of providing universal access and coverage to maker spaces. This has led to the design of a 'Low-cost Maker' space (LCM) which can be established at Rs. 1,50,000/- per lab, with an annual maintenance cost of Rs. 15,000/-.

The low-cost maker space (LCM) has almost all tools that the ATLs have. It also includes basics electronics, hands tools, agriculture and art and craft tools. Optimum usage of the LCM can support almost 80% of the projects that are typically done at the ATLs. Equipment such as the 3D printer, which is not part of the LCM design, can be outsourced from nearby ATLs.

To demonstrate the idea of a Low-cost maker space in schools. UNICEF has supported the establishment of 42 such spaces (two in Andhra Pradesh, and 20 each in Karnataka and Telangana).

This handbook is an instructional manual for teachers in the school having the LCM space. It gives teachers ideas related to various project activities for students. Activities are suggested considering age of students, their curricular areas and learning objectives. It is advised that these activities should not be performed ritualistically. Teachers are requested to use these activities to illustrate topics learnt in the classroom, and at the same time, use the tools in the LCM space to experiment with innovative projects and solutions to day-to-day problems that they come across at home, school or the local community.

'Learning while doing' is non-negotiable principle for the program.

It is important that the school and teacher must ensure availability of sufficient raw material for activities in advance before conducting the session.

Further, the teacher must be present all the time when students are performing activities. Safe handling of tools is important and students must be informed regularly about safety instructions.

Activities given in this manual are only suggestive. Teachers are encouraged to explore and suggest new activities. To establish a strong connection with the curriculum, it is also advised to have a discussion with the children on how the activities at the LCM space are linked closely with what they learn in the classroom. This will reinforce the core curriculum.

Teachers are also suggested to explore new activities using resources available on internet. They can search using prompts like 'DIY + XX concept to be taught'; 'hands on Project for students + XX concept to be taught'. This will give new ideas for new projects.

LCM lab has tools that can be considered as 'basic'. Multiple projects can be developed with these basic tools. The possibilities are actually limitless!

If your LCM space can demonstrate the possibility of enhancing the learning experience of every child by doing, policy makers will be pushed to consider the establishment of LCM spaces in every school.

We wish you all the best in this exciting endeavor!

- UNICEF and Vigyan Ashram teams

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Index

Guide to use the handbook

1. Guide to use the handbook:

This hand book is an instructional manual for teachers in the school. It gives teachers ideas of various project activities for students. Activities are suggested considering age of students, curricular areas and to achieve learning objectives. It is advised that these activities should not be performed ritualistically. Teachers are advised to implement the activities to fulfill real life needs of any individual, school or society. Material used for the activity should not get wasted but must be used for productive purpose. Few examples of such community service activities are given for each activity.

'Learning by Doing' is non-negotiable principle for the program. Therefore, teacher must ensure that every student will participate in the activity. It is important that teacher must ensure availability of sufficient raw material for activities in advance before conducting the session. Teacher must be present all the time when students are performing activities. Safe handling of tools is important and students must be informed regularly about safety instructions. Activities given in the books and suggestive. Teachers are encouraged to suggest new activities. It is also advised to take lesson on related curricular topics after hands on activities. This will help in developing better understanding of curricular concepts.

2. The principles behind 'Learning by Doing' initiative:

Explaining the principles in point wise but with examples and adequate details. The focus should be on why these principles are to be followed to achieve the desired learning outcomes. How this initiative is linked with NEP:

1. **Learning while doing in real life situation is a Natural way of learning.**
   A child learns his mother tongue by 'Learning while doing'. We learn cooking, swimming, riding bicycle, operating computer, etc. by 'Learning while doing'. Whatever we are confident of doing, is always learned by 'Learning while doing'.
2. **Activity to hand stimulate intellect / Education is process of training Head, hand and heart.**
   Many great innovators & entrepreneurs viz Thomas Alva Edison, Wright brothers became great due to variety of experiences they got in their childhood. Objective of this program is not limited to impart skills training for earning livelihood. Objective of the program is to increase experiential horizon of a child.
3. **Science, Technology, Engineering, Mathematics (STEM) education can be given by project-based methodology.**
   Project / productive work requires knowledge of different subjects' areas. It is easy for students do concrete activities and then understand 'abstract concept' behind it. This can be understood from the example of learning bicycle maintenance and different curricular concepts.

For Example:

Bicycle maintenance

Understanding parts and function (brakes, wheel, valves, bearings, tyre, spokes)	Types of cycles, Benefits of cycling	History of bicycle, invention	Expressing about cycle – Essay, poem, literature, video, sketch
Science – Simple machine, friction, air pressure, center of gravity	Environment, health, New design	History	Language, Art

New Education Policy and connect with Makerspaces:

New Education Policy

4.26 Bag-less WEEK

4.23 Multiple Skills, Life skills

4.9 Integration of subjects

16.4 Vocational Exposure to all

16.5 Vocational Education to all

'Strengthening Makerspaces' program details

Fixed time in time table for 'Learning while doing' or 'Do-It-Yourself'.

Min tools and raw material will be available in every school.

Activities in the areas of Engineering, Energy and electronics, Agriculture and Art and craft.

Every students learns multiple skills. Skills linked to their curricular concepts.

Skilled people from the community can be honorary teachers.

3. Introduction to the courses and streams:

The four streams need to be explained in detail along with overall Dos' and Don'ts. These Do's and Don'ts are not written separately for each course. They are explained taking examples from crucial activities.

Our program is linked to different subject areas and it is divided into 4 streams as follows:

Engineering	Energy and Electronics	Agriculture	Art and Craft

Class-wise activities for of the above streams is given in the index for reference. It is necessary that all students to take part in all sections. It is necessary to give various kinds of experiences to young mind. Such multiple exposure is necessary in the formative years of development of child for developing creativity of child.

4. Linkage with academic course curriculum vis-à-vis streams:

Subject	Stream	
Physics and Chemistry	Engineering, Energy and electronics	→ Languages Social sciences
Biology	Agriculture	→
Geography	Map making	→
Mathematics	Art and craft	→

5. Setting up the Makerspaces:

Let us go through the details of setting up maker spaces in the schools. Various aspects like proper space in the school premises and proper management/administration of the maker spaces, etc. need to be ensured while setting up maker spaces. Availability of water and electricity is as necessary as having tools and equipment in the maker spaces.

Completely developed Makerspace

I) ‘Maker Space’ program needs a dedicated lab or workshop for its activities.

II) It is recommended to have at least 250-300 sq.ft. workshop space.

III) It requires cupboard to keep tools, raw material and work benches for activities.

IV) Sample photograph of ‘Makerspace’ setup is as given :

Different tools organized neatly and properly on pegboards

Essential tools like mechanical and electrical, measuring instruments, electronic tools and components, art and craft, etc. are essential part of maker spaces. The user needs to undergo trainings on basic safety and proper usage of the tools before using them.

The tools in the Low-cost maker space comprises of following tools:

I) Basic mechanical tools- Basic measuring instruments, cutting tools, screw drivers and spannersand other fabrication tools

II) Energy and electronics

III) Basic agriculture tools

IV) Arts, craft and sewing

V) Safety equipment.

Tool list for 'Makerspace' is attached separately in annexures.

6. Conducting the activities:

Lesson plan given in the manual explain steps in conducting activities. While conducting activities following things are non-negotiable:

I) Use of safety precautions are must and its responsibility of instructors.

II) You can select activity depending upon availability of raw material and need to the school.

III) You should have enough material arranged before the class begins. Material should be enough so that every student can participate in the activities.

IV) Many activities like agriculture and art & craft can be taken with any class of students. Teacher must guide students for appropriate documentation, records, calculation, use of internet search for additional knowledge from higher classes.

V) Last 30 min after each activity, teacher and students sit together in a classroom and reflect on activities done during the day. Students should be encouraged to ask questions 'Why, What, How, When and where' with reference to activity. These discussions will help in generating knowledge and understanding of curricular areas. This part of each activity is non-negotiable.

VI) Writing notes, costing, records of work done with measurement are important and non-negotiable part of the activity.

7. Managing consumables:

I) There are certain types of consumables such as glue, wires, soldering materials, plywood, card board, rubbers and pins, nails and screws, glue tapes, PVC pipes and fitting, etc. to be stocked in the school.

II) Perishable goods such as paint, seeds, needs to be purchased in planned manner. Instructors must ensure seasonal availability of perishable goods and plan accordingly.

III) A scrap bank to be created in a school. It should have collection of all broken appliances, old bearings, plastic bottles, empty cans, carton boxes, scrap material sorted and stocked properly. This material will be useful raw material for projects.

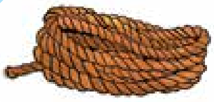
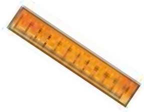
IV) It is always better to put the project made in use. Don't keep material in the school and gathering dust. It should be used and consumed. It is better to sale the product. If you are not able to sale the product, then at least the feedbacks from customers, name of the person to whom the project has handed over.

Following registers to be maintained

I) Inventory register: All material purchased and used with its value.

II) Activity register: Daily activities taken, number of students participated and customer/ use of the activity, cost incurred and sales amount (if applicable).

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


Engineering Section

Title of Activity

1. Selecting appropriate Measurement tools and their usage

Syllabus reference:
Std. 6th

Standard concept / Principle:
Measurement

Material required:
Pen, Paper

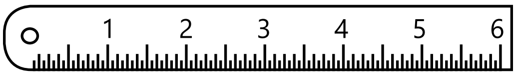
Tools required:
Meter tape, 15 cm and 30 cm scale, rope, etc.

Time required: 1 Hr.
No. of students in class: Maximum 20

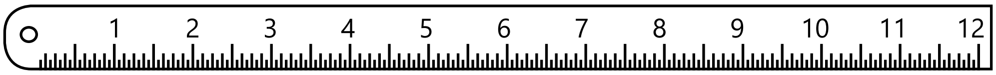
Introduction:

We are measuring various things in our daily life. In the past measurement was done using different parts of human body. For e.g. Feet, handbreadths, fathom, etc. But there are many limitations on accuracy of such measurement. For e.g. length of handbreadth varies from a person. Therefore, need of standard measurement practices was emerged. The method of measurement depends upon the accuracy required.

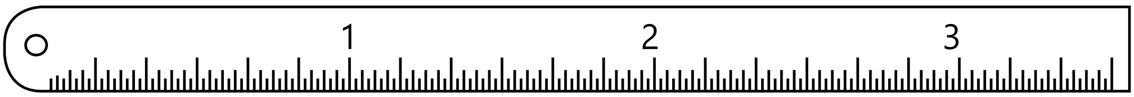
In this activity students will be able to select an appropriate measuring instrument for measuring length. See the diagram of various scales you will be using.



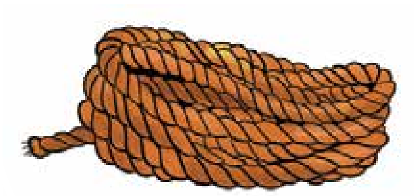
6 INCH SCALE



1 FEET SCALE



1 METER SCALE



ROPE 6 FEET

Process:

I) **Make 3 groups of 5 students and ask them to measure the length and width of the classroom.**

II) **All groups will measure length and width of classroom.**

Group I : Use 15 cm scale

Group II : Use 30 cm scale

Group III: Use meter scale

Group IV: Use long rope

III) Observation and recording:

Give students 30 minutes to complete the task and note down the readings in the table given below:

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

Ask questions:

1. How can you reduce the errors you have got in your readings?
2. What are the advantages and disadvantages of each method?
3. Is the rope convenient to measure large distances? Can we measure the rope itself and reduce the overall time required to measure the distance?
4. Can you measure any curved path any of these tools? Which measuring tool is best for measuring a curved path?

Do's and Don'ts:

1. Make sure that you are taking end to end measurements.
2. Avoid human errors.

Summary / Principal / Knowledge gain:

- Each measuring tool is suitable for a particular task. Selection of measuring tool depends on accuracy required and the time available for measurement.
- Another important aspect is 'Least count' of the tool. It is the minimum unit; we can measure with the tool. E.g. 15cm scale has least count of 1mm. whereas meter tape has least count of 5mm.
- It is also possible for us to calibrate a tool for e.g. rope with the help of other measuring tools such as meter tape and make our own measuring tool.

Resources:

Q.R.Code

Title of Activity

2. Know your cycle and its maintenance

Syllabus reference:
Std. 6th, 7th

Standard concept / Principle:
Simple machines, Friction

Material required:
Bicycle, machine oil, oil can

Tools required:
Screw, Spanners, nut bolts, cycle pump

Time required: 1 Hr.
No. of students in class: Maximum 20

Introduction:

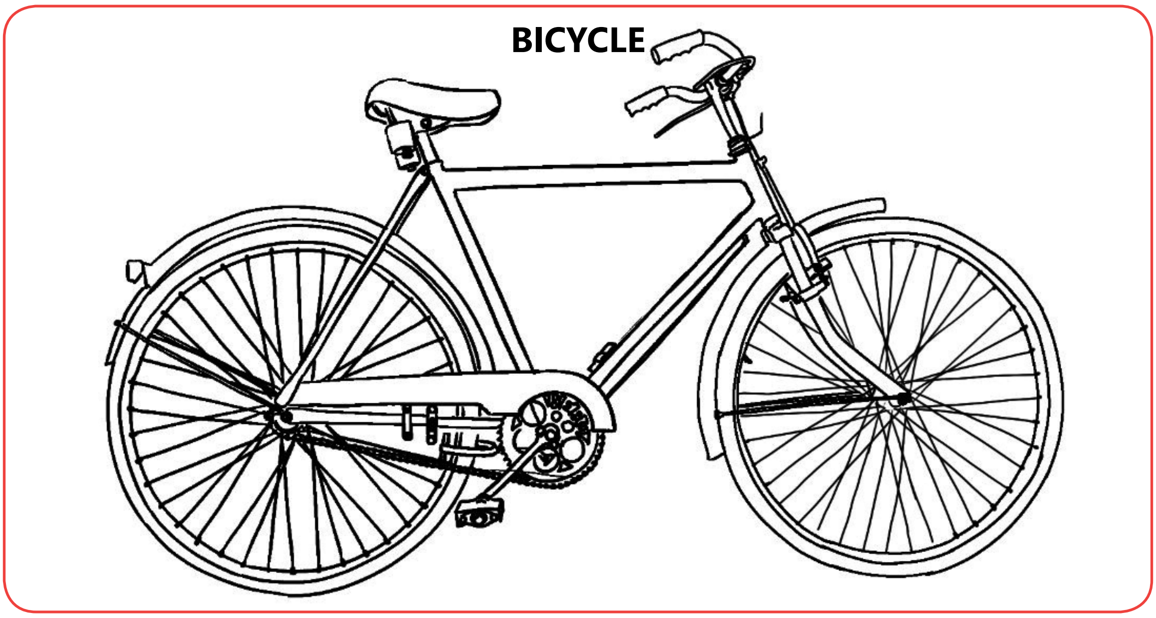
Riding a bicycle is a necessary skill. In this activity, we will learn different parts of bicycle, their function and also learn to do basic maintenance of our bicycle.

Part I:

Take bicycle of any teacher /student. Teacher and students will observe bicycle carefully and list their different parts. They will discuss function of each part.

Various parts of cycle:

Part of Cycle	Sub-parts	Purpose of each part also understand functioning of each part	Any other purpose / observation / special things about part
Bicycle wheel	Consist of rim, spoke, hub, valve, tube, tyre		
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 II:

Observe all the movable parts of a bicycle and check their condition. Clean the cycle for any dirt, rust, etc. Use different spanners to fix any loose part. Use oil to reduce friction.

Check list of movable parts.

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

Ask questions:

1. What will happen if you suddenly apply the brake on the cycle. Why should we apply the brake slowly?
2. What part in the wheel prevents the air in the tube from leaking?
3. What will happen if you rotate the pedal in reverse direction?
4. Why does riding the bicycle ride become difficult when tyres are flat?

Do's and Don'ts:

1. Whenever the cycle chain and wheels are moving do not put you hand/fingers in them.
2. Riding a bicycle is necessary skill and everyone must learn it.
3. Bicycle design and functioning demonstrates many scientific principles. Teacher must attract the attention of students towards them. Important principles are: Simple machines, Friction and lubrication, Pressure, area, balancing, environment & health benefit, etc.

Summary / Principal / Knowledge gain:

Students will understand the different parts of a bicycle and their functions. They will able to take care of their own bicycles.

Resources:

- https://www.youtube.com/watch?v=90_gudrCi2M

Q.R.Code

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Title of Activity

3. Making articles using wood work (carpentry)

Syllabus reference:
Std. 8th

Standard concept / Principle:
Technology around us

Material required:
Procure the material required for your project (it can be plywood or hard wood), sun mica, varnish, nails, screws, fevicol or wood glue, etc.

Tools required:
Wood saw, hack saw, table vice, sandpaper 120, 220, 400 grit sizes, hammer, mallet, plier, etc.

Time required: 30 minuntes for theory and 1.5 hr for practical
No. of students in class: Maximum 20

Introduction:

In this activity we are going to make a project using wood as per your choice. Wood is a natural material. Plywood is also made from wood. You need to select the object you want to make using wood in advance and source all required material.

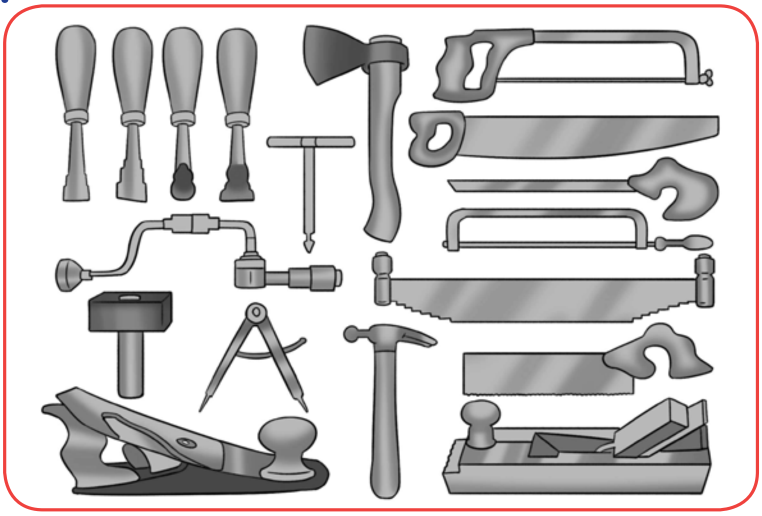
It is necessary for the teacher to explain all the tools & materials used in wood work such as hand saw, planes, sand/polish paper, files, mallet, hammer, hand drill, adhesive, varnish, etc. and the safety precautions to be used while using these tools.

Wood is available in various types such as soft wood, hard wood, MDF, HDF, plywood, sun mica, etc. You must choose the right type of wood for your project. Cost of raw materials is one of the considerations. Another aspect of wood to be considered is how suitable it is for the product you are making. For example, plywood has greater strength and can be used for making furniture or any application that requires flat surfaces. Whereas hard wood can be used where strength is required across curvy surfaces. While working with wood, we must also keep in mind that it is strongest along the direction of its grains.

Sample projects:

Mobile phone stand, pen stand, writing pad, cutting board, photo frame, duster and any other.

Required Tools:

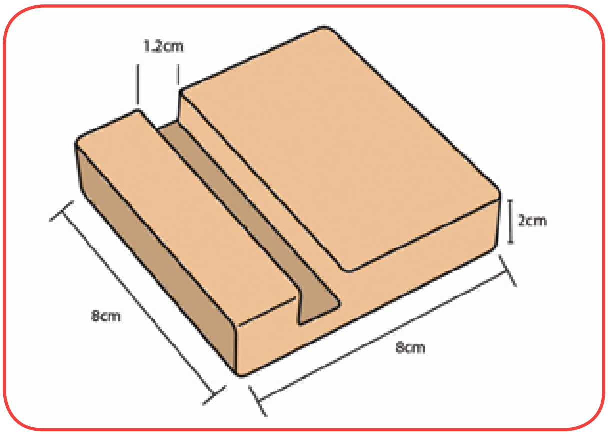


SAMPLE TOOL BOX

Process:

1. Select project and draw a sketch with dimensions.
2. List the raw materials required & its cost estimate, purchase the materials
3. Use various tools and processes to make the object.
4. Finishing and documentation

Sample Design:



MOBILE STAND

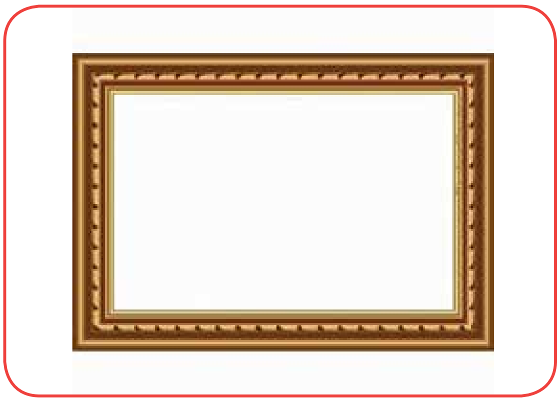


PHOTO FRAME

WRITING PAD

PEN STAND

KEY STAND

Observation:

1. Check the strength of parts that you make.
2. Check if the parts fit into the dimensions else you can sand few parts
3. Check the finish and presentation of the object made by you.

Ask questions:

1. Which other materials can be used to make the same project?
2. What is the cost of the alternate options available?
3. What are advantages of wood objects over plastic and vice-versa?

Do's and Don'ts:

1. Use of hand, power tools must be done under the supervision of experts/adults.
2. Use hand gloves, safety goggles whenever required.

Summary / Principal / Knowledge gain:

- Wood is a natural resource. It is used traditionally in making furniture and in construction. Wood just cut from the tree has a lot of moisture and hence it is not very strong and may also catch wood bugs. Hence it must be allowed to dry completely. This process is called as seasoning.
- Plywood is made from layers of wood cut across the grain. These layers are glued using a press.
- Life of Wood and plywood can be increased by using polishing, varnishing and painting.

Resources:

- https://www.youtube.com/c/Matthiaswandel
- https://www.wikihow.com/Make-a-Photo-Frame

Q.R.Codes

Title of Activity

4. Making toys from plastic bottles

Syllabus reference:
Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:
Energy, Air around us, Motion and Time, Technology around us, Force and Pressure

Material required:
Waste plastic bottles, pipe, glue sticks, etc.

Tools required:
Scissors, cutter, glue gun, etc.

Time required: 2 Hrs.
No. of students in class: Maximum 20

Introduction:

Used plastic bottles are easily found as a scrap. Various toys can be made using plastic bottles. These toys use various scientific principles and hence it is an enjoyable way to learn science.

The list of toys given here are indicative but teachers and students can make toys using their ideas.

Following materials and tools are required to work with plastic bottles.

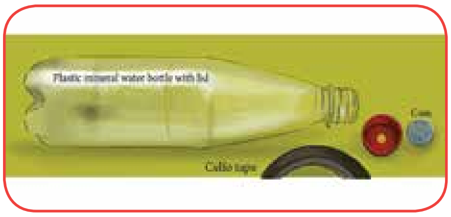
1. Sharp cutting tool - To cut plastic bottles, make holes, etc.
2. Candle: To make holes on hard plastic, you may need to heat the cutting tool.
3. Cello tape (size 1" ; 3")
4. Adhesive like Fevicol, Fevistick

There are various videos and Do-It-Yourself activities that are available online. Teacher may search online and visit them to get new ideas.

Sample toys:

I) Making pump using plastic bottle:

1



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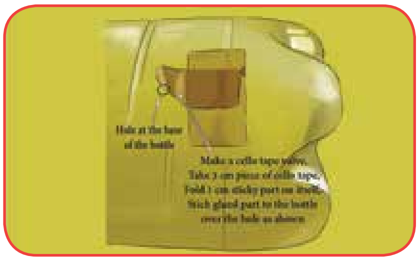

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6

Summary / Principal / Knowledge gain:

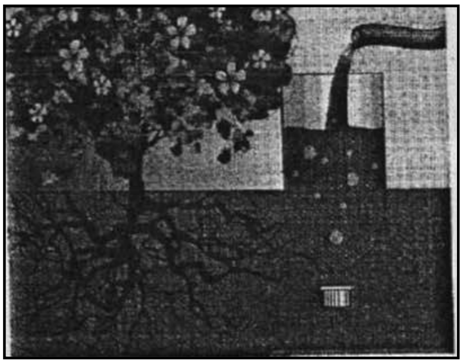
In the plastic bottle pump, when the bottle is squeezed, the air inside it is released out. This creates a vacuum inside the bottle and as a result, the water from the bucket gets sucked into the bottle. The Cello tape flap at the top of the hole near the base of the bottle prevents the air outside from entering the bottle. The coin placed in the bottle cap works as non-return valve. It stops the water from flowing out of the bottle back into the bucket.

II) Make a drip for watering plant:

Low-cost drip irrigation unit can be made for trees by using a plastic bottle. By using the plastic bottle as a water container, water can be supplied to the roots of plants through various ways.

1. By using cotton thread
2. By using waste IV injection drip

1



2

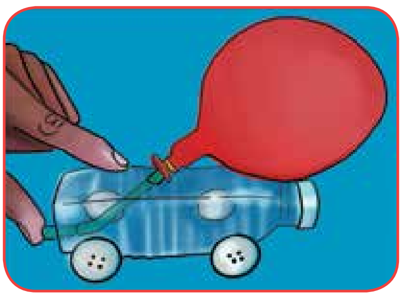
Summary / Principal / Knowledge gain:

The drip irrigation unit ensures that the water from the container goes directly to the roots of the plant in sufficient quantity. At the same time it also prevents excess supply of water to the plant and also reduces loss of water due to evaporation.

III) Car from plastic bottle:

A car can be made using a plastic bottle. It can be powered by balloon or a fan rotated by a DC motor. Please visit https://www.arvindguptatoys.com/ to see different designs of toy car.

1



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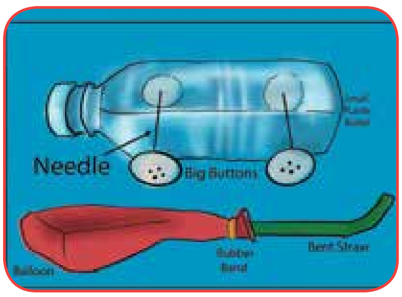

Summary / Principal / Knowledge gain:

- The Bottle Car uses Newton's third law of motion.
- When the finger is removed, the air released from the balloon creates a backward thrust which makes car to move forward.
- In bottle car with a fan, when the fan on the bottle car rotates, it moves the air around it. This makes the car move further.

Observation:

1. Making toys is enjoyable activity but we must try to find out science behind working of toys.
2. Every toy uses some or the other principle given in our science text book. Please observe the working of the toy carefully and relate it with scientific principles. **If the toy does not work for some reason, try to find the reason behind it.**

Ask questions:

1. What is the principle behind the working of that toy?
2. What are the alternative ways to make the toy work? For e.g. motion of a car?

Do's and Don'ts:

1. Safety is always important. Accidents can happen any time. Please be careful while working with a cutter, soldering gun, etc.

Resources:

1. Water pump:

https://www.youtube.com/watch?v=3LD1W3tG9QI

2. Drip irrigation:

https://www.wikihow.com/Make-a-Drip-Irrigator-from-a-Plastic-Bottle

https://www.youtube.com/watch?v=FDEtBeHEyCY

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Title of Activity

5. Making a catapult

Syllabus reference:
Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:
Std. 6th - Energy, Std. 7th - Forms of energy, Force and pressure

Material required:
Card board, fevicol, Rubber band, Y shaped wooden piece, old cycle tube and old cycle tire pieces.

Tools required:
Scissors, hack saw, screw driver, compass box, etc.

Time required: 2 Hrs.
No. of students in class: Maximum 20

Introduction:

We are making use of simple machines (Lever, pully, wedge, screw, inclined plane) in various ways. These simple machines are used to reduce our effort while doing work.

Catapult was used in a war in 300 BC in China. It was used to throw stones on the enemy from long distances. Similar application of catapult principles is used in a slingshot used to scare birds and animals. We will make toys using the same principles.

SLINGSHOT

Process:

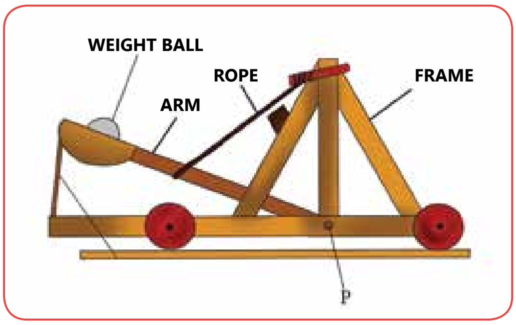
1. Make a 'Y' shape slingshot

- Take a 'Y' shaped wood piece (can be taken from a tree) use the hack saw if needed.
- Use a tight rubber band as shown in the picture.

2. Make a catapult

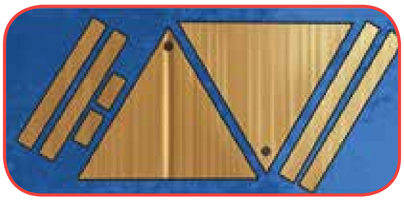
Cut triangles and strips of following sizes:

- 2 Equilateral triangles of 20 cm side.
- Two rectangle strips of size: 20 x 2 cm.
- Two rectangle strips of 18 x 2 cm.
- Two rectangle strips of 3 x 2 cm.



Connect all parts as shown in the figure.
Use a bolt as the balancing weight.

1



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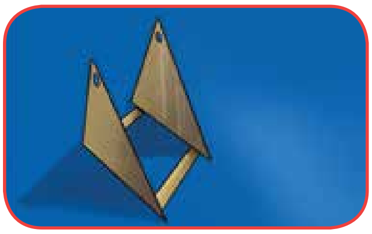

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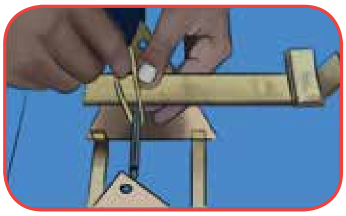

4

5

The Holder will hold a small ball or weight. Balancing weight has to be at the bottom of arm. When you release the balancing weight, the arm will rotate and throw ball.

Ask questions:

1. Will changing the balancing weight have effect on throw length?
2. What kind of energy do you apply while stretching the tube rubber?
3. What kind of energy is in the rubber when it is released? Or when balancing weight in catapult is released?

Do's and Don'ts:

1. Slingshot is a toy and it should not be used to harm anyone. Don't point it at anyone.

Summary / Principal / Knowledge gain:

- Mechanism in this toy converts muscular energy to potential energy then into kinetic energy.

Resources:

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Title of Activity

6. Learning to build a brick wall

Syllabus reference:
Std. 8th

Standard concept / Principle:
Cube and cuboid, Construction material

Material required:
Bricks, cement, sand.

Tools required:
Trowel, measuring tape, pan and spade, water leveling tube, plumb bob, spirit level tube, etc.

Time required: 1.5 Hrs.
No. of students in class: Maximum 12 to 15

Introduction:

Construction means building of houses, infrastructure. It also covers repairs and maintenance work. Materials required for construction are cement, sand, bricks, reinforcements, etc. Some of them are given below.

Materials readily available in the area generally dictate the construction materials used (e.g.: brick versus stone versus timber). Costs of construction on per square meter (or per square foot) basis for houses can vary dramatically based on site conditions, access routes, availability of local raw material and the availability of skilled people.

Now we will see the flowchart of brick laying construction process:

1

Start

To start the construction work we need to first draw the plan of our work and then mark the ground where we are going to perform the construction.

2

Foundation

It is the important part of the construction; this provides the support to the structure. Foundation depth is decided according to the height of the structure. A spade is used to dig the ground.

3

Cement mortar

To join the bricks together we need cement mortar. We need to create mortar by adding 1 part cement, 3 parts of sand and 70% water of cement sand weight.

4

Brick soaking and laying

Take a bucket filled with water and put the bricks in the water and leave them for 30 min. There are 4 ways of lying bricks stretcher bond, header bond, English bond and Flemish bond.

5

Applying mortar

While laying bricks we must apply a uniform coat of cement mortar to the surface of brick. Use the trowel for this purpose. When it is done, proceed to the next section of bricks.

Using a water level tube, plumb bob & spirit level

Water level tube: To check two points at same level.

Plumb bob: To check verticle construction in one line.

Spirit level: To check if surface is flat.

6

End

When the structure is finished, we need to apply water every interval of 3 hours for 7 days. After that we can plaster the structure.

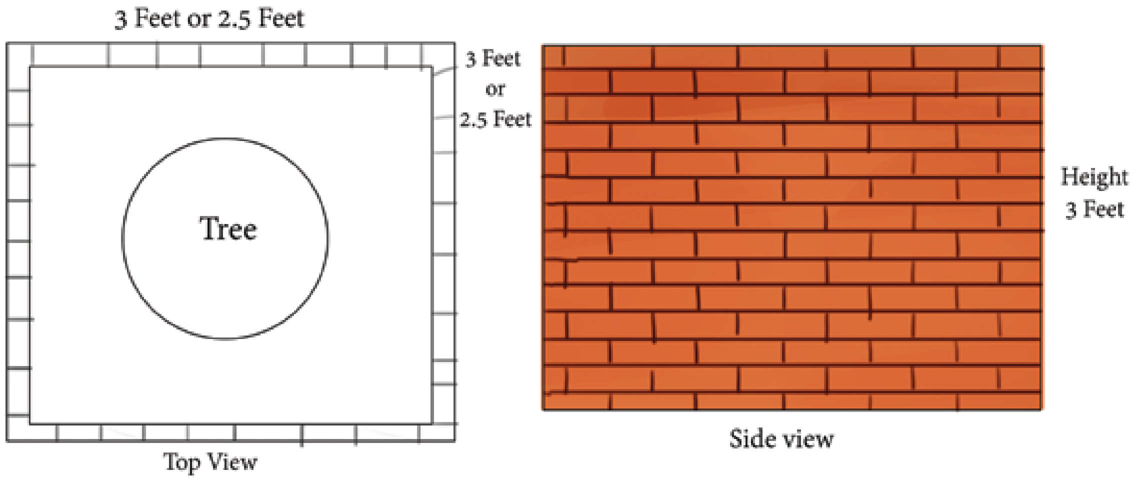
Practical:

Using the construction technique we can build tree guard, ramp, washing area, etc.

Let us build a brick tree guard around a plant to protect it from animals.

Construction:

1. Make 3 groups of students with at least 4 students per group.
2. Select a plant where you wish to construct a brick guard.
3. Mark the place with the help of chalk and measure the dimensions of the work area, preferably a square that is 3 x 3 sq.ft. Or 2.5 x 2.5 sq.ft.
4. With the dimensions mentioned above, calculate the number of bricks required if our structure is 3ft high. Draw a sketch of your work on paper show it to your teacher.
5. Provide the required materials and tools to students.
6. Now go to your workplace. Use the space to dig the marked area where the bricks will be laid. This will form the foundation of our structure.
7. Take some cement and sand in the pan and mix it with water using a trowel (1 part cement, 3 part sand, 70% by weight water).
8. Get a bucket filled with water, put the bricks in the water allow them to soak for 30 min. Then use the trowel to apply and spread correct quantity of the cement mortar to the bricks.
9. Now place the next brick and repeat the same process. When you finish one layer of brick work check the level using water level meter of the plumb bob and make corrections in the structure if needed. We cannot do this later on if the cement sets.
10. When you have finished the construction make sure to apply water to the whole structure every 3 hours for 7 days. This will increase the strength of your work.
11. See the diagram for reference.



Brick Tree Guard

Observation: If the brick tree guard is correct then we can observe it saving the plant from the animals like Goat, dogs, etc.

Ask questions:

1. Why we need a brick guard for tree?
2. Can we make a removable brick guard so that when the plant becomes a tree we can use it for next plant?
3. How can we check if laid bricks are perpendicular to the ground?
4. What are the tools/ materials used to build roads? Have you seen any such work going on?

Do's and Don'ts:

1. Make sure that the wall is straight and perpendicular to the ground. Use proper tools for this
2. When you are making a pattern using bricks, take any object with fixed shape so that the gaps between 2 bricks are equal.

Summary / Principal / Knowledge gain:

- In this process we are using bricks; they are easily available, low-cost and provide excellent strength to the construction work.
- Another very important aspect here is the cement mortar. Earlier lime mortar was used to join the stones. This used to be costly and stones used to be very heavy. Whereas cement is low-cost to manufacture and provides greater strength than lime mortar.
- As you can see we apply water to the structure every 3 hours, this is important because the water triggers a chemical reaction that hardens the cement. If cement doesn't harden or set properly our structure will lose the strength, hence water is essential element in this process.
- We can also do the plastering work to our structure this enhances the shine and smoothness. Usually internal walls of the houses are done with plastering. Furthermore we can paint the walls to bring better look and freshness in the structure. Paint will also increase the life of the structure.

Resources: https://www.youtube.com/watch?v=3XGt-p-hpdU

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Title of Activity

7. Painting of a wall

Syllabus reference:

Std. 6th

Standard concept / Principle:

Measurement, Finding the area

Material required:

Paint, water and thinner, polish paper, sandpaper, distemper, putty, water, etc.

Tools required:

Brushes, bucket, etc.

Time required: 3 Hrs.

No. of students in class: Maximum 20

Introduction:

Painting is a process used to colour wood, metals, acrylic, walls, etc. Painting increases shine of the surface and increases life of the material. It slows down rusting in metals, keeps bugs away from wood and keeps walls free from insects. Today we are going to paint a wall in our school to understand the painting process.

Location:

Select any wall in the school which needs to be re-painted. Do not select a wall that is high which requires children to climb on a ladder.

Process:

1. Selection of paint depends on the type of wall. Paints differ in terms of their glaze, appearance and binder used. Whitewash, distemper paint, Oil paint, acrylic paint, exterior paints, etc. are some of the types available in the market.
2. To calculate quantity of paint required. Calculate area of the wall to be painted. Normally paint manufacturers recommend the amount of paint required. A wall of area of 6 sq.m. needs approximately 1 litre of paint.
3. For the school wall, we can select distemper paint and any color.
4. Generally, a primer is applied before applying paint. Primer ensures better adhesion of the paint and increases its durability. But distemper paint does not require the use of primer.

Steps in painting:

1 Use sandpaper to remove dust & loose colour. Clean and wash the surface of wall

2 Apply putti to all the holes and scratches on the wall

3 Use sandpaper to make the surface even and smooth

4 Apply paint. Apply an extra coat of paint for better quality

5. **Select the right choice of brush:**
   Selection of proper tools ensures better quality of job. Brushes come in different sizes and shapes. Please select appropriate brush. See the picture.

TYPE OF BRUSH

Following brushes are useful for our purpose:

1. **Wall brush:** This type spreads the most paint over most of the surface.
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.

Observation:

1. See the paint guide of manufacturer.

Ask questions:

1. What is the composition of the paint?
2. What are the chemical differences in oil bond, distemper, oil paint, etc.?

Do's and Don'ts:

1. Paint and water have to be added in proper ratio.
2. The area to be painted should be cleaned with sandpaper.
3. The brush used should be clean and free of dust. Use a mask while removing dust using a sandpaper.
4. Students should not be asked to paint above their own height.

Extra credits:

- There are different paint visualization websites. Most of the leading paint manufacturers have this feature on their website. Please visit that website. You can upload a photo of your wall and apply different colours to the wall. It will help you to visualize the appearance of the wall after painting.
  Example: https://bergerpaints.com.sg/colour-visualiser

Summary / Principal / Knowledge gain:

- Whichever wall is to be painted must be cleaned properly with the help of sandpaper and polish paper
- Choose the right brush, check for brush length, width, density, etc.
- Students will be able to see the different paints available in the market.
- Students will learn the advantages of painting such as better distribution of light in the room, increased longevity of walls and artifacts, etc.

Resources:

- https://www.youtube.com/watch?v=6noW8bBBh6I

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Title of Activity

8. Making a measuring device from a plastic bottle to measure the quantity of milk

Syllabus reference:

Std. 6th

Standard concept / Principle:

Measurement

Material required:

Transparent water bottle, measuring cylinder with least count less than 100ml (You can also use injection syringe because it also has markings), black marker, 1 liter water/milk, etc.

Tools required:

-

Time required: 45 Minutes.

No. of students in class: Maximum 20 (No. of students in a group: 5)

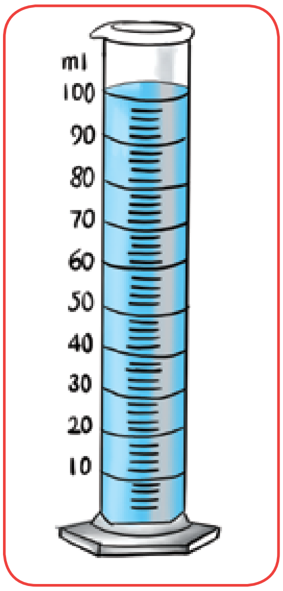
Process:

1. Take an empty plastic bottle. We will turn this ordinary bottle into a measuring instrument and use it to measure the volume of liquids. This process is known as 'calibration'.
2. First, you must decide two things about your new measuring instrument.
    a) What is the maximum volume that the instrument should be able to measure (Range)
    b) What should be the smallest difference in volume that the instrument should be able to measure (Least Count).
3. After deciding these two things, take a measuring cylinder and measure the amount of milk/water that you have decided as your least count. Pour that milk/ water in the bottle. Mark the level of milk/water with a marker and next to it, write down the volume.
4. Measure out same volume of milk/water again from the measuring cylinder and add it to the bottle. Mark the new level. Keep on doing this till you mark up to the desired range. Now, your instrument is ready.
5. Use this instrument to measure out milk or any other type of liquid.

    For example,

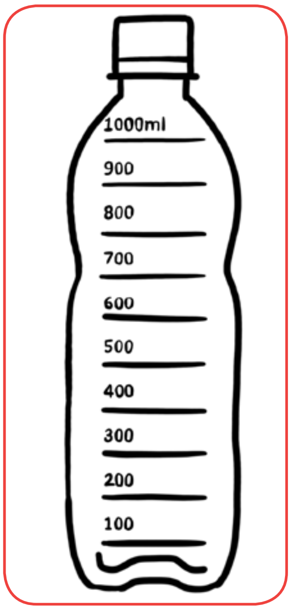
    a. Let's use a 1 litre bottle as a measuring instrument with 100ml least count.
    b. Take 100ml water in a measuring cylinder as shown in Picture No. - 1.
    c. Pour it into the plastic bottle and mark its level as 100ml on the bottle with a marker. (See Picture No. - 2).
    d. Go on adding 100ml water and keep marking new levels as 200ml, 300ml, and so on. (See Picture No. - 2).

PICTURE NO. - 1



MEASURING INSTRUMENT

PICTURE NO. - 2



MARKED PLASTIC BOTTLE

Ask questions:

1. What does your local milkman use for measuring milk?
2. What is the smallest volume of milk that they can measure out using that instrument?
3. How will you decide which measuring instrument is to be used? The one with small least count or the one with large least count?
4. Are the markings on the bottle at equal distances if the bottle is not a perfect cylinder?
5. What is the proportion of all components (by volume) required to make a good sharbat from ready-made fruit extract solution? Find answer by making a sharbat.

Do's and Don'ts:

1. **How to organize activity:** 1. Make groups. 2. Provide material. 3. Explain the use of measuring instruments. 4. Explain Range and Least Count.
2. **Use:** This new measuring instrument can be used to measure volumes of many types of liquids.

Summary / Principal / Knowledge gain:

All the measuring instruments that we use daily, were once only ordinary objects that somebody turned into instruments. For example, the ruler in your compass box was just an ordinary piece of plastic on which the manufacturer printed some markings to turn it into a measuring instrument. The same is true for measuring cylinders, protractor, etc. This action of taking an ordinary object which can't be used as a measuring instrument and turning it into a usable measuring instrument by making appropriate markings on it is known as 'Calibration'.

Calibration is important because we continuously need to make new measuring instruments and each new instrument must be accurate and precise. By following good calibration methods, this can be achieved.

Every instrument has two properties- Least Count and Range. Imagine a measuring cylinder has markings as 0ml, 10ml, 20ml, 30ml, ... If there are no smaller markings available, then 10ml is the smallest difference that this instrument can measure. Thus, we say that the Least Count of this measuring cylinder is 10ml.

In the same instrument, the markings go from 0ml, 10ml, 20ml, ... up to 100ml. You cannot measure volumes greater than the maximum 100ml. We say that the Range of the measuring instrument is 100ml.

Resources: https://www.youtube.com/watch?v=J23L2hXOLzc

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Title of Activity

9. Making a map of our school campus to navigate our way around

Syllabus reference:
Std. 6th

Standard concept / Principle:
Measurement

Material required:
Markers, chart paper, pencils, etc.

Tools required:
Magnetic compass, measuring tape, etc.

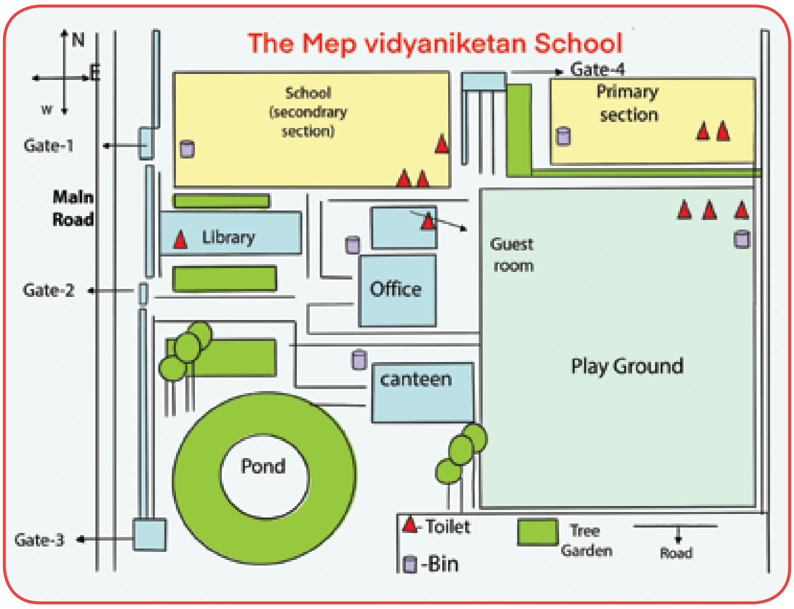
Time required: 3 Hrs.
No. of students in class: Maximum 20 (No. of students in a group: 5)

Process:

1. To make a map of your school campus, stand outside, in an open area.
2. Use a magnetic compass to identify the North, South, East, and West directions. The red part of the magnetic compass always points towards the North.
3. It would be helpful to identify landmarks in each direction. E.g., there is a big banyan tree in the west, and school building in the south, etc.
4. Starting from one corner of your school's campus start measuring the length and breadth of the boundaries of your campus in metres and centimetres using measuring tape and note them down.
5. Then measure the length and breadth of all major objects and places. Draw their rough diagrams and write the lengths along each side.
6. If any place/ building is not rectangular, measure the lengths of all sides.
7. After measuring the length of all places, measure the distances between different places and note them down.
8. Now, to draw a map on a chart paper, choose an appropriate scale for shrinking the measurements.

   For example, 1 metre = 1 cm OR 5 metres = 1cm.
9. Convert all measurements according to the scale and write them down.
10. Now, draw the boundary of your school on the chart paper using a ruler and pencil. Try to keep all measurements to the scale.
11. Now start drawing places and buildings. You should try to maintain the sizes and distances to the scale and keep the shapes same.
12. Make sure you indicate North correctly on your paper.
13. You can visit google maps (www.maps.google.com), select satellite view, find your school and check how accurate your map is to the real picture of your school from top.

SAMPLE MAP



Ask questions:

1. Why do we need maps?
2. What is the science of map-making called as?
3. Why is it important to maintain size, shape, and distances accurate in a map?
4. Where have you seen accurate maps being used in day-to-day life?

Do's and Don'ts:

1. **How to organize activity:** 1. Divide students into groups of five. 2. Ask them to list down places, buildings and landmarks in the school campus. If the school campus is very big, make students choose a certain area from it for mapping.
2. Ask students all the steps that they are going to follow. Provide the required material to each group and ask them to start measurement. Students should start drawing the final map only after measuring everything.
3. **When to take activity:** Any time.

Summary / Principal / Knowledge gain:

Measurement has all sorts of direct practical applications. Map-making or Cartography is one such example. All the buildings that we see built around us were built by referring to various types of maps. Imagine if those drawings were not drawn accurately. Maps are useful for city planning, for day-to-day navigation, etc. And in all these cases, having accurate, well-drawn maps saves time as well as resources. For drawing accurate maps, taking measurements of every little detail is very important. Those details need to be measured with the smallest possible units. Will you measure the side of a building in kilometers?

Resources:

- https://www.wikihow.com/Make-a-School-Map-(for-a-Class-Project)

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Title of Activity

10. Learning to make a telescope

Syllabus reference:
Std. 8th

Standard concept / Principle:
Light

Material required:
Cardboard rolls - 3 Qty., sticky tape,
Convex lenses (1 big, 1 small) - 2 Qty.

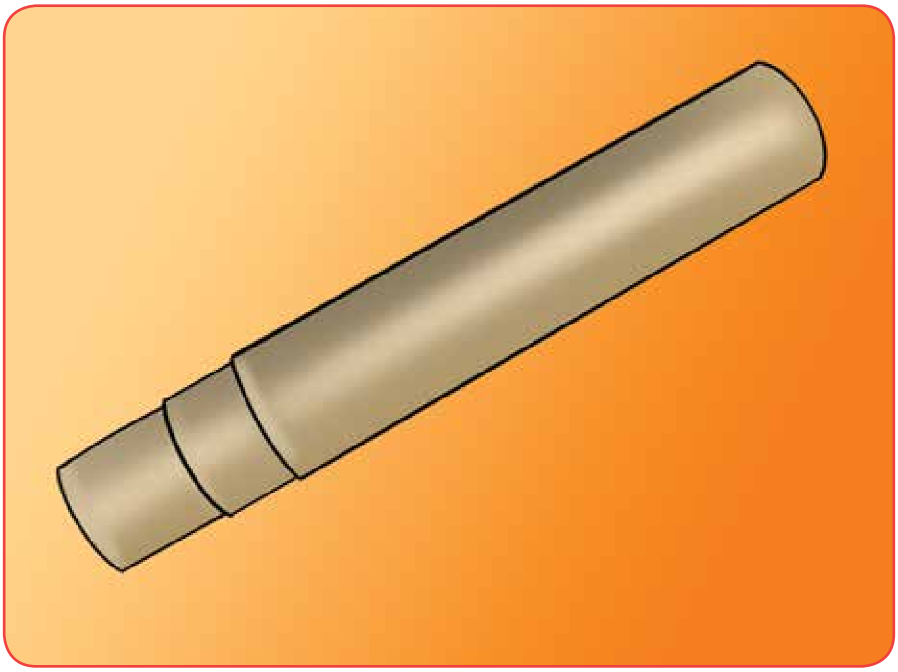
Tools required:
Scissors/ cutter, etc.

Time required: 2 Hrs.
No. of students in class: 20 (No. of students in a group: 3-4)

Process:

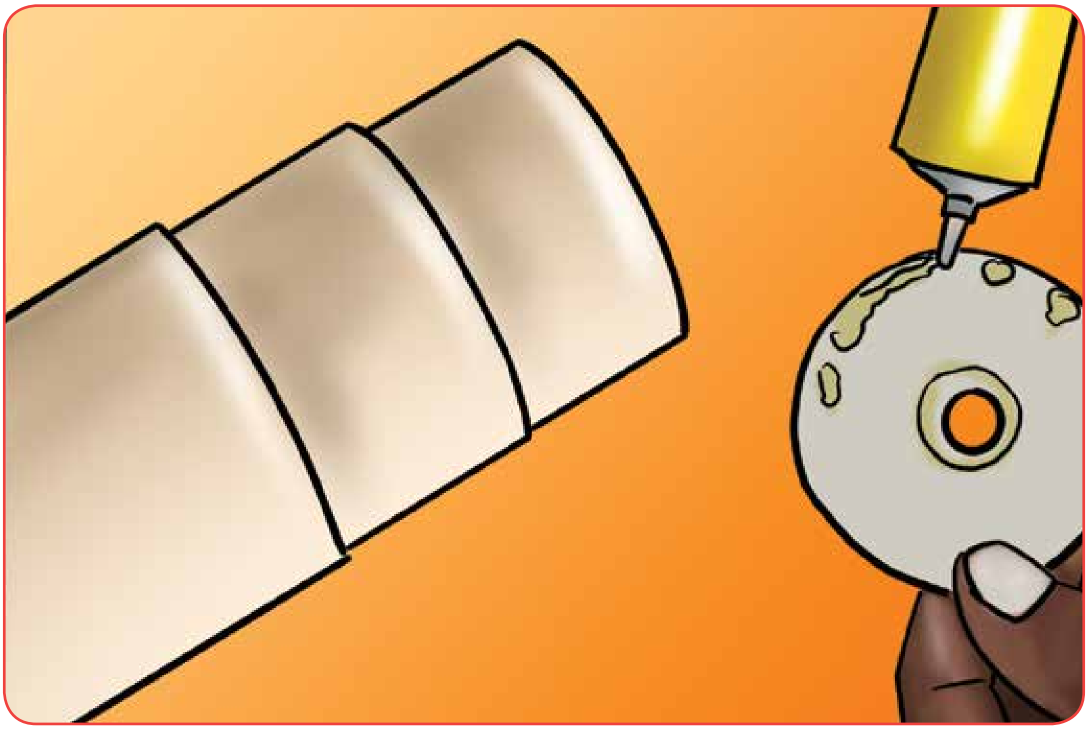
1. Make 3 tubes with chart paper if you cannot find readymade tubes. Take two tubes to be the inner tubes and cut these 2 tubes lengthwise as shown in the picture.

2. Take the cut tubes and make them narrow by wrapping one cut edge over the other. Insert the tubes inside one another (small-medium-large). See the diagram.

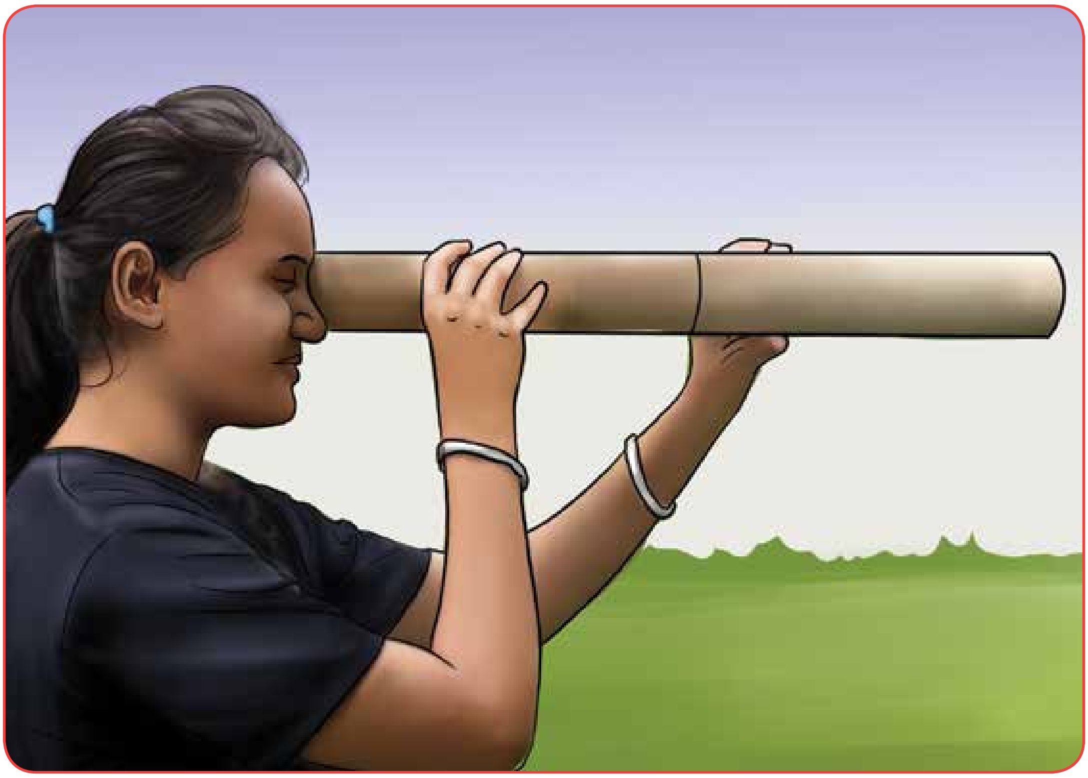


3. Just in case the inner tube is not sliding smoothly, roll the inner tube again to make it slightly small in diameter and retry. Make sure the tubes slide smoothly over one another.

4. Now use sticky tape to fix 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 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.



Ask questions:

1. What kind of image is formed in the telescope? Real or virtual?
2. What happens when distance between the lenses is changed?
3. What can be done to increase the magnification of the telescope?

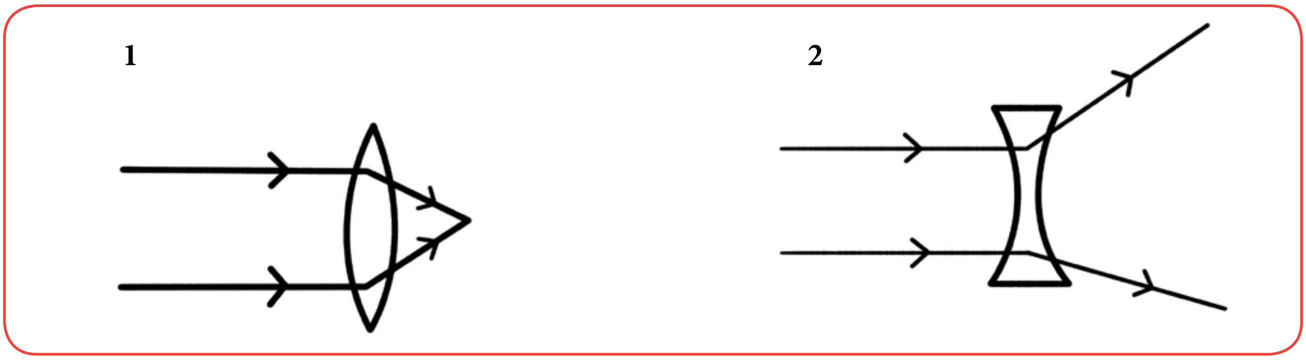
Do's and Don'ts:

1. **How to organize activity:** 1. Divide students in groups. 2. Give them instructions and resources. 3. Make them compare object sizes with and without telescope.
2. **Safety:** 1. Don't look at the sun with the telescope. 2. Use cutter under teacher's supervision.
3. **Use:** Objects which are far away get magnified and thus easier to observe. Stars and planets are observed in the same way.
4. **When to take activity:** Any time.

Summary / Principal / Knowledge gain:

This type of telescope is called a "refracting telescope", as it uses lenses to help gather more light than your eye can see on its own. When light passes through the lenses, its path is bent. Convex lenses converge the light falling on it. Telescope uses two convex lenses to bend light, which makes any object appear closer than it actually is.

The size of the image produced by the telescope depends on the curvature of the lenses used. We can use lenses with different curvature to change the magnification power of our telescope.



Resources: • https://www.arvindguptatoys.com/toys/Simplesttelescope.html

• https://youtu.be/uZeF1KETaU4

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Title of Activity

11. Making a projector for smartphone

Syllabus reference:

Std. 8th

Standard concept / Principle:

Light

Material required:

Rectangular cardboard box, convex lens/ magnifying glass, thick black paper/ brush and paint, sticky tape/ glue, mirror, protractor (optional but helpful), ruler, pencil, smartphone

Tools required:

Cutter/scissors, etc.

Time required: 2 Hrs.

No. of students in class: 25 (No. of students in a group: 2-5)

Process:

1. Cut one of the shorter sides of a rectangular shoe box. Save this cut- out for later (you will place the lens on this later).

2. Cover the inside of the box with black paper (you can also use black paint).

3. Use a cutter to make a lens-size hole in the centre of the side you had cut out earlier and keep it aside.

4. Fix the convex lens in place of the hole you cut out (use glue or tape to stick the lens).

5. Stick black paper on remaining portion of the side (make sure you do not cover the lens).

6. Stick the cutout side back on to the box.

7. On the opposite side, place a mirror at 45-degree angle.

8. Cover your box with its lid.
9. Make a rectangular hole which is a little smaller than the size of your smartphone, on top of the lid, on the side just above the mirror.
10. Play any video on your smart phone and place the phone face down on the lid and aim it towards the wall in front of it. See how your projector works.

11. If the image on the screen is not clear, move the box until you get a clear image.
12. Organize a movie day in your class and show a patriotic movie to your class on your projector.

Ask questions:

1. What happens when the sides are not painted black or covered with black paper?
2. What should you do to adjust the image sharpness?
3. Why is a convex lens used in the projector?
4. Where should you place lens to get the biggest clear image?

Do's and Don'ts:

1. **How to organize activity:** Group students before starting the activity and then give them the instructions and materials.
2. **Safety:** Use cutter carefully and under teacher's supervision.
3. **Use:** Projector can be used to project images from smartphone screen to a wall/ screen.
4. **When to take activity:** Any time.

Summary / Principal / Knowledge gain:

Path of light can be changed by using glass. The shape of the glass determines how the light will bend. When we use convex lens, the light coming from a source converges to one place. This is why we get a sharp image on the wall. If we had used concave lens, the light would have diverged away. Convex lens has a focal length at which rays coming from far away are concentrated. If an object (smartphone) is kept farther than this distance, then you will get an image on the screen. If the object distance is changed, image distance will also change depending on that.

Resources: https://shotkit.com/diy-projector/

Q.R.Code

❋ ❋ ❋

Title of Activity

12. Making a solar dryer for preserving vegetables

Syllabus reference:

Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:

Std. 6th (Work or Energy), Std. 7th (Energy),
Std. 8th (Alternative sources of energy)

Material required:

Bamboo, Black plastic paper/film, wire mesh, Velcro, metal wire, etc.

Tools required:

Cutter, wire cutter, etc.

Time required: 3 Hrs.

No. of students in class: Maximum 20 (No. of students in a group: 5)

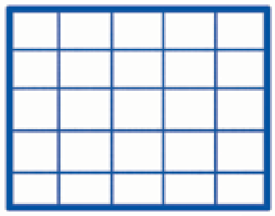
Process:

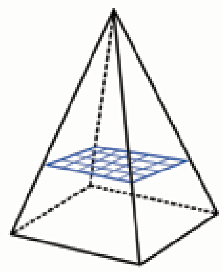
Part 1: Making simple ARTI solar dryer:

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

Steps to make ARTI dryer.

1. Take four bamboos of 160cm each and form a pyramid structure.
2. Make bamboo frames of following sizes
   a. 100 x 100 cm
   b. 50 x 50 cm
   c. 30 x 30 cm
3. Insert wire mesh in the frame and fix it.
4. Mark and fix wire mesh frame firmly on equal interval using metal wire.
5. Keep small vent at the top of dryer while wrapping the structure with black plastic sheet, so that hot air can escape outside.
   This simple pyramid dryer can be easily dismantled when not in use.





Part 2: Using ARTI dryer for drying leafy vegetables:

Material: Clean chopped leafy vegetables.

1. Dryer is used to dry vegetables. Clean the vegetables: remove the stem and other non-edible portion. Chop the vegetables properly.
2. Keep the dryer under sunlight
3. Uniformly spread the chopped leafy vegetables on the wire mesh trays.
4. Wrap the dryer with a black sheet.
5. It may take a few hours for the vegetables to dry completely.
6. Dried vegetables can be given to kitchen for use in mid-day meal. Students can also cook dried vegetable and taste it.

Observation:

Time when drying is started	Weight before drying	Time when drying is complete	Weight after drying

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

Time taken for drying = ______________

Loss of moisture (LOM) = Weight before drying – Weight after drying

Loss of moisture (LOM) = _________________

Ask questions:

1. What are the advantages of drying vegetables? How does it work?
2. When can dryers be used?
3. What happens if some moisture remains in vegetables after drying?

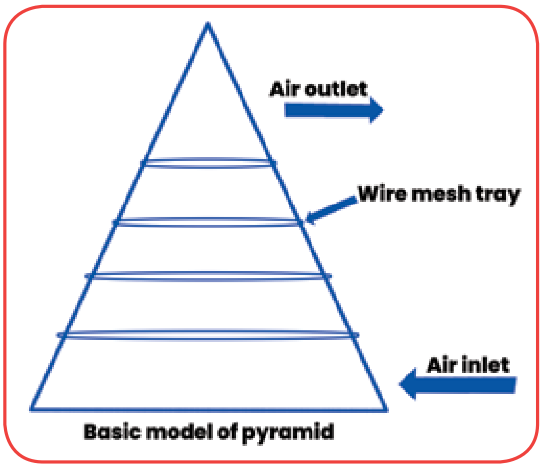
Do's and Don'ts:

1. **How to organize activity:** Divide students in groups before starting the activity and then give them the instructions and materials.
2. **When to take activity:** In summer.

Summary / Principal / Knowledge gain:

Solar dryer uses solar energy. Traditionally, people use open sun drying method. Following are disadvantages of open sun drying.

1. Colour of leafy vegetable changes.
2. Smell of vegetable may get lost.
3. Vegetables may get dirty due to dust, bird dropping and insects.



Hot air is lighter than cold air and it moves in upward direction. Therefore, the exhaust vent of the dryer is at the top. This principle helps to remove moisture content of vegetables. In a solar dryer, since vegetables are not directly exposed to the sunlight, the colour of vegetable remains same. Black sheet is used because it absorbs sunlight.

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

Q.R.Code

❋ ❋ ❋

Title of Activity

13. Creating a model using P.V.C. pipe

Syllabus reference:
Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:
Science and Maths

Material required:
P.V.C. pipe, Elbow joints, union, T-joint, adhesive (solution used for P.V.C. pipes), fibre sheets, etc.

Tools required:
Hacksaw, hacksaw blade, meter tape, gloves, helmet, goggles, etc.

Time required: 2 Hrs.
No. of students in class: 25 (No. of students in a group: 2-5)

Introduction:

To prepare useful models to be used in everyday life using P.V.C. pipes. P.V.C. is an abbreviation for Poly Vinyl Chloride. It is one of the most commonly used terms in the construction industry. P.V.C., or polyvinyl chloride, is a special type of plastic that is used in various industries.

Process:

Under the guidance of the instructor, you will learn to make a book stand, clothes hanger, mobile stand, laptop stand, clothes dryer stand, etc. As an example, we will first learn to make a book stand.

1. Before we begin, we must check if we have all the necessary equipment and materials.
2. Now based on the decided dimensions of the book stand that we want to make, we must measure the pipe with a measuring tape and cut it into smaller pieces, using a hack saw.
3. After that we will connect the pipes with the help of elbow and t-joints. We must make sure that the length of the pipes used is not more than what we need.
4. Now we will close the bottom of the pipes by placing caps on them.
5. At last, all the joints will be fixed with the help of solution.

First, select the model and prepare its sketch → **After choosing the model to be made, cut the pipe to the required length** → **As per the design connect the pipe pieces using fittings and adhesive solution** → **Your book stand is ready**




Ask questions:

1. What is the full form of P.V.C.?
2. Can the book stand just be made using P.V.C. pipes? What all can a book stand be made from?

3. Apart from book stand, what other things can we make using P.V.C. pipes?
4. What is the use of book stand?
5. In which other areas is P.V.C. being used?

Do's and Don'ts:

1. Cut the P.V.C. pipe according to your design by taking the correct measurements using a measuring tape.
2. Cut the pipe only after wearing safety gloves.
3. While applying the adhesive solution, ensure that the solution does not get on your hands.
4. Do not use old and rusted saw blades.
5. **Safety:** Use hacksaws and saw blades under teacher's supervision.
6. **When to take activity:** Any time.

Summary / Principal / Knowledge gain:

Through this activity, children will learn about P.V.C. You will learn to make various types of household multifunctional models through pipes. Along with this, they will learn more about measurement of length, width and diameter.

Resources:

Q.R.Codes

Title of Activity

14. Visit and observation of service industries (industrial factories) in your vicinity

Syllabus reference:
Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:
Science, E.V.S., Moral education

Material required:
Pen, notebook, etc.

Tools required:
-

Time required: 3 Hrs.
No. of students in class: 15 to 20 (No. of students in a group: 5)

Process:

School teachers must take students on field visits to nearby service industries (industrial factories) like shopping malls, mega marts, sugar mills, newspaper presses, etc.

Teachers should request shopkeepers and factory owners to explain their work and the nature and form of their business to students.

Such educational tours develop scientific and practical attitude in the students. Let the students observe how the layout of service industries has been systematically planned. Talk to students about different techniques used by various businesses to attract the attention of customers like discount offers and so on.

For example, visit to a daily newspaper press:

Here, the working principle and processes of various machines should be explained in detail to the students. By observing the workers in the factory, students will get an idea of how such a large printing press is managed. Also, the manager of the printing press should be requested to share information with the students about how market analysis is done before starting any business. They will also gain knowledge on the practicality of concepts like marketing, product branding and brand positioning, etc.


Note:

The language teacher should motivate students to write a report/news/essay about this meeting in their local language or English.

Ask questions:

1. What is the nature of your business?
2. What made you think about starting this business. Or why did you choose this profession?
3. How do you meet people's needs and order stock?
4. How do you remember the prices of many items?
5. What is the mantra of your success?

6. How to handle/negotiate with the customer?
7. How to negotiate the rate? What is the discount? Why do you give discounts?
8. How to manage the shop?

Do's and Don'ts:

1. Students should not put their hands in/touch any machine
2. Listen carefully and note down what the manager says.
3. Take special care of cleanliness.
4. **When to take activity:**Any time, specifically during summer or festival breaks.

Summary / Principal / Knowledge gain:

Through this activity, children will be able to know about different enterprises and their work plans. Along with this, their knowledge of marketing, branding, promotion and packaging will also increase.

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Title of Activity

15. Maintenance of hinges and handle using screw, nuts, bolts

Syllabus reference:
Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:
Maths- measurement and surface area

Material required:
Plywood, hinge, screw, bolts, etc.

Tools required:
Hand drill machine, screw driver, pliers, hammer, mortise chisel, meter tape, pen/pencil, etc.

Time required: 3 Hrs.
No. of students in class: Maximum 32 (No. of students in a group: 8)

Introduction:

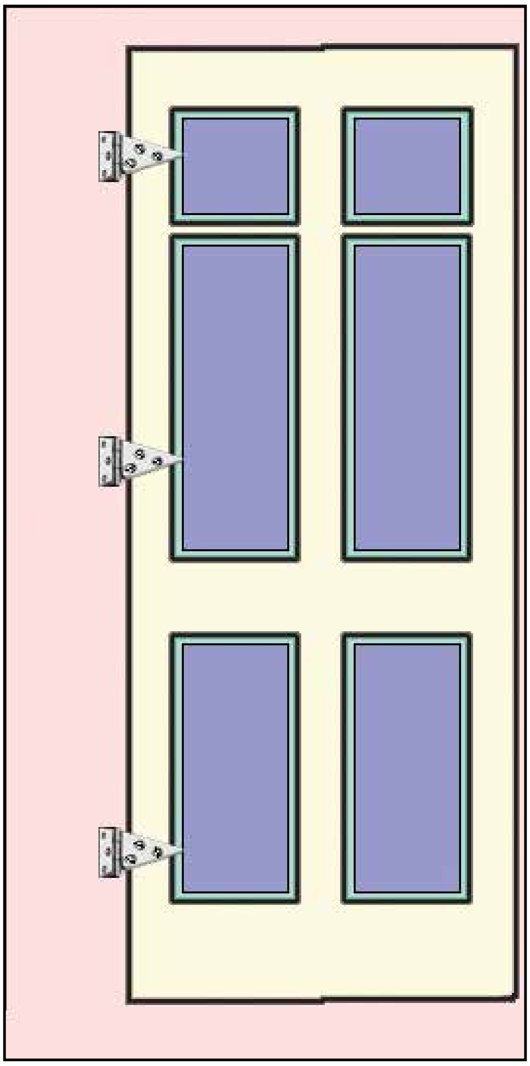
We use wood in our home, office and school and for construction work. Various types of doors, windows and many other items made of wood are used by people. To connect doors and window to their frames and open them easily, it is necessary to install hinges or mortise. A hinge is a type of bearing. Hinges or mortise are made from mild steel and brass, etc.

Location:

Choose a door or window in your school that needs repair. If there is no such need in your school, then any old door or window can be used to fix the hinges.

Process:

1. Determine the type and size of the hinge as per the size of plywood or as per requirement.
2. Using a pen, mark the area on the plywood (wooden plank) where the hinge is to be placed.
3. At the marked spot, using a mortise chisel and a hammer, make a groove of the size of thickness of the hinge.



4. Keeping the hinge again in place, make a mark on the plywood by inserting a pen through the holes used for screws.
5. Make holes on the marks with the hand-drill machine.
6. After this, place the hinges on those holes, insert the screws through the holes and tighten them using a screwdriver.

Precautions:

1. While marking on the plywood (wooden plank), keep the hinge joint (connected part) outside the plank.
2. While marking the holes, ensure that the hinge does not move.
3. Do not make a hole at an angle or do not tighten the screw at an angle.
4. While inserting the screw, do not use a hammer to hit it inside the plywood. Instead make the hole with a hand drill machine and then tighten the screw properly using screwdriver.

Types of Hinges:

Butt hinge, flush hinge, strap hinge, T-hinge, offset hinge, etc.

Overview:

All students should understand the types of hinges. All students should also learn the skills of marking, using a mortise chisel and hammer and also tightening screws using a screw driver.

Ask questions:

1. What are the types of hinges?
2. What type of metal are the hinges made up of?
3. What are different items in your home/school that have hinges in them?
4. What different objects are the hinges attached to?
5. The wood of which tree is used to make doors and windows?

Do's and Don'ts:

1. Use hand or electrically operated tools and sharp objects only in the presence of the teacher or instructor.

2. While doing wood work, wear a mask over the mouth to avoid inhalation of sawdust/wood particles.
3. Wear safety gloves and goggles while using hand drill machine and mortise chisel and hammer.
4. Do not use old and rusted saw blades.
5. **When to take activity:**Any time.

Summary / Principal / Knowledge gain:

- Students will know that hinges are useful for opening or closing doors and windows easily.
- Students will learndifferent types of hinges that are available in the market.
- Students will learn that the hinges can be installed on different objects (doors, windows, shop, house, etc.).
- While installing hinges, students will learn about measurement, installation of screws, nuts andbolts, etc.

Resources:
Q.R.Codes

Title of Activity

16. Learning Hydraulics- Making toys using syringe and pipes

Applications of hydraulics:

16 A. Hydraulic scissor lift

16 B. Hydraulic press

16 C. Hydraulic crane

Title of Activity

16A. Hydraulic scissor lift

Syllabus reference:

Std. 8th

Standard concept / Principle:

Force and air pressure.

Material required:

Cardboard, 2 syringe - 10 ml, 1 pipe, 3 chopsticks - 4 mm and 2 chopsticks - 5 mm.

Tools required:

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: 2 Hrs.

No. of students in class: Max. 20 (No. of students in a group: 2-3)

Process:

Let us make a model of a scissor lift and a master-slave piston assembly using cardboard and two syringes.

1. Take cardboard and cut 8 rectangular plates of 1.5 cm width and 10 cm length using a paper cutter. Now, mark 3 points on these plates, one at the center of the plate and two at 1 cm distance from its edges.
2. Make a hole of 4 mm diameter on the marked points.

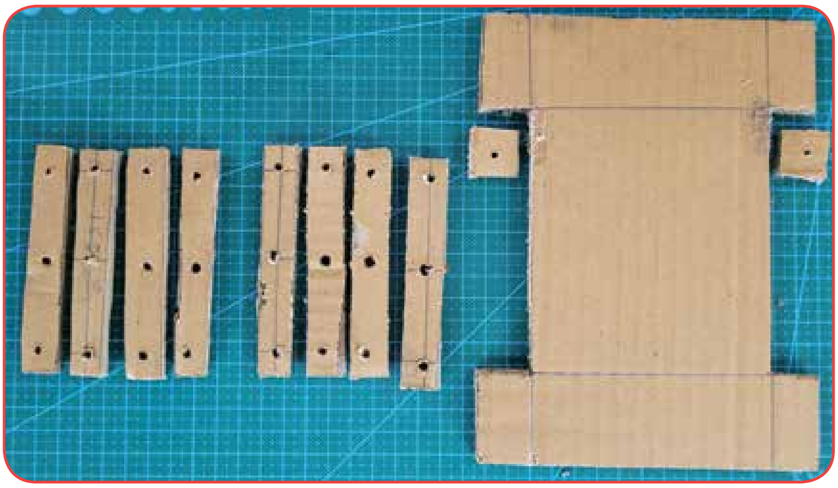


IMAGE 16A-1

3. Similarly, cut another rectangle of 15 cm width and 25 cm length to make the base of the scissor lift. Now, on the rectangle, cut out rectangular slots of 1.5 cm width and 17 cm length along the longer sides of the rectangle.
4. Cut out two square pieces of side length 1.5 cm **(Refer the image 16A-1)**.

Q.R.Code

5. Scan this QR code and follow the steps to cut rest of the parts as suggested in the reference video.
6. To make a master-slave cylinder system, take a syringe and fix the pipe of 15 cm length on its nozzle using hot glue. Take the other syringe and fill it with water. Fix the free end of the tube to its nozzle using hot glue

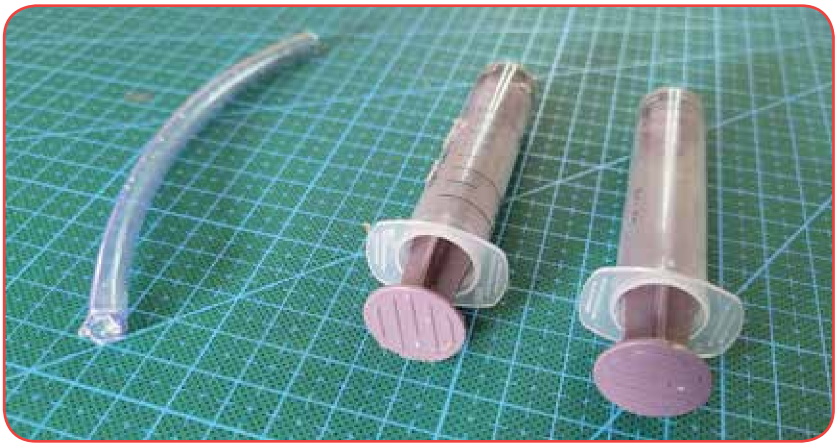


IMAGE 16A-2

7. Fix the piston of the slave cylinder to the stick at the bottom of the scissor lift assembly and using hot glue.
8. Make a small tray of cardboard and fix it on the top of this scissor lift mechanism.
9. Now, test it by placing different loads in the tray.

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Title of Activity

16B.
Hydraulic press

Syllabus reference:
Std. 8th

Standard concept / Principle:
Force and air pressure.

Material required:
Cardboard, 2 syringe - 10 ml, 1 pipe, 3 chopsticks - 4 mm and 2 chopsticks - 5 mm.

Tools required:
Hand gloves, glue gun, pencil, scale ruler, scissor, utility cutter/ paper cutter, wire stripper.

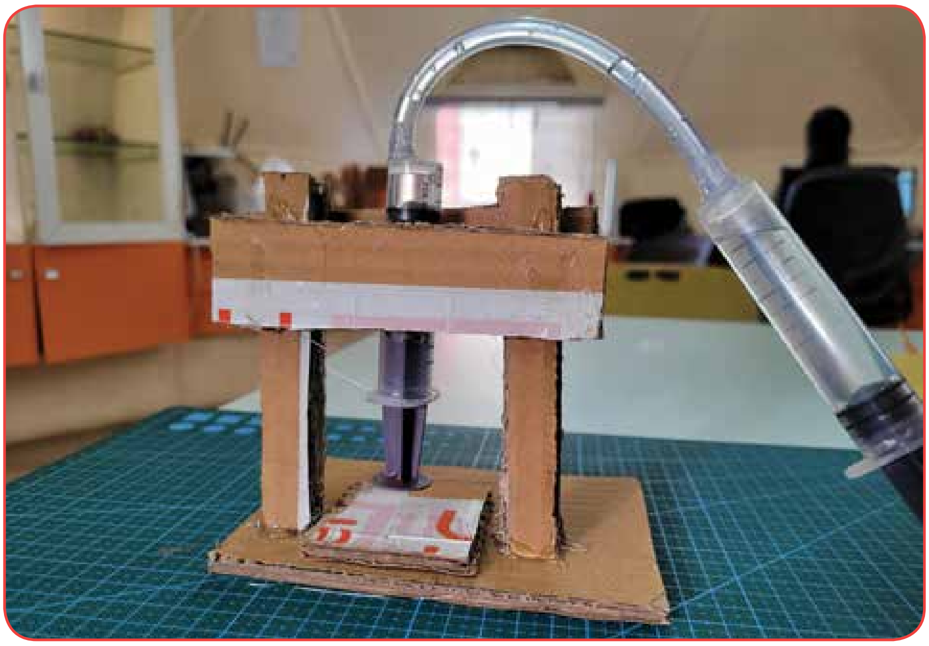
Time required: 1.5 Hrs.
No. of students in class: Max. 20 (No. of students in a group: 2-3)

Process :

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

Q.R.Code

1. Take 5 mm thick cardboard sheet and cut them according to given dimensions:
   a. One 14 cm x 10 cm rectangular plate for the base plate of hydraulic press.
   b. One 5.5 cm x 5.5 cm square plate for the base at the center.
   c. Two 12 cm x 3 cm rectangular plates as support plates for syringe assembly.
   d. Six 12 cm x 1.5 cm rectangular plates as pillars for hydraulic press.



2. Out of the 6 plates (12 cm x 1.5 cm), stick 3 plates to each other with hot glue. Do the same for the remaining 3 sticks. These will be used as columns to make a pillar.
3. Fix these two columns on either side, at least 6 cm apart, on the base plate of hydraulic press.
4. Fix the square plate (5.5 cm x 5.5 cm) on the base, between the 2 pillars.
5. Now, fix one of the two rectangular plates (12 cm x 3 cm) to the pillars, on the upper side to support syringe assembly.
6. Make a syringe assembly just as mentioned in the scissor lift activity and glue it vertically to the base plate as shown in the figure above and then fix the second rectangular plate (12 cm x 3 cm) on the other side of the syringe assembly to keep it stable.
7. Our press is ready, now place a tomato below the slave piston on the base plate and press the master piston and crush the tomato. This shows the actual application of hydraulic pressure.

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Title of Activity

16C.
Hydraulic crane

Syllabus reference:
Std. 8th

Standard concept / Principle:
Force and air pressure.

Material required:
Plywood plate, 2 syringe - 20 ml, 1 pipe, 2 chopsticks - 4 mm, nut and bolt of 5 mm diameter.

Tools required:
Hand gloves, glue gun, drill machine with 5 mm drill bit, pencil, scale ruler, scissor, utility cutter/ paper cutter, wire stripper.

Time required: 1.5 Hrs.
No. of students in class: Max. 20 (No. of students in a group: 2-3)

Process:

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

Q.R.Code

1. Take a plywood of 3.5 mm thickness and 30 cm x 30 cm dimension. Cut the plywood in the following dimension.
    a. One 25 cm x 15 cm - Base plate.
    b. Two 12 cm x 1.5 cm - Pillar plates.
    c. One 20 cm x 1.5 cm - Support plate.
    d. One 5 cm x 5 cm square plate - Tray.
2. Drill a hole at one side of the pillar plate and support plate. Make one hole at another end of the support plate.
3. Now, fix these plates with each other with a 5 mm nut and bolt. Now fix the pillar plates on the base plate at the appropriate location.
4. Make a tray with a square plate and chopstick as shown in the image. Connect this tray to the other end of the support plate.
5. Now attach the syringe assembly in the set as shown and now our hydraulic crane is ready and you can operate the crane by pressing the master cylinder piston and releasing it back to its original position.

Ask questions: For Applications of hydraulics:

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

Do's and Don'ts:

1. **How to organize activity:** Group students before starting the activity and then give them the instructions and materials.

2. Use hand gloves and safety goggles while using the glue gun and drill machine
3. Instructors to help students to use drill machines and glue gun.
4. Do not touch the tip of the glue gun bare handed as it is very hot.
5. Use of stripper and utility knife should be under supervision.
6. If you are using a utility knife for the first time then use gloves for safety.
7. **When to take activity:** Any time.

Summary / Principal / Knowledge gain:

In this experiment we have learned about the basics of hydraulics and its applications. We have learned how to make hydraulic scissor lift, hydraulic press and hydraulic crane using available materials. We also learned about 3 states of matter: solid, liquid and gasses and what happens when we apply force on these states of matter. Most importantly, we learned how to make hydraulic scissor lift, hydraulic press and hydraulic crane and how it works.

Resources:

Q.R.Code

- **Video reference for making hydraulic crane**

Title of Activity

17. Making a periscope using cardboard

Syllabus reference:
Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:
Std. 6th - Science - Light, shadows and reflection,
Std. 7th and Std. 8th - Science - Light

Material required:
Periscope Pattern Print, Cardboard sheet, two mirrors (5cm x 5cm).

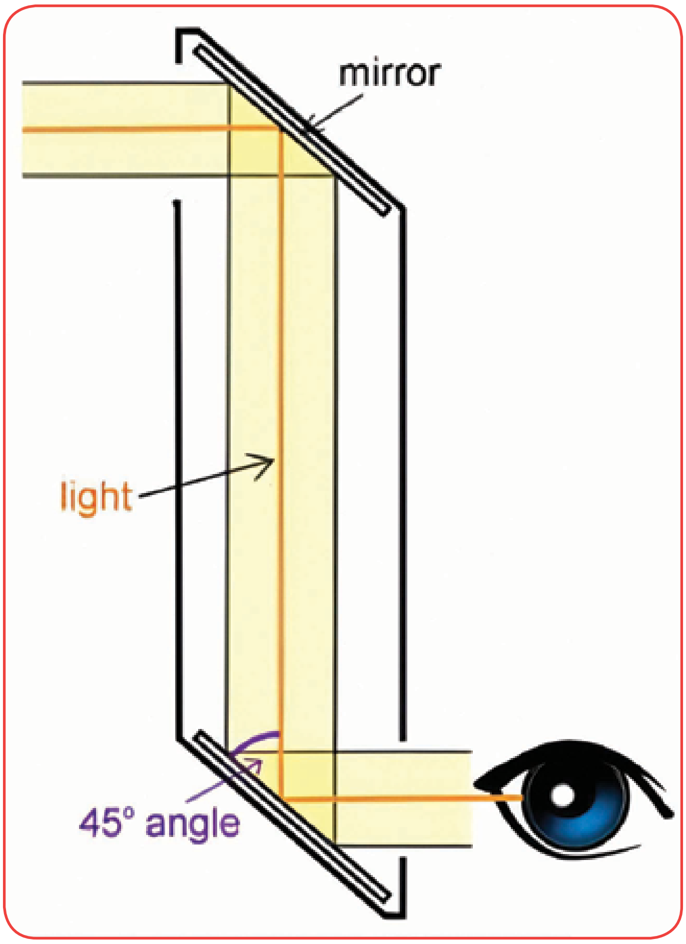
Tools required:
Scissors, Glue, Ruler, Pencil, Hot glue gun, etc.

Time required: 1 Hr.
No. of students in class: Max. 30 (No. of students in a group: 3-4)

Purpose of the activity:

The periscope project provided students with a hands-on exploration of optics, specifically focusing on reflection and refraction. This project also help students learning the basics of light, mirrors, lenses, etc.

Figure:



FUNCTION OF REFLECTION AND REFRACTION

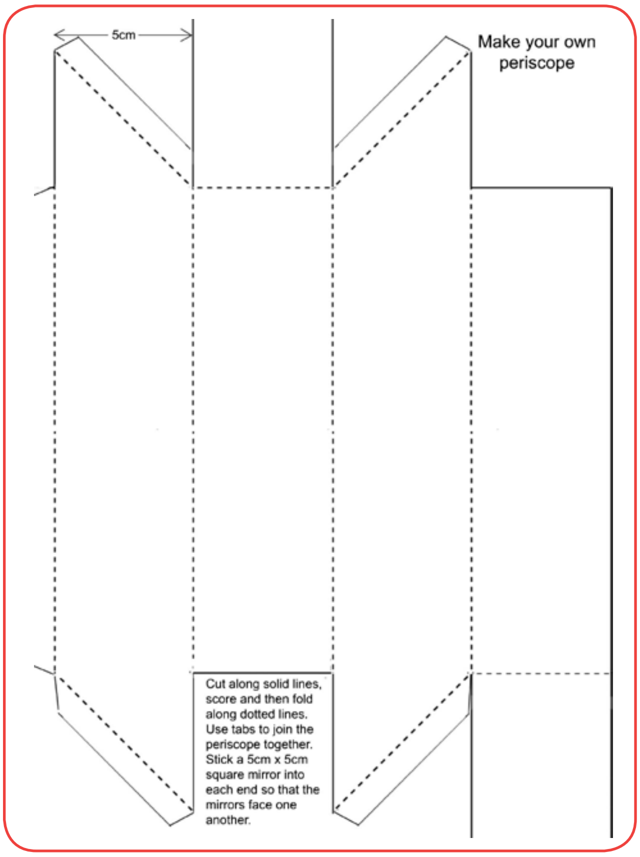
TOOLS REQUIRED

MATERIAL REQUIRED

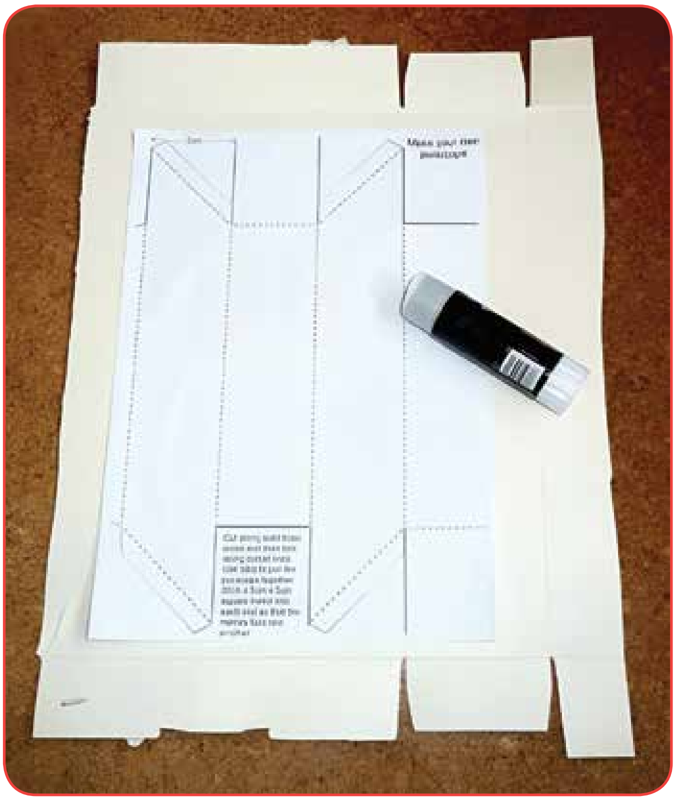
Process:

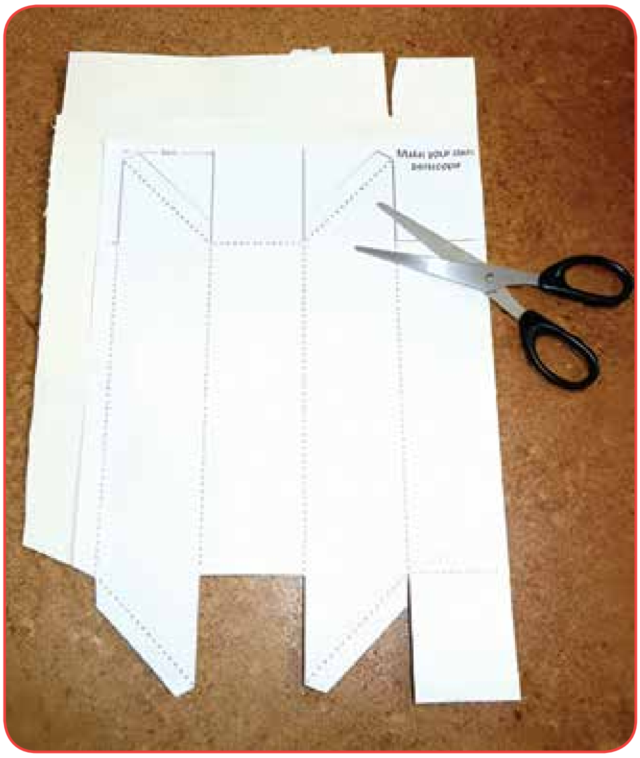
Q.R.Code

- **Step 1: Cut cardboard.**
  Take a cardboard sheet and cut it into an A4 size.
- **Step 2: Print periscope template on A4 paper.**
  Download and print periscope template by scanning given QR code.

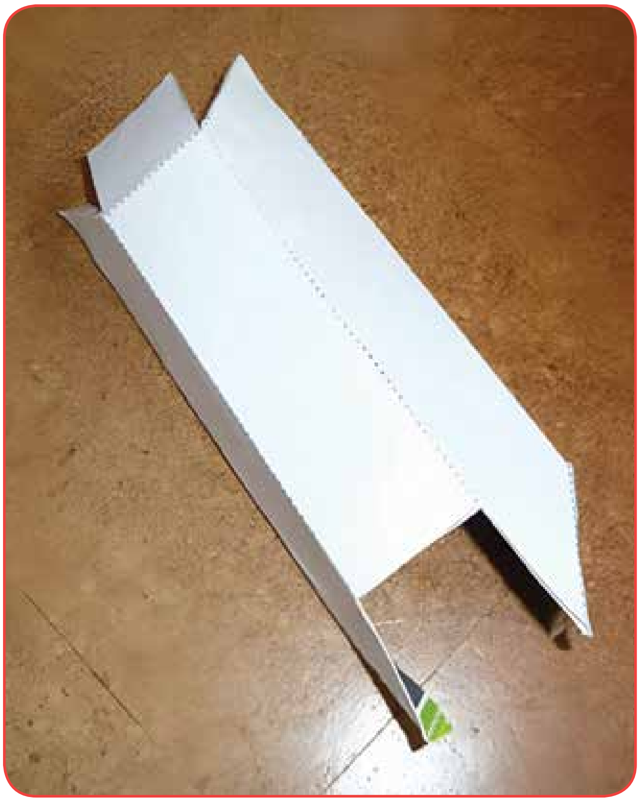


- **Step 3: Paste A4 printed template to the cardboard/ thick paper.**
  Glue A4 printed pattern on cardboard. You can use old notebook hard cover. This will serve as the top part of your periscope.

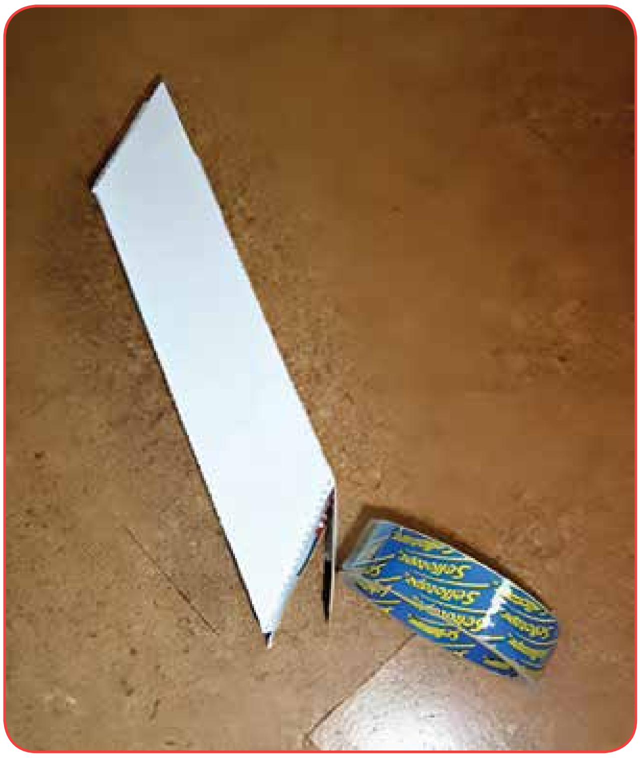




- **Step 4: Cut template after pasting on cardboard**
  Cut out the template carefully along the solid lines. Do not cut the side tabs that will be used for folding.



- **Step 5: Folding the periscope**
  Fold carefully (you can fold round the ruler) along all the scored dotted lines.



- **Step 6: Glue the periscope**
  Use tape or strong glue/ hot glue to stick the periscope together using the tabs.

- **Step 7: Attach mirrors**
  Place one mirror each at a 45-degree angle in the bottom and top corners of the pattern. Glue them securely, ensuring that they reflect the area above the cardboard.

- **Step 8: Test your periscope**
  Look through the open end of the periscope and observe the reflection in the mirrors. Adjust the mirrors if needed to ensure a clear view.

- **Step 9: Decorate (optional)**
  You can paint or decorate your periscope if you'd like. Be creative and make it your own.

Ask questions: For Applications of hydraulics:

1. What is the working principle of periscope?
2. How might you use a periscope in real life or in different situations?
3. What aspects of the project did you find most enjoyable or interesting?
4. What are different types of mirrors?
5. What is the difference between a mirror and a lens?
6. What challenges did you face during the construction of the periscope, and how did you overcome them?

Do's and Don'ts:

1. **How to organize activity:** Group students before starting the activity and then give them the instructions and materials.
2. **Follow safety guidelines:** Use safety equipment, such as gloves or safety glasses, as needed. Work in a well-ventilated area.
3. **Supervise younger participants:** Ensure proper adult supervision, especially while using cutting tools and handling mirrors that are required in the activity
4. **Understand the scientific principles:** Discuss and understand the basic principles of reflection and refraction that the periscope demonstrates.

5. **When to take activity:** Anytime.
6. Don't cut the template pasted on the cardboard keeping it directly on the table. Use cutting mat or old cardboard
7. Don't force components: Avoid excessive force when assembling or adjusting the mirrors in periscope to prevent damage.

Summary / Principal / Knowledge gain:

Constructing students periscopes allowed them to apply theoretical knowledge to practical scenarios. Students developed problem-solving skills by carefully aligning mirrors for optimal reflection. The project also offered a creative outlet, as students personalized their periscopes with decorations. Discussions extended beyond the immediate project, can encourage students to consider real-life applications of periscopes.

Resources:
Q.R.Codes

- **Reference link- how to make periscope using cardboard and template.**

- **Video reference on how to make periscope using cardboard (without template).**

❊ ❊ ❊

Title of Activity

18. Making water dispenser using waste plastic bottle

Syllabus reference:

Std. 8th

Standard concept / Principle:

Technology around us, Principal - Force and air pressure.

Material required:

A plastic bottle, a bend plastic straw, and a paper glass

Tools required:

Battery operated drill machine with 5 mm drill bit, glue gun, scissor, pencil or a pen, hand gloves.

Time required: 1.5 Hrs.

No. of students in class: Max. 30 (No. of students in a group: 5-6)

Material required:

Process:

1. Take a plastic bottle and mark the point at the bottom of the bottle and make a hole using a drill machine at the marked point. (Refer the given image)

1

2

2. Insert the straw inside the hole and fix it with a glue gun. Bend the plastic straw to look like a water tap.

3

4

3. Our water dispenser is ready now. Let us test it. Open the cap of the bottle and fill it with water completely. While filling the water, close the outer end of the straw tightly so that water does not come out of it. Now, close the bottle and release the straw end.

5

4. As you open the bottle cap, the water will start coming out of the straw. Once you close the cap again, the water flow stops.

Ask questions:

1. How does water come out when you open the cap of the bottle?
2. What happens when you close the cap of the bottle ?
3. What is the principle behind this experiment ?
4. Have you observed the same working principle in your surroundings ? Give examples.

Do's and Don'ts:

1. **How to organize activity:** Group students before starting the activity and then give them the instructions and materials.
2. Use hand gloves and safety goggles while using the glue gun and drill machine.
3. Instructors to help students to use drill machines and glue gun.
4. Do not touch the tip of the glue gun bare handed as it is very hot.

Summary / Principal / Knowledge gain:

- In this experiment when we open the bottle cap, the air outside the cap in its surrounding enters the bottle and applies pressure on the water which makes the water flow out of the straw.
- When we close the bottle lead no air enters the bottle hence there is no pressure on the water and hence water does not come out of the straw.

This experiment is based on the working principle of air pressure. Same principle is applicable in water taps, in pneumatic actuators, like in the brake system of public transport buses.

Resources:

Q.R.Codes

- **Water dispenser using balloon and also using bottle cap.**
- **Reference for Making a water dispenser using a single plastic bottle.**
- **Water dispenser using multiple bottles.**

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Title of Activity

19. Knowing 'First Aid Kit' and able to do simple bandage as first-aid treatment

Syllabus reference:
Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:
Science, Grih-Shilp

Material required:
First-aid box, disposal gloves, clean cotton, bandages (triangular 1 + crepe roll 1), sticky tape, antiseptic cream, non-alcoholic disinfectant (e.g.- Dettol), pain relief spray, antiseptic soap, distilled water (100 ml), sanitizer, ORS sachet, etc.

Tools required:
Thermometer, first-aid scissor, etc.

Time required: 1.5 Hrs.
No. of students in class: Max. 30 (No. of students in a group: 5-10)

Purpose of the Activity:

1. To introduce students with 'first-aid-kit' and its content.
2. To train students in performing basic 'first-aid' like dressing a small wound and measuring body temperature.

Importance of First-aid:

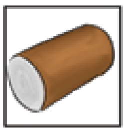
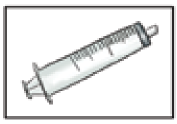
1. First aid is the first and immediate assistance given to any person with either a minor or serious illness or injury, etc. before the doctor arrives. Burning/cutting during cooking in the kitchen, cutting during working in the maker spaces/lab or playing on the ground can be given first-aid.
2. First-aid assistance required at all places like home, school, maker spaces/labs, community places, playground, kitchen, etc.

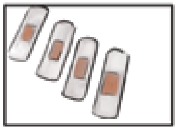
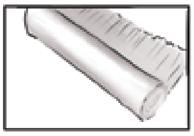
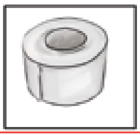
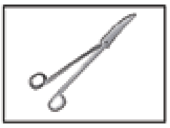
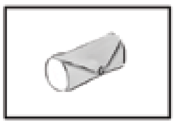
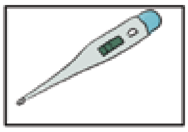
Component of 'first-aid-kit' box for class:

1. Display all material (medicines) in the first-aid-kit and show them to the students.
2. Explain the role of each item (material) like bandage, anti-septic cream, etc. to students
3. Make list of material in the first-aid box along with their uses, using protocol, price, expiry date, etc.

FIRST AID BOX

COMMON MEDICINES & MATERIAL USED IN FIRST-AID

Sr. No.	Component of first-aid	Sample Photo	Recommended use
1	Disposable gloves		Personal protection from infection while treatment.
2	Cotton plug		Cleaning wound using clean cotton, water and disinfectant, also used inside the bandage to cover the wound with antiseptic cream
3	10 mil syringes		For taking disinfectants/ medicines

Sr. No.	Component of first-aid	Sample Photo	Recommended use
4	Non-alcoholic disinfectant		To clean wounds for avoiding microbial infection on the wounds
5	Antiseptic cream		Healing of wound and protecting it from microbial infection
6	Water-proof Disposable Bandage		Covering wounds, to keep dressings in place, to apply pressure to control bleeding, etc.
7	Gauge tape		Keeping gauze in place, stemming bleeding, and providing light compression
8	Sticky tape		To place bandage on place sticking on the gauge
9	First aid scissor		Cutting bandage
10	Pain relief spray		To spray externally on the skin (Strictly NOT on the wound/ bruises) where there is a swelling, pain, sprain.
11	Crip Bandage		To use in sprains in arms, legs, etc.
12	Digital Thermometer		Measuring body temperature

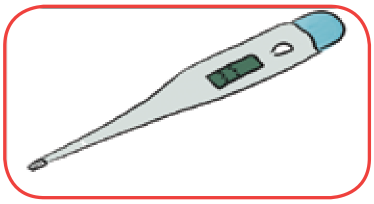
Activity 1. Performing basic first-aid tasks- Dressing of small wound:

- First wash hands thoroughly and properly before starting the dressing. Cleaning a wound with dirty hands increases the risk of infection. If needed, wear disposable gloves.
- When you try to stop bleeding, don't apply pressure to the wound and allow the blood to clot. Make sure to use a clean cloth or bandage to cover on the surrounding areas of the wound while applying pressure on the wound. Also, raise the part of the body that has suffered the wound.

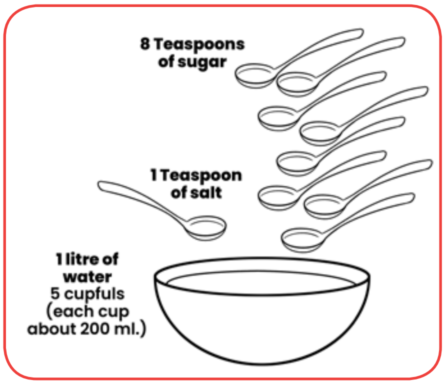
- Wash wound with clean water.
- Take a clean cotton ball, add some disinfectant liquid like Dettol/Savlon (quantity just needed- not too less, not too much). Clean the wound slowly with the cotton. Dispose the cotton ball as a medical waste after applying the disinfectant.
- Apply an antibiotic ointment to one more clean cotton ball. The antibiotic will prevent the growth of bacteria that may lead to an infection. Apply this cotton with cream on the wound carefully.
- Use water-proof disposable bandage if the wound is small. If the wound is medium to big, use the gauge tape as a sterile dressing to cover the wound as shown in the image.

Activity 2. Measuring body temperature:

Steps for measuring body temperature using digital thermometer:



- First of all, check if the thermometer is switched on. If it is not working even if it is switched on, the batteries must be drained. Replace the batteries.
- Clean tip of thermometer with gentle soap water or by taking surface disinfectant on clean cloth before use.
- Turn on thermometer only after it is completely dry.
- Select the unit of measurement for temperature since some thermometers can measure both in Celsius or Fahrenheit.
- Put thermometer under-arm gently and hold till a beep sound.
- Upon hearing the beep sound, remove the thermometer and check the body temperature of the person displayed on the screen. Check the unit of measurement selected and note the temperature with unit on the sheet of paper.
- A normal adult body temperature is in range of 97 to 99° F. If temperature is more than 100° F then person has fever. Fever more than 101° F needs person to visit doctor and take medicine.



Activity 3: Preparing 'Oral Rehydration Solution' (ORS) solution:

- Human body contains on an average 50 to 60% water.
- Dehydration is the lack of water in body.

- Dehydration is caused due to excessive sweating (due to work or play), Continuous vomiting, lack of enough fluid intake, diarrhoea and other such diseases, severe diabetes, intense skin burns, etc.
- Oral Rehydration Solution (ORS) is mixture of salt and sugar. It helps in faster absorption of water in body. ORS is especially used in diarrhoea for children.

Steps to make ORS solution:

- Take 1 lit drinking water.
- Boil water and cool it to the normal room temperature.
- Mix 8 table spoon of salt and 1 spoon of sugar and mix well.
- Now, the solution is ready. Feed this solution to the child in small quantities at certain interval.

Observation:

1. Note different symbols marked on first-aid kit material along with their meaning.
2. Make list of temperature data for class or your group.
3. Write small stories (your experience) of first aid.

Ask questions:

1. Why first-aid is important? Why to keep fist aid box in school?
2. What are different home remedies your parent perform in common diseases? For example- Fever, Loose motion, swelling, joint pain, cough, etc.
3. How is dressing done for animal bite (dog, snake, scorpion, etc.)?
4. What are the other common first-aid requirements in school premises? Like re-hydration, breathing assistance, etc.?

Do's and Don'ts:

1. **How to organize activity:** Make small groups (5-10 students) for activity. Arrange all material for first-aid box.
2. **When to take activity:** Any time.
3. **Precautions:** Care has to be taken while handling disinfectants, medicines, scissor, etc. Cleaning of scissors to avoid rusting is important. Frequently check expiry date of each item in first aid kit.

   The lab instructors have to monitor if students are using the material in the first-aid kit like cream, disinfectant, pain-relief spray, hand sanitizer, etc. only as needed and as prescribed. Students should not waste the material. It should be available at all the time.
4. **Use:** Keep first aid box in classroom, maker spaces/labs, office ready to be used in case of accidents/mishaps.

Summary / Principal / Knowledge gain:

- First aid used only in case of non-availability doctor or trained medical professional and its not optional for medical treatment.
- Large wounds/cuts/burns MUST be treated by doctors/medical professionals after primary first-aid treatment is done.
- Human body temperature is important health parameter. Body temperature is measured in degree Celsius (°C) or degree Fahrenheit (°F). A typical adult body temperature is in range of 97 to 99° F. In small babies it could be 97.9 to 100.4°F.
- First aid treatment for electrical shock, burning wounds are different than normal wound dressing. A special training is required to perform these tasks.
- Everyone has a basic understanding and knowledge of common ayurvedic medicines like turmeric powder, tulsi leaves, aloe vera, etc. These medications too can be used only after seeking the advice of knowledgeable elders.

Resources:

- **What is first aid:** https://en.wikipedia.org/wiki/First_aid
- **Dehydration:** https://www.wikihow.com/Make-an-Oral-Rehydration-Salts-Drink-(ORS)
- **Video link -** https://www.youtube.com/watch?v=0sT3PcxDxjc

Q.R.Codes

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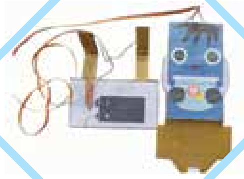



Energy and Electronics Section

Title of Activity

20. Calculating your own power in horsepower

Syllabus reference:
Std. 7th

Standard concept / Principle:
Energy

Material required:
Paper, pen, etc.

Tools required:
Timer/ Stopwatch, meter tape, weighing machine, etc.

Time required: 20 Minutes
No. of students in class: 15 to 20 (No. of students in a group: 4)

Process:

1. Find a building which has 2-3 floors.
2. Stand at the bottom of the staircase. One student should start the timer and other should climb to the top as fast as possible.
3. As soon as the student reaches the top, stop the timer and make note of the time taken in seconds.
4. After this, measure the total height (in metres) climbed by the student using a meter tape. If a long tape is not available, measure the height of one step and multiply it by total number of steps to get the height of the staircase.
5. Also, note down the mass (in kg) of the student who climbed the stairs.
6. Now let's start calculating energy that was spent in climbing the staircase.
7. Potential energy at the bottom was 0. The potential energy gained by increasing height is given as

   V= m x g x h

   [where m is your mass in kilograms, g is the acceleration due to gravity (9.8 m/s2 at the surface of the earth and h is the total height of the steps climbed in metres. It has units- Joule.]
8. Now let's calculate our power. Power is calculated by dividing energy with the time taken to reach the top.

   P=V/t   You will get this power in Watts.
9. Power in units of horsepower is given as hp = Watt/ 746. In this way, by dividing power in watts by 746, you will get power in horsepower.
10. Try climbing different heights, measure the time, and see how your power changes. Compare it with your friends. Who has the greatest power?

For example:

Potential Energy increased = m x g x h

= 40 x 9.8 x 15

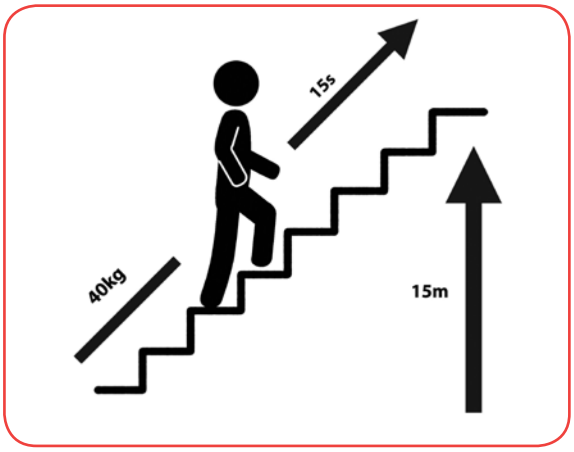
= 5880 Joules

Power = Energy / time

= 5880/15

= 392 Watts

Power in horsepower = 392/746 = 0.525 hp



Ask questions:

1. Is your power constant the whole time you are climbing the stairs?
2. When will the power be maximum- on tallest height or when speed is maximum?
3. Which is bigger, 1 Watt or 1 horsepower?
4. How to convert power in hp to watts?

Do’s and Don’ts:

1. **How to organize activity:** Make groups of students. Organize competitions among groups to see which group scores maximum total ‘power’.
2. **When to take activity:** Any time.
3. **Safety:** Running too fast may increase risk of slipping and falling on stairs.

Summary / Principal / Knowledge gain:

Gravity is always pulling objects down towards earth. It takes us energy to climb against gravity. This energy is stored as potential energy. If we spend the energy too slowly, we will climb up slowly. If we spend the energy very fast, we will climb up quickly. This speed of spending energy is known as Power. Therefore, power is calculated as $P = E/t$. When climbing slowly, power is less. When climbing fast, power is more. You can feel the difference when you climb the stairs yourself.

Power is measured in Watts. Horsepower is another unit in which power is measured. Although a horse can apply very high maximum power in a short time, 1 horsepower is about the power that a horse can apply for a very long time’s work.

Watts can be converted to horsepower by using following formula-

Power in hp = Power in watts / 745.7 or approximately 746.

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Title of Activity

21. Making L.E.D. (Light emitting diode) torch

Syllabus reference and Standard concept / Principle:

Std. 7th - Current, conductor insulator,
Std. 8th - Introduction - electric circuit, Power source, Battery / cells, Electrical symbols, use of Multimeter.

Material required:

Hinged transparent lockable plastic box, Switch, LED light, 9V battery, 100-ohm resistor, etc.

Tools required:

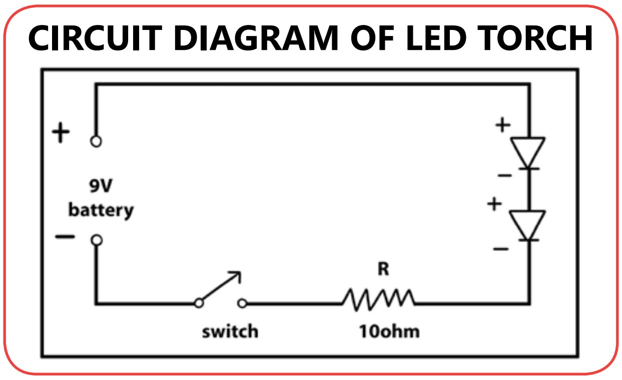
Soldering gun 25 w, flux, solder wire, wire striper, blade cutter, Multimeter, nose plier, etc.

Time required: 3 Hrs.

No. of students in class: 15 to 20 (No. of students in a group: 3)

Process:

1. Arrange the battery, connector switch, and LED in the Plastic box as shown in figure.
2. Connect and solder the components as shown in the circuit diagram.



3. Done! Now you can keep this torch in your pocket.

Observation:

Observe and note down specification given on different material:

a. Note specification printed on battery.

b. Observe and note the color code of given resistance.

Ask questions:

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

Do's and Don'ts:

1. **When to take activity:** Any time.
2. **Safety:** Instructor has to take caution when students will use soldering iron.
3. **Use:** Students can use torch at their home or sale/gift to visitors / teachers / parents

Summary / Principal / Knowledge gain:

- The torch circuit includes power source (9V battery), conducting medium (Wire) and Load Light Emitting diode (LED).
- When switch is turn on then chemical energy stored in the battery is converted into electrical energy making current to flow. LED uses this electric energy to convert it into light energy. Resistor is used in the circuit to limit the current in the circuit. Switch is used to control the flow of current in the circuit.

Q.R.Code

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Title of Activity

22. Making solar energy operated car

Syllabus reference and Standard concept / Principle:

Std. 6th - Work or Energy, Std. 7th - Energy, Std. 8th - Alternative sources of energy

Material required:

3.8 V Solar Panel, 3VDC motor, on-off switch, 2 Straws, 5 Plastic water bottle caps, small gears, Ice cream sticks, wood stick,1 fan blade, Solder wire, glue stick, etc.

Tools required:

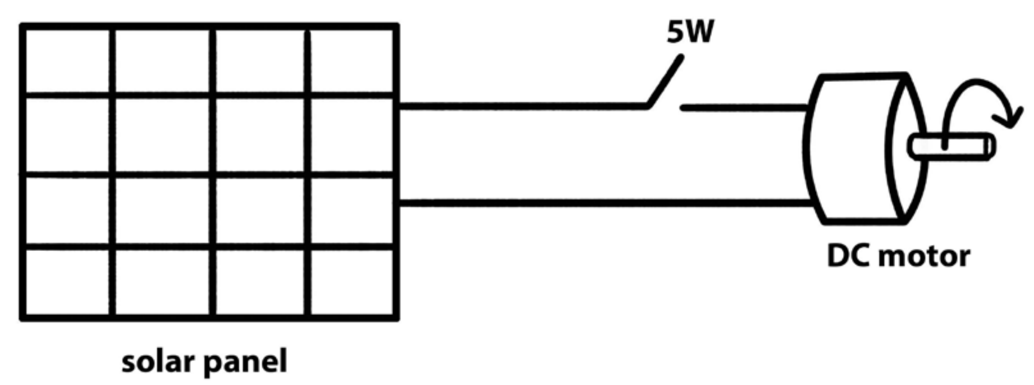
Blade cutter, wire stripper, soldering iron, glue gun, etc.

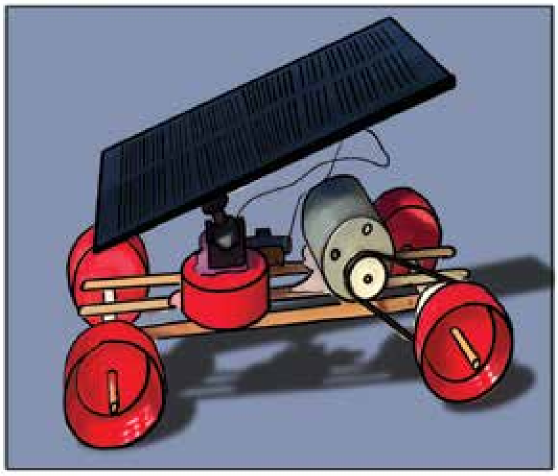
Time required: 2 Hrs.

No. of students in class: 15 to 20 (No. of students in a group: 2-3)

Process:

1. A 3.8-volt solar panel can be directly connected to a DC motor.
2. When solar panel is kept under sunlight, it will make the DC motor to rotate.
3. A switch added to circuit helps in switching the motor ON / OFF.
4. Connect the solar panel, DC motor and switch as shown in the given circuit diagram.
5. Test the working of the DC motor on the solar panel.
6. Now students can fit the solar panel on a toy car chassis.
7. Student can transfer the rotations of DC motor shaft to the car axel through a gear or rubber band.





8. You can watch DIY videos available on internet to make different solar cars.

a. https://youtu.be/poO_CGhWSvo

b. https://miniscience.com/kits/car-solar/

c. https://www.youtube.com/watch?v=fePr-9t6PKo&t=135s

Ask questions:

1. When will the car stop?
2. Will the angle of the solar panel affects performance of car?
3. Will your car able to take turn? If not why?
4. How does power transmission happen in a car?

Do's and Don'ts:

1. **When to take activity:** Any time.
2. Take a precaution while doing soldering.
3. Instructor must help students to solder the connection safely.
4. Solder gun is hot. Students must handle it under supervision of instructor.
5. Use of utility knife should be done under supervision.

Summary / Principal / Knowledge gain:

Solar panel uses sunlight as a source of energy to generate DC current. Solar panels are made of photovoltaic cells. Array of such photovoltaic cells are connected to produce more electricity. DC motor converts electrical energy into mechanical energy. Working principle of DC motor is based on Flemings left hand rule that when current carrying conductor is placed in magnetic field, the conductor experiences a mechanical force.

Resources:

- www.youtube.com/watch?v=8li1Vp8vLaI
- https://youtu.be/poO_CGhWSvo
- https://miniscience.com/kits/car-solar/
- https://www.youtube.com/watch?v=fePr-9t6PKo&t=135s

Q.R.Codes

Title of Activity

23. Let's learn to do analysis of the past electricity bills

Syllabus reference:
Std. 8th

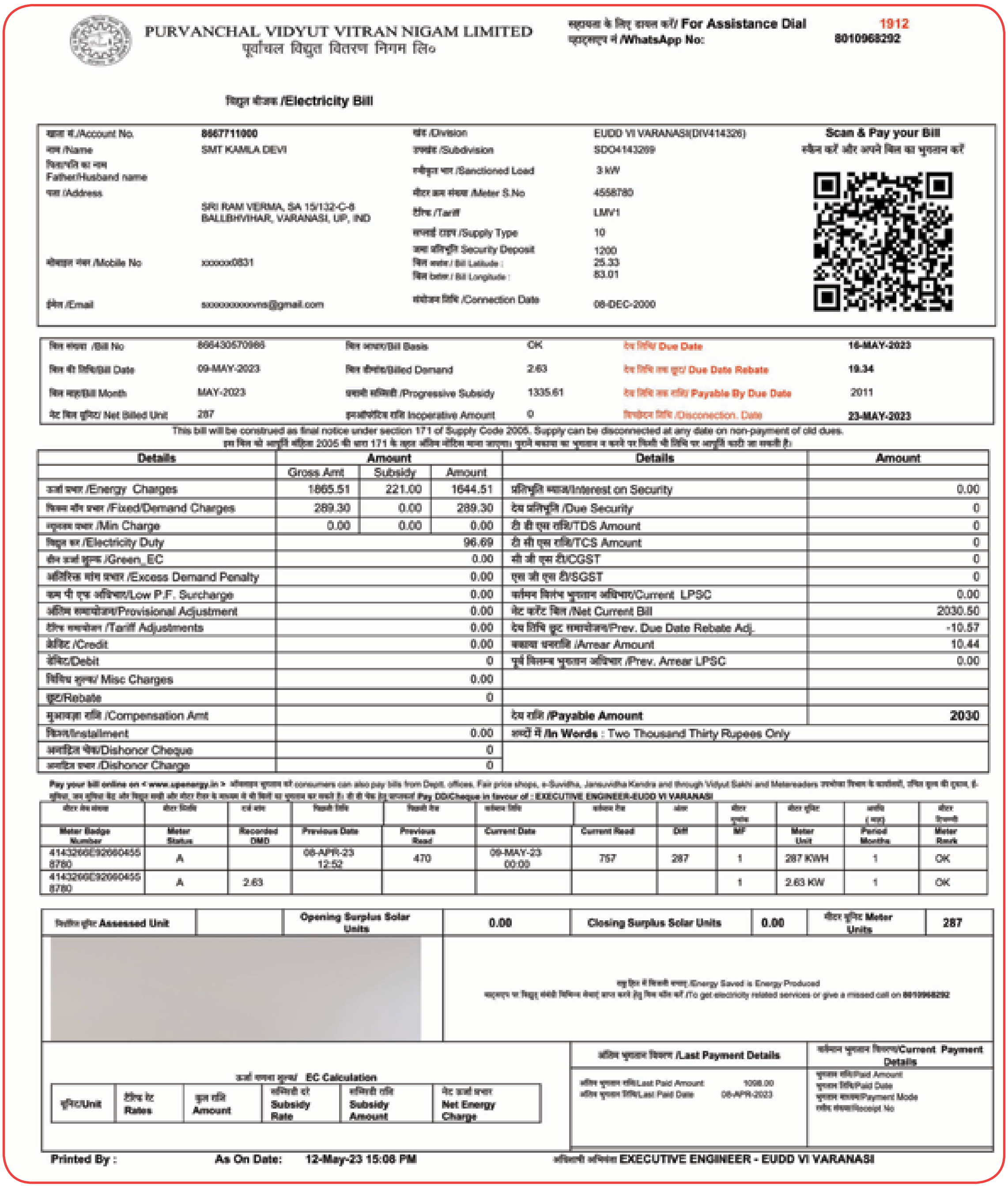
Standard concept / Principle:
Current Electricity

Material required:
Electricity bills of the same school/ household for at least 1 year, blank paper, graph paper, pencil, ruler (alternatively- a PC or smartphone with MS Excel or any other spreadsheet software)

Time required: 2 Hrs.
No. of students in class: 20 (No. of students in a group: 3-4)

Process:

1. Collect monthly electricity bills for your school/ a single household (preferably your own) of at least the past year. Even better if you could gather bills for more than a year. It is okay if you are missing some months' bills, as a single electricity bill may have records of past 6 months of electricity consumption, as shown in yellow box in the sample electricity bill below. You can also visit state electricity board's website for downloading past electricity bills.


PURVANCHAL VIDYUT VITRAN NIGAM LIMITED
पूर्वांचल विद्युत वितरण निगम लि०

For Assistance Dial 1912
WhatsApp No: 8010968292

Electricity Bill

Account No.	8667711000	Division	EUDD VI VARANASI(DIV414326)	Scan & Pay your Bill
Name	SMT KAMLA DEVI	Subdivision	SDO4143269	
Father/Husband name		Sanctioned Load	3 kW	
Address	SRI RAM VERMA, SA 15/132-C-8 BALLBHVIHAR, VARANASI, UP, IND	Meter S.No	4558780	
		Tariff	LMV1	
		Supply Type	10	
Mobile No	xxxxxx0831	Security Deposit	1200	
		Bill Latitude	25.33	
		Bill Longitude	83.01	
Email	sxxxxxxxxxvns@gmail.com	Connection Date	08-DEC-2000	

Bill No	866430570986	Bill Basis	OK	Due Date	16-MAY-2023
Bill Date	09-MAY-2023	Billed Demand	2.63	Due Date Rebate	19.34
Bill Month	MAY-2023	Progressive Subsidy	1335.61	Payable By Due Date	2011
Net Billed Unit	287	Inoperative Amount	0	Disconection. Date	23-MAY-2023

This bill will be construed as final notice under section 171 of Supply Code 2005. Supply can be disconnected at any date on non-payment of old dues.

Details	Gross Amt	Subsidy	Amount	Details	Amount
Energy Charges	1865.51	221.00	1644.51	Interest on Security	0.00
Fixed/Demand Charges	289.30	0.00	289.30	Due Security	0
Min Charge	0.00	0.00	0.00	TDS Amount	0
Electricity Duty			96.69	TCS Amount	0
Green_EC			0.00	CGST	0
Excess Demand Penalty			0.00	SGST	0
Low P.F. Surcharge			0.00	Current LPSC	0.00
Provisional Adjustment			0.00	Net Current Bill	2030.50
Tariff Adjustments			0.00	Prev. Due Date Rebate Adj.	-10.57
Credit			0.00	Arrear Amount	10.44
Debit			0	Prev. Arrear LPSC	0.00
Misc Charges			0.00		
Rebate			0		
Compensation Amt				Payable Amount	2030
Installment			0.00	In Words : Two Thousand Thirty Rupees Only	
Dishonor Cheque			0		
Dishonor Charge			0		

Pay your bill online on < www.upenergy.in > ... Pay DD/Cheque in favour of : EXECUTIVE ENGINEER-EUDD VI VARANASI

Meter Badge Number	Meter Status	Recorded DMD	Previous Date	Previous Read	Current Date	Current Read	Diff	MF	Meter Unit	Period Months	Meter Remark
4143266E92660455 8780	A		08-APR-23 12:52	470	09-MAY-23 00:00	757	287	1	287 KWH	1	OK
4143266E92660455 8780	A	2.63						1	2.63 KW	1	OK

Assessed Unit		Opening Surplus Solar Units	0.00	Closing Surplus Solar Units	0.00	Meter Units	287

Energy Saved is Energy Produced

EC Calculation

Unit	Rates	Amount	Subsidy Rate	Subsidy Amount	Net Energy Charge

Last Payment Details: Last Paid Amount 1098.00; Last Paid Date 08-APR-2023

Current Payment Details: Paid Amount; Paid Date; Payment Mode; Receipt No

Printed By : As On Date: 12-May-23 15:08 PM EXECUTIVE ENGINEER - EUDD VI VARANASI

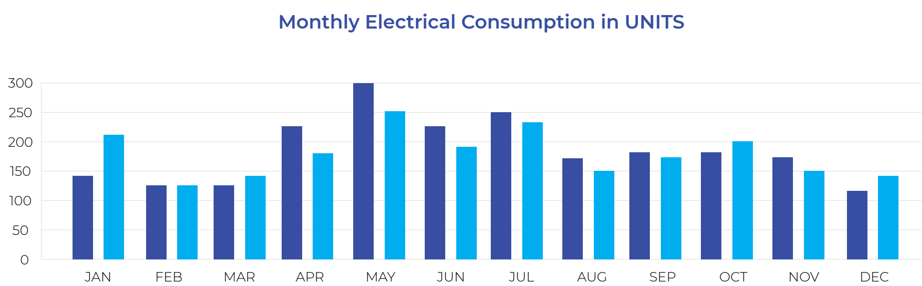
2. Once you have gathered all the bills, take one bill and circle all the important fields mentioned on the bill. You should be able to understand meaning and purpose of everything printed on the bill. You may take help from elders or the internet.

3. Now, make a table as shown below for the years for which you have the bills. Fill corresponding boxes with units of electricity consumed in those months. Example is given below.

Month	2022 (No. of units)	2021 (No. of units)
January	375	365
February	365	310
March	310	300
April	290	280
May	320	300
June	325	300
July	400	350
August	380	350
September	360	320
October	290	250
November	285	260
December	250	230

4. If you don't have a spreadsheet software, take a graph paper. Draw x and y axes. Write names of months from January to December on x-axis, keeping equal distance between them. Take appropriate scale and mark the y-axis such that you should be able to mark from 0 to whatever maximum electricity consumption is in your table. Draw a 'multiple bar graph' of the data.

Month	2021	2020
Jan	140	308
Feb	130	128
Mar	126	132
Apr	218	180
May	301	250
Jun	230	192
July	199	188
Aug	166	150
Sep	176	172
Oct	184	200
Nov	174	152
Dec	127	133



5. If you have a spreadsheet software, such as MS Excel, make the above table in that software. Select the data, go to Insert ⇒ Charts ⇒ Column or Bar Charts. Click on 2-D Column Chart. A multiple bar graph will be generated on the screen.
6. Observe your on-paper/ on-screen graph carefully. Can you spot any patterns? Are there any months when electricity consumption was very low/ very high? If you have data of multiple years, are there any months where consumption is almost always high/ always low irrespective of year? In a particular year, how much is the maximum, minimum, average consumption? Has your average yearly consumption increased or decreased or stayed somewhat same over the past years? Ask more of such questions and try to find patterns through answers.
7. After finding the pattern, try to find out the reasons for the pattern. If there are some months with repeatedly high/ low consumption, can you attribute the pattern to your local weather and thus increased use of some electric appliances such as fans, A.C.s, heaters, etc.? If you notice a single month with exceptionally high consumption, try to recall if there were any special occasions, such as a wedding, at your house. If you notice that your consumption has increased drastically since a specific month, ask your family members when you had bought any big appliances such as washing machine, A.C., electric vehicle, etc. and check if the dates match. Investigate all patterns in this manner.
8. As a next step, you can compare your electricity consumption data with your friend's data and see if you can explain the similarities and differences in your data sets. Ask such questions- Do they have same/ different types of appliances, did they have any special events, is the weather same or different, do your families have different habits of keeping appliances on when not in use?

Ask questions:

1. Which months are top 3 in electricity consumption in a year?
2. Why does weather have an effect on electricity consumption?
3. What needs to be done to reduce electricity consumption?
4. What is the difference between Power, Energy, Voltage, and Current and what are their units?

Do's and Don'ts:

1. **How to organize activity:** Make small groups (3-4 students) for activity and provide them with copies of electricity bills of your school/ their homes of past 1 to 3 years. Ask them to write the data in tables, draw graphs, and have a discussion on the patterns in the graph.
2. **When to take activity:** Any time.
3. **Use:** This activity teaches students the importance of data analysis as well as the patterns in electricity consumption.

Summary / Principal / Knowledge gain:

Electricity has become the most important for of energy used everywhere. This is because it can be easily converted to other forms of energy. Our homes have many appliances. When we use these appliances, our electricity consumption increases. These uses are dependent on many factors. For example, in Diwali, many types of lights are lit. In summer, A.C., fans, coolers, etc. may be running on high power for longer times. Some houses may own power consuming machines such as washing machines, A.C.s, ovens, etc. All of these have an effect on our monthly electricity consumptions.

To find patterns in kind of data, we should first collect the data and write it in neat table form. But it is hard to find pattern by just looking at the numbers, which is why we represent the data in picture format by using graphs. After that the up-down patterns become easily noticeable. We see that data is going up-down in different places. Just finding patterns is not enough. We should be able to find the reasons behind these patterns. Which is done by searching for events which might have caused the data to change in the way it did. Why should we do such a big exercise? Because, finding the reasons behind changes in electricity consumption will help us make plans to reduce this consumption. Data analysis is important to help us make better decisions in the future.

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Title of Activity

24. Calculating electric load of your house/ school

Syllabus reference:
Std. 8th

Standard concept / Principle:
Electric Current

Material required:
Pen, Notebook, etc.

Time required: 3 Hrs.
No. of students in class: 15 to 20 (No. of students in a group: 2-3)

Process:

1. This activity is to be done indoors, inside the house. You have to calculate approximately how much electricity is consumed in your household.
2. The total electricity consumed in a house is the addition of consumption of electricity by all the appliances in the house. The Power of each appliance is given in 'Watts'. If an appliance of power 1 Watt is kept ON for 1 hour, it is said to consume '1 Watt-hour' of electrical energy. We multiply 'power in Watts' by 'no. of ON hours' to get energy in 'Watt-hour'.
   1000 Watt-hours is called as '1 kilowatt-hour' (1 kWh). This 1 kWh is also called as **'1 Unit'** of electrical energy.
3. Make a list of all the appliances that are usually used in your house in a month, such as- light bulbs, fans, T.V., water pump, iron, etc. If you have multiple appliances of same kind, name them light bulb-1, 2, 3, ..., etc.
4. Now, check each appliance and find a label on it which will indicate how much power the appliance consumes.
   E.g., a sticker on a light bulb may read '18 W' meaning that it consumes 18 Watts of electrical power.
5. After writing the power, also write for how many hours, on an average, that appliance is used in your house.
   E.g., 18-Watt light bulb is used for 3.5 hours.
6. Now, you will be able to calculate daily electricity consumption of each appliance by multiplying Watts with no. of ON hours.
   E.g., 18-Watt light bulb, kept on for 3.5 hours, will consume 18 x 3.5 = 63 Watt-hours of electrical energy in a day. Multiply this number by the number of days in the past month, say 30 days as in November, to get total monthly power consumption of that specific appliance.
7. In this manner, go to each appliance, note the power, write approximate daily use of the appliance in hours, multiply these two to get Watt-hour energy consumption, and multiply this by number of days in the past month. By doing this, you will have made a list of monthly electricity consumption of all appliances in your house.
8. Add all of these numbers together to get the total electricity consumption of your entire house. This will be a very big number in Watt-hours. Convert it to kilowatt-hours by dividing this big number by 1000. This will give you electricity consumption in kWh or Units.
9. Now, take the bill of past month and find where electricity consumption in UNITS of that month is written. Check this number with your calculated number and check how close your calculation was.

Sr. No.	Appliance Name	Power in Watts (A)	No. of hours of daily usage (B)	Daily Electricity consumption in Watt-hour (A x B)
1	Light Bulb	18	3.5	63
2				
			Total consumption =	

Ask questions:

1. Which appliance in your house has the highest power?
2. Which appliance in your house consumes the most electrical energy in a day?
3. What can you do if you want to lower your electricity bill?
4. Why are power ratings of various light bulbs different?

Do's and Don'ts:

1. **How to organize activity:** Assign rooms in school/ houses to groups of students and ask them to perform this activity under the supervision of an adult.
2. **When to take activity:** Any time.
3. **Safety:** Turn off electricals before touching them.

Summary / Principal / Knowledge gain:

- Electrical Power is the measure of 'how fast is electric energy being consumed'. It is measured in Watts. There are some high-power appliances in our houses such as fridge, iron, etc. which consume electricity at a very fast rate.
- But energy consumption is not dependent on power alone. It depends on time also. If a low-power appliance is kept ON for a whole day, it will have consumed large amount of electric energy. Thus, we need to consider the ON time of the appliance also.
- To get the total electricity consumption by an appliance, we multiply its power with the time for which it was ON.

Electric Power (Watt) x No. of ON hours (hours) = Electric Energy consumed (Watt-hours)

- Thus, we now also know that unit of electric energy should be Watt-hours.

We already know that

1000 meters = 1 kilometer.

In the same way,

1000 Watt-hours = 1 kilowatt-hour.

This is because the word 'kilo' means 'thousand'. If you can't find wattage written on the appliances, here is a list of some common appliances with their normal wattages.

Appliance	Approximate Power (Watts)
Ceiling Fan	80W
Yellow filament bulb	40W
CFL bulb	20W
Fridge	500W
Iron	1000W
Washing Machine	600W
A.C.	1000W
TV	60W

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Title of Activity

25. How to read electricity bills

Syllabus reference:
Std. 6th, Std. 7th

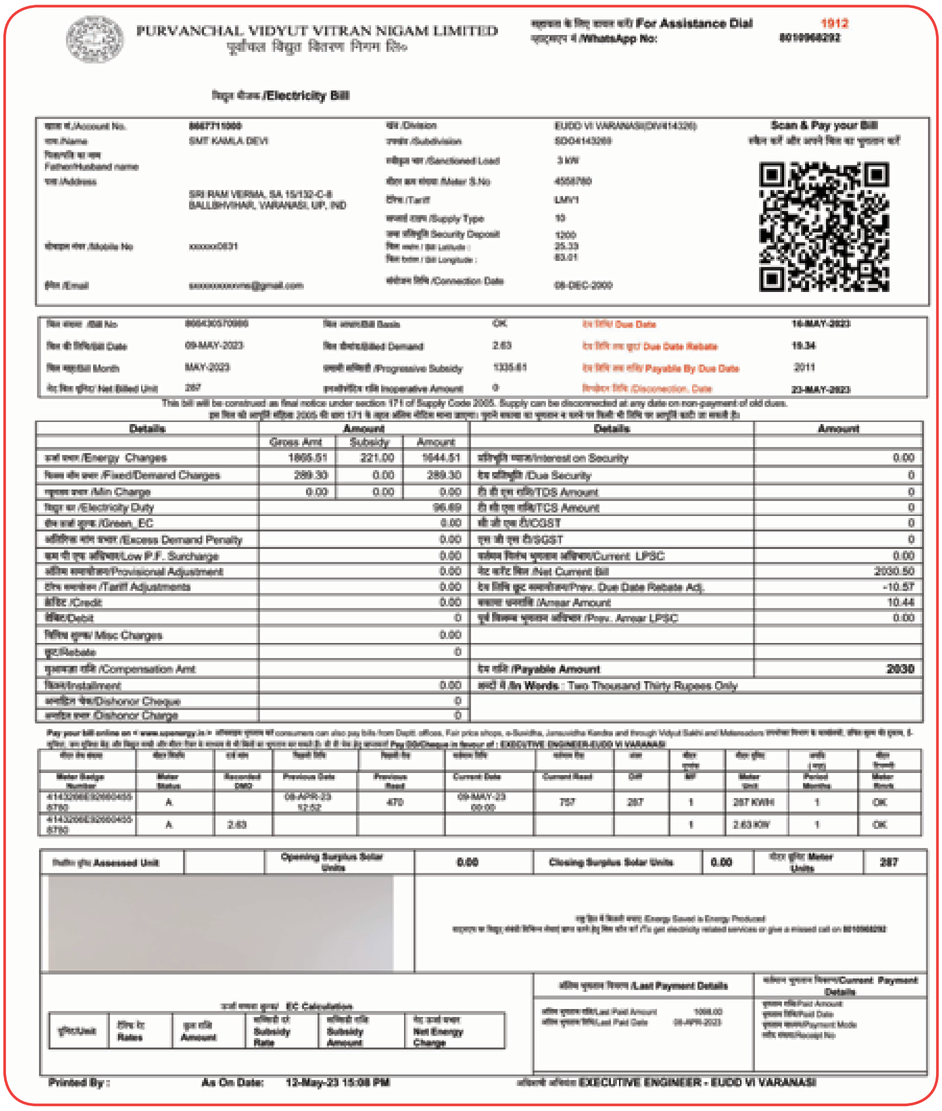
Standard concept / Principle:
Energy

Material required:
Last month's electricity bill, pencil

Time required: 30 Minutes
No. of students in class: 20 (No. of students in a group: 3-4)

Process:

1. Get your electricity bill for last month. If it is not available, you can visit state electricity board website for downloading past electricity bills. Two sample bills are shown in the pictures. One is available on the website and the other one is given by state electricity board representative who comes at the house to check meter every month.



2. After getting the bill, first check whether it is your bill. For this, look at the top of the bill to find 'Name' and 'Address'. Check if these are correct. Your account number will also be written there.
3. Once you confirm that the bill is yours, check the 'Bill Month' written next to it. Every month, you should get the electricity bill of the past month. Confirm that you are holding the bill of the month that you want.
4. After the details are confirmed, let's check how much electricity we have consumed in that month. If we use electricity with power 1 Watt for 1 hour, it is said that '1 Watt-hour' of electrical energy was consumed. We multiply 'power in Watts' by 'no. of hours' to get energy in 'Watt-hour'. 1000 Watt-hours is called as '1 kilowatt-hour' (1 kWh). This 1 kWh is also called as '1 Unit' of electrical energy.

5. The meter is not reset to zero every month. So how to calculate how much electricity has been consumed in past month alone? This is explained in the bill. Meter reading at the end of previous month is written as 'Previous Reading' and the meter reading at the time of checking for the recent month is written as 'Present Reading' or 'Current Reading'. Whatever is the difference (DIF) between the Previous and Current Readings, it is the number of units consumed during that period.

6. We will be charged money for the number of units that we have consumed. Rates for one unit is given in the large bill. The rates have levels/ slabs. For example, in the large bill, out of the total 202 units consumed, first 150 units have been charged at the rate of 4.9 rupees per unit and the remaining 52 units have been charged at the rate of 5.4 rupees per unit. If you multiply number of units with their rate, you will get the amount for those units (as shown in the image). The total amount is the sum of these two levels. These are your 'Electricity Charges (EC)'
7. There are some additional calculations remaining before getting final payment amount. Firstly, if you have paid more/ less than the bill amount in the previous bill, that amount gets adjusted in the current bill. It is shown as 'Arrears'. You can cross check if this amount is printed correctly by checking past bill and payment receipt.
8. Other addition is of some extra charges applied by the electricity company. Their explanation is given in 'Bill Details' table in the large bill. You may check if only the charges applicable to you are applied there.
9. After considering Electricity Charges, Arrears, and other charges, total amount of payment is calculated by adding all of these together. This is your 'Current

Payable Amount'. This amount is rounded up to the nearest whole number for easy payment. (e.g., 1326.86 rupees becomes 1327 rupees). This is your 'Total Payable Amount'.

Ask questions:

1. Electrical Power is measured in which units?
2. Where should you go if you think your bill has been wrongly calculated?
3. What are the rates of electricity for houses, schools, shops, factories? Are they the same?
4. Why are electricity rates divided in slabs?
5. From where does electricity come to your house? Who is in charge of the distribution?

Do's and Don'ts:

1. **How to organize activity:** Give electricity bills to students or ask them to bring them from their homes. Give them some time to observe the bill. Ask them questions to see if they are understanding the bill on their own. After that, explain parts of the bill to students and ask them to repeat all the calculations in the bill on their own and verify the bill.
2. **When to take activity:** Any time.

- **Use:** Students will understand how to read the electricity bill and understand its intricacies. This will improve their understanding of electricity.

Summary / Principal / Knowledge gain:

- Electricity has become an important part of our lives. We should know how electricity is distributed to us and how the system is setup for tracking its usage.
- Electric power is calculated by finding how much electrical energy is consumed in one second. Electric power is measured in watts and electrical energy is measured in watt-hours. The appliances in our house use electricity when they are turned on. This used electrical energy is continuously measured by the electricity meter fitted near your house. There are analog meters which have number plates which rotate and record the reading. There are also digital meters which have a display screen which shows readings. Each month, previous month's consumption is measured and its bill is sent.
- There are many types of charges involved in calculation of the bill. We should be able to use simple mathematics to calculate what our total bill should be. If we find any errors, we can contact the authorities and get our bill corrected.

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Title of Activity

26. Making of a solar cooker

Syllabus reference and Standard concept / Principle:
Std. 6th - Work or Energy, Std. 7th - Energy,
Std. 8th - Alternative sources of energy

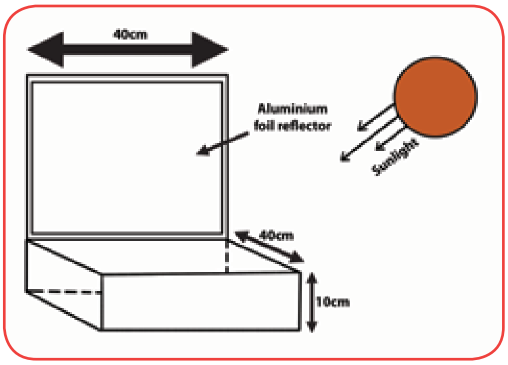
Material required:
Cardboard, Cardboard box, Aluminium foil, glue, black paint or black paper, transparent plastic lid, etc.

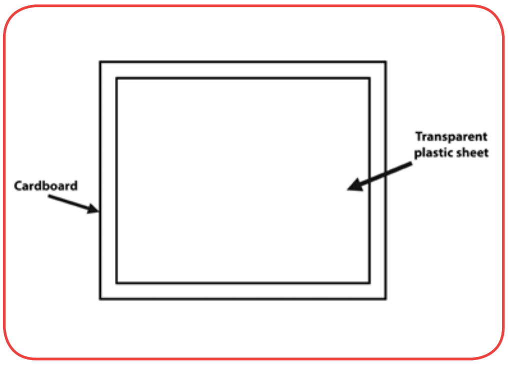
Tools required:
Scissor, paint brush, blade cutter, etc.

Time required: 60 Minutes
No. of students in class: 20 (No. of students in a group: 5)

Process:

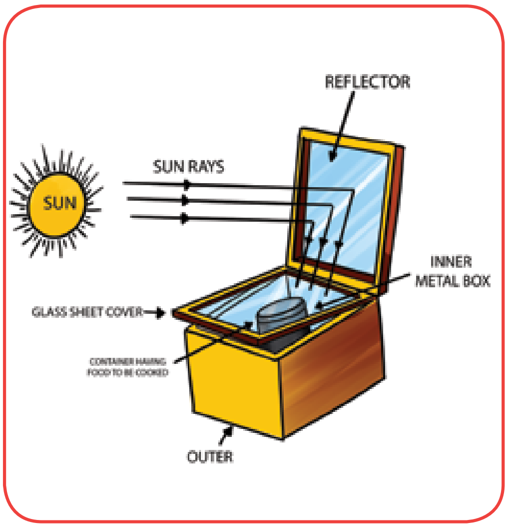
Part 1: Making solar cooker:





1. Cut four pieces of cardboard of 10 x 40 cm dimension and 1 piece of 40 x 40 cm dimension for bottom side or take a cardboard box of approximately similar size.
2. Apply glue to one side of each four carboard pieces and stick glued side with black paper or paint the inside of cardboard box with black paint.
3. Make a box by attaching the cut cardboard pieces together as shown in the image.
4. Make transparent plastic sheet to cover box using cardboard.
5. Cut a carboard of 40 x 40 cm to make reflector. Aluminium foil is pasted on one side of the cardboard sheet. This reflector is kept in standing position facing towards sun. Orient Aluminium foil in such a way that sunlight will get reflected inside the cooking chamber.

Part 2: Using solar cooker:



1. Place solar cooker in a place where there is no obstruction to sunlight.
2. Place a bowl filled with water in a cooker
3. Cover the cooker with transparent glass lid.
4. Aluminium foil reflector side is kept facing toward sun. Sun light should get reflected inside the cooking chamber.
5. Keep temperature records at regular intervals.

Observation:

Time when water bowl placed in cooker	Initial temperature of water	Record temperature at regular interval of 10 min		

Ask questions:

1. Where should we place a solar cooker?
2. How does solar cooker work?

Do's and Don'ts:

1. **How to organize activity:** Group students before starting the activity and then give them the instructions and materials.
2. **When to take activity:** Any time.

Summary / Principal / Knowledge gain:

Solar cooker works on the principle of reflection and concentration of sunlight to generate heat. Sun rays get reflected inside chamber. The energy is trapped inside the cooker using transparent sheet lid. Black paint is used to absorb the sunlight and aluminium foil is used to reflect sunlight.

The cooker made by us is to understand working principle of solar cooker. Standard cooker in the market uses Aluminium box, glass wool for insulation, glass to trap heat and black colored utensils. It is possible to cook dal – rice, roast groundnuts inside the cooler, in solar cooker available in market.

Resources:

- http://www.youtube.com/watch?v=v5CdNH3sQT0&t=149s

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Title of Activity

27. Making charcoal from biomass

Syllabus reference:
Std. 8th

Standard concept / Principle:
Charcoal and fossil fuel, Environmental consequences of fuel combustion

Material required:
Agriculture waste, leaves, etc. cow dung, wheat power, etc.

Tools required:
Old metal drum (barrel) or approx. max. 2 ft x 2 ft x 2ft chamber, Metal sheet of approx. same size to cover barrel / pit, etc.

Time required: 2 Hrs.
No. of students in class: 15-20 (No. of students in a group: 4-5)

Process:

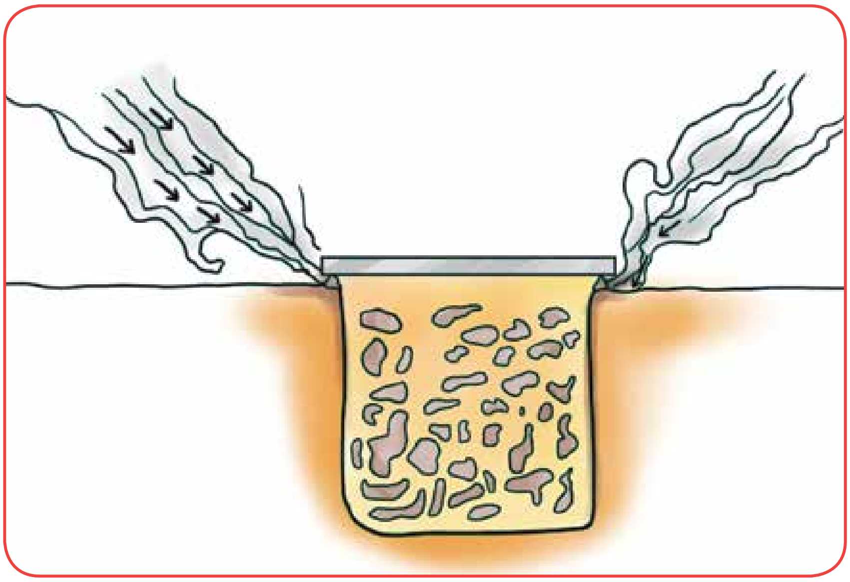
Charcoal is prepared by partial combustion of biomass. It is possible when insufficient oxygen is available.

Method 1: Combustion in barrel:

1. Make 10 to 15 small holes on barrel of 10 cm diameter.
2. Collect sufficient dried biomass from surroundings. It includes leaves, branches, agri waste, etc.
3. Fill the barrel with biomass. Press the biomass by applying pressure so that no empty spaces remain inside the tin can.
4. Put the barrel / pit on fire. Let the biomass burn slowly. It may take few hours. Put fire through holes on side as well
5. Remove the metal lid when the fire will cool down.
6. You will get black charcoal powder.
7. Mix charcoal powder into cow dung or wheat powder as a binder and make charcoal ball. You can give it the desired shape.
8. Keep charcoal ball on terrace for open sun drying.
9. Charcoal ball is ready to be used.

Method 2: Combustion in pit:

1. Fill the pit with biomass. Press biomass by applying pressure so that no empty spaces remain inside the pit.



2. Put the biomass on fire and put lid on the pit. Uneven land and metal lid allow limited oxygen to enter into the pit.
3. Remove the metal lid when the fire will cool down.
4. You will get black charcoal powder in the pit.

Ask questions:

1. What are advantages of using charcoal?
2. Why metal lid is kept on the barrel when fire is applied to biomass?

Do's and Don'ts:

1. **How to organize activity:** Group students before starting the activity and then give them the instructions and materials.
2. **Safety:** Ask all students to keep away from barrel / pit when it's on fire.
3. **When to take activity:** In Summer.

Summary / Principal / Knowledge gain:

- Charcoal is made from Biomass by process called pyrolysis. Pyrolysis is burning substances in absence of oxygen.
- Biomass charcoal use recycled agro waste as a raw material hance there is no loss to environment where as ordinary charcoal is made from burned wood directly.
- Carbon content in biomass charcoal is higher than that of the ordinary wood. Its calorific value is 7500-8000 kcal /kg where as ordinary charcoal has about 6500 kcal /kg.
- Biomass charcoal is easy to burn and it results in no smoke.
- Biomass charcoal can be made in uniform shape and structure. While ordinary charcoal is in uneven shape.
- Biomass charcoal takes longer time to burn as compared to ordinary charcoal.
- There are no chemical substances present in the biomass charcoal or it does not produce poisonous gases.
- Biomass charcoal is ecofriendly, ordinary charcoal can contribute to environmental pollution.
- Biomass charcoal is cheaper than coal.

Resources:

- www.youtube.com/watch?v=2H6L8Pn9VfM
- www.youtube.com/watch?v=YD5crG0xx6A

Q.R.Code

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Title of Activity

28. Paper electronics

(Introduction to circuits, basic electronic components and soldering)

Syllabus reference:

Std. 8th

Standard concept / Principle:

Introduction - electric circuit, Sources of current - battery, generator.

Material required:

Drawing paper Copper adhesive tape, 5mm LEDs, 3-volt lithium button battery or coin cell, pen, pencil, crayons, sketch pens, etc.

Tools required:

Scissor/paper cutter, soldering iron, etc.

Time required: 3 Hrs.

No. of students in class: 8-10 (No. of students in a group: 2-3)

Introduction:

Normally copper wires are used in making electric circuits. Copper wires are capable of carrying more current. Copper is good conductor of electricity. Hence, we can use copper adhesive tape for making different circuits with small current to understand the working of different electronic components. We can also make different greeting cards, crafts using paper electronics.

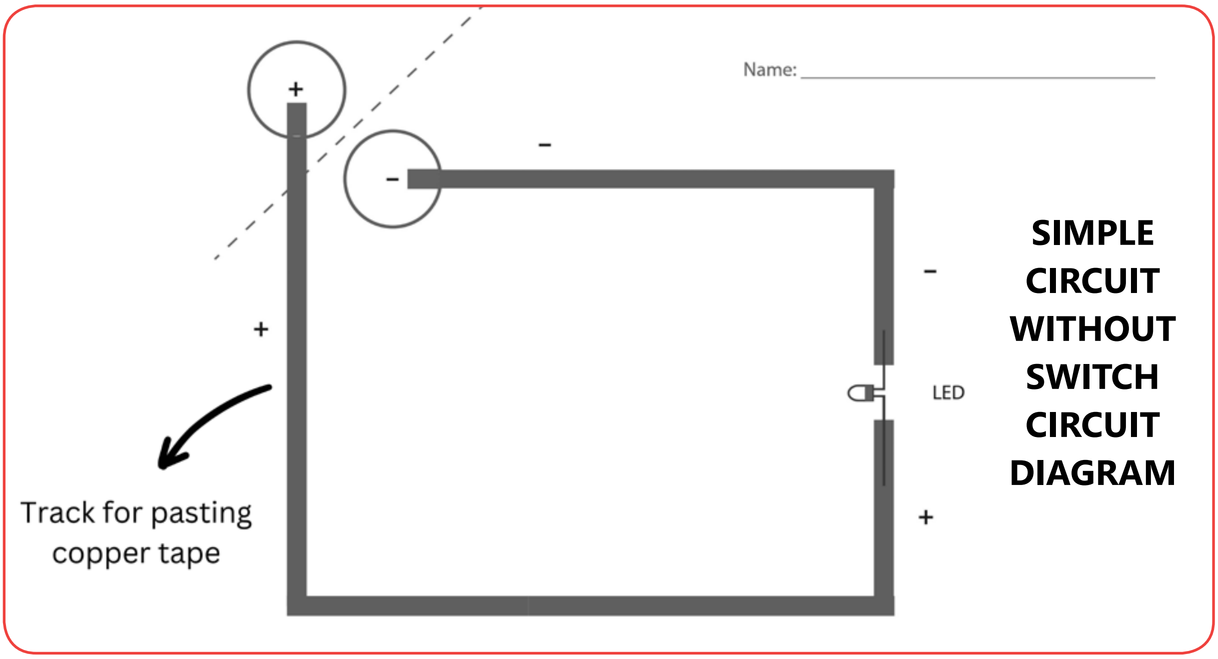
Process:

- Paper circuits are made with just a few simple items- Battery, copper tape, LED and many other electronic components like resistors, transistors, capacitors, LDRs, etc. It is easy to build different circuits.
- Download different papertronics circuits from the provided links and apply copper tape onto the circuit's line tracks. Utilize LED, buzzer, resistor, and capacitor as specified.

Sub Activity 1: Making simple circuit (with and without switch) using copper tape, LED and 3.3V coin battery.

A. Simple circuit without switch:

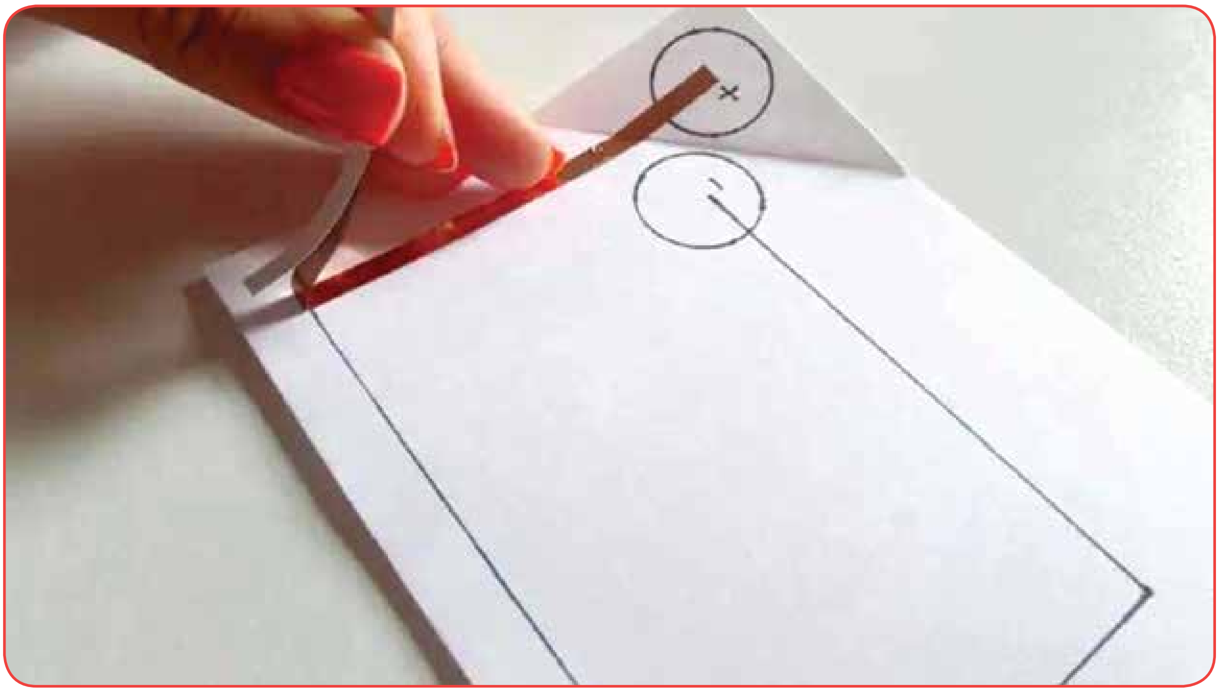
- Download template for simple circuit without switch by scanning either of the below two QR codes. You can also draw given simple circuit without switch using pen or pencil on drawing paper.



Q.R.Codes A1 A2

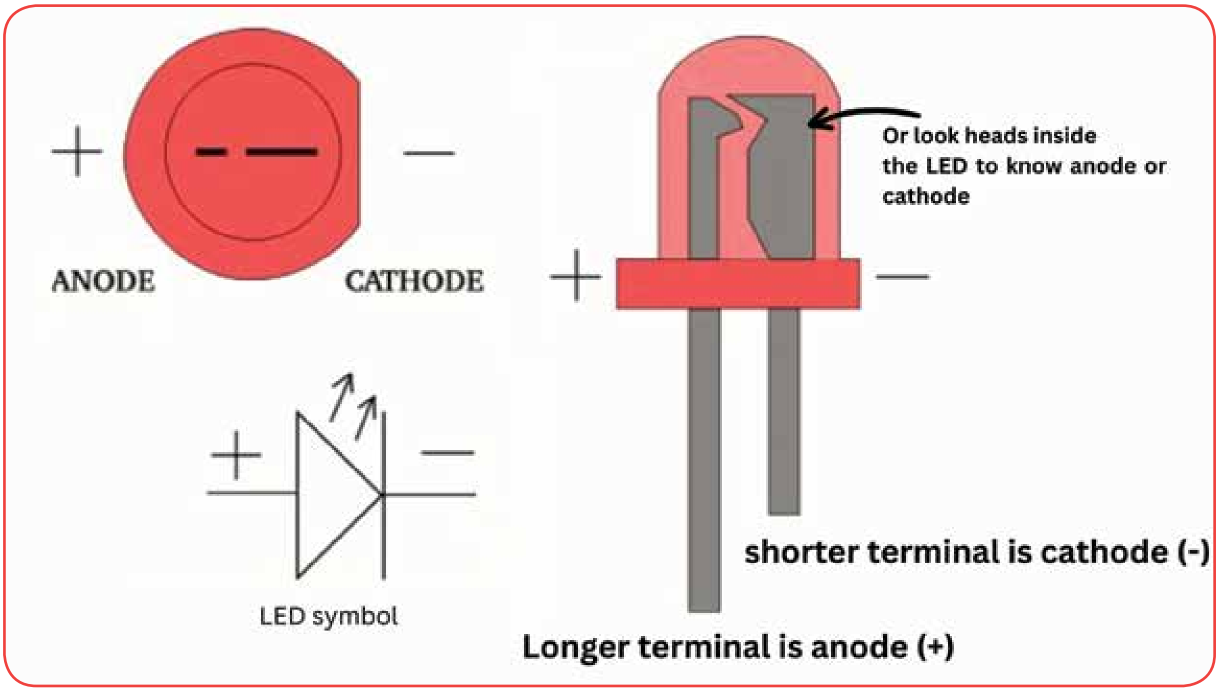
- Remove the paper backing from the copper tape and place copper adhesive tape gently on the track drawn (dark path) on the designed circuit as a conducting medium.

1



SIMPLE CIRCUIT WITHOUT SWITCH STEP 1

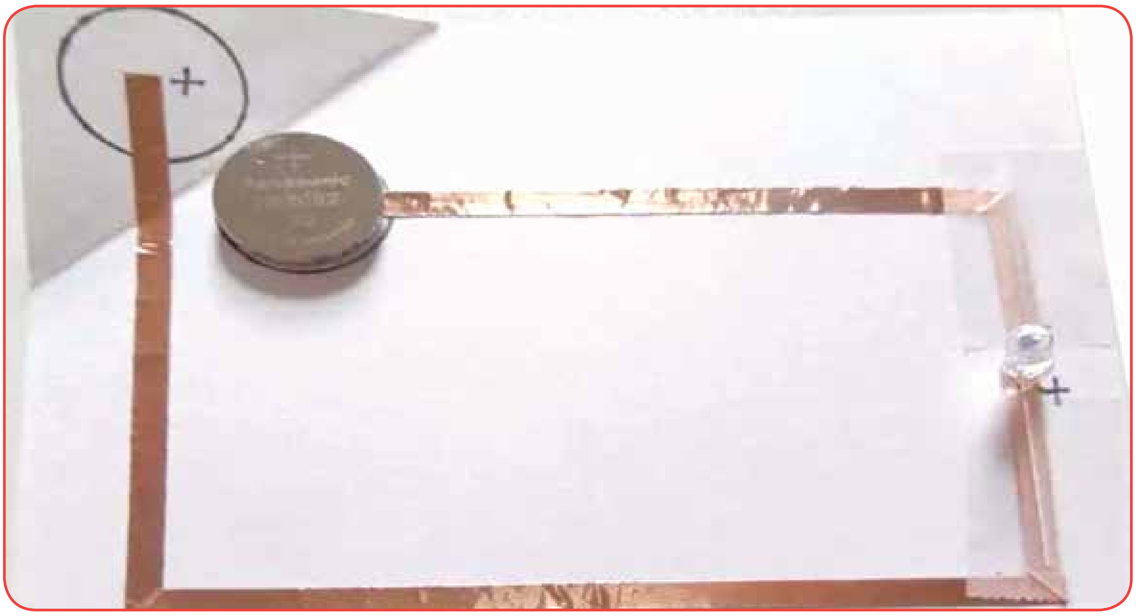
- Check the polarity of LED (Refer the image below) and then solder the terminals of the LED on the copper adhesive tape as per the polarity. Alternatively, fix both the terminals of LED with transparent tape as shown in the circuit.



LED TERMINALS

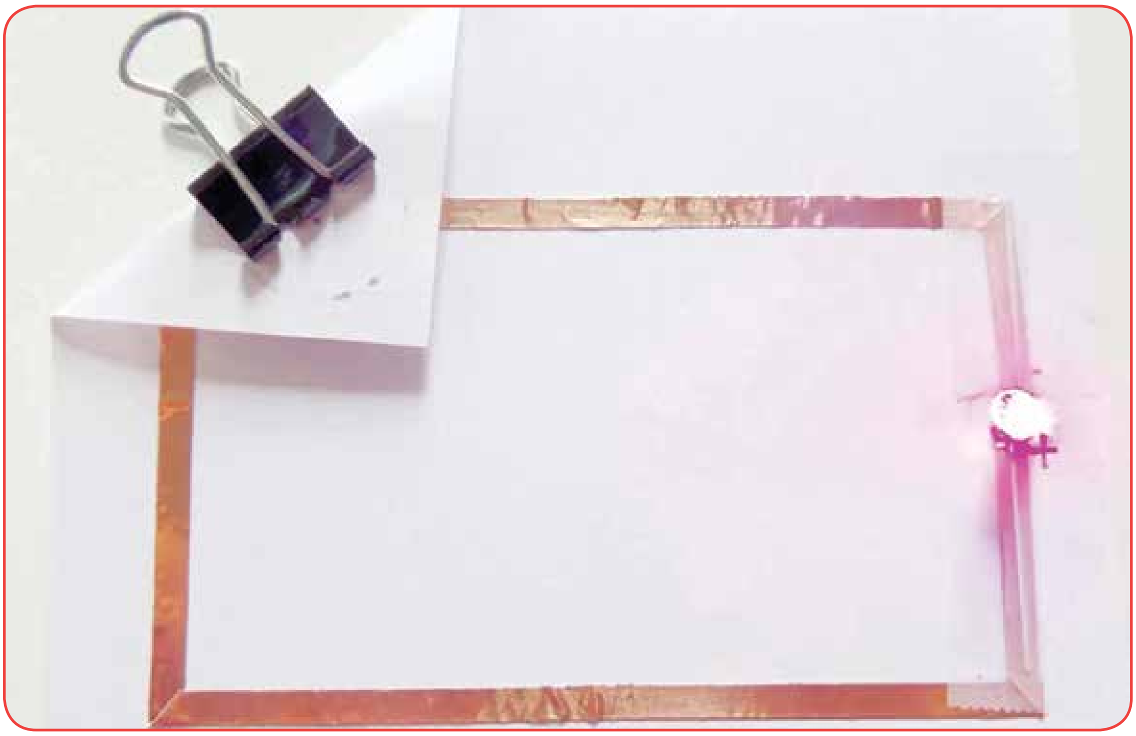
- Place 3.3V coin battery as pet the terminal. Anode of the battery facing upwards. As you fold the edge of the paper on the top left side as shown, the LED will turn ON. You can add binder clip to battery.
- When you don't fold the top left corner of the circuit over the battery, the circuit is called as open circuit. When you fold that portion or add a binder clip, the circuit is called as a closed circuit.

2



SIMPLE CIRCUIT WITHOUT SWITCH STEP 2

3



SIMPLE CIRCUIT WITHOUT SWITCH STEP 3

Note: If the LED is not turning ON, check the continuity of the copper tape.

B. Simple circuit with switch:

- You can make also add a switch to the above circuit and try turning LED ON and OFF with the use of switch added.
- Download the template for simple circuit with switch by scanning following QR code. You can also draw given simple circuit with switch using pen or pencil on drawing paper.

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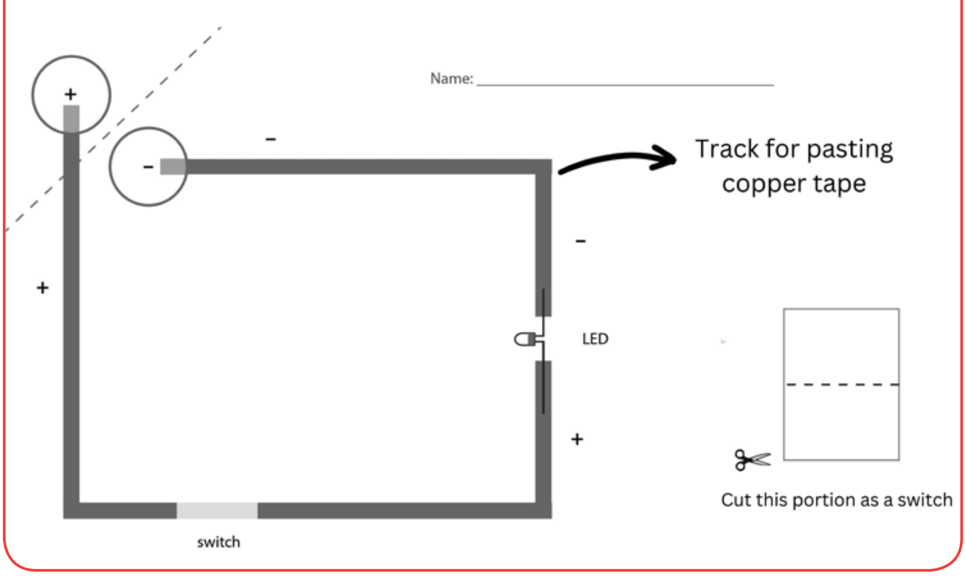
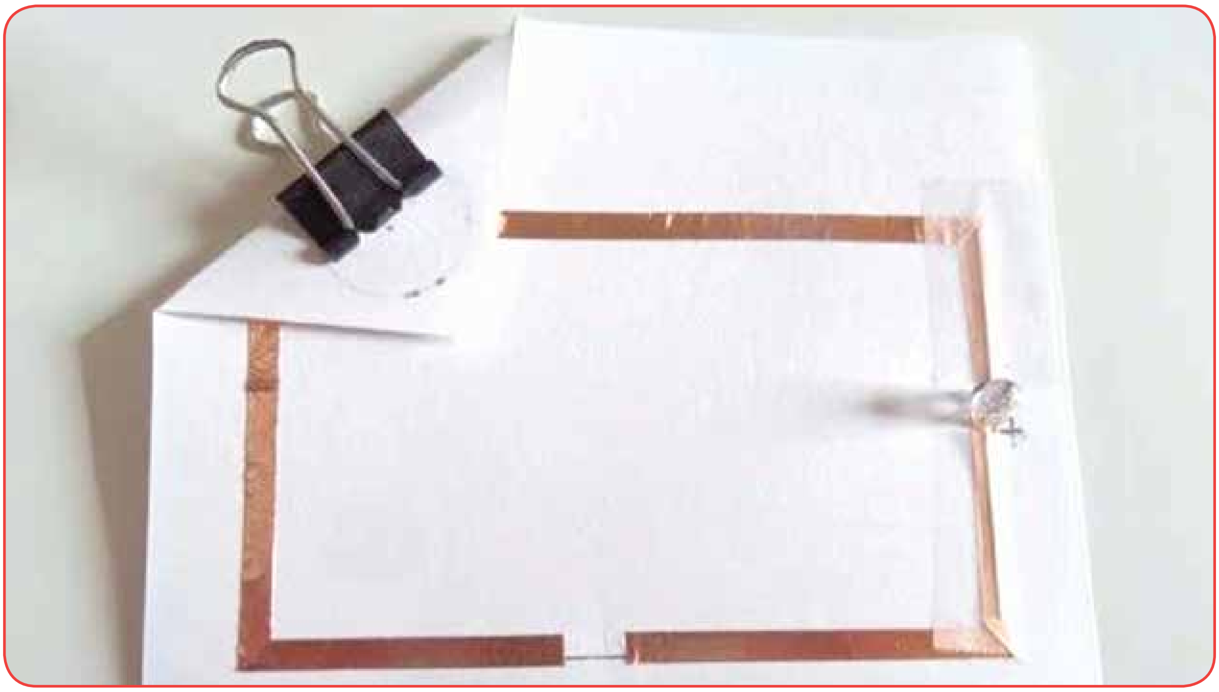
B

SIMPLE CIRCUIT WITH SWITCH CIRCUIT DIAGRAM



- Remove the paper backing from the copper tape and place copper adhesive tape gently on the track drawn (dark path) on the designed circuit as a conducting medium. Leave space for switch as shown below.

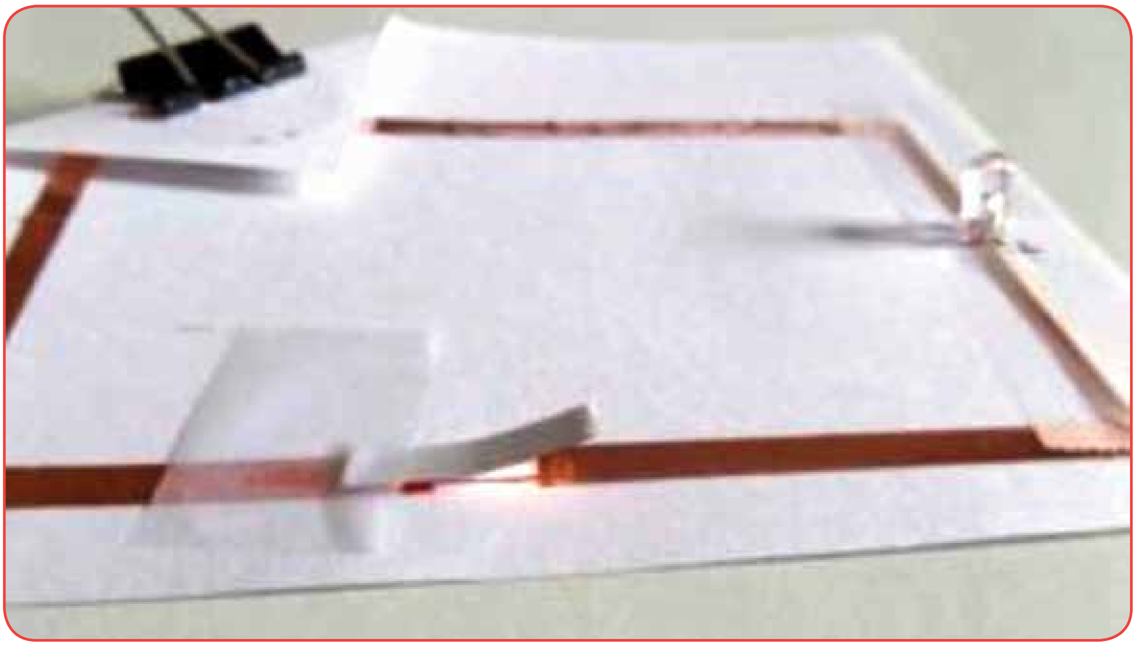
1



SIMPLE CIRCUIT WITH SWITCH STEP 1

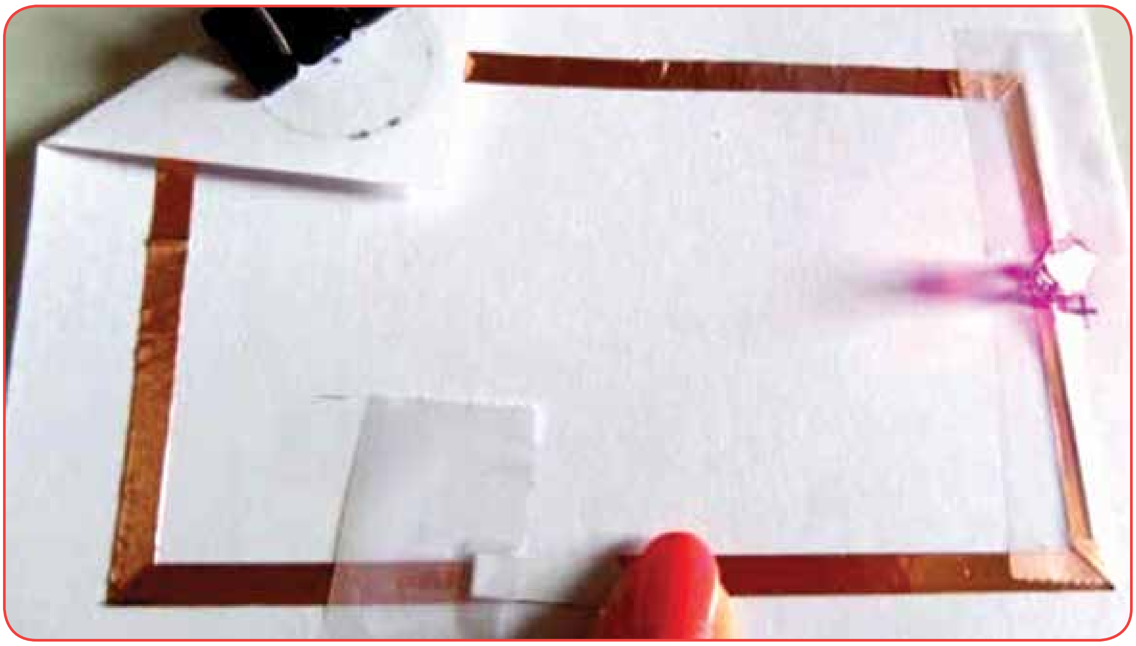
- Cut switch from the paper template and fold it on the dotted line. Stick one half of the switch on the circuit keeping remaining half portion of the switch (fold in upward direction) on the switch area marked on the circuit. On the second half part of the switch, stick a piece of a copper tape facing down as shown below.
- As you press the switch ON, the LED will turn ON as the circuit gets closed as shown below.

2



SIMPLE CIRCUIT WITH SWITCH STEP 2

3



SIMPLE CIRCUIT WITH SWITCH STEP 3

Note: If the LED is not turning ON, check the continuity of the copper tape. Instead of joining LED using cello tape, solder the LED terminals on the copper tape. Also, add a small solder on the joints of copper tape.

Sub Activity 2: Making series circuit using copper tape, LED and 3.3V coin battery.

- Download the template for series circuit (LEDs in series) by scanning following QR code. You can also draw given series circuit using pen or pencil on drawing paper.

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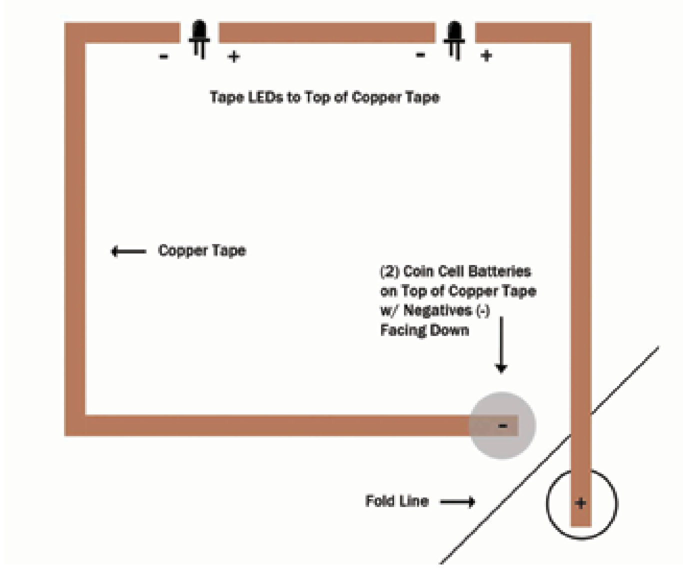
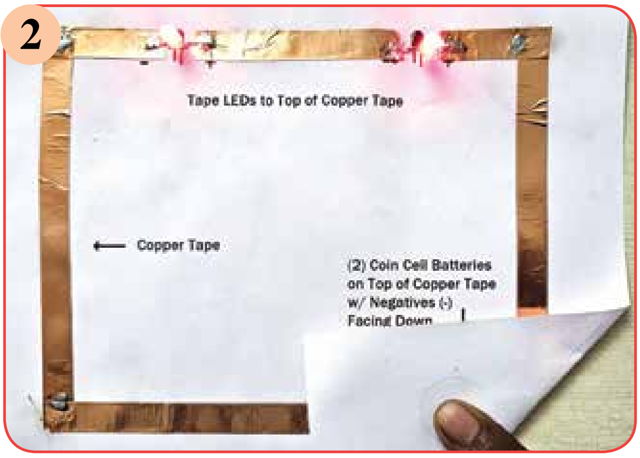
SERIES CIRCUIT DIAGRAM - LEDs IN SERIES



- Follow the same process to paste the copper tape and fix LEDs (after checking LED polarity) on copper tape. You can use cello tape or solder the LEDs.
- Add **two 3.3V coin batteries** and fold the corner to turn the LEDs ON. Two 3.3V coin batteries to be kept on top of each other (positive terminals of both batteries facing upwards).

SERIES CIRCUIT DIAGRAM - LEDs IN SERIES STEP 1

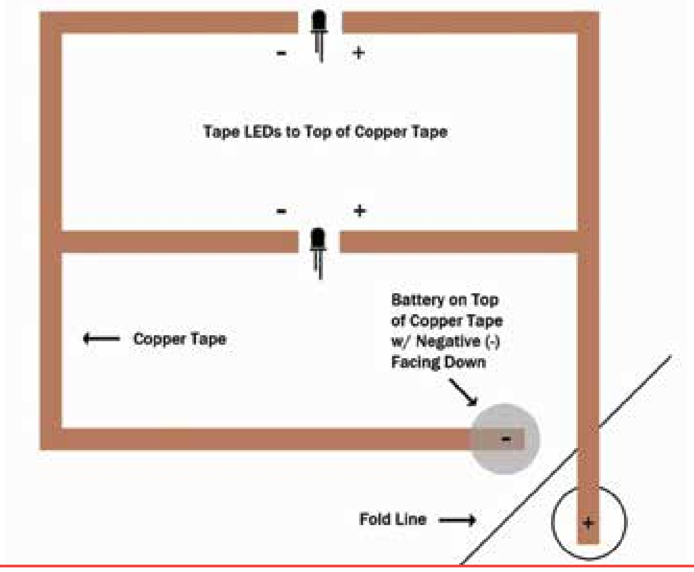


SERIES CIRCUIT DIAGRAM - LEDs IN SERIES STEP 2

Sub Activity 3: Making parallel circuit using copper tape, LED and 3.3V coin battery.

- Download the template for parallel circuit (LEDs in parallel) by scanning following QR code. You can also draw given series circuit using pen or pencil on drawing paper.

PARALLEL CIRCUIT DIAGRAM - LEDs IN PARALLEL



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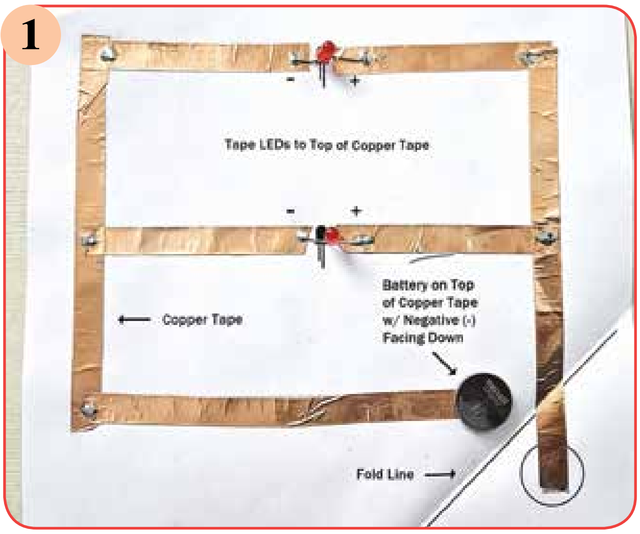
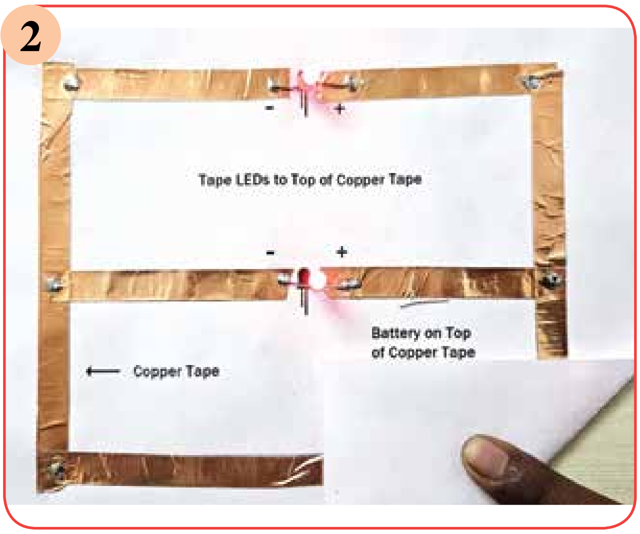
- Follow the same process to paste the copper tape and fix LEDs (after checking LED polarity) on copper tape. You can use cello tape or solder the LEDs.
- Add **one 3.3V coin battery** (Positive terming facing up) and fold the corner to close the circuit and see the LEDs turning ON.



PARALLEL CIRCUIT DIAGRAM - LEDs IN PARALLEL STEP 1



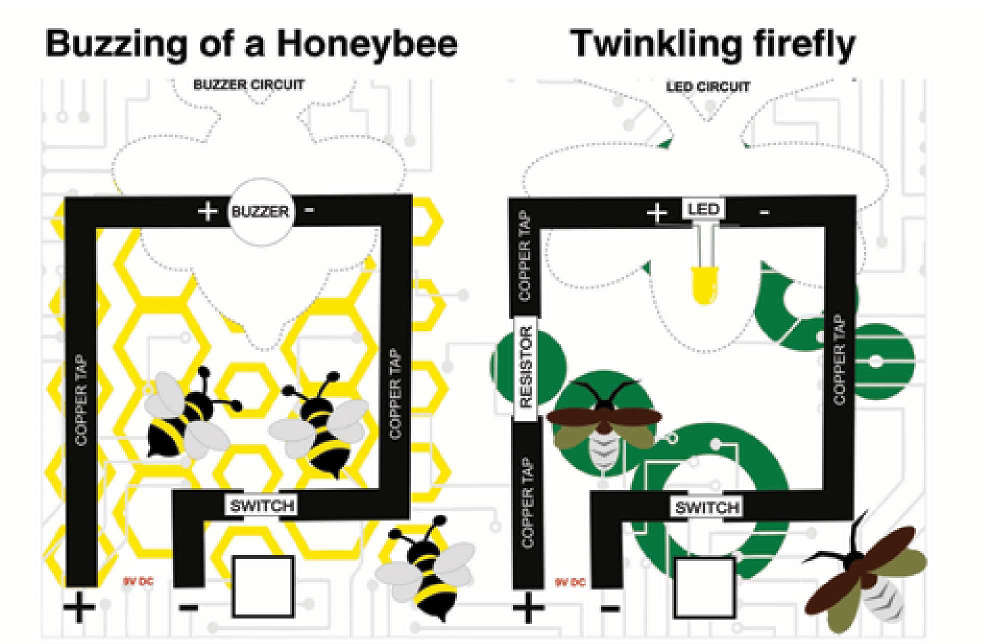
PARALLEL CIRCUIT DIAGRAM - LEDs IN PARALLEL STEP 2

Sub Activity 4: Making some other creative and artistic circuits using copper tape, buzzer, LED, resistor and 9V battery to demonstrate the buzzing sound of a honeybee and twinkling light of a flrefly.

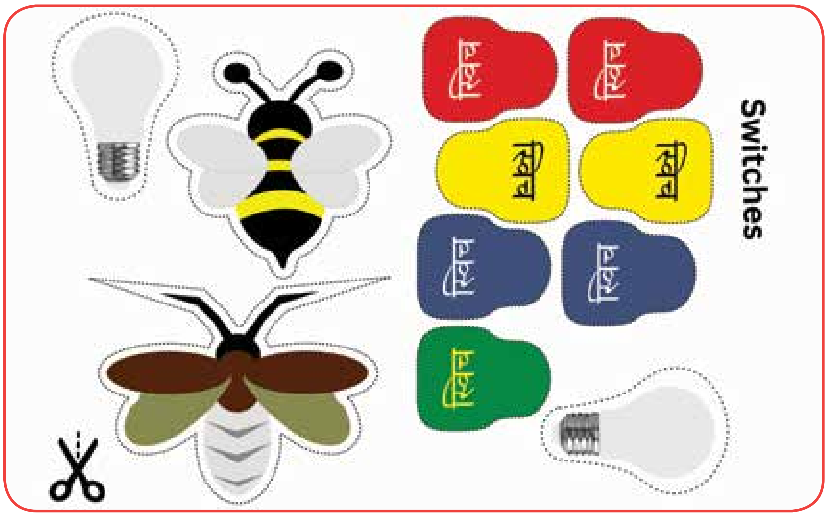
- Download the template for these circuits (buzzing honeybee and twinkling firefly) by scanning following QR code. You can also draw given series circuit using pen or pencil on drawing paper.

Q.R.Code

CIRCUIT FOR BUZZER AND LED (HONEYBEE AND FIREFLY) DIAGRAM



- Follow the same process to paste the copper tape and fix LED and buzzer (after checking LED and buzzer polarity) on copper tape.
- Add switch as instructed earlier. You can cut switches from the template as shown. For firefly circuit, you need to add one resistor of 220 Ohm in the circuit.

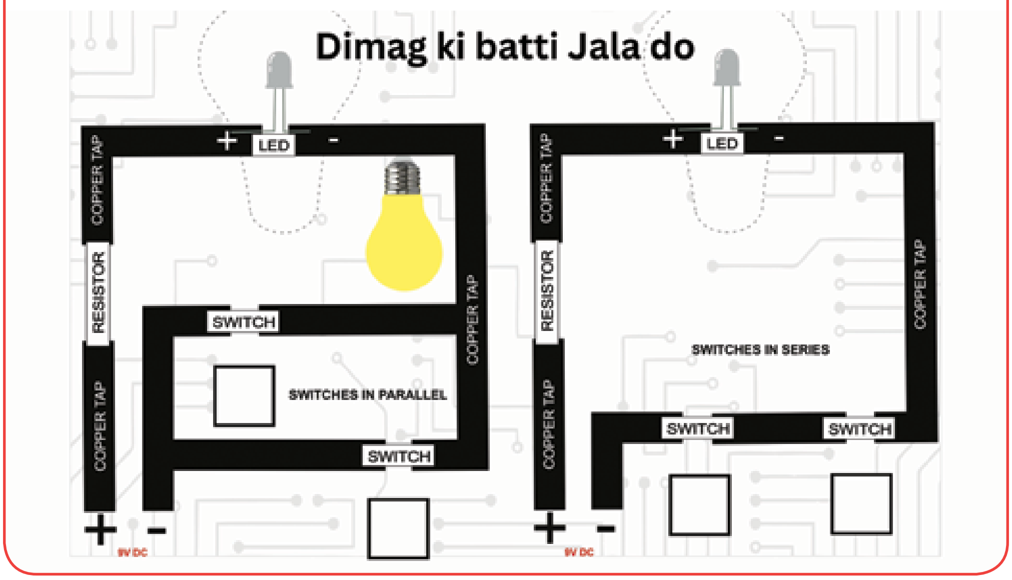


- Use 9V battery with a battery clip to check the LED and buzzer turning ON.

Sub Activity 5: Making circuits with switches in series and parallel.

- Follow the same process as mentioned in all above sub-activities for pasting copper tape and fixing LED and resistor.
- Here switches are in series and parallel. Check what happens when one switch is OFF in both the cases.

CIRCUIT FOR SERIES PARALLEL SWITCHES DIAGRAM



Ask questions:

1. What is a circuit?
2. What are different types of circuit?
3. What are different methods of making a circuit?
4. What are the different materials used in making a paper circuit and circuits made using other methods?
5. Why series circuit is called as a series circuit and why parallel circuit is called as a parallel circuit?
6. How else can you use paper circuits?
7. What will happen when we change polarities?
8. What happens when the battery is connected, and switches are pressed?
9. Why is it important to overlap the copper tape strips well when pasting them?

Do's and Don'ts:

1. **How to organize activity:** Group students before starting the activity and then give them the instructions and materials.
2. **Safety:**
   - Do check your circuit diagrams, polarities of components twice before making connections.
   - Take a precaution while doing soldering.

- Instructor has to help student to solder the connection safely.
- Soldering guns are hot and students to handle them under the supervision of the instructor.
- Use of stripper or utility knife should be done under supervision.
- Do not try paper circuit with AC supply.
- Do not rush while doing these circuits. Check your surrounding while handling the soldering gun, scissors and paper cutters.

3. **When to take activity:** Any time.

Summary / Principal / Knowledge gain:

We learned how to make a circuit using the components like copper tape, paper, battery and basic components like LEDs. We also learned how to use soldering gun. Apart from this, things to revise- The material that allows electrical current to flow is called conductor while insulator is material that restrict current to flow. We are using copper tape instead of wires. It is possible to make flexible circuits, festive greeting cards or any other craft using your creativity using copper tape.

Resources:

Q.R.Codes

✵ ✵ ✵

Title of Activity

29. Automation of classroom light as per the ambient light

Syllabus reference:

Std. 8th

Standard concept / Principle:

Technology around us

Material required:

100k ohm preset, 1K ohm resistor, 1N 4007 diode, LDR 5mm, BC 547 transistor Qty. 2, 2 x 4 PCB, 9V battery with snapper, 1 Qty. 5V relay (1 each or 1 per group)

Tools required:

Soldering gun with stand, soldering metal, wires, wire nipper, wire stripper, etc. (1 setup for 2-3 students). digital multimeter if needed.

Time required: 1 Hr. - Theory, 3 Hrs. - Practical

No. of students in class: Max. 15 (No. of students in a group: 2-3)

Theory:

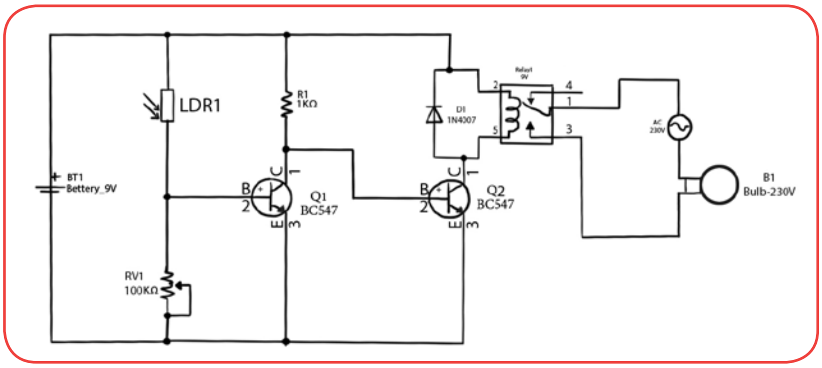
In this activity we are going to make an automated light in our classroom, which will operate as per the ambient light condition.

In this activity we will need a sensor which will convert ambient light into electrical signal which can be used to control the relay. The LDR uses cadmium sulphide track which decreases its resistance when light falls on it and increases its resistance when it's dark around it. This track can be seen on the LDR if you watch it carefully. Relay is a device which is an electromagnetic switch which means that when current flows through its coil it will connect or disconnect the mains supply.

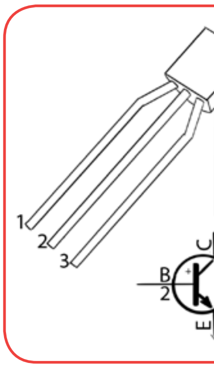
If you look at the circuit diagram there is LDR which is connected to preset RV1, this created a voltage drop at the base of transistor Q1. When light falls on LDR the resistance of LDR decreases and more current flow through the base of Q1. This will switch on the Q1 transistor and this decreases the current flowing through the base of transistor Q2. This will switch off this transistor to cause change in state of relay. We can connect the Tube light to the relay to switch it on/off as per our requirement.

Practical:

- Draw the circuit on the PCB so it will be easy to place the components.
- Begin with preset and LDR and solder them using the soldering gun and metal. The components should firmly attach the PCB. Now proceed with the remaining components transistor BC547 and the relay. Connect the components to each other as per the diagram.
- Then we have to connect 2 wires to the relay. There wires are from the tube light/bulb.



CIRCUIT DIAGRAM OF AUTOMATIC STREET LIGHT CONTROLLER USING LDR



BC-547	
1	Controller
2	Base
3	Emitter

BC 547 TRANSISTOR PINOUT

Observation:

1. Check whether our system works in the day/night as per the requirement.
2. If the system is not switching at a particular light condition then change the preset value to obtain exact results.

Ask questions:

1. What is the effect of dark/light on LDR?
2. Can we make a circuit which will perform exactly the opposite function?

Do's and Don'ts:

1. **How to organize activity:**
   - Group students before starting the activity and then give them the instructions and materials.
   - Identify the tube light which needs this automated circuit. It will help us save energy if the light is ON during the daytime.
2. **Safety:**
   - Assume all soldering guns to be hot. When you are working with the high voltage AC make sure that the supply is off, wear shoes and insulate the wires after connecting them. Teacher should assist the students while working with 230V AC.
   - This circuit can be used for automating lights in corridor, street lights, etc.
3. **When to take activity:** Any time.

Summary / Principal / Knowledge gain:

- We are using few resistors in our circuit; a resistor provides resistance to electric current, which can be of different values. So we need to understand the color coding scheme on the resistors. Value of a resistor can be identified from the color band printed on resistor. There are resistor color code calculators available on the internet that can be used to find out the value of resistor.
- LDR is used to automate circuits which depend on intensity of light.
- We can automate other electrical devices like motor, alarm, etc. instead of tube light.
- Automation helps in preventing unnecessary wastage of energy.
- Resistance is used to control electrical current in the circuit.
- Transistor is used to amplify or switch electrical signals.

Q.R.Code

Title of Activity

30. Using smartphone as an equipment and a laboratory tool

Syllabus reference:
Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:
Light, Sound, Measurements, Quality of air

Material required:
Smartphones

Tools required:
-

Time required: Hrs. As per Student's recognisation
No. of students in class: 12-15 (No. of students in a group: 3-4)

Process:

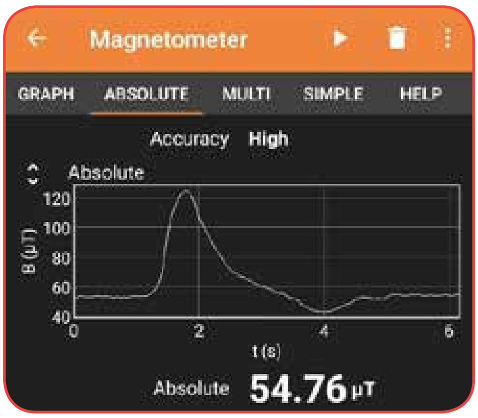
Smartphone as a measuring instrument: The modern smartphone has many sensors built inside it for various reasons. These sensors help the phone sense light, sound, orientation, location, movement, pressure, magnetism, etc. There are various apps available on the internet which take advantage of these features to turn the smartphone into a measuring instrument. These apps give you direct data from the sensors as well as processed data.

There are various such free or paid apps available on play store. We will see one such app named 'phyphox' as an example.

There are 7 measurements related to 7 sensors. If any sensors are not present in the phone, that option is unavailable.

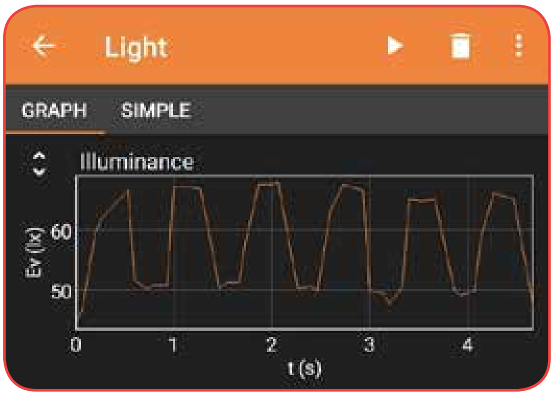
Example 1. Magnetometer measures the magnetic field near the phone. When a magnet is brough near the phone and then taken away, following live graph is seen on the screen. The unit of magnetism is 'micro-Tesla'. This can be used for performing experiments related to magnetism and electromagnetism.

Activity: Take a magnet and find out how strong its magnetic power is. Heat it for some time, then again check its magnetic power again.



Example 2. Light sensor measures the brightness of light falling on the phone. When a light is turned ON-OFF-ON-OFF... in front of the phone, the following graphs is seen. Brightness is measured in 'Lux' units.

Activity: Use this sensor to measure light intensity inside and outside your classroom. Find out how much light is required to have sufficient light inside the room.



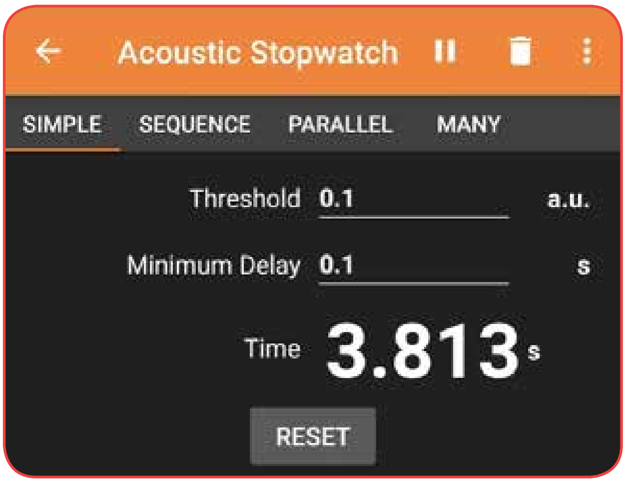
Time (s)	Illuminance (lx)
0.000438493	44.61750031
0.06710443	46.7100029
0.200436357	59.46750259
0.267102399	61.96500397
0.40043443	64.39500427
0.533766305	66.55500031

For all sensors, not only graphs can be seen, but all the data in the form of numbers can also be taken out as shown in the image. This can be useful for advanced analysis.

This all might seem complicated, but these sensors can be used to make difficult tasks easier by using clever options in the app. For example,

Example 3. The app has a 'acoustic stopwatch' which uses sound to start and stop a timer. When a loud clap or any loud noise is heard, the stopwatch starts. When another loud noise is heard, it stops.

Activity: This can be used to measure time for running races. Arrange a race and use this app.



There are many such tools built into the app, such as GPS location, audio level meter, motion stopwatch, magnetic ruler, optical stopwatch, etc.

Example 4. There are also some other apps such as 'compass' which are used to detect north direction.

Activity: Use this app to find which is the north direction inside your classroom.

Example 5. 'Sound meter' is an app which can measure sound levels and alert you when it is too high. It has scales to indicate which noise produces how many decibels of sound.

Activity: Use this app during festivals and celebrations to detect when noise levels get too high. In such cases, ask for the volume to be turned down.

Smartphone/ Computer as data source:

In the above section, we saw how to use smartphone as a measuring instrument. But there are various satellites and sensors that are being used globally. There are many websites and apps which provide that data to us which we can see and take information.

Example 1. Google Maps to find location, measure distance, and find out area.

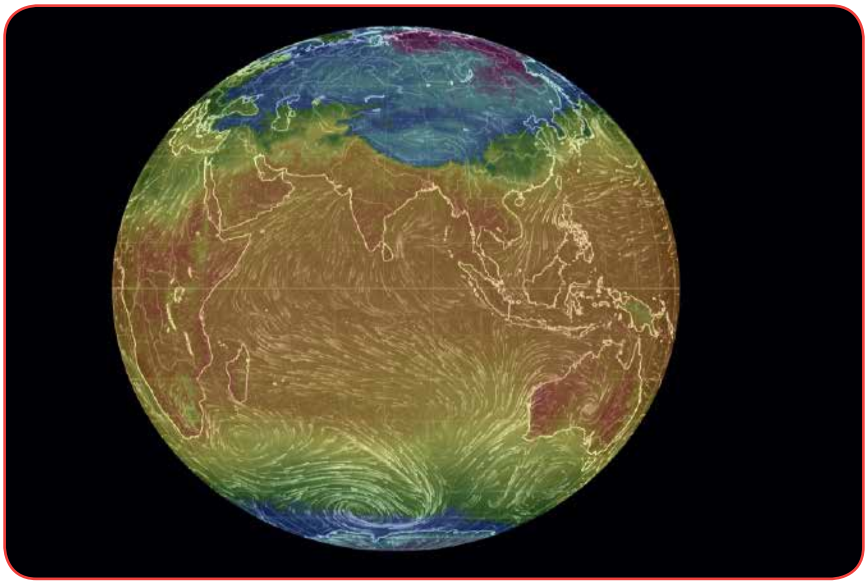
Visit www.google.com/maps. GPS (Global Positioning System) is a system used to find coordinates- latitude and longitude, of a location. Latitude tells how far north or south of the equator (-90° to 90°). Longitude tells how far east or west of the prime meridian (-180° to 180°).

In this image, one school 'P.S. Dilra Raipur' is searched on google maps. Right-click on the school to find its GPS coordinates (28.82199,78.83602). You can click on 'Measure distance' to measure distances and calculate areas, as shown in image two. The perimeter of school is around 79.42m and area is around 232.49m^2.

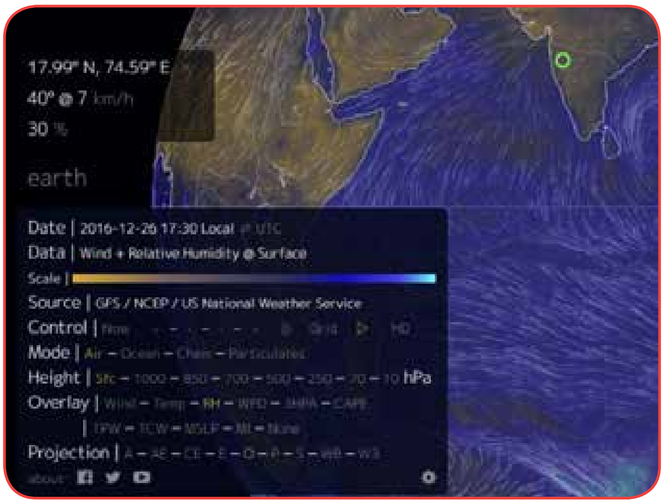
Activity: Find the location of your school and measure its area, perimeter, distance from nearest school.

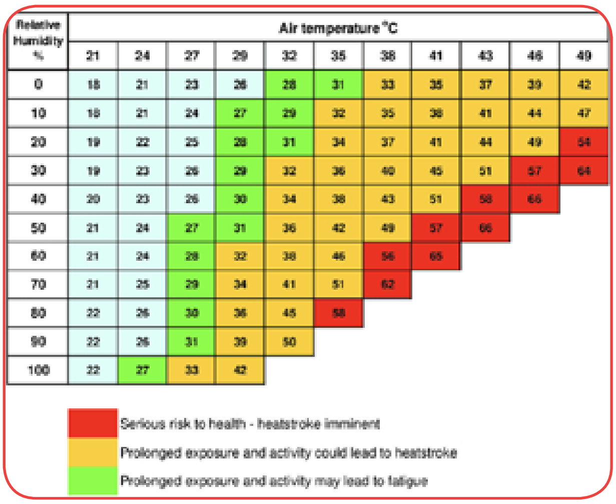
Example 2. 'Earth nullschool' for seeing weather patterns.

Visit www.earth.nullschool.net to look at the whole earth and see weather parameters such as temperature, wind speed, humidity, pollution level, ocean currents, etc.



Activity: Temperature and humidity information can be obtained for any location by clicking on it and selecting option. Make a 'weather board' in your school to write and show today's temperature and humidity. If humidity and temperature are very high, there are chances of heatstroke. Issue warning to your fellow students in such cases by referring to the table below.





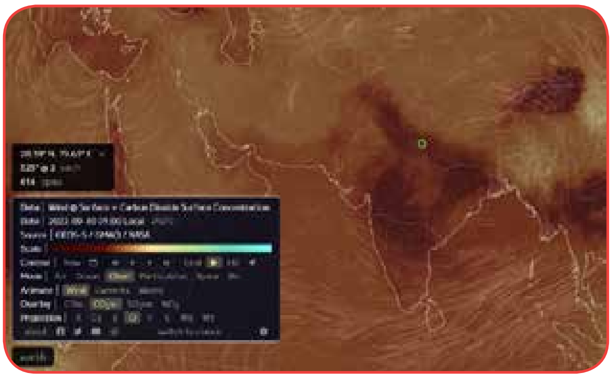
Relative Humidity %	Air temperature °C										
	21	24	27	29	32	35	38	41	43	46	49
0	18	21	23	26	28	31	33	35	37	39	42
10	18	21	24	27	29	32	35	38	41	44	47
20	19	22	25	28	31	34	37	41	44	49	54
30	19	23	26	29	32	36	40	45	51	57	64
40	20	23	26	30	34	38	43	51	58	66	
50	21	24	27	31	36	42	49	57	66		
60	21	24	28	32	38	46	56	65			
70	21	25	29	34	41	51	62				
80	22	26	30	36	45	58					
90	22	26	31	39	50						
100	22	27	33	42							

Serious risk to health - heatstroke imminent

Prolonged exposure and activity could lead to heatstroke

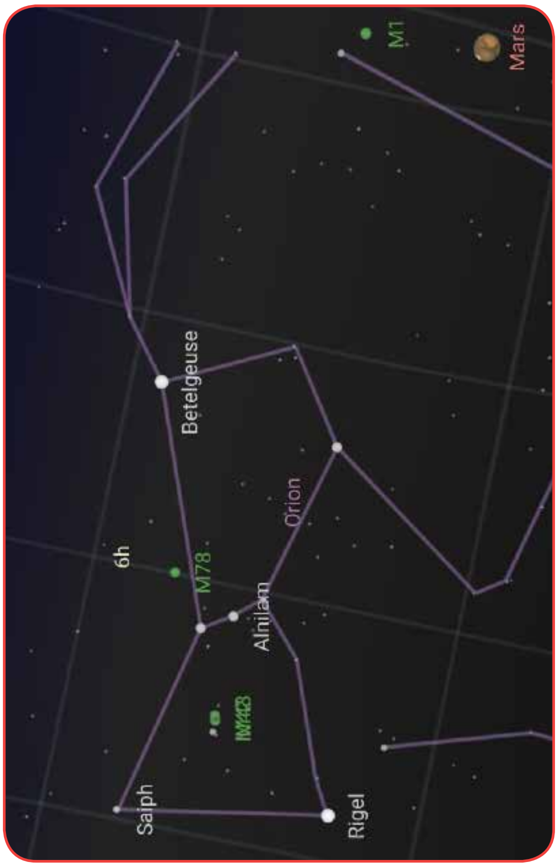
Prolonged exposure and activity may lead to fatigue

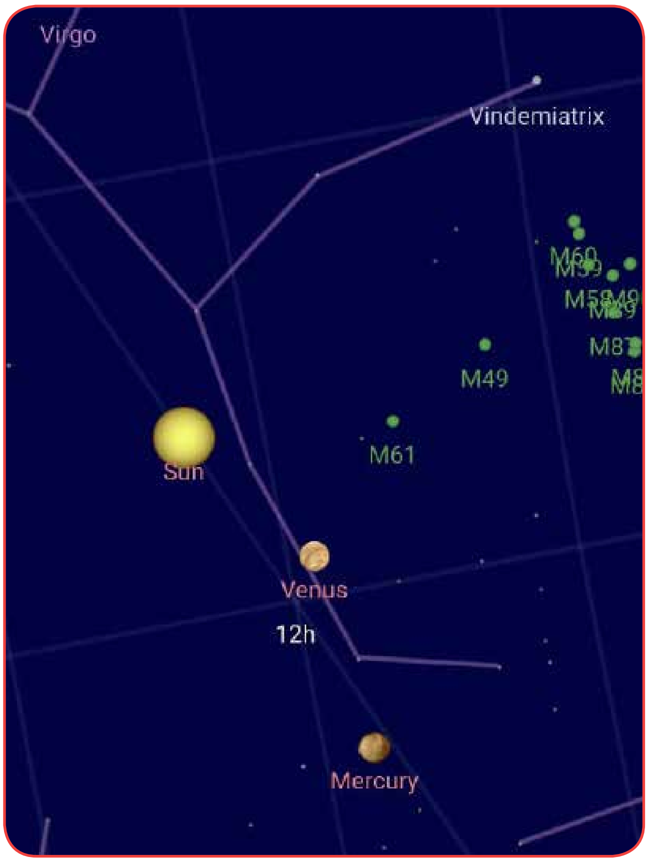
You can also track CO_2, SO_2 pollution levels near your village and issue warnings if levels are too high.



You can also track the status of hurricanes and cyclones. In the image you can see 'hurricane Ian' near USA.

Example 3. 'Sky Map' app for observing live locations of planets, stars, galaxies, meteor shower, etc.





On Sky Map app on phone, you can view objects in the sky live. Planets, constellations in the direction the mobile is pointing are shown on the screen. If there are comets, that can also be seen.

Acitivity: In the night, identify constellations by naked eye and then confirm using the app. Note down rising and setting times of various planets.

Ask questions:

1. Which appliances in your house have a magnet inside? Measure using a sensor.
2. How fast can you clap twice? Measure using 'acoustic stopwatch'.
3. What is the location of Taj Mahal? Use google maps to find out.
4. What is the difference in humidity and temperature in Lucknow and Itanagar (Arunachal Pradesh's capital) right now? Use earth.nullschool.net to find out.
5. In which constellation the sun is right now? Use Sky Map to find out.

Do's and Don'ts:

1. **How to organize activity:**
   - Group students before starting the activity and then give them the instructions and materials.
   - Go slowly. Introduce an app/ website, then conduct the activities. Let students familiarize themselves to it. Then move on to next one.
2. **When to take activity:** 'Sky Map' can be used when meteor showers, eclipses are happening. 'Earth.nullschool' can be introduced after/ during a weather calamity/ danger in India. 'Sound meter' can be introduced before the loudest festivals.

- **Use:** All these apps are useful in their own regard. They act as a portable mini-laboratory. They can be used anytime, anywhere.

Summary / Principal / Knowledge gain:

Many measurements that need to be done can be done using smartphone and internet. If we use these technologies smartly, they can be powerful tools. The tools can be used for exploration of the world around us.

Resources:

Q.R.Codes

Title of Activity

31. De-construct, Re-construct & repair, Re-purpose & create (Tod-Fod-Jod)

Syllabus reference:

Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:

Science- Electricity, Batteries, Solar energy and so on.

Material required:

Old cloth for cleaning purpose, old equipment in not-working condition, etc.

Tools required:

Wrench set, Allen key set, screw driver set, meter tape, digital multimeter, cutter, stripper, WD-40 liquid spray or you can alternatively use petroleum jelly, grease, machine oil, etc.

Time required: 3 Hrs.

No. of students in class: Max. 15 (No. of students in a group: 5)

Process:

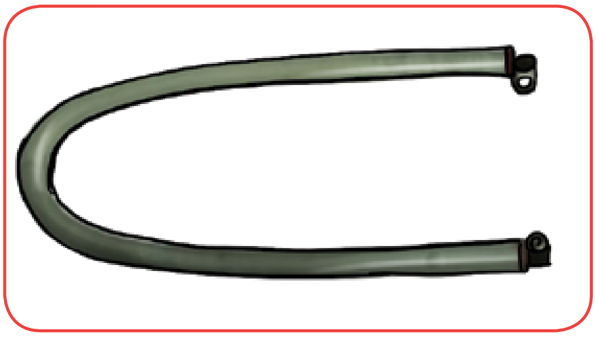
Through 'Tod-Fod-Jod' (De-construct, Re-construct and repair, Re-purpose and create) activities, children will learn how mechanical, electronic and electrical systems integrate together in different devices and equipment to make human's daily activities easier. Through this activity, students will be able to learn how to assemble/connect various parts and components of equipment by understanding their working principle, the scientific concepts behind these equipment and objects.

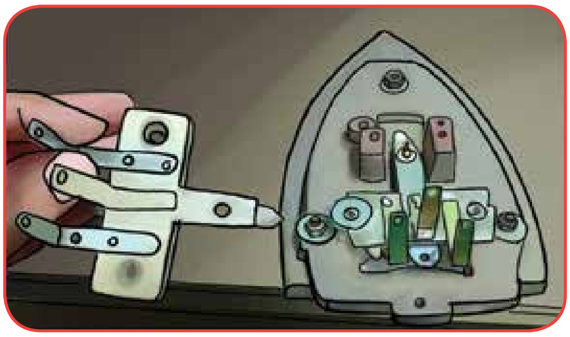
De-construct, Re-construct and repair, Re-purpose and create (DR2/Tod-Fod-Jod):

1. Collect unused household appliances.
2. Teachers/instructors will encourage students to open such unused devices.
3. Use appropriate tools to open the appliance.
4. List the different parts and components while separating them.
5. Keep the removed parts properly and neatly. You will need these parts while reconstructing the device again. Use trays, boxes to keep smaller parts like screws, nuts, washers, etc.
6. Understand the mechanism and function of these parts/components.
7. To know the function, structure, mechanism of each part and to know more information about them, use internet, Google, YouTube, etc.
8. Assemble the device again after repairing it.

Example:

- A device for ironing clothes (press) (see picture.)
- For example, we can understand the different parts of an iron (press) and its function as follows:





Name of the part	Function of the part
Thermostat	Bimetallic (made of two metals) strips are used in the thermostat. The thermostat keeps the press heated to the desired temperature level.
Heating coil	Converts electrical energy into thermal energy. This plate removes wrinkles from clothes.

Below is the table describing a few equipment and their major parts:

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

Ask questions:

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

Do's and Don'ts:

1. **How to organize activity:**
   - Collect old electric appliances.
   - Provide appropriate tools and equipment to open and re-assemble the devices including trays, boxes, old cloth, etc.
   - Let student open the appliance by themselves.
   - Let student write down their understanding in tabular formats given above.
2. **When to take activity:** Anytime.
3. Do not connect faulty equipment to the power supply.
4. The instructor/teacher should be personally present during the entire activity.
5. If necessary, label the wire so that the wire does not get interchanged.
6. Keep the removed parts properly and neatly. You will need these parts while reconstructing the device again.
7. The number of students in a group should not exceed 5.

Summary / Principal / Knowledge gain:

1. Students will be able to understand the working of various equipment.
2. With the help of internet, you will be able to understand the working and repair of the equipment.
3. Many times discarded equipment parts can be reused for other science projects like DC fans, motors, cables, etc.

Resources: Q.R.Codes

Title of Activity

32. Making of a ‘soak pit’

Syllabus reference:
Std. 6th

Standard concept / Principle:
Health and Hygiene

Material required:
Broken bricks, coarse sand, etc.

Tools required:
Meter tape, digging tools Hoe, head pan, digging bar, etc.

Time required: 3 Hrs.
No. of students in class: Max. 20 (No. of students in a group: 5)

Introduction:

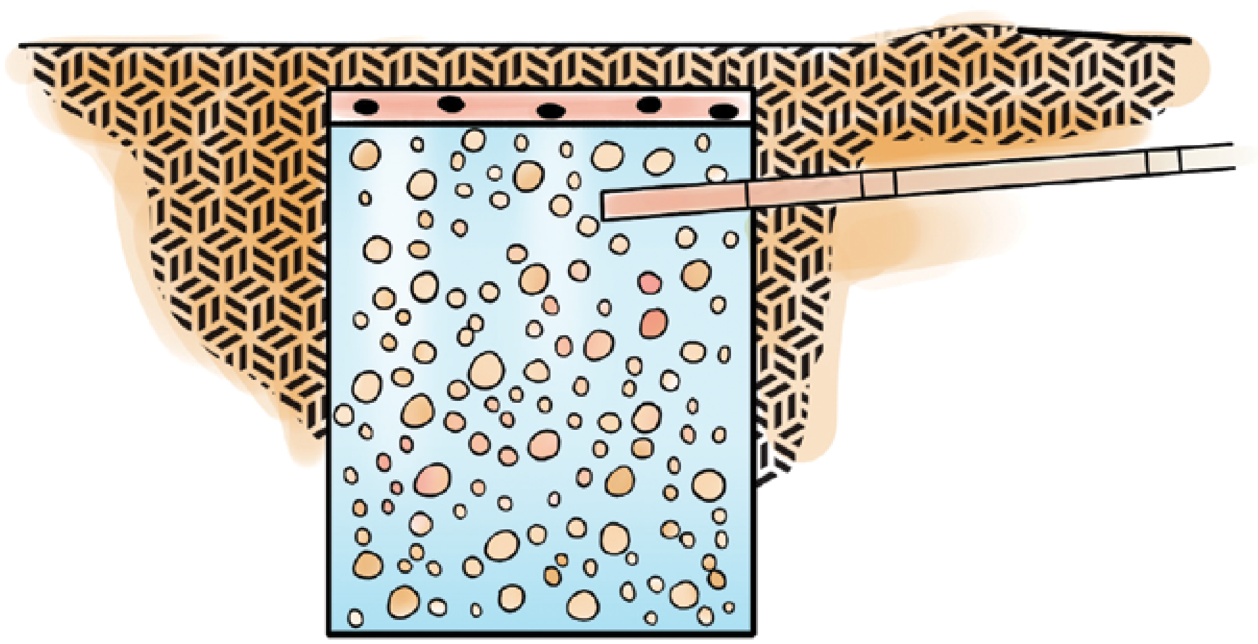
Soak pit is made to soak run off water or grey water. It will be useful to keep area around washing places clean.

Location:

Soak pit must be made where used water gets accumulated for example near handpump, washing area, bathroom drainage water, water discharge of cleaning utensils. Soak pit to be made at least 5 meters away from borewell or well. It also has to be 5 meters away from home.

Follow the following step to make soak pit.

1. Dig a 1m x 1m x 1m pit where sewage is to be released.
2. Make 20 cm alternate layer of sand and brick respectively.
3. Again, create 10cm thick layer of sand.
4. Make an arrangement to carry the sewage water to soak pit.



Ask questions:

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

Do's and Don'ts:

1. **When to take activity:** Anytime.
2. **How to organize activity:** 1. Make groups. 2. Provide material. 3. Explain the use of tools.

Summary / Principal / Knowledge gain:

If the sewage water coming out of houses continues to spread on ground, then it creates gutter/pond. It further creates bad odors and form breeding sites. This causes disease to spread. A soak pit, allows water to slowly soak into the ground.

Advantages of soak pit:

- Prevents seepage of contaminated water in ground water sources.
- Prevents mosquitos and bacterias.
- The odour created by the spread of sewage water on the ground is removed.
- Soak pit can be made with minimum expenses.

Resources:

Q.R.Codes

❋ ❋ ❋

Title of Activity

33. Making a DIY cardboard study lamp

Syllabus reference:

Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:

Light

Material required:

600 x 600 mm size 8mm thick cardboard, 2 x (50mm length, 6mm diameter bolt), 6 x washer and 2 x lock nuts, 2 x (1 inch 2mm bolt, washer and nuts), mirror paper/mirror plastic wrap paper, Some Ribbon Wires, 1x Limit Switches, 1x COB White LED 9-12v dc / 9-12v dc white led strip, 1x 9v dc battery and connector, Glue and paper tape, A4 papers, etc.

Tools required:

Blade cutter, scissor, ruler scale, pencil, eraser, printer for printing on A4.

Time required: 2 Hrs.

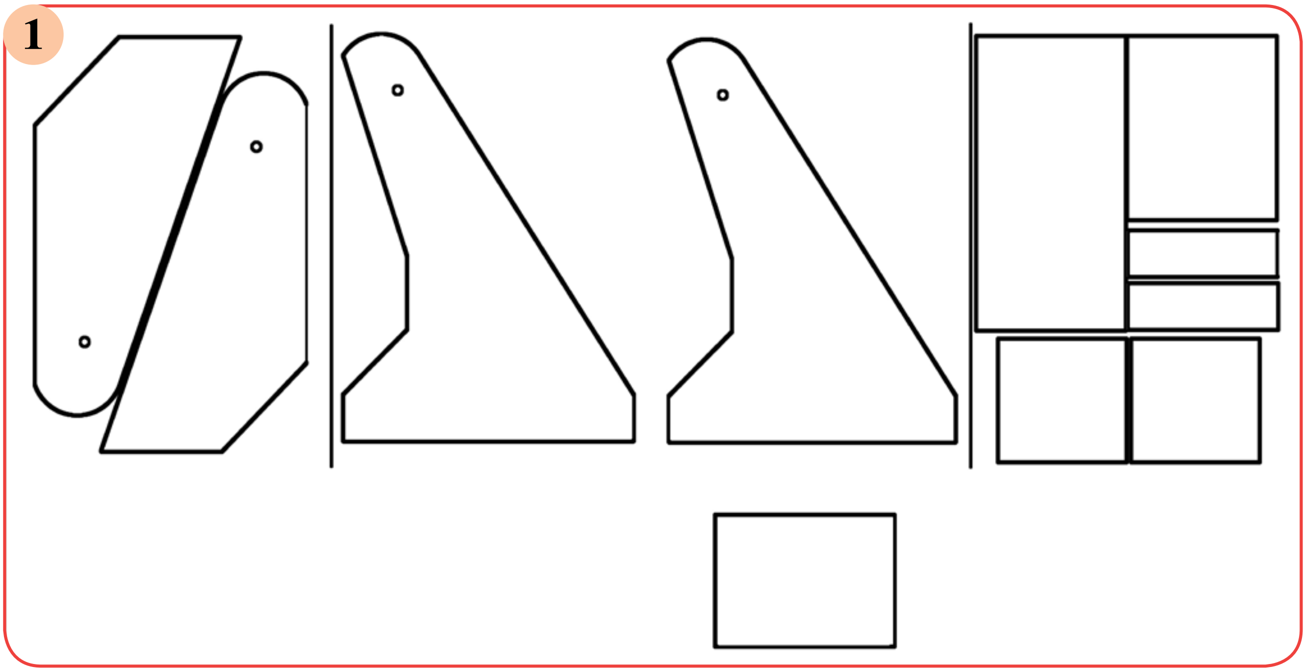
No. of students in class: 12-15 (No. of students in a group: 3-4)

Process:

Q.R.Code-1

1. Scan QR code-1 to download the cardboard template and print it on A4 size paper.

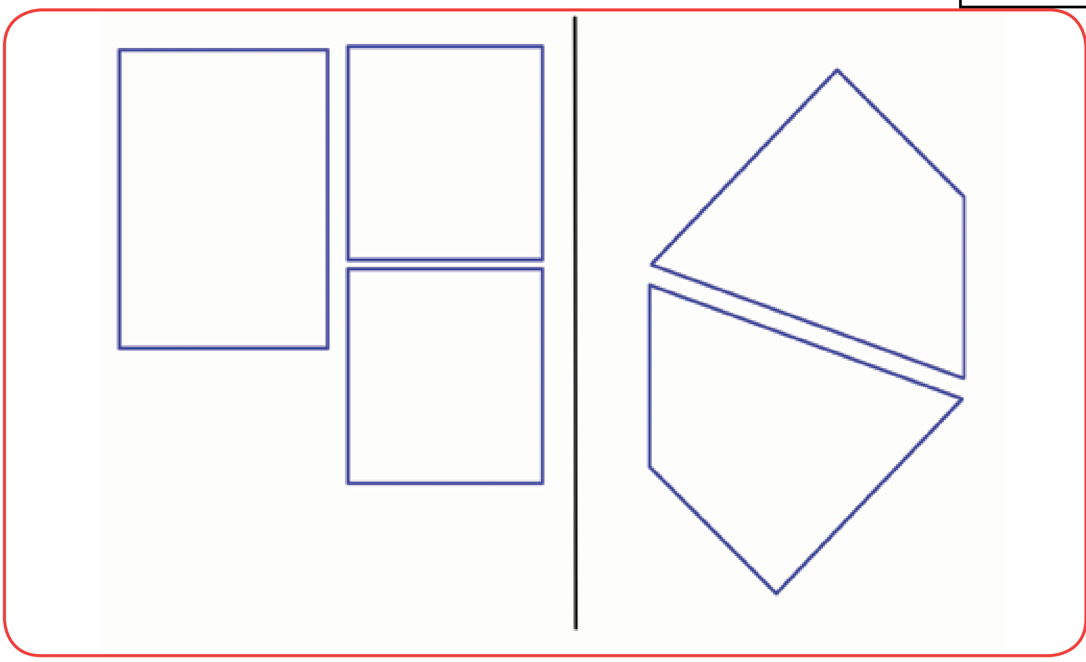
1



Q.R.Code-2

2. Scan QR code-2 to download the mirror paper template and print it on A4 size paper.

2



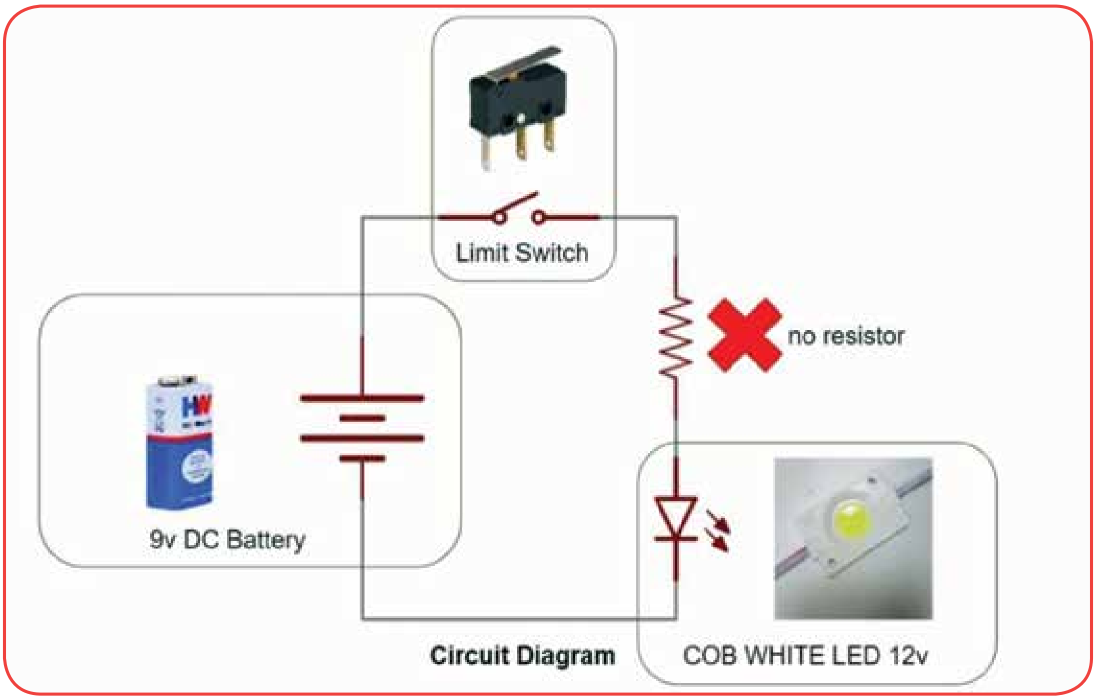
3. Stick the print outs of these templates on a cardboard. Cut them using a blade cutter and scissors.

3

Q.R.Code-3

4. Now assemble the parts with each other. You can modify the cut parts if they do not get assembled properly. Please refer the website by scanning this QR code - 3.
5. Now take electronic components and make circuit as shown in the below image.

4



6. Fix the circuit in the lamp. Refer step 4 in the website for making this assembly.

5

Ask questions:

1. What is light?
2. What is a switch?
3. How does the Limit switch work?
4. Explain the flow of current in the circuit of this lamp?
5. Where can you utilize this lamp?

Do's and Don'ts:

1. Use hand gloves and safety goggles while using the glue gun and drill machine
2. Instructors should help students to use drill machines and glue guns.
3. Do not touch the tip of the glue gun bare handed as it is very hot.
4. Use of blade cutter should be done under supervision and use of cutting mat is compulsory.
5. If you are using a blade cutter for the first time then use gloves for safety.
6. **When to take activity:** Anytime.

Summary / Principal / Knowledge gain:

Here we learned how to use scissors, paper cutters to make a cardboard lamp. We have also learned various electronic components like limit switch, LED, etc.

Resources:

Q.R.Code

❋ ❋ ❋

Title of Activity

34. Making a hand operated electric generator

Syllabus reference:

Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:

Std. 6th- Electric circuits, Std. 7th-Science- Electric Current and its Effects, Std. 8th-Science- Chemical effects of electric current, Sources of current – battery, generator.

Material required:

Ice cream sticks, old CD, wires, elastic, LED, DC motor, bottle cap, board (for base), nut and bolt, etc.

Tools required:

Glue gun, hand drilling machine, soldering iron, scissor, cutter and ruler.

Time required: 1.5 Hrs.

No. of students in class: 12-15 (No. of students in a group: 3-4)

Process:

Step 1: Material preparation:

- Gather all the necessary materials.
- This includes ice cream sticks, old CD, wires, elastic (rubber band), LED, DC motor, bottle cap, board (for base), nut and bolt, Glue gun, hand drilling machine, soldering iron, scissor, cutter and ruler.

Step 2: Create the stand:

- Use ice cream sticks to make a stand for the shaft, providing a strong base for the shaft to rotate.
- Take four ice cream sticks. Start by drilling a hole at one end of each stick. Then, cut the other end at a 45-degree angle (as shown in Picture 1). Stick the drilled ends of two sticks together, and do the same for the other two.
- Take a screw and carefully insert it into the holes (Picture 2).

1

PREPARE THE ICE CREAM STAND

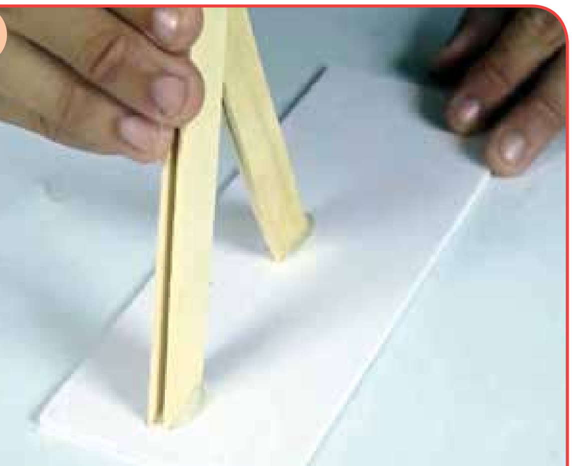
2

ASSEMBLE THE STAND

Step 3: Prepare the base:

- Utilise a board as the base. This will act as the solid groundwork for your generator, ensuring stability and support for the entire structure.
- With the help of a Hot Glue Gun, firmly attach the stand to the base (Fix the base - Picture 3). This ensures that the stand is securely fixed, providing a stable platform for the shaft to rotate.

3



FIX THE BASE

Step 4: Prepare the shaft:

- Take one CD and mark one circle on the CD (of diameter smaller than the diameter of the CD).
- Take wire and glue it along the circle onto the CD using a glue gun. Then, take another CD and stick it above the wire (as shown in Picture 4). The gap between the two CDs will serve as a support for the elastic band that will be connected to the motor.

4

ASSEMBLE THE CDs

5

ATTACH TWO BOTTLE CAPS

- Now, take two bottle caps and stick them on both sides of the CD at the centre (one on the either of the sides). This will act as the support base for the shaft while fixing it to the stand.
- Make a hole through the caps that are attached to the CD in order to fix it to the stand using a screw (Picture 6).
- To make a handle for the shaft, drill a hole at one side of the shaft where the handle will be fixed.
- Create a handle using a wire or a nail and fix it to the shaft using a glue gun. This handle will allow you to manually operate the generator (Picture 8).

7

DRILL HOLES FOR THE STAND

8

FIX THE HANDLE

Step 5: Connect DC motor and LED together:

- Connect a DC motor and LED. The DC motor will convert the mechanical energy from the rotating shaft into electrical energy. The LED will light up when electricity is generated, indicating energy production.

CONNECT THE DC MOTOR & LED

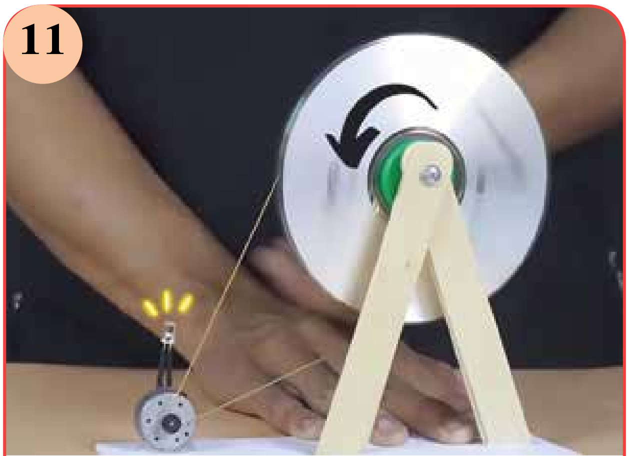
ASSEMBLE THE COMPONENTS

Step 6: Assemble all the components:

- Fix the motor, LED to the base as instructed. Assemble shaft to the stand using a nut. Make sure they are securely attached to ensure efficient energy transfer.

Step 7: Connect shaft to the motor:

- Connect the shaft to the motor using an elastic band. This will allow the rotation of the shaft to drive the rotation of the motor.



FINAL MODEL

Ask questions:

1. What is the scientific principle behind the operation of this hand-operated electric generator?
2. How does the generator convert mechanical energy into electrical energy?
3. What is the role of each component (ice cream sticks, CDs, wire, bottle cap, etc.) in the functioning of the generator?
4. How can the efficiency of this hand-operated generator be improved?
5. Can you think of real-world applications where such hand-operated generators could be useful?

Do's and Don'ts:

1. Do use safety equipment like gloves and safety glasses when handling tools and electrical components, but don't ignore safety guidelines.
2. Do follow step-by-step instructions carefully, but don't rush through the steps or skip any.
3. Do ensure all electrical connections are secure, but don't force components to fit or connect.
4. Do test the generator at various stages of construction, but don't leave your project unfinished or in an unsafe state.
5. Do ask for help if you're unsure about any step, but don't proceed with uncertainty which could lead to mistakes or accidents.

Summary / Principal / Knowledge gain:

- This activity demonstrates the application of scientific principles and technological skills. It aligns with the school curriculum's emphasis on understanding and applying scientific concepts.
- The generator converts mechanical energy into electrical energy, demonstrating the principle of energy conversion taught in physics.
- The school curriculum encourages experiential learning. This activity provides a hands-on experience which enhances understanding and retention of concepts.
- By creating a generator using everyday materials, students engage in innovative thinking and creative problem-solving, skills that are emphasized throughout the curriculum.
- The activity promotes the idea of sustainable and renewable energy sources, aligning with environmental education.

Resources:

Q.R.Code A

- **Video reference for making a hand operated electric generator:**
  Scan the QR Code: A for the step-by-step process of Making a hand operated electric generator.

Q.R.Code B-1 and B-2

- **Alternatively, you can make different types of hand operated electric generator:**
  Refer different document provided by scanning the QR Codes: B-1 and B-2.

❋ ❋ ❋

Title of Activity

35. Making of RC paper robot using cardboard

Syllabus reference:

Std. 7th, Std. 8th

Standard concept / Principle:

Std. 7th- Current, conductor insulator,

Std. 8th- Introduction - electric circuit, Power source, Battery / cells

Material 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, etc.

Tools required:

Stripper, scale, paper cutter/utility knife, soldering gun, soldering metal, glue gun with glue sticks, etc.

Time required: 1.5 Hrs.

No. of students in class: 12-15 (No. of students in a group: 3-4)

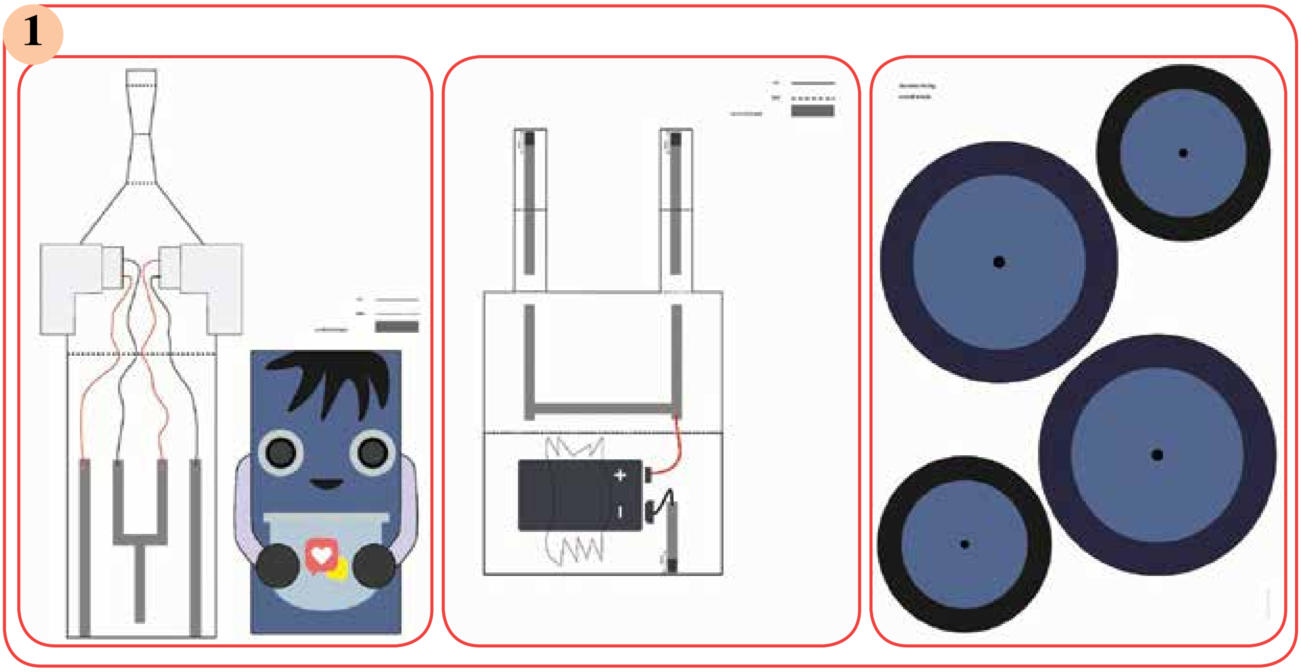
Process:

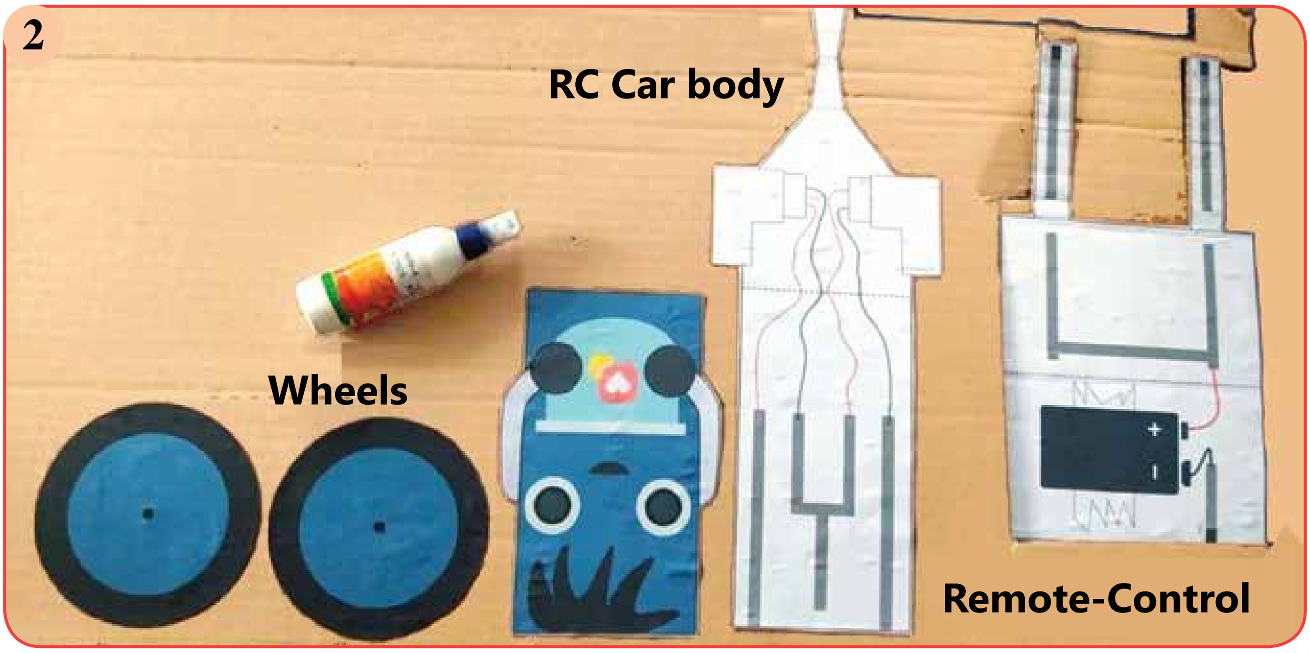
A Q.R.Code for step by step Instructions.

1. Scan this QR code to refer the step-by-step instructions.

B Q.R.Code for downloading template.

2. Scan this QR code to download the template to print. Take printout on A4 paper.
3. Cut the printed template using scissor and paste them on a cardboard sheet, use a paper glue as shown in the images below.



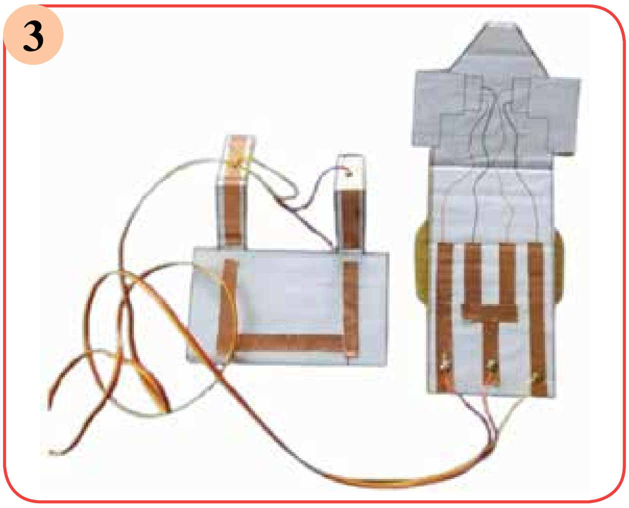


4. Cut these designs that are pasted on the cardboard sheet.

5. Follow the dark markings on the design to stick the conductive copper tape (this tape has a sticky back). Connect the RC car body with 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. Please scan this QR code to watch the reference video to understand this step.

C **Q.R.Code**

3



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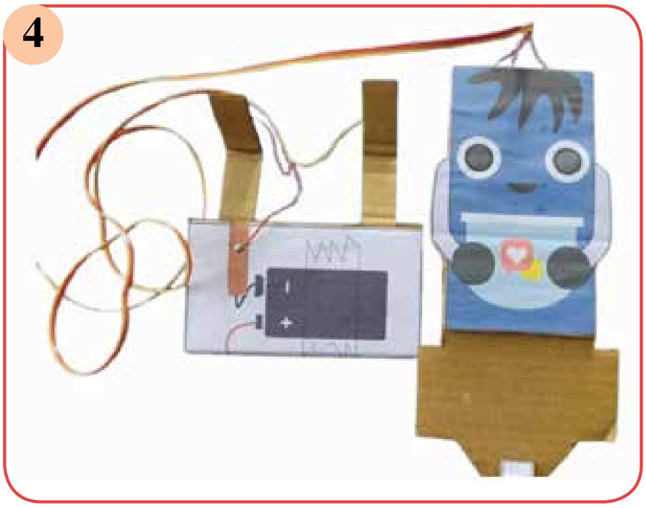
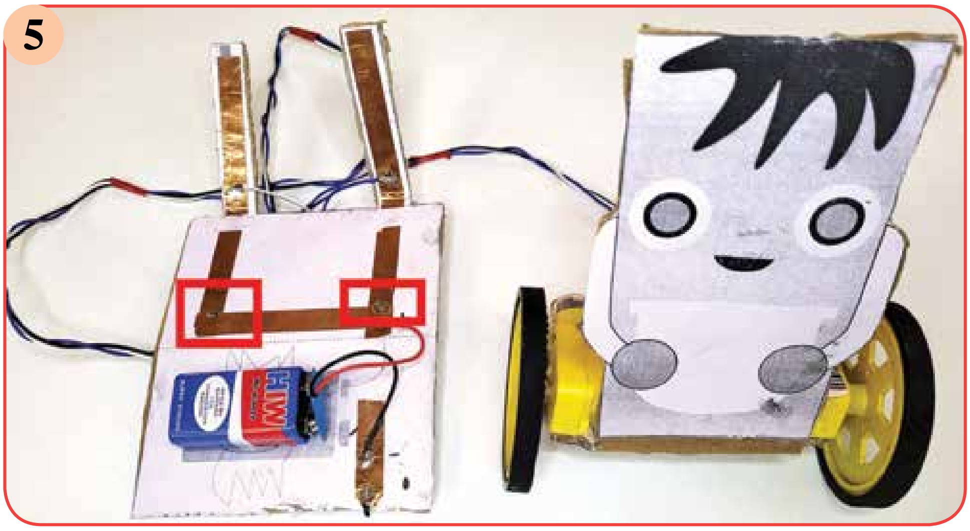


6. Fold the design on the given marking and glue BO motor using silicon hot glue, then solder motor wires as per the instructions in the video. If the motor runs backward then change the wire orientation and resolder it again. Stick battery on the given place on the remote.
7. After checking the rotation of the motor, glue both the wheels on motor shaft. In the video, we have used other type of robot wheels. You can use them too if you have them, else use cardboard wheels.
8. Last step is to test run it to see if it is working well or not.
9. If the circuit is not working, check all soldering joints. You can use multimeter to check the current continuity in the circuit. You can also put a soldering joint, where there is an intersection of two copper tapes as shown in the image (high-lighted these joints using rectangles).

5



RC PAPER ROBOT CAR USING CARDBOARD- FINAL ASSEMBLY

Ask questions:

1. What will you use to check the continuity of the circuit?
2. When will you do motor wire soldering to the copper tape pasted on the RC car body?
3. What needs to be done to reduce the speed of the car and to increase the speed of the car?
4. What will you do if the cardboard wheels do not rotate on the floor even if the motor is working fine?

Do's and Don'ts:

1. Take a precaution while doing soldering.
2. Instructor has to help student to solder the connection safely.
3. Soldering gun and glue gun are hot and students to handle them under the supervision of the instructor.
4. Use of stripper or utility knife should be done under supervision.
5. Do not connect the battery clip to the battery before all the soldering work is complete.

Summary / Principal / Knowledge gain:

We learned how to use a conductive copper tape to make a circuit along with using the components like motor, 9V battery, battery clips and wires. We also learned how to use hot glue gun to join the components. We used geared DC motor (Battery operated motor), which converts electrical energy into mechanical energy. Working principle of DC motor is based on Flemings left hand rule that when current carrying conductor is placed in magnetic field, the conductor experiences a mechanical force.

We learned how use multimeter to check the continuity in the circuit. Also how to make your own robot using the material and tools in the lab.

Resources:

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

  https://youtu.be/MQtPXr2fg9U?si=KhWKZNYvMwDlEmwT

Q.R.Code

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Title of Activity

36. Making of skiing robot using BO (Battery operated) motor

Syllabus reference:

Std. 7th, Std. 8th

Standard concept / Principle:

Std. 7th - Current, conductor insulator, Std. 8th - Introduction - electric circuit, Power source, Battery / cells

Material required:

100 RPM BO (Battery operated) double shaft motor, 1.5V AA battery, 2 wires, switch, ice-cream sticks, ear buds, small plastic ball.

Tools required:

Marker, pencil, stripper, 6 inch scale, paper cutter/ utility knife, soldering gun, soldering metal, glue gun with glue sticks, etc.

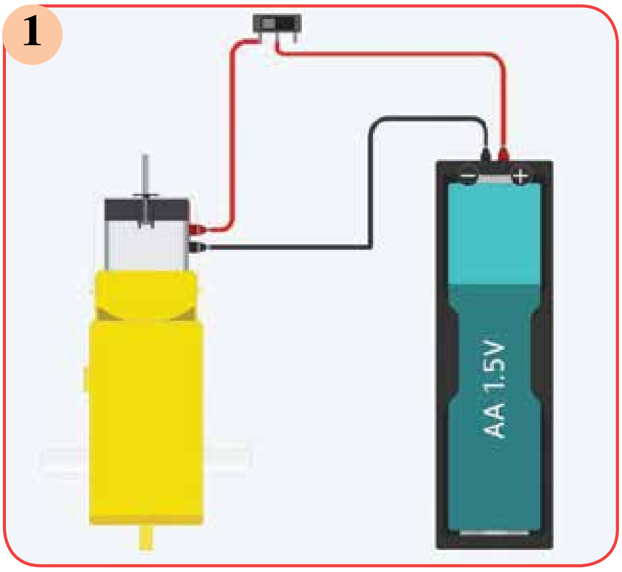
Time required: 3 Hrs.

No. of students in class: 15-20 (No. of students in a group: 3-4)

Process:

1. Connect dual shaft BO motor to 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 battery holder also. 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 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 join all the parts as per the instructions in the video.

1



CIRCUIT DIAGRAM OF THE SKIING ROBOT

2

THE SKIING ROBOT

Ask questions:

1. What should be the length of the ear-bud so that the robot can jump?
2. Why do we need to join the two ice-cream sticks in the bottom with small pieces?
3. What is required to make the robot structure stable so that it can stand still when it is not switched on?

Do's and Don'ts:

1. **How to organize activity:** 1. Make groups. 2. Provide material. 3. Explain the use of instrument.
2. Take a precaution while doing soldering.
3. Instructor has to help student to solder the connection safely.
4. Soldering gun and glue gun are hot and students to handle them under the supervision of the instructor.
5. Use of stripper or utility knife should be done under supervision.

Summary / Principal / Knowledge gain:

We learned how to make a circuit using the components like motor, switch, battery and wires. We also learned how to use hot glue gun to join the components. We used geared DC motor (Battery operated motor), which converts electrical energy into mechanical energy. Working principle of DC motor is based on Flemings left hand rule that when current carrying conductor is placed in magnetic field, the conductor experiences a mechanical force.

We learned how to make your own toy like this skiing robot using the material and tools in the lab. When the thrust/force is applied by the ear-buds through the BO DC motor, the robot jumps.

Resources:

Q.R.Codes

- **Video reference for making skiing robot using BO motor.**

  https://bit.ly/SkiingRobot

- **Alternatively, you can build the skiing robot with wheels on matchbox like in the next video.**

  https://bit.ly/skiingrobotmatchbox

❋ ❋ ❋

Title of Activity

37. L.E.D. desk lamp automation using LDR sensor

Syllabus reference:

Std. 7th, Std. 8th

Standard concept / Principle:

Std. 7th - Light, Current, conductor insulator,
Std. 8th - Introduction - electric circuit, Power source, Battery / cells, Technology around us

Material required:

Resistor (1k ohm resistor - Qty 3, 10k ohm resistor- Qty 1), BC547 transistor - Qty 1, LDR sensor - Qty 1, LED - Qty 1, 5 Volt battery - Qty - 1, etc.

Tools required:

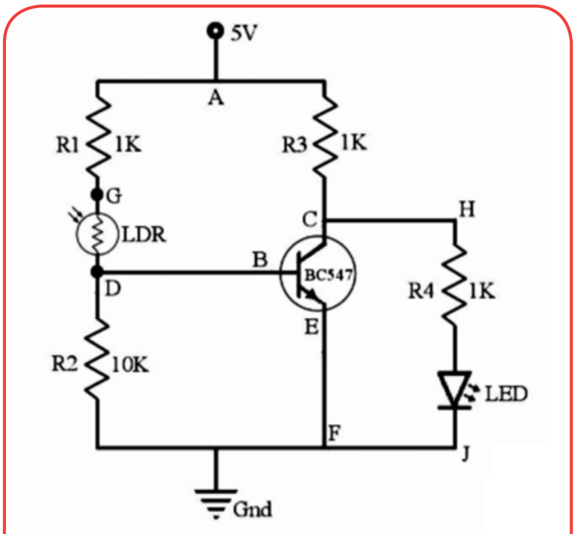
Soldering station.

Time required: 1 Hrs.

No. of students in class: 12-15 (No. of students in a group: 3-4)

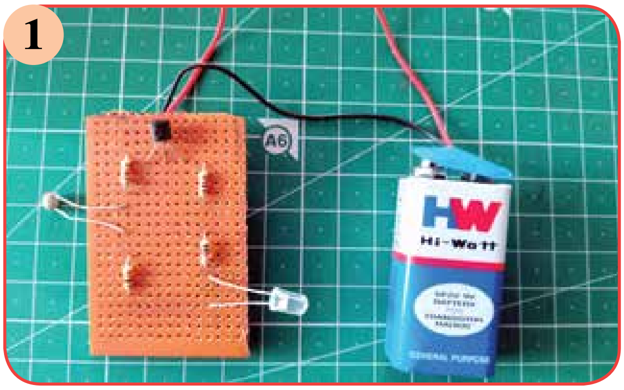
Process:

1. Gather all the components, necessary materials and initially establish connections on a breadboard. Later, transfer the connections onto a general PCB for permanency, referring to the provided circuit diagram throughout the process.



CIRCUIT DIAGRAM

2. Connect a 1k resistor and an LDR to points G and D, respectively, ensuring the LDR is linked to the base of the transistor at point D. Connect the emitter pin to the ground/negative terminal of the battery. Integrate a 1k resistor and LED in series, connecting them to the transistor collector pin/point C, with the cathode side of the LED linked to the ground.
3. Follow the circuit diagram for all connections and place the remaining resistors (1k and 10k) in their designated positions. After testing the circuit, recreate it on a general-purpose PCB. Proceed to solder the components onto the PCB, conduct a test run, and finalize the assembly.
4. Make a desk lamp using a cardboard and positioning the circuit inside in a way that it appears aesthetically pleasing from the outside. Your automatic desk lamp is now ready for use.



Ask questions:

1. What components are required for the construction of the automatic lamp described in the process?
2. When is the transition from the breadboard to the general PCB recommended in this procedure?
3. Where should the 1k resistor and LDR be connected in relation to the circuit diagram?
4. Why is it essential to take a test run before finalizing the assembly of the automatic lamp?
5. How does placing the circuit inside a DIY lamp or an old lamp contribute to the overall appearance and functionality of the automatic lamp?

Do's and Don'ts:

1. **How to organize activity:** 1. Make groups. 2. Provide material. 3. Explain the use of instrument.
2. Take a precaution while doing soldering.
3. Instructor has to help student to solder the connection safely.
4. Soldering gun and glue gun are hot and students to handle them under the supervision of the instructor.
5. Use of stripper or utility knife should be done under supervision.
6. Do not connect the battery clip to the battery before all the soldering work is complete.
7. Give information about fundamental electronic connections, LDR sensor, zero PCB, Resistor, etc.

Resources:

- **Scan this QR code for reference video.**

Q.R.Code

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Title of Activity

38. Making projects using Arduino uno

Syllabus reference:
Std. 8th

Standard concept / Principle:
Technology around us

Material required:
Arduino uno, breadboard, connecting wires (single stranded), computer/laptop with arduino IDE software and SG-90 servo motor.

Tools required:
Wire nipper, wire stripper, etc. (1 setup for 2-3 students). Digital Multimeter if needed, etc.

Time required: 2.5 Hrs.
No. of students in class: 10 (No. of students in a group: 2-3)

Introduction:

Arduino uno is used to control sensors, motors, lights by a program written into it. Arduino is widely used in consumer electronics as well as industrial applications. A controller can take inputs from various sensors and process them to control lights, motors, etc.

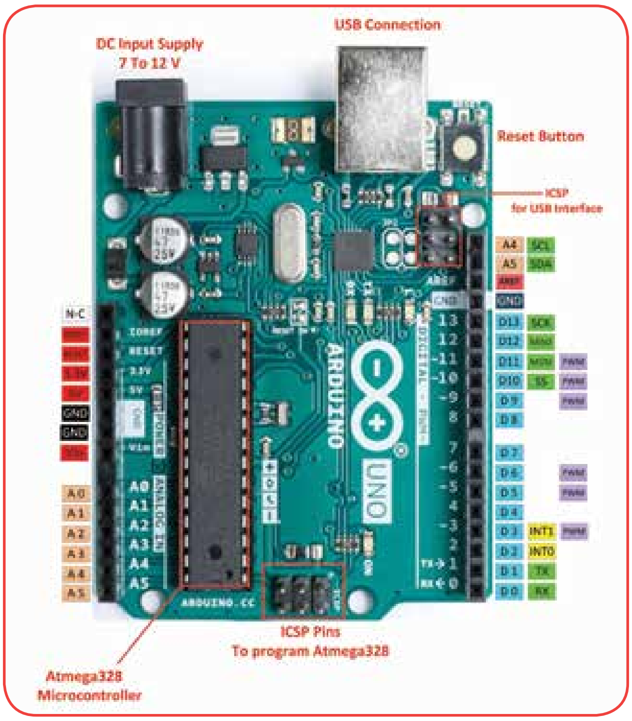
Arduino controller is easy to learn and use. We can use arduino in making automation is our science projects.

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:

1. **Power pins:-** GND ground VCC 5V.
2. **Input pins:-** Analog and Digital.
3. **Output Pins:-** Digital and PWM (Pulse Width Modulation, it converts digital signal into analog signals).



Process:

We will learn to use Arduino by making simple application of blinking LED on the board with the help of Arduino program. (There are several video tutorials available on internet, you can use them or learn tutorials from https://www.arduino.cc/).

1. If you are using Arduino for the first time, download the Arduino IDE software on your computer from https://www.arduino.cc/en/software.
2. Start the arduino IDE program on the computer; go to **file** ⇒ **examples** ⇒ **basics** ⇒ **blink**. This will open a new window with the blink program.

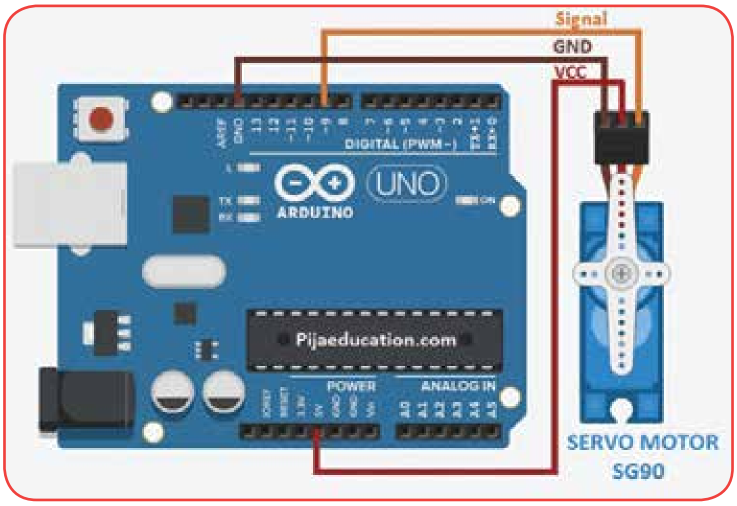
3. Now connect the arduino board to the computer using its cable. Then open the tools menu on the computer and go to port select arduino Uno Com ___.
4. When this is done click on the arrow under file menu. This will upload the program on the Uno board. This should blink the onboard LED of Uno every second. Now change the value in the delay command to set a different time for the on and off state of the LED and upload the program again.

Controlling motor using Arduino:

5. Now we will control the servo motor using arduino Uno. For this purpose we need to connect the Servo motor to any PWM (Pulse Width Modulation) pin. You can search the servo program in **file** ⇒ **examples** ⇒ **Servo** ⇒ **Sweep**. The sweep program will continuously run the servo motor from 0 to 180 and back to 0 degrees. This program will run the servo on pin 9 by default. You may change the pin if required but it must be a PWM pin.
6. When you have selected the program connect the servo motor connections to Uno board, there are 3 connections VCC (5V), SIG (Signal), GND (Ground). Use single stranded wires to connect these to Uno board. See the diagram.

   VCC ⇒ **5V (Red wire of Servo)**
   SIG ⇒ **PIN 9 (Orange wire of Servo)**
   GND ⇒ **GND (Brown wire of Servo)**
7. Check the servo motor program as seen in arduino IDE. Every statement is followed by a comment. E.g. delay (15.; wait 15ms for servo to reach the position. Using these comments you can understand the program and make changes if required.

ARDUINO IDE CODE FOR SERVO MOTOR



CIRCUIT DIAGRAM

Now upload the sweep program in the Uno board and observe what happens. You can make changes in the program to change the speed and angle of the servo motor.

Then make a paper doll and attach it to the actuator on the servo motor. This will make the doll rotate when the servo motor is on. There are 3 types of actuator available with the servo motor you can use the appropriate one for your project.

Observation:

Students can observe the LED blinking in the first activity. Its flashing rate can be changed by adjusting delay value in the blink program.

In second activity we can see the motor rotating 0-180 degrees back and forth. This motion can be set in the program, if you want to rotate it from 45-90 degree then that can be changed in the program.

Ask questions:

1. What is needed if we want to connect more than 1 LED?
2. How to do the same program with just 1 delay?
3. Can you figure out what kind of motors is used in robotic arms?
4. Where can we use the servo motor to get our job done? Can we solve any problem around us?

Do's and Don'ts:

1. **How to organize activity:** 1. Make groups. 2. Provide material. 3. Explain the use of instrument.
2. Students should work with multiple programs which are available in the examples menu.
3. Students can visit https://www.arduino.cc/ to find out more about arduino, IoT and related projects.
4. Power pins on the arduino should never be short circuited.
5. **Safety:** Computer should have proper earthing otherwise Unos will get permanently damaged.

Summary / Principal / Knowledge gain:

- Students should understand working of arduino hardware and IDE. Controllers can be easily programmed or reprogrammed as per the requirement which is not possible using integrated circuits.
- Students will work on basic coding required to run a simple LED and SG90 servo motor. More they work on coding more projects can be done using various sensors like temperature sensor, humidity sensor, rain water sensor, etc.
- Students will do basic electrical connections and troubleshooting.

Resources:

Q.R.Codes

- **For arduino related projects**

  https://www.arduino.cc/

- **Download Arduino IDE from here**

  https://www.arduino.cc/en/software

- **Servo motor video**

  https://www.youtube.com/watch?v=SfmHNb5QAzc

- **Blink**

  https://www.youtube.com/watch?v=PcusGFga46U

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Title of Activity

39. Gas detection system using MQ2 sensor, LEDs, and buzzer

Syllabus reference:
Std. 6th to Std. 8th

Standard concept / Principle:
Physical Science - Properties of Gases, Combustion and flame

Material required:
Arduino uno, MQ2 gas sensor, LEDs (2), resistor 220 ohm(5), buzzer 5 volts, breadboard, jumper wires (male-male-5, male-female-4), etc.

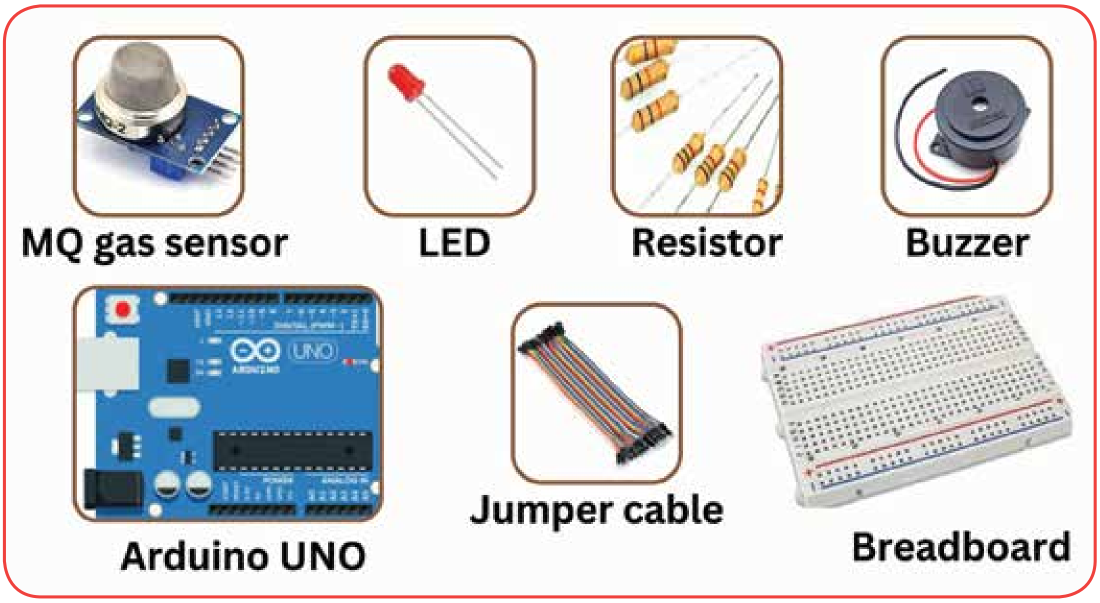
Tools required:
Desktop/Laptop to upload the code.

Time required: 30 minutes
No. of students in class: 12-15 (No. of students in a group: 4-5)

Process:

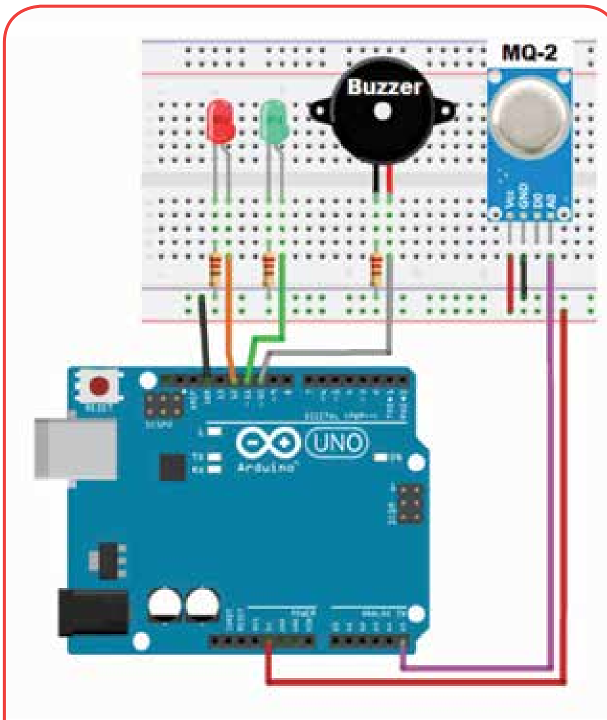
Step 1: Gather all the components required for the project as shown below:

1. Get an Arduino board, an MQ2 gas sensor, two LEDs, a buzzer, jumper wires, and a breadboard.



Step 2: Connect the MQ2 gas sensor as per the circuit diagram as shown below:

1. Connect the VCC pin of the MQ2 sensor to 5V on the Arduino.
2. Connect the GND pin of the MQ2 sensor to GND on the Arduino.
3. Connect the AOUT pin of the MQ2 sensor to any analog pin on the Arduino (like A5).



CIRCUIT DIAGRAM

Step 3: Connect LEDs.

1. Connect the anode (longer leg) of each LED to separate digital pins on the Arduino (like pins 11 and 12).
2. Connect the cathode (shorter leg) of each LED to a current-limiting resistor (around 220 ohms) and then connect the other end of the resistor to GND on the Arduino.

Step 4: Connect buzzer:

1. Connect the longer leg of the buzzer to any digital pin on the Arduino (like pin 10).
2. Connect the shorter leg of the buzzer to GND on the Arduino.

Step 5: Write the code:

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

```
const int gasPin = A5; // Connect gas sensor to A5
const int ledPin1 = 12; // Connect first LED to D2
const int ledPin2 = 11; // Connect second LED to D3
const int buzzerPin = 10; // Connect buzzer to D4

void setup() {
 pinMode(gasPin, INPUT);
 pinMode(ledPin1, OUTPUT);
 pinMode(ledPin2, OUTPUT);
 pinMode(buzzerPin, OUTPUT);
}

void loop() {
 int gasValue = analogRead(gasPin);
 // Adjust this number based on your gas sensor
 int threshold = 500;

 if (gasValue > threshold) {
 digitalWrite(ledPin1, HIGH); // Turn on the first LED
 digitalWrite(ledPin2, HIGH); // Turn on the second LED
 digitalWrite(buzzerPin, HIGH); // Turn on the buzzer
 } else {
 digitalWrite(ledPin1, LOW); // Turn off the first LED
 digitalWrite(ledPin2, LOW); // Turn off the second LED
 digitalWrite(buzzerPin, LOW); // Turn off the buzzer
 }

 delay(1000); // Wait for a second before checking again
}
```

Q.R.Code

Or alternatively, you can download the code file from this QR code.

Step 6: Upload code:

1. Connect your Arduino to your computer, write the code into the Arduino software, select the correct board and port, then click "Upload" to transfer the code to the Arduino.

Step 7: Test it:

1. Expose the MQ2 sensor to gas. If the gas concentration exceeds the set threshold, both LEDs will light up, and the buzzer will make a sound.

Ask questions:

1. How does the MQ2 gas sensor work?
2. What is the use of this system?
3. Where can this project be implemented?
4. What else can you use instead of the buzzer?

Do's and Don'ts:

1. Follow wiring diagrams or pinout guides for your components to ensure proper connections. Check your connections as per the circuit diagram twice before connecting everything to your computer for uploading the code. This helps prevent electrical issues.
2. Ensure all connections are secure to prevent malfunctioning or unpredictable behavior.
3. Label your wires or use different colors for different purposes to facilitate troubleshooting and modifications.
4. Connect the ground (GND) of all components together for a common ground reference.
5. Don't provide a voltage to any component that exceeds its specified operating range. Check the voltage requirements for each component.
6. Don't neglect basic safety practices. Turn off the power when making wiring changes and avoid exposing electronic components to moisture.
7. Don't allow wires to touch each other unintentionally to prevent short circuits that could damage components and the Arduino board.
8. Don't connect wires to the wrong pins on the Arduino. Double-check pin assignments in your code to ensure they match the physical connections.

Summary / Principal / Knowledge gain:

In summary, the gas detection system project is a hands-on experience that combines electronics with real-world applications. It introduces students to gas sensors, their working principles, and the use of Arduino in monitoring and alert systems.

Q.R.Code

Resources: video link - MQ gas sensor.

❋ ❋ ❋

Title of Activity

40. Making sound reactive LEDs using Arduino and sound sensor

Syllabus reference:
Std. 6th to Std. 8th

Standard concept / Principle:
Physical Science - Sound and Waves, Electronics

Material required:
Arduino uno, sound sensor module, LEDs - 4 Qty, resistors (220 ohms) - 4 Qty, breadboard jumper wires (male-male - 8, male-female - 4), etc.

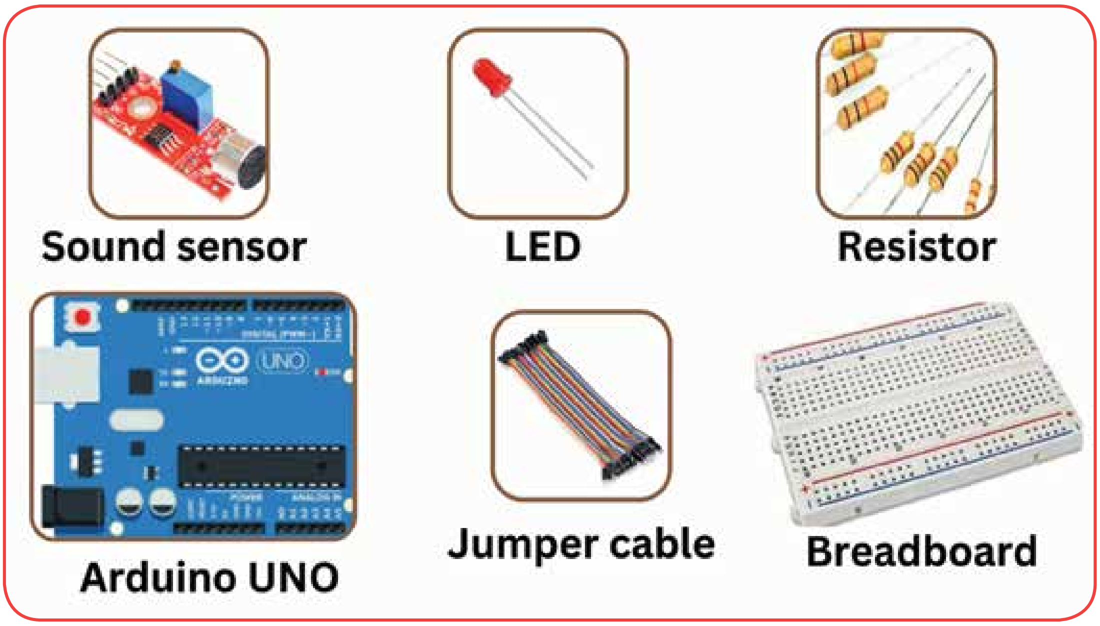
Tools required: Desktop/Laptop to upload the code.
Software required: Arduino IDE

Time required: 30 minutes
No. of students in class: 12-15 (No. of students in a group: 4-5)

Process:

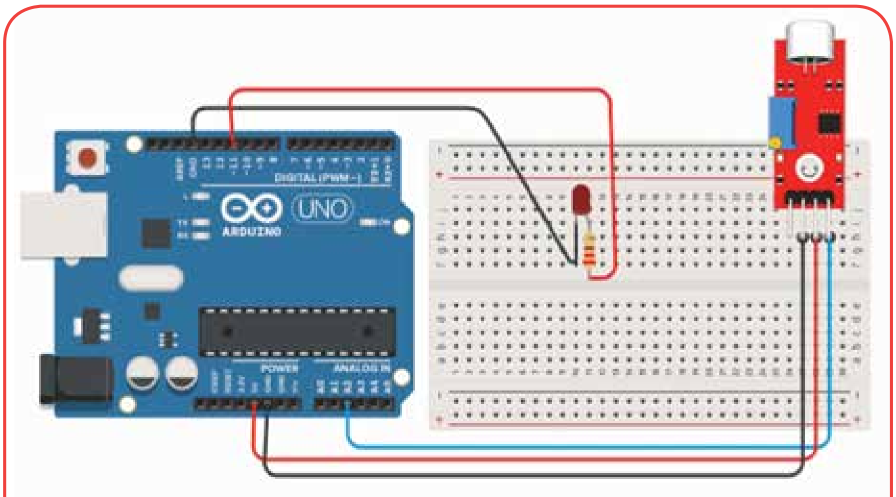
Step 1: Gather all the components required for the project as shown below:

1. Get an Arduino board, a sound sensor, LEDs, resistors, jumper wires, and a breadboard.



Step 2: Connect sound sensor:

1. Connect the sound sensor to the Arduino as per the circuit diagram as shown below:
2. Connect the VCC pin of the sound sensor to the 5V on the Arduino.
3. Connect the GND pin of the sound sensor to the GND on the Arduino.
4. Connect the OUT pin of the sound sensor to analog pin on the Arduino (like A2).



CIRCUIT DIAGRAM

Step 3: Connect LEDs:

1. Connect LEDs to the Arduino as follows:
2. Connect the anode (longer leg) of LED to a digital pin on the Arduino (like pin numbers 11) through a 220-ohm resistor.
3. Connect the cathode (shorter leg) of LED to the GND on the Arduino.

Step 4: Write the code:

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

```
constint LED = 11;
constint Sensor = A2;

int level;
constint threshold = 640;

voidsetup()
{
pinMode(LED, OUTPUT);
Serial.begin(9600);
}

voidloop(){
level = analogRead(Sensor);
if(level > threshold)
{
digitalWrite(LED, HIGH);
delay(1000);
digitalWrite(LED, LOW);
}
else
{
digitalWrite(LED, LOW);
}
}
```

Q.R.Code

Or alternatively, you can download the code file from this QR code.

Step 5: Upload code:

1. Connect your Arduino to your computer, write the code into the Arduino software, select the correct board and port, then click "Upload" to transfer the code to the Arduino.

Step 6: Test it:

1. Clap your hands near the sound sensor. The LED should light up in response to the sound detected.

Ask questions:

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

Do's and Don'ts:

1. Do follow wiring diagrams or pinout guides for your components to ensure proper connections. Check your connections as per the circuit diagram twice before connecting everything to your computer for uploading the code. This helps prevent electrical issues.
2. Do ensure that all connections are secure. Loose connections can lead to malfunctioning or unpredictable behavior.
3. Do label your wires or use different colors for different purposes. This makes troubleshooting and modifications easier.
4. Do connect the ground (GND) of all components together to create a common ground reference.
5. Don't provide a voltage to any component that exceeds its specified operating range. Check the voltage requirements for each component.
6. Don't neglect basic safety practices. Turn off the power when making wiring changes, and avoid exposing electronic components to moisture.
7. Don't allow wires to touch each other unintentionally. Short circuits can damage components and the Arduino board.
8. Don't connect wires to the wrong pins on the Arduino. Double-check pin assignments in your code and ensure they match the physical connections.

Summary / Principal / Knowledge gain:

In summary, the sound-activated LED dance party project is a hands-on activity that introduces students to sound sensors, basic electronics, and coding. It enhances their understanding of sensor applications and fosters creativity in combining sound and light elements.

Resources: video link - Sound sensor.

Q.R.Code

❊ ❊ ❊

Title of Activity

41. Temperature and humidity monitoring system using Arduino, DHT11 sensor and LED

Syllabus reference:
Std. 6th to Std. 8th

Standard concept / Principle:
Physical Science - Heat and Temperature, Weather and Climate.

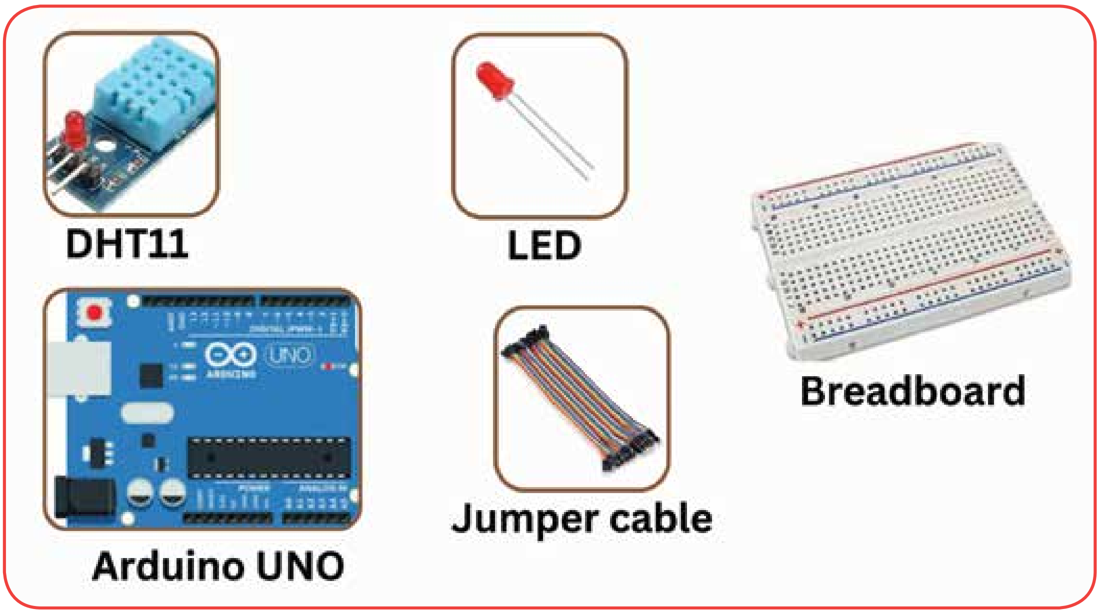
Material required:
Arduino uno, DHT11 temperature and humidity sensor, LED- 1 Qty, resistor (220 ohms), breadboard, jumper cables (male-male: 4, male-female: 3), etc.

Tools required: Desktop/Laptop to upload the code.
Software required: Arduino IDE

Time required: 30 minutes
No. of students in class: 12-15 (No. of students in a group: 4-5)

Process:

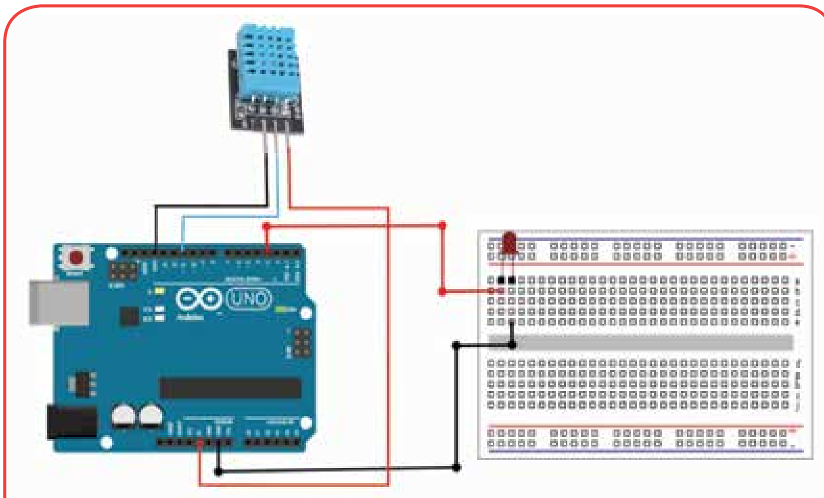
Step 1: Gather all the components required for the project as shown below:



1. Get an Arduino board, a DHT11 sensor, an LED, a resistor, jumper wires, and a breadboard.

Step 2: Connect DHT11 sensor as per the circuit diagram as 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 11).



CIRCUIT DIAGRAM

Step 3: Connect LEDs:

1. Connect the longer leg (anode) of the LED to a digital pin on the Arduino (like pin 3. through a 220-ohm resistor.
2. Connect the shorter leg (cathode) of the LED to the GND on the Arduino.

Step 4: Write the code:

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

```
#include <DHT.h>
#define DHTPIN 11       // Connect DHT11 sensor to D11
#define LEDPIN 3       // Connect LED to D3
#define DHTTYPE DHT11   // DHT11 sensor type
DHT dht(DHTPIN, DHTTYPE);
void setup() {
  pinMode(LEDPIN, OUTPUT);
  Serial.begin(9600);
  dht.begin();
}
void loop() {
  delay(2000);  // Wait for 2 seconds between measurements
  float temperature = dht.readTemperature();
  float humidity = dht.readHumidity();
  Serial.print(“Temperature: ”);
  Serial.print(temperature);
  Serial.print(“°C, Humidity: ”);
  Serial.print(humidity);
  Serial.println(“%”);
  if (temperature > 35) {
    digitalWrite(LEDPIN, HIGH);  // Turn on the LED if temperature is above 25°C
  } else {
    digitalWrite(LEDPIN, LOW);  // Turn off the LED otherwise
  }
}
```

Q.R.Code

Or alternatively, you can download the code file from this QR code.

Step 5: Upload code:

1. Connect your Arduino to your computer, write the code into the Arduino software, select the correct board and port, then click “Upload” to transfer the code to the Arduino.

Step 6: Test it:

1. Observe the LED. If the temperature exceeds 25°C, the LED will light up, indicating a warmer environment.

Notes:

1. The DHT11 sensor measures temperature and humidity.
2. The LED provides a visual indication based on the temperature threshold set in the code.
3. If the code is not uploading, please recheck the code.

Ask questions:

1. How does the DHT11 sensor work?
2. Where can this Project be implemented?
3. What is the use of this system?
4. What else can you use instead of an LED?

Do's and Don'ts:

1. Follow wiring diagrams or pinout guides for your components to ensure proper connections.
2. Ensure all connections are secure to prevent electrical issues.
3. Label your wires or use different colors for different purposes for easier troubleshooting.
4. Do not provide voltage to any component that exceeds its specified operating range. Check the voltage requirements for each component.
5. Do not neglect basic safety practices. Turn off the power when making wiring changes, and avoid exposing electronic components to moisture.
6. Do not allow wires to touch each other unintentionally. Short circuits can damage components and the Arduino board.
7. Do not connect wires to the wrong pins on the Arduino. Double-check pin assignments in your code and ensure they match the physical connections.

Summary / Principal / Knowledge gain:

In summary, the temperature and humidity monitoring system project is an educational tool that combines electronics with environmental monitoring. It provides insights into coding, sensor usage, and practical applications of temperature and humidity data.

Q.R.Code

Resources: Video link - DHT11 sensor.

❉ ❉ ❉

Title of Activity

42. Making a 'Line following Robot' using IR sensor and DC motors

Syllabus reference:
Std. 6th to Std. 8th

Standard concept / Principle:
Physics - Electromagnetism

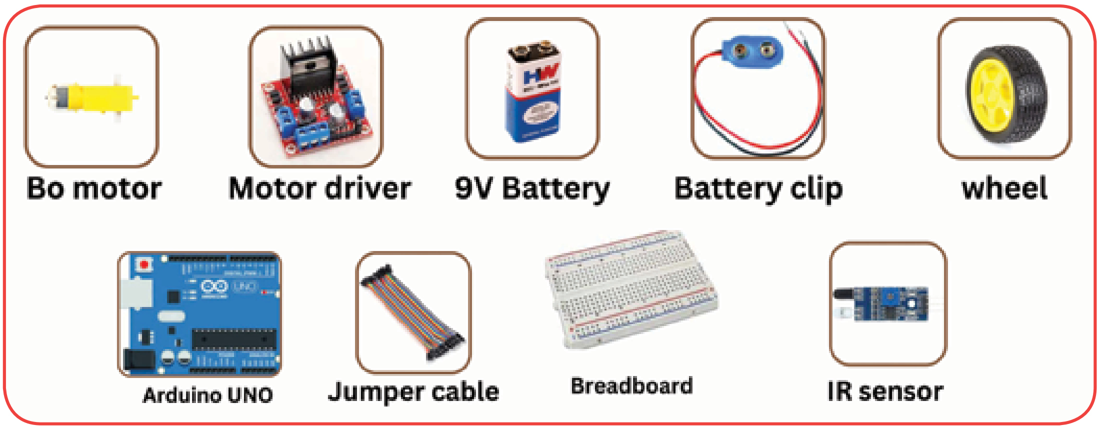
Material required:
Arduino uno, IR sensor module, DC motors (2), motor driver module (L298N), wheels (2), chassis, breadboard, jumper wires (male-male-10, male-female-4), 9V battery, etc.

Tools required: Desktop/Laptop to upload the code.
Software required: Arduino IDE

Time required: 45 minutes
No. of students in class: 12-15 (No. of students in a group: 3-4)

Process:

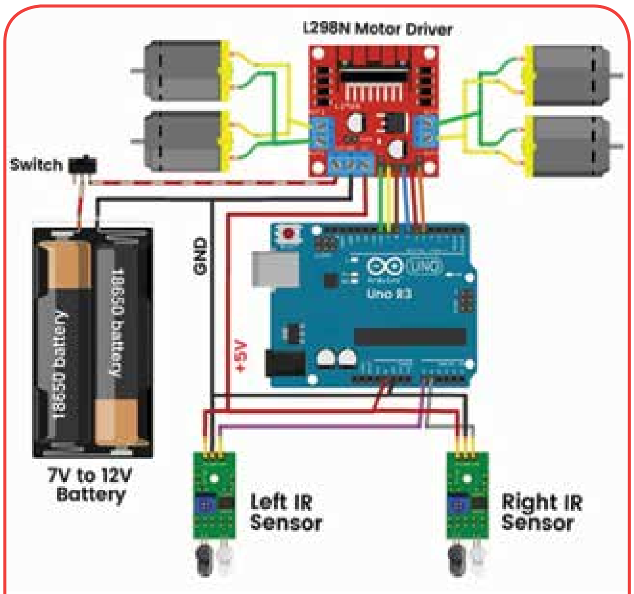
Step 1: Gather all the components required for the project as shown below:



1. Get an Arduino board, an IR sensor module, 2 DC BO motors, a motor driver module, wheels, chassis, jumper wires, a 9V battery, and a battery clip, Breadboard.

Step 2: Connect motors:

1. Attach the DC motors to the chassis. Connect the wires from the motors to the motor driver module (L298N).



CIRCUIT DIAGRAM

2. **Motor 1:** Connect to OUT1 and OUT2 on the motor driver.
3. **Motor 2:** Connect to OUT3 and OUT4 on the motor driver.

Step 3: Connect IR sensor:

1. Connect the IR sensor to the breadboard.
2. Connect the VCC pin of the IR sensor to 5V on the Arduino.
3. Connect the GND pin of the IR sensor to GND on the Arduino.
4. Connect the OUT pin of the IR sensor to any digital pin on the Arduino (like D2).

Step 4: Connect motor driver to Arduino:

1. Connect the motor driver module to the Arduino.
2. Connect the ENA and ENB pins to any digital pins on the Arduino (like D5 and D6).
3. Connect the IN1, IN2, IN3, and IN4 pins to digital pins on the Arduino (like D7, D8, D9, and D10).

Step 5: Connect 9V battery:

1. Connect the battery clip with a DC jack to the Arduino and the motor driver module.
2. Connect the red wire of the battery clip to the VIN pin on the Arduino.
3. Connect the black wire of the battery clip to the GND on the Arduino.
4. Connect an additional pair of wires from the battery clip to the VCC and GND on the motor driver module.

Step 6: Write the code:

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

1

```
int M1_Speed = 80; // speed of motor 1
int M2_Speed = 80; // speed of motor 2
intLeftRotationSpeed = 250; // Left Rotation Speed
intRightRotationSpeed = 250; // Right Rotation Speed

int in1 = 2; // Example pin numbers, replace with your actual pin numbers
int in2 = 3;
int in3 = 4;
int in4 = 5;
intenA = 6;
intenB = 7;

voidsetup(){
pinMode(in1, OUTPUT);
pinMode(in2, OUTPUT);
pinMode(in3, OUTPUT);
pinMode(in4, OUTPUT);

pinMode(enA, OUTPUT);
pinMode(enB, OUTPUT);
pinMode(A0, INPUT); // initialize Left
```

2

```
sensor as an input
pinMode(A1, INPUT); // initialize Right sensor as an input
}

voidloop(){
int LEFT_SENSOR = digitalRead(A0);
int RIGHT_SENSOR = digitalRead(A1);

if(RIGHT_SENSOR == 0&& LEFT_SENSOR == 0){
forward(); // FORWARD
}elseif(RIGHT_SENSOR == 0&& LEFT_SENSOR == 1){
right(); // Move Right
}elseif(RIGHT_SENSOR == 1&& LEFT_SENSOR == 0){
left(); // Move Left
}elseif(RIGHT_SENSOR == 1&& LEFT_SENSOR == 1){
Stop(); // STOP
}
}

voidforward(){
```

3

```
digitalWrite(in1, HIGH);
digitalWrite(in2, LOW);
digitalWrite(in3, HIGH);
digitalWrite(in4, LOW);

analogWrite(enA, M1_Speed);
analogWrite(enB, M2_Speed);
}

voidbackward(){
digitalWrite(in1, LOW);
digitalWrite(in2, HIGH);
digitalWrite(in3, LOW);
digitalWrite(in4, HIGH);

analogWrite(enA, M1_Speed);
analogWrite(enB, M2_Speed);
}

voidright(){
digitalWrite(in1, LOW);
digitalWrite(in2, HIGH);
digitalWrite(in3, HIGH);
digitalWrite(in4, LOW);
analogWrite(enA,
```

4

```
LeftRotationSpeed);
analogWrite(enB,
RightRotationSpeed);
}

voidleft(){
digitalWrite(in1, HIGH);
digitalWrite(in2, LOW);
digitalWrite(in3, LOW);
digitalWrite(in4, HIGH);

analogWrite(enA, LeftRotationSpeed);
analogWrite(enB,
RightRotationSpeed);
}

voidStop(){
digitalWrite(in1, LOW);
digitalWrite(in2, LOW);
digitalWrite(in3, LOW);
digitalWrite(in4, LOW);
}
```

Q.R.Code

Or alternatively, you can download the code file from this QR code.

Step 7: Upload code:

1. Connect your Arduino to your computer, write the code into the Arduino software, select the correct board and port, then click "Upload" to transfer the code to the Arduino.

Step 8: You can use breadboard as chassis for robot:

1. **Position the breadboard:**
   Place the breadboard horizontally on a flat surface. This will serve as the base of your robot.
2. **Attach motors:**
   If your motors have brackets, attach them to the sides of the breadboard using screws. If not, you can tape or use adhesive to secure the motors. Check the rotation of all motors, if it is in same direction. If it is different you can alter the terminals.
3. **Connect wheels:**
   Attach the wheels to the motor shafts. Ensure that the wheels can move freely.
4. **Secure the Arduino:**
   Place the Arduino board on the breadboard, positioning it toward the front or center of the robot.
5. **Attach motor driver module:**
   If you are using a motor driver module, secure it on the breadboard near the motors. Connect the motor driver module to the Arduino using jumper wires.
6. **Position IR sensor:**
   1. Place the IR sensor module on the breadboard at the front of the robot. Ensure that the IR sensor is close to the surface for effective line detection.
   2. Connect Components.
   3. Use jumper wires to connect the motors, IR sensor, and motor driver module to the Arduino according to the wiring diagram for your line-following robot.
7. **Secure components:**
   Tape or use adhesive to secure the IR sensor, Arduino, and any loose wires to the breadboard. Ensure that they are firmly attached but can be easily removed for adjustments.
8. **Test the robot:**
   Upload the line-following robot code to the Arduino and place the robot on a track with a contrasting line. Observe its behavior and make adjustments as needed.
9. **Make adjustments:**
   Fine-tune the placement of components, especially the IR sensor, to improve the robot's line-following accuracy.

Step 9: Test it:

1. Place the robot on a black line (you can draw one on a white surface). The robot should follow the line using the IR sensor and move forward.

Ask questions:

1. How does the IR sensor work in this project?
2. Where can this project be implemented?
3. What is the use of this system?
4. What else can you add to enhance the robot's functionality?

Do's and Don'ts:

1. Follow wiring diagrams or pinout guides for your components to ensure proper connections.
2. Ensure all connections are secure to prevent electrical issues.
3. Label your wires or use different colors for different purposes for easier troubleshooting.
4. Do not provide voltage to any component that exceeds its specified operating range. Check the voltage requirements for each component.
5. Do not neglect basic safety practices. Turn off the power when making wiring changes, and avoid exposing electronic components to moisture.
6. Do not allow wires to touch each other unintentionally. Short circuits can damage components and the Arduino board.
7. Do not connect wires to the wrong pins on the Arduino. Double-check pin assignments in your code and ensure they match the physical connections.

Summary / Principal / Knowledge gain:

In summary, the line-following robot project is an engaging way for students to learn about sensors, motor control, and basic robotics. It provides hands-on experience in programming and building a simple autonomous robot.

Resources: Video link - Line following Robot.

Q.R.Code

❋ ❋ ❋

Title of Activity

43. Making a soil water level detection system using Arduino, buzzer and soil moisture sensor

Syllabus reference:
Std. 6th to Std. 8th

Standard concept / Principle:
Physical Science -Electric circuits, Water: A Precious Resource

---

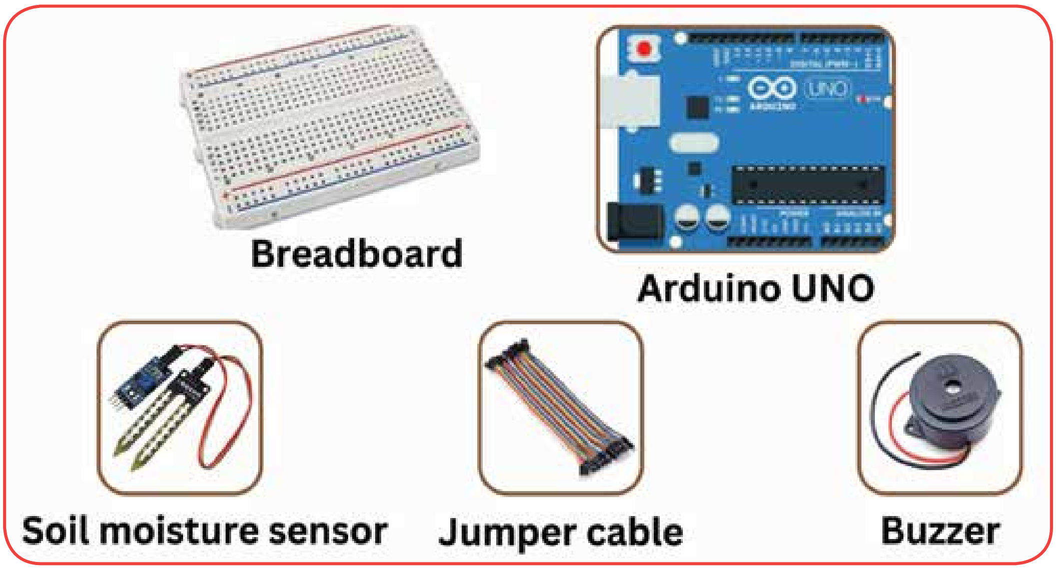
Material required:
Arduino uno, soil moisture sensor, 5V buzzer, breadboard, jumper Wires (male-male:4, male-female:3), etc.

Tools required: Desktop/Laptop to upload the code.
Software required: Arduino IDE

Time required: 30 minutes
No. of students in class: 12-15 (No. of students in a group: 4-5)

Process:

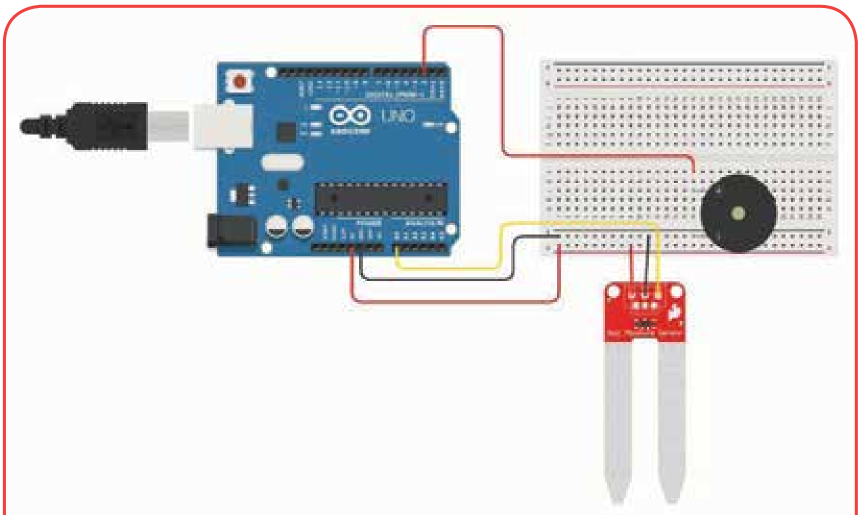
Step 1: Gather all the components required for the project as shown below:



1. Get an Arduino board, a soil moisture sensor, a buzzer, jumper wires, and a breadboard.

Step 2:

1. Connect the soil moisture sensor as per the circuit diagram as shown below:
2. Connect the VCC wire from the soil moisture sensor to the 5V on the Arduino.
3. Connect the GND wire from the soil moisture sensor to the GND on the Arduino.



CIRCUIT DIAGRAM

4. Connect the signal from the soil moisture sensor to any digital pin on the Arduino (like A0).

Step 3: Connect buzzer:

1. Connect the positive terminal of the buzzer to any digital pin on the Arduino (like pin 2).
2. Connect the negative terminal of the buzzer to the GND on the Arduino.

Step 4: Write the code:

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

```
constintsoilMoisturePin = A0;
constintbuzzerPin = 2;
constintmoistureThreshold = 500; // Adjust this threshold based on your soil and plant needs

voidsetup(){
pinMode(buzzerPin, OUTPUT);
Serial.begin(9600);
}

voidloop(){
intsoilMoisture = analogRead(soilMoisturePin);

Serial.print("Soil Moisture: ");
Serial.println(soilMoisture);

if(soilMoisture<moistureThreshold){
   // Soil is too dry, activate the buzzer
digitalWrite(buzzerPin, LOW);
}else{
   // Soil is moist enough, turn off the buzzer
digitalWrite(buzzerPin, HIGH);
}

delay(1000); // Adjust the delay as needed
}
```

Q.R.Code

Or alternatively, you can download the code file from this QR code.

Step 5: Upload code:

1. Connect your Arduino board to your computer, write the code into the Arduino software,select the correct board and port, then click "Upload" to transfer the code to the Arduino.

Step 6: Test it:

1. Stick the soil moisture sensor in some soil. If the soil gets too dry (you can adjust this in the code), the buzzer will make a sound.

Notes:

1. The code is like a set of instructions for your Arduino.
2. The sensor measures how wet or dry the soil is.
3. If the soil gets too dry (below the number you set in the code), the buzzer makes a noise.
4. If the code is not getting uploaded please recheck the code.
5. That's it! You've made a soil moisture sensor that beeps when your plant needs water. Have fun experimenting and learning!

Ask questions:

1. How does the soil moisture sensor work?
2. Where can this Project be implemented?
3. What is the use of this system?
4. What else can you use instead of Buzzer?

Do's and Don'ts:

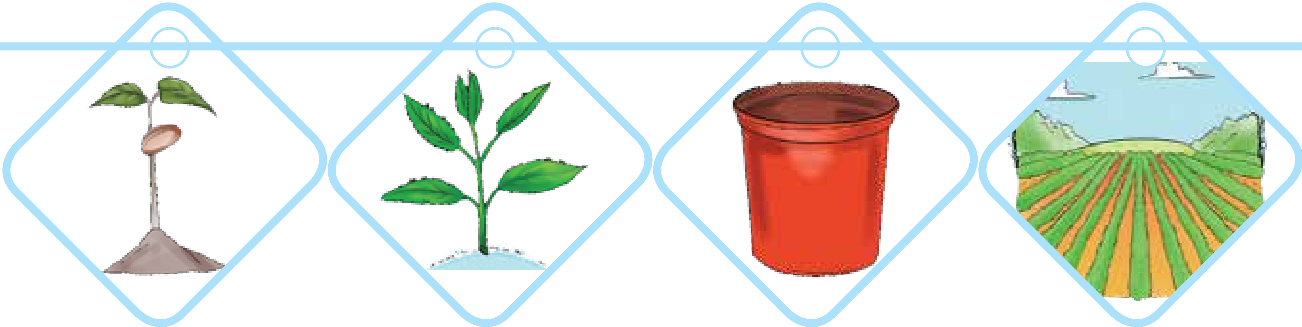
1. Do follow wiring diagrams or pinout guides for your components to ensure proper connections. Check your connections as per the circuit diagram twice before connecting everything to your computer for uploading the code.This helps prevent electrical issues.
2. Do ensure that all connections are secure. Loose connections can lead to malfunctioning or unpredictable behavior.
3. Do label your wires or use different colors for different purposes. This makes troubleshooting and modifications easier.
4. Do connect the ground (GND) of all components together to create a common ground reference.
5. Don't provide a voltage to any component that exceeds its specified operating range. Check the voltage requirements for each component.
6. Don't neglect basic safety practices. Turn off the power when making wiring changes, and avoid exposing electronic components to moisture.
7. Don't allow wires to touch each other unintentionally. Short circuits can damage components and the Arduino board.
8. Don't connect wires to the wrong pins on the Arduino. Double-check pin assignments in your code and ensure they match the physical connections.

Summary / Principal / Knowledge gain:

In summary, the soil moisture sensor project is a practical and educational tool that combines electronics and plant care. It addresses real-world needs, promotes water conservation, and offers a hands-on learning experience for individuals interested in DIY projects and automation.

Resources: Video link - soil moisture sensor.

Q.R.Code



Agriculture Section

Title of Activity

44. Learning the basics of soil testing for crop cultivation

Syllabus reference and standard concept / Principle:

Std. 6th, Std. 7th, Std. 8th - Agricultural Science, Lessons- Soil, Crop protection, Cultivation of main crops, Horticulture.

Learning concepts:

- To teach students the basics of soil formation by collecting different soil samples to identify the color and texture of soil, etc.
- To train students in basic soil testing like pH paper, soil partial testing, etc.

Material required:

Old newspapers, 500 ml mason jar (wide open glass bottle), 15 cm measuring scale, pH paper (Range 0 to 14), etc.

Tools required:

Gardening tools – spade, axe, weeding hoe, pots, etc.

Time required: 45 to 60 minutes

No. of students in class: Max. 20 (No. of students in a group: 5-10)

Introduction:

Soil is one of the most essential inputs for farming. Soil is formed due to weathering and natural erosion of rocks (parent material). Weathering occurs due to flow of water, change in air temperature, etc. Weathering is a very slow process. It was believed that approximately 500 years were required to form a 1-inch layer of soil. Therefore, to get better production from farming, it is very important to use the soil properly and maintain its health.

Characteristics of good cultivated soil for plants:

- It consists of approximately 25% air, 25% water, 45% minerals and 5% organic matter.
- pH should be 6.5-7.5.
- Organic carbon (OC) content should be more than 2%.
- Have good drainage capacity.
- 16 essential plant nutrients are present.

To ensure good yield from the field year after year, farmers can test the soil in the soil testing laboratory.

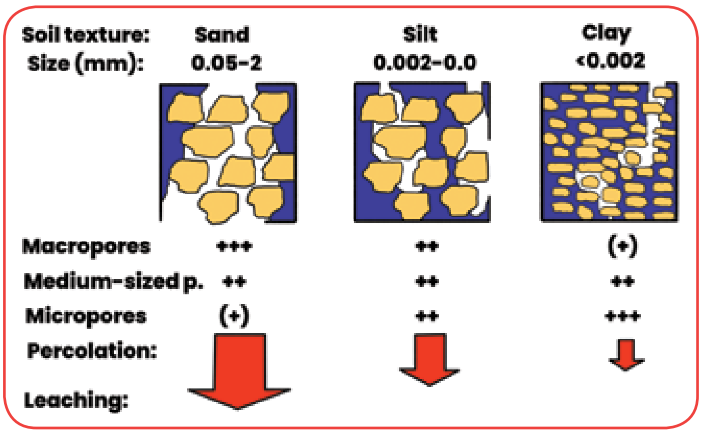
With simple tools and procedure, we do some primary tests of soil:

Activity-1: Collect soil from the garden for analysis.

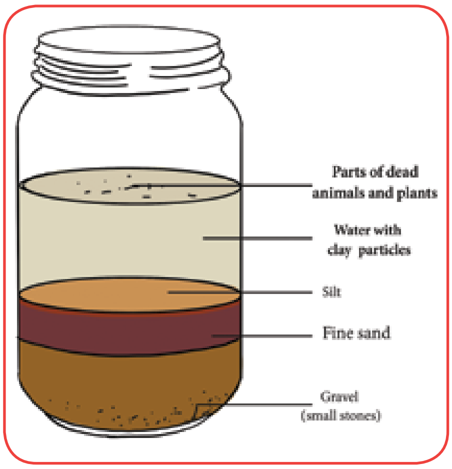
1. With the help of weeding hoe, dig 15 to 20 cm pits at 5 to 6 different places in the farming plot.
2. Collect 1-2 scoops of loose soil from each pit and collect in a pot or plastic tray.
3. Spread soil on the used newspaper and dry it in shade for 4-6 hours.
4. Observe the color of the soil carefully. Its color will depend on the bed-rock properties (rock from which soil is formed through the process of weathering), organic matter content, etc.
5. Use this soil for further analysis.

Activity-2: Testing of clay, silt and sand percentage of soil (physical properties).

Soil is in the form of many small particles. These particles are classified as soil, silt and sand particles depending on their size. Soil contains the finest particles with a size of less than 0.002 mm. We call this clay soil. The largest particles are those ranging in size from 0.002 to 0.5 mm, whereas the sand particles are the largest, ranging in size from 0.05 to 2.0 mm.



1. The percentage of these particles affects the quality of soil in many ways like water holding capacity, cation-exchange capacity (CEC), etc.
2. Generally, for good plant growth, soil should contain 40 percent sand, 40 percent silt and 20 percent clay.
3. The percentage of clay, silt and sand in our soil can be tested by simple tests. This test is called test of physical properties. The name of this test is **'Mason Jar Test'**. Its name is derived from the glass jar used to conduct the test. If a mason jar is not available then we can use any glass jar as follows:
4. Take approximately 200 grams of sample soil (collected and dried in the first activity).
5. With the help of hands, mash the soil thoroughly to remove large particles and gravel.
6. Take a 500 ml glass bottle (mason jar) with a tight lid.
7. Put 200 grams of soil sample in the bottle, this will fill approximately half the bottle.
8. Now add 200 ml. of water.
9. Now add half a spoon of any detergent powder. Detergent powders help in removing soil particles with their strong grip.
10. Close the jar lid tightly.
11. Shake the jar 3-4 times for 2 to 3 minutes at an interval of 10 minutes.
12. Now leave the jar undisturbed for 24 to 48 hours.
13. In about 2 minutes, sand particles settle on the surface of the bottle, after 2 hours silt particles settle and a very fine layer of soil particles settles in 24 to 48 hours.
14. With the help of a marker, mark different layers on the bottle. Carefully note the width of each layer with the help of a 15 cm measuring instrument. Measure the bottle from top to bottom in mm.
15. Now use simple arithmetic to calculate the percentage of sand, silt and clay.
16. For example, consider:



- The thickness of the sand is 45 mm.
- The thickness of the silt is 35 mm.
- And the thickness of clay is 05 mm.
- Now total thickness will be 45 + 35 + 5 = 85 mm.

Now its percentage will be:

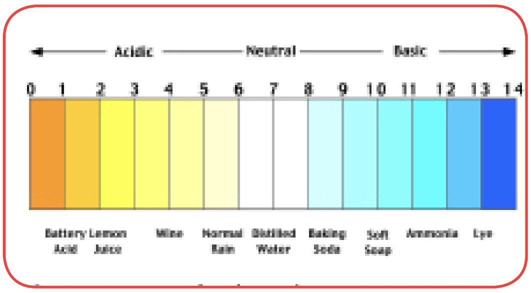
- Percentage of sand = (45/85. x 100 = 52•94%
- Percentage of Silt = (35/85. x 100 = 41•17%
- Percentage of Clay = (5/85. x 100 = 5•88%

Some suggestions for improving the soil after testing (for home garden):

No.	Result	Suggestions for improvement
1	The percentage of soil is more than 20 percent so it will absorb more water. Due to which the roots will suffocate.	To fix this, add river sand or red colored garden soil, this will improve drainage.
2	The percentage of sand and silt is more than 80 percent. It will absorb very little water which may cause the plants to dry out	To correct this, add river soil or coco peat or sawdust or dry leaves and manure. This will increase the water storing capacity of the soil.
3	The percentage of sand is more than 80 percent, it will store very little water which may cause the plant to dry out.	To correct this, add good quality vermi-compost. This will increase the water storing capacity of the soil. Apart from this, also add essential nutrients.

Activity-3: Testing pH of soil (chemical properties):

pH is the measure of acid or alkali in a substance. pH is measured on a scale of 0 to 14 points. pH 7 is considered neutral, which means the substance is neither alkaline (salty) nor acidic (sour). If the pH is below 6 then it is called acidic pH and if it is above 8.0 then the substance will be alkaline.



pH is one of the chemical properties of soil. Soil pH affects cation exchange capacity (CEC), microbiome growth, etc. PH level of 6.5 to 8.5 is considered most suitable for major crops.

To test the pH level accurately, the help of sophisticated instruments is taken, but by adopting the following steps, we can find out its almost accurate value with the help of pH paper also.

1. Take approximately 50 grams (2-3 teaspoons) of soil sample (dried, collected from the first activity).
2. Collect it in a small plastic cup or stainless-steel glass.
3. Add about 20 ml of distilled water or pure filtered water into it. Do not put more water in the glass than this because the pH level of the soil can change according to the quality of water.
4. Wait for 30 minutes.

5. Insert the tip of the pH paper into the soil and water mixture.
6. Note the change in color of the tip of the pH paper. Now note down the pH reading from the pH paper strip measuring device.

No.	Result	Suggestions for improvement
1	The pH of soil is acidic i.e. below 6.	Mix good quality vermicompost (3 parts soil: 1 part compost) and add raw salt (2 percent of total soil).
2	pH of soil is very basic i.e. above 8.5	Wash the soil 2-3 times with rain water or RO filtered water and add good quality compost. (3 parts soil:1 part compost)

Overview:

Ask students to collect soil from different areas (from fields near home, from different corners) and observe it carefully to see what its colour, texture (salty, sticky, loamy, etc.) is.

Compare the effects of soil on plant growth. Fill a small pot (poor cup or bottle) with ordinary soil and plant the plant (first container) and plant the second plant in river sand (second container).

Now observe both the pots for the next 1 week and observe the growth of the plants. Make a chart of plant growth.

Ask questions:

1. What is the use of soil in plant growth?
2. Why is the color and texture of soil different in different geographical places?
3. Where is the nearest soil testing lab located in your area?
4. How is the soil of forests different from the soil of farmers' fields?
5. How can we keep the soil healthy?
6. Apart from the field, where else is the soil tested?

Do's and Don'ts:

Precautions:

1. **How to conduct the activity:**
   - Ask to bring soil samples from different places in the school.
   - Ask each group to do the activity independently.
   - Make a comparative study of the results of each group.
   - Select better soil for future applications.
2. **When to do the activity:** This activity can be done at any time during the summer season except after noon and during heavy rains.

3. **Safety:**
   - All agricultural activities should not be carried out in the afternoon heat.
   - Students should do the activity after wearing a cap and drinking adequate amount of water.
   - Caution should be exercised while using sharp and edged tools/equipment during the activity.

Summary / Principal / Knowledge gain:

1. The most important element for agriculture is soil. The structure of soil depends on geographical conditions, climate and agricultural knowledge.
2. Soil testing is important in getting better yields in agriculture.
3. For soil testing one has to go to the soil testing center. Soil testing can also be done at school level for some limited properties.
4. The texture of soil mainly consists of sand, mud (silt) and clay. This texture is important for the growth of plants, especially the development of roots.
5. pH of soil is an important chemical property. It affects the release of nutrients from the soil to the roots and the growth of bacteria.

Resources: Reference video link:

- **How to use pH paper? Link:** http://www.wikihow.com/Read-PH-strip#
- https://www.youtube.com/watch?v=TwcNyYx00bQ
- https://www.wikihow.com/Read-pH-Strips#:~:text=Dip%20one%20end%20of%20the,pH%20level%20of%20any%20liquid,

Q.R.Codes

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Title of Activity

45. Preparing soil for growing crops (vegetables) in school

Syllabus reference:
Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:
Agricultural Science, Lessons- Soil, crop protection, cultivation of main crops, Horticulture.

Preliminary preparation:
Preparing plots for crop production.

Tools required:
Spade, wooden peg, rope, tape (meter), sickle, etc.

Time required: 45-60 Minutes
No. of students in class: Maximum 30 (No. of students in a group: 10)

Learning concepts:

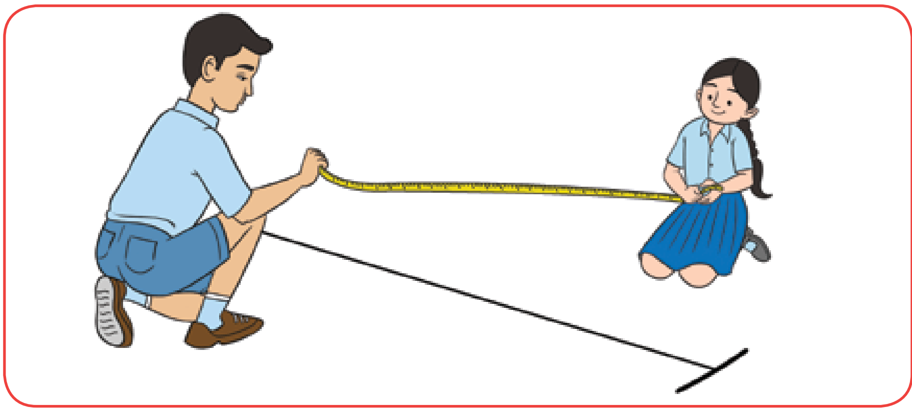
As we know that soil is a very important resource for farming and it is formed through a very long process of weathering. We also learned basic soil testing methods and various measures to improve soil quality. Now we will learn about various methods of preparing soil in farming. We will also learn how to measure land in a kitchen garden and prepare a flat bed or plot for cultivating vegetables.

Principles/Objectives: Making level beds for vegetable cultivation.

1. Students will prepare a designated sized bed by performing primary farming operations (ploughing, levelling, etc.).
2. Students will understand that soil preparation is an important step in successful farming.
3. Students will be able to understand the different stages of farming.

Process: Flat Beds - Tillage Operation

FLAT BEDS - TILLAGE OPERATION



LAND MEASUREMENT

Notes for teacher:

1. The teacher will explain about the common crops grown in the area.
2. The teacher will explain the need for measurement and the units of measurement.
3. We will explain the primary preparations for preparing the soil for sowing seeds like soil ploughing, levelling, removing weeds and delimitation, etc.
4. The teacher will explain the nature (properties) of the soil.
5. Students will do the indicated activities.

Methodology Flow:

1. Identify land/ area
2. Determine the size of the plot (3 m x 3m)
3. Draw different sizes of the plot and different beds on a paper
4. Measure the plot
5. Mark the plot with lime powder
6. Loosen the soil with a spade
7. Remove stones and debris from soil
8. Remove weeds (if any) with sickle
9. Level the land
10. Mix compost, organic-inorganic fertilizers and manure in the soil as per the requirement of the crop to be cultivated
11. Now create a bed and sprinkle water

Method-1 Learning basic land measurement skills and land measurement units:

In farming, land is measured in different units like hectare, acre, bigha, etc.

1. 1 hectare = 10000 square meters. We can also say that this is an agricultural plot of 100 m length x 100 m width.
2. Similarly, 1 acre = 4000 square meters and 1 bigha = 2508 meter

Now let's measure our farming plot:

1. In school, measure a plot of 1 bigha or 1/2 bigha by measuring with a meter tape.
2. Now convert it into acres or hectares.

Ask questions:

1. Why is it necessary to plow the soil?
2. What are the preliminary tasks of tilling the land?
3. Which are the crops with small roots?
4. What are the different methods of bed preparation in your area?
5. How to select crops on the basis of water storage capacity and soil nature?

Do's and Don'ts:

1. **How to do the activity:**
   - Make sure all equipment and materials are ready.
   - Make different groups according to the number of students. There will be 10 students in each group.
2. **When to do the activity:** This activity can be done at any time during the summer season except after noon and during heavy rains.
3. **Safety:**
   - Use lime powder carefully and wash hands after use. If lime is not available, wood ash can be used.
   - Use equipment carefully while doing preliminary ploughing activities.

Knowledge gain:

- Plants themselves take the elements necessary for plant growth from the soil.
- Soil provides support to plants.
- Fertilizers are essential elements that are necessary for the growth of plants. When their quantity in the soil is low, they are compensated with fertilizers.
- Soil stores water which is very important for plants.
- While selecting land for farming, the nature of soil, quality, availability of water, weather, profit and loss, etc. should be considered.
- Soil is home to many microorganisms, which are essential for plant growth.

Summary:

As a result of this activity, students will understand how land can be prepared for farming by measuring a plot and digging the ground. Ploughing, weeding, fertilizing and leveling are the three essential steps for farming. The soil is loosened by ploughing and weeding so that adequate air circulation can occur in the soil and plants can grow properly by getting adequate oxygen to the roots.

Resources: Reference video link:

- https://www.wikihow.com/Prepare-Soil-for-a-Garden
- https://www.wikihow.com/Prepare-a-Garden-Plot

Q.R.Codes

Title of Activity

46. Counting of plants and planting them according to the agricultural area

Syllabus reference:

Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:

Agricultural Science- Lessons- Soil, Crop protection, Cultivation of main crops, Horticulture.

Time required: 10 Minutes

No. of students in class: Max. 20 (No. of students in a group: 3-4)

Learning concepts:

After knowing about the soil and preparing the soil for planting, now we have to calculate the right quantity of seeds or seedlings. This calculation is called the budding rate or plant population. This calculation is very important for planning any crop. With this calculation, we can reduce the cost of farming, reduce our losses and get better profits. Once we know the right quantity of seeds or plants, we will learn the seed treatment and plant them in our field.

Objectives:

1. To teach the students to count the actual number of plants required as per the unit area of the field.
2. To reduce wastage of seeds. Reducing cost/price for agricultural crops. Prepare for seed treatment by ascertaining the number of plants required in the field.

Methodology:

1. Measure the length and width of the plot ready for sowing seeds.
2. Calculate the area by multiplying length x width.
3. Now calculate the space required for one plant.

   Formula:

   Distance between two plants x Distance between two rows = Plant distance.
4. Calculate seeding rate using the following formula.

   Formula:

   Seed rate = Area of the farm/plant distance
5. **For example:**

   If the length of our plot is 10 feet and width is 10 feet, then its area will be 10 x 10 = 100 square feet.

   If we sow maize crop. Maize seeds will be sown at a distance of 15 cm (plant to plant) x 10 cm (row to row). To grow one plant, 10 x 15 = 150 cm square area will be required.

   The total area of our plot is in square feet while the distance between the plants is in square cm, so we have to equate both the units.

   We know 1 square foot = 929 square cm. If we have 100 square feet of land then we can also call it 92900 square cm.

   So according to the formula 92900/150 = 619 i.e. we will need 620 maize seeds to sow in 10 x 10 land.

Ask questions:

1. What is the formula of Plant distance?
2. How to calculate the Seed rate?

Do's and Don'ts:

1. **How to do the activity:**
   - Prepare a small group of students.
   - Give them plant spacing for various crops like maize, sorghum, rice, tomato, brinjal, etc.
   - Let each group calculate the seed rate for the selected crop. Let them compare their results
   - If possible, give students seeds and let them calculate it according to the seed rate calculation.
   - The treated seeds can be used for seed treatment activity.
2. **When to do the activity:** In summer.

Do you know?

Seed rate in farming depends on various factors like:

- Planting method and distance
- Soil fertility
- Suitable weather for crop growth
- Seed Viability
- Seed age
- Seed size
- Right time to sow seeds

Summary / Principal / Knowledge gain:

- Seed rates are calculated on per hectare basis for field crops like rice, maize, sorghum, etc.
- Hybrid seeds are created with a lot of scientific research for better yield.
- Hybrid seeds are very expensive when purchased from the market.
- Seed rate is a very basic calculation in farming.
- It helps in proper planning of agricultural activity and also saves the seed cost.

Title of Activity

47. Seed treatment to increase the speed of seed germination

Syllabus reference and standard concept / Principle:

Std. 6th - Agricultural Science, Lesson - Fertilizer/Seeds.

Material required:

Hundred seeds or 100 grams of seeds, different types of seeds can be taken according to their size (e.g. Peanuts, peas, black gram, green gram, wheat, millet, mustard, lentils, sunflower, urad and moong, etc.), clay mixture, salt, ash (made from cow dung), pieces of old but clean cotton cloth, hand gloves, etc.

Tools required:

Rectangular germination tray, strainer, weighing scale, measuring vessel (500 ml), watering can, bucket, sickle, sprinkler machine, etc.

Time required:

- 30-45 days depending on seed type
- Primary time of seed treatment: 60 minutes
- Daily, water sprinkling and observation writing time - 5 minutes

No. of students in class: Max. 20 (No. of students in a group: 4-6)

Learning concepts:

We have already learned about calculating proper soil and seed rate. Before sowing the seeds, they need to be treated. Seed treatment is helpful in improving the germination of seeds. This also helps in avoiding microbial or other insect infestations. Treatment of seeds can be done with the help of chemical and natural compounds. We will learn about some fundamental seed treatment methods in this activity.

Objectives:

1. Students will learn the process of seed treatment.
2. Students will be able to understand the primary stages of seed germination.
3. Students will learn to remove unfit/unusable seeds for germination.
4. Students will know how to choose appropriate seeds by counting certain quantity of seeds for a good harvest.
5. Students will get information about seed treatment by ascertaining/calculating how many plants are required in the field.

Instructions for teachers:

1. The teacher will explain seeds and seed treatment.
2. The teacher will clarify the definition of seed treatment.
3. The teacher will explain the process of seed germination in detail.
4. The teacher will explain ways to treat different types of seeds.
5. The teacher will explain the utility and importance of the activity, along with necessary precautions and safety measures.

Activity-1: Seed treatment by salt and ash:

Choose at least one seed for both the methods given below:

Seed treatment with salt	Seed treatment by ash
Coriander, grains like sorghum (jowar), bajra, millet, ragi, maize, etc.	Peanuts, gram, red gram, green gram and peas, etc.

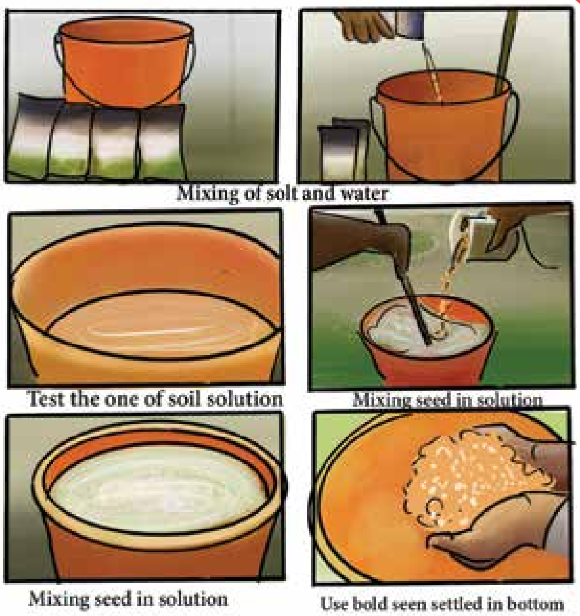
Students will carry out the activity in 2 steps:

1. Seed treatment by salt:

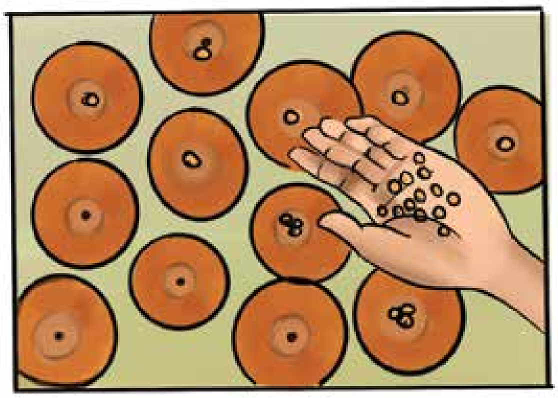
Process Flow:

- Select seeds for germination by counting/weighing.
- Dissolve 20 grams of salt in 1 Liter of water.
- Stir the water until the salt dissolves completely.
- Soak the selected seeds in this salt solution for 10-15 minutes.
- Remove the seeds floating on the top using a sieve because these seeds are not fit for sowing.

- After 10-15 minutes, separate the salt solution from the seeds.
- Spread the extracted seeds on cotton cloth and dry them in the shade for 30 minutes.
- The treated seeds are now suitable and ready for sowing.



SEED TREATMENT BY SALT



SEED SOWING IN TRAY

2. Seed treatment by ash:

Process Flow:

- Select seeds like gram or peanut by counting them.
- Spread the seeds on dry cotton cloth for treatment.
- Weigh 100 grams of ash (dry).
- Put this ash over the seeds and rub the with your hands. Then dry them for 30 minutes in shade.
- Treated seeds are ready for use (sowing).

Activity-2: Sowing:

After seed treatment, seeds will be sown for germination using the following steps.

1. Take sifted soil.
2. Add compost to the soil. (1 part soil : 1 part compost)
3. Fill the rectangular germination tray with soil mixture (with compost).
4. Hundred seeds/100 grams seeds can be sown in a rectangular tray. If the seeds are very small, spread them evenly by hand. If the seeds are large and countable, put each seed at a designated place.
5. Water the seeds daily t a sprinkler/watering can.

6. Draw an observation table with the help of the teacher.
7. Observe the germination process of seeds.
8. Record the changes taking place along with the date.
9. After 15 days, count the seeds that have germinated
10. Calculate the percentage of germination/viability.

Overview Table:

Details	
Names of seeds sown	
Date of sowing seeds	
Number/quantity of seeds sown	
Number of germinated seeds	
Formula: After 15 days, out of 100 seeds/100 grams of seeds, the germination percentage will be calculated using the following formula on the basis of germinated seeds. *Germination percentage = (number of germinated seeds)/(total seeds) × 100*	
Calculation: Conclusion:____________________________________ Germination percentage tells us the number of viable seedlings. For example, if the germination rate is 70% then 70 out of 100 seeds are useful for planting.	

Knowledge gain:

Various crops like grains, pulses get infected by various insects/micro-organisms originating from the soil. Crop production can be increased by removing these infections through seed treatment.

What is seed treatment?

To free the seeds from the infection of seed borne/soil borne microorganisms (germs/germs), seeds are made infection free, cleaned/purified using fungicides, insecticides or both. This is called seed treatment.

Benefits of seed treatment:

- Prevents soil borne diseases.
- Increases the germination capacity of seeds in the field.
- Crop growth is fast and good
- The production capacity of the crop increases.

- Small plants have less chance of drying/withering/destruction.
- The disease resistance of plants increases.
- The expenditure on seed treatment is very less as compared to the benefits from it.

Ask questions:

1. What is a seed?
2. What types of seeds have you seen?
3. What is seed treatment? How many types are there?
4. What is the use of salt in seed treatment?
5. What is the use of ash in seed treatment?
6. Do all the seeds used in the rectangular tray germinate?
7. When did you see the first germination?
8. How many days did it take for complete germination?
9. What are the factors affecting the germination process?
10. Why is it necessary to spray water on the seeds during germination?
11. Have you noticed any disease or insect infestation on seeds or plants? What is the reason behind this?

Do's and Don'ts:

1. **How to do the activity:**
    - Teachers will form groups of students.
    - Each group will choose different types of seeds for seed treatment.
    - Students will perform seed treatment (by any one method) and sowing.
    - Students will take care/irrigate the sown seeds and record their observations and calculate the germination percentage.
2. **When to do the activity:** In summer.

Use:

- The small plants grown in trays will be transferred and planted in the beds/ fields.

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Title of Activity

48. Creating a plant nursery in the kitchen-garden of the school

Syllabus reference:
Std. 6th, Std. 8th - Agricultural Science

Learning Concept/Objective:
By understanding the multiplication/reproduction method of plants through transmission/propagation process, we will learn to make different plants.

Material required:
Pot filled with soil, used milk bag/polythene bag, 5 bamboo sticks (2000 mm length and 25 mm diameter), one polythene sheet of 2 meter long and 3 meter wide.

Tools required: Blade, cutter, sharp knife, etc.

Time required:
- Initial time for cutting leaves and stalks of plants - 10 minutes.
- Daily time for watering, plant care and recording - 5 minutes

No. of students in class: Max. 20 (No. of students in a group: 4-6)

Introduction:

Plant propagation is the process in which new plants are grown from various sources such as seeds, cut leaves, cut stems and other plant parts. Plant nursery is the place, where plants grow and propagate. Small plants require proper environment to grow. They require moist soil (50 to 60 percent moisture) and under normal conditions 50 percent shade, humidity 60 to 70 percent.

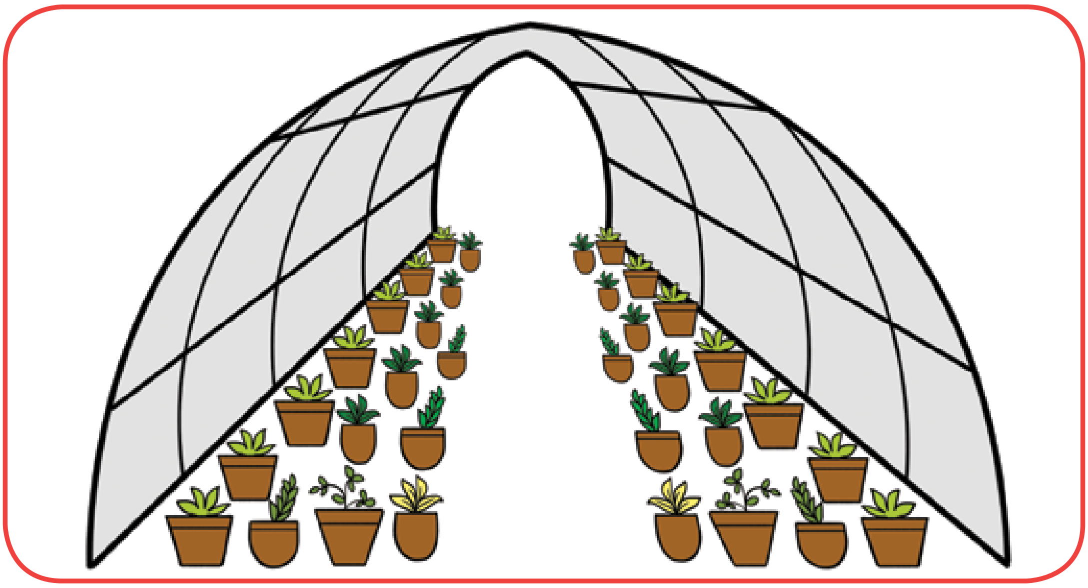
These environmental parameters have to be maintained in the plant nursery by properly observing them.

Objective of the activity:

1. To acquaint students with methods of plant propagation like leaf cutting, stem cutting, seeds, etc.
2. To teach students to grow plant nurseries in the school kitchen garden. To make a nursery, students will collect plants (general ornamental or flowering plants) only with the permission of the parents or teachers.

Activity-1: Creating a plant nursery near the kitchen garden in the school premises.

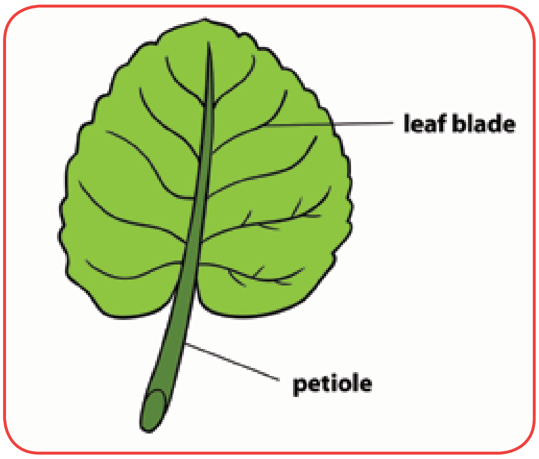
- Clear an area of 5 square meters in the corner of the school kitchen garden.
- Remove big stones and pieces of bricks, etc. while cleaning the ground.
- A tunnel of 1 meter length and 1 meter width will be made from bamboo sticks or similar things which will be strong.
- This tunnel will be covered with plastic sheets on three sides.
- The plastic sheet on the ground will be well reinforced with soil, stones, etc.
- The plastic sheet will be kept open from the front so that it can be used for planting new plants, etc.
- This tunnel will be used as a nursery for new plants.

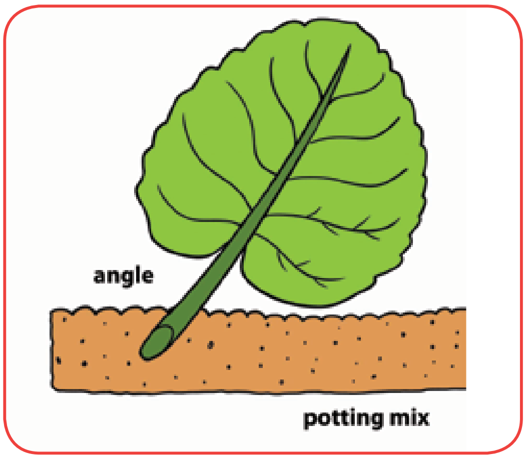


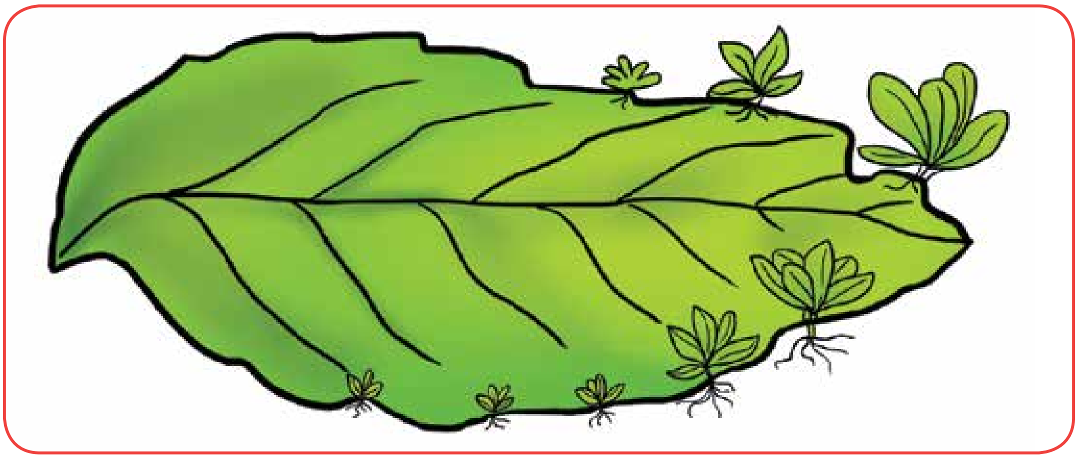
NURSERY PLACE

Activity-2: Preparing new plants through leaves (carrying out transmission/ propagation process on leaves)

- Collect Ajubaa (stonecrop) leaves from around the school.
- Prepare at least 10 plants using the following method. You will need to fill soil mixture in 10 polythene bags.







- Choose a healthy leaf.
- Cut leaf to 2.5 cm length from the stalk.
- The stalk will be pressed into the soil at a slight angle so that the entire leaf remains above the soil.
- Put soil around the leaf and press it gently.
- Keep the leaf in a humid place. This leaf is susceptible to diseases like fungus, etc. and its immunity power is low. Protect it from diseases.

Activity-2.2: Making a new plant from the stem:

- Producing a new plant by stem and asexual vegetative reproduction is also a method of transmission/propagation of plants. It is good for domestic plants and bushes, etc. In this, a new plant is prepared by cutting a part of the stem from the mother plant and planting it in the ground.

- Students will use ornamental or flowering plants like bougainvillea, money plant, potato, etc. from around the school or home.
- Using this method, prepare at least 10 plants in 10 polythene bags.

Activity-2.3: Preparing new plants from seeds:

- In this method, seeds are used to produce new plants.
- Collect seeds of marigold, tulsi, brinjal, ladyfinger, fenugreek, coriander, etc.
- At least 10 plants will be prepared by filling soil mixture in 10 polythene bags.

Now the new plants obtained from the above three methods (Activities 2.1 to 2.3) will be kept in the nursery tunnel and will be watered continuously. These plants can be used to plant in schools as well as in the surrounding areas. They can be used for gifting or selling to respectable people.

Ask questions:

1. What are the different modern methods of plant growth (reproduction)?
2. Which method did you find easy and liked the most?
3. Do all plants have seeds, if not then why?
4. What are the factors that stop the growth of new plants?
5. How important is asexual reproduction of plants in agriculture?

Do's and Don'ts:

1. **How to do the activity:**
    - Teachers will form groups of students.
    - Students will take care/irrigate the sown seeds and record the observations.
2. **When to do the activity:** Anytime

Summary / Principal / Knowledge gain:

- Propagation process is an important skill in agriculture
- Developing a plant nursery in the kitchen garden of the school can be an independent venture.
- Plants can be grown through asexual reproduction (leaves, stem, etc.) and sexual reproduction.
- Nowadays, more new modern methods of plant growth like tissue culture, genetic breeding, etc. are being used.

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Title of Activity

49. Preparing kitchen-garden through vertical bag farming

Syllabus reference: Agricultural Science: Std. 6th: Lesson 3, 5, 6, 7, 8, 9, 11, Std. 7th - Lesson 5, 6, 8, Std. 8th - Lesson 3, 5, 8, 9

Learning Concept:

Vertical bag farming is a method of making a small land productive and convenient.

Material required:

Soil, compost, sand, pebbles, well-rotted or decomposed cow dung, plastic bag (compost bag, cement bag or gunny sack), wood-ash, rice husk, green manure, PVC pipe (12 cm diameter), 7-9 small vegetable plants, etc.

Tools required: Sickle, spade, spade, watering can, strainer, tub/pot.

Time required: • About 45-60 days (depends on plants selected)

• Initial planting time - 60 minutes

• Daily time for plant care and observation - 05 minutes

No. of students in class: Max. 20 (No. of students in a group: 4-6)

Introduction:

The traditional belief is that farming requires large land. But now, due to many advanced agriculture techniques like hydroponics, indoor farming, etc. farming without large land is possible. Vertical bag farming is one such advanced farming method. In school we can use this method to learn many agricultural skills. This method can be used in small balconies, terraces, etc.

Objectives of the activity:

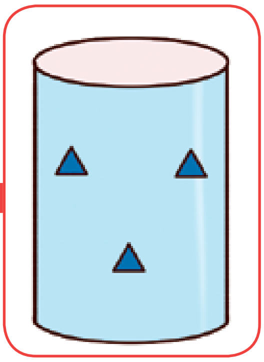
1. Proper use and re-use of available tools and space.
2. To acquire information about new farming techniques.
3. To know about new techniques of organic vegetable cultivation.

How to conduct the activity:

- Teachers will make groups of students.
- Each group will select different types of plants like vegetable plants, medicinal plants, etc. for different bags (One bag for 5 students).

Water drainage: If there is no proper drainage, the plant may die. There is a simple and easy process of drainage, proper drainage can be done by making 4-5 holes in the polythene bag/pot.

TRIANGULAR MARK ON THE SIDE OF THE BAG



VERTICAL BAG FARMING

Overview:

- Write the following comments:

1. Total number of polythene bags used :______________________
2. Number of seeds sown per bag :______________________
3. Number of plants sown per bag :______________________
4. Identify different plants sown (name with quantity of plants)

   i. ______________ ii. ______________ iii.______________

   iv. ______________ v. ______________ vi.______________
5. Size of used polythene bags :______________________
6. Age of transplanted plants :______________________
7. Initial height of transplanted plants :______________________
8. Number of leaves on a seedling :______________________
9. Types of soil mixture with proportions of ingredients used: ______________
10. Conclusion: ______________________________________

Overview: Vertical Bag Farming:

- Take polythene bags. Now, to ensure proper drainage of water through the polythene bag, make holes at several places in the bottom of the bag.
- Make 4-5 slightly bigger holes on the top side of the polythene bag, from which the plants will come out.
- Prepare soil mixture by mixing cow dung manure, wood ash, sand, paddy husk and organic fertilizer in equal quantities.
- Soil mixture will be filled in the polythene bag till 10 cm.
- Some broken brick pieces will be placed in the middle of the polythene bag and then keep a piece of P.V.C. pipe and it will be filled with pebbles.
- Fill the P.V.C. pipe with the prepared soil mixture, but keep in mind that the pipe will be kept empty for 6 to 10 cm from the top.
- Now take out the pipe slowly and fill brick pieces/pebbles in the middle of the bag.
- Now any healthy seed or plant will be transferred and planted in the bag.
- Keep watering the plants from time to time. Weeds/weeds will be removed as per requirement.

Ask questions:

1. How many types of plants can be grown in one bag?
2. Have you seen any disease or disease-causing insect or any type of fungus? Describe it.
3. Which plants are suitable for polythene bag farming?
4. Can we use vine for bag farming?
5. Which fertilizers are added to the bag?
6. How did you water the plants in polythene bags?

Safety: Be careful while using tools and equipment, body parts should not be injured.

Summary / Principal / Knowledge gain:

- Vertical bag farming is one of the advanced farming methods. It is used as an urban farming method in poor soils/ for rooftops. Compared to regular farming, with this method we can get 3 to 5 times more yield per unit area. This method requires precise management of fertilizer, irrigation, pest management, etc.

Resources: Q.R.Codes

- https://youtu.be/GQrO5ktno3Y
- https://www.wikihow.com/Use-Growing-Bags-for-Plants

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Title of Activity

50. Learning to prepare Vermi-compost

Syllabus reference and standard concept / Principle:

Std. 6th, Agricultural Science, Lesson - 3

Learning Concept:

Making vermi-compost using earthworms and other organic waste.

Material required:

Water, cow dung, soil, gunny bags, earthworms, dry grass and leaves collected from fields and waste obtained from kitchen and fields.

Tools required:

Spade, bucket, shovel, tub, gunny bags, etc.

Time required:

- Process time: 60 to 90 minutes for initial preparation to make a plant
- Daily watering - 05 minutes (25 to 30 days)
- Total time taken to complete the entire process 03 months

No. of students in class: Max. 20 (No. of students in a group: 10)

Introduction:

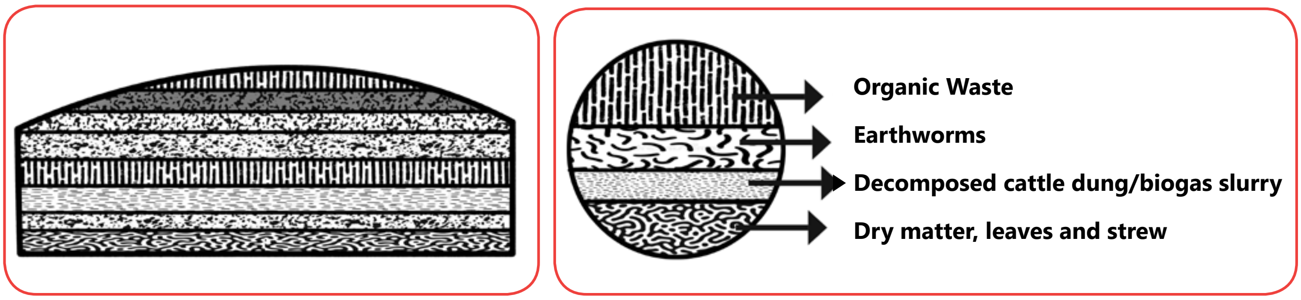
Plants need proper care for farming. Use of fertilizers is one of the important activities in farming. Fertilizers maintain soil fertility. Fertilizers are of two types: natural and artificial. Vermi-compost is one of the natural and organic fertilizers used for plants.

Vermi-compost is a natural fertilizer, which is essential for plant growth. Earthworms are used here mainly because they consume organic waste and expel it through their digestive system. This converted soil is used for agriculture as organic fertilizer.

Process:

After collecting the material, students will follow the procedure in the following sequence.

1. Moisten the land with the help of water.
2. Mix waste material like coconut husk, rice husk, grass, etc. at the bottom of the plant making a pile about 3 to 5 cm.
3. Spraying adequate water.
4. Spreading a thick layer of decomposed cow dung and soil.
5. Take full grown/adult earthworms weighing about 1 to 1.5 kg from Krishi Vigyan Kendra. Their number will be around 300 to 500.
6. In the plant pile, create a second layer using thoroughly decomposed peels and husks of fruits and grains into small pieces, animal faeces, cow dung, grass flowers, leaves of plants, manure of fish and chicken faeces, etc.
7. Cover this heap well with gunny sack and sprinkle water on it for 25 to 30 days.
8. If the pile made of organic matter becomes hard, loosen it by hoeing with hands.
9. After 30 days, turn the stacked layers once for good aeration and proper dissolution. Do the weeding.
10. Vermi compost will be ready in 45-50 days.



PREPARED BED/PLANT OF VERMI-COMPOST

Summary/Usefulness:

- When the raw material used is completely decomposed it looks black and granular. It is, when the plant/pile is ready to be filled with earthworms.

- When compost is ready, sprinkling of water should be stopped. Compost should be placed on top of a pile of half decomposed cow dung, so that the earthworms can reach the cow dung from the compost.
- After two days, the compost should be separated from the cow dung and filtered for use.
- The vermicompost prepared in this way should be placed in the form of a conical heap.
- The manure should be separated from the upper part of the heap, dried in the shade and sifted.
- The pupae and eggs of the earthworms that remain after filtering can be used again to make vermicompost.

Dosage of vermi-compost:

Crops	Dosage
Cereal crops	5-6 Tonnes/hectare
Fruit crops	3-5 kg/plant
For pots	100-200 grams/pot

Do you know?

Definition: "Vermi-compost is a process in which earthworms convert organic waste into compost with high nutritional content."

What is vermi-composting?

Vermi-compost is a scientific method of making compost by earthworms. Earthworms generally live in the soil and consume the decomposed organic substances present in the soil and expel them through the digestive system in the form of organic manure.

What is vermi-culture?

Vermi-culture means "cultivation of earthworms". Earthworms eat organic waste and expel it through their digestive system in the form of earthworm food. This earthworm food is rich in nitrates and minerals like phosphorus, magnesium, calcium and potassium, which are used as fertilizer to improve the quality of the soil.

Benefits of using vermi-compost in agricultural soil:

- Soil ploughing is done in a natural way without causing any harm to the roots and trees. Therefore, with sufficient air circulation in the roots, their growth also improves.
- The water absorbing capacity of soil increases.
- Reduces soil erosion.
- Use of vermicompost increases organic carbonic acid in the soil.
- Reduces evaporation of water.

Ask questions:

1. Why is it necessary to sprinkle water on piles?
2. Where will we get earthworms?
3. What factors influence this process of preparing vermi compost?
4. How many days will it take to make vermicompost?
5. How can we increase the number of earthworms?
6. How many earthworms will be required in this process?
7. What are the uses of vermi compost?

Do's and Don'ts:

1. **How to do the activity:**
    - To create vermicompost plant/heap, students of each group should collect materials and equipment from nearby areas.
    - We can also get earthworms from the nearby Krishi Vigyan Kendra.
    - The process should be done during the rainy season.
    - If earthworms are not available, make different compost.
2. **When to do the activity:** Rainy season.

Usage:

- In future, prepared vermicompost will be used to increase the quality of plants.
- Use the earthworms to sell in the future.

Summary / Principal / Knowledge gain:

- In the absence of light, the process of vermi composting of kitchen waste and other green waste materials takes place which makes the soil nutritious. It is an environmentally friendly process that turns organic matter into compost and produces valuable nutrients.

Resources:

- https://en.wikipedia.org/wiki/Vermicompost

Q.R.Code

Title of Activity

51. Making pots from waste plastic bottles, planting plants in them & preparing a nursery by painting the pots

Syllabus reference and standard concept / Principle:

Agriculture Science - Std. 6th - Lesson No. 8

Std. 7th - Lesson No. 4 and 5, Std. 8th - Lesson No. 5 and 7

Material required:

Waste plastic bottles/cans, fertilizers, soil, cow dung manure.

For ornamental plants: Colored polythene bags/kulhads/paper cups/glasses, soil mixed with manure, seeds/stalks of flowering/ornamental/medicinal plants, etc.

Tools required:

Sickles, Tasla, sickle, mug, painting brush, etc.

• **To paint pots:** Ochre or terracotta color of your choice, brush or cotton cloth and water.

Time required: Procedure time: 15 to 20 days

• First day 40 to 50 minutes • Time to paint the pot - 60 minutes

• Daily time required to water the plants - 15 to 20 minutes

No. of students in class: Max. 15 (No. of students in a group: 4)

Objective of the activity:

Children will learn to prepare seedlings of flowering/ornamental/medicinal plants in pots. And they will also learn to paint pots and decorate the wall or corner with colored pots.

Names of ornamental flowers:

Dianthus, Pensy, Gerbera, Daisy, Chrysanthemum, Dahlia, Calendula, Saneria, Salvia, Phlox, Cosmos, Zitia, Rose, Marigold, etc.

Names of ornamental plants:

Coleus, Christmas Tree (Araucaria) Kochia, Snake Plant, Money Plant, Jade Plant, Fern, Erica Palm, Croton, etc.

REUSING PAINTED PLASTIC BOTTLES

REUSED PLASTIC BOTTLES

DECORATIVE WALL FROM WASTE GI TINS

HANGING POTS FROM WASTE GI TINS

Steps to reuse plastic items:

1. Cut the plastic box/utensil/container into desired shape and size with the help of knife/scissors. Then wash it thoroughly.

2. If the bottle is cut in the middle, both halves can be used.
3. Make 3-4 holes at the bottom of the cut vessel for water drainage.
4. Paint it using a brush and dry it. Apart from this, plastic tape can also be used.
5. Now after certain measurement, fill in the fertilizer, manure, sand, pebbles, wood ash, etc. in the pot made

from this bottle. By mixing vermicompost, etc. in soil, we will prepare the fertilizer mixture.

6. Now plant the plants in these containers, water them and take care of them.

Ask questions:

1. What kind of colours were used on the plastic or tin pots you made? Which type of colors are appropriate to be used on which type of pot?
2. Should we water plants daily?
3. In which type of container/pots, plants grow faster?
4. Did you notice any disease or disease-causing insect on the plant?
5. Have you observed healthy plant growth?

Do's and Don'ts:

1. **Caution and Safety:**
    - Care should be taken while cutting/using tin cans. This should be done only in the presence of the teacher/instructor.
    - Do not touch the paint with direct hands. Use a wooden stick to mix the paint.
2. **When to do the activity:** Generally rainy season (July - August).

Usage:

- Old plastic/tin cans/bottles can be reused.
- The prepared pots/boxes can be used for decoration.
- The flowers obtained can also be used in decoration by making garlands or they can be gifted to the dignitaries or guests coming to the schools.
- When the plants grow properly in 30-40 days, you can earn profit by selling them. Do this only after the permission of the teachers or instructors.

Summary / Principal / Knowledge gain:

- Students will learn to reuse old plastic cans, bottles, etc. creatively.
- Reuse of plastic will benefit to some extent in compaction/solid waste disposal.
- Students will learn to take care of plants.

Resources: Q.R.Code

- https://housing.com/news/diy-plastic-bottle-planters-for-modern-homes/
- https://www.crayonsnspices.com/post/diy-plastic-oil-can-planter-waste-material-planter-simple-planter-making-ideas-quick-easy-craft

Title of Activity

52. Preparing organic pesticides

Syllabus reference: Agricultural Science: Std. 6th: Lesson 5

Objective/Learning Concept:

Students will learn to prepare organic pesticides.

Material required:

1. Native cow dung 1 kg.
2. Native cow urine 1 liter (the older the better)
3. Native organic jaggery – 50 grams
4. Water 10 Liters

Tools required:

Plastic bucket, wood/stick, gloves, etc.

Time required: • First day 30 minutes

• 05 minutes per day for 05 days (to mix/stir)

• Total time: 5 to 6 days

No. of students in class: Max. 30 (No. of students in a group: 5-10)

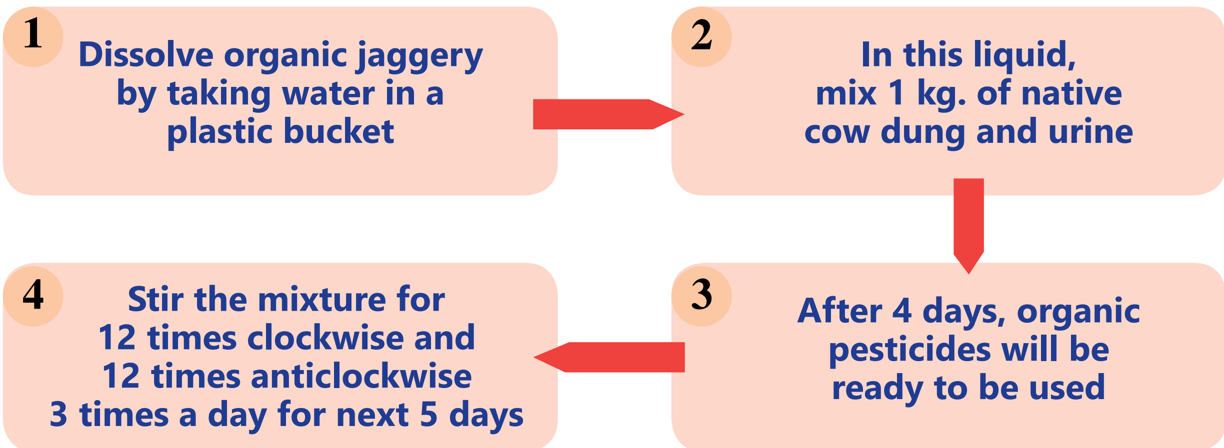
Objectives of the activity:

Farming attracts many pests. Insects are not our enemies but they are a part of our ecosystem. So, we need to understand that we should not destroy them, but we can manage them to keep our losses at minimum level. Chemical pesticides are not only harmful for ecology but also cause many diseases to humans. These are harmful especially for small children or sick people; hence we use organic pesticides. We will learn a process of making and using it. We will be able to manager pests with this.

Process:

1. Collect water or cow urine and jaggery in a plastic or steel bucket. Mix cow dung and cow urine in this and mix it well. Use a wooden or plastic stick for whipping but do not use any metal stick.
2. Now add water and leave the bucket tied loosely with a cloth. This will produce fermentation/foam. Keep the bucket at a place where direct sunlight and rain water do not fall on it.
3. The mixture has to be stirred with a stick 3 times daily (morning, afternoon and evening), 12 times in clockwise and 12 times in anti-clockwise direction. This will allow the microorganisms/bacteria to spread evenly throughout the mixture.
4. From the second day itself, it will be seen that the fermentation process has started. On the fourth day, the activities of the microorganisms will have been completely completed. Now we can use organic pesticides.
5. From the fourth day onwards, you can take 1 Liter of the liquid mixture, mix it with 10 liters of water and use it on plants.

Process Flow:



Ask questions:

1. Name some organic pesticides that you know?
2. What are the common pesticides for vegetables around you?
3. Without using any chemical pesticides, how can we protect crops from pest attacks?

4. Why is spraying of organic pesticides considered good to protect crops from pests?
5. For how long can we use organic pesticides on the plants and crops?

Do's and Don'ts:

1. **How to organize the activity:**
   - The teacher will direct the students for the activity.
   - Students will collect the materials and equipment needed for the activity.
2. **When to do the activity:** Do it during rainy season.

Usage: Irrigation of plants with organic pesticide keeps the soil alive and increases the amount of nutrients in the soil. Irrigation/spraying with organic pesticide protects plants from pesticides.

Do you know?

What are organic pesticides?

Harmless multipurpose substances made from natural ingredients are called organic pesticide liquids. This is not harmful to humans.

Properties of cow dung and cow urine:

- Many types of beneficial microorganisms are found in cow dung.
- Microorganisms found in cow urine increase the process of photosynthesis and it is useful as a food for microorganisms.
- Native organic jaggery acts as food for microorganisms, which nourishes them and increases their growth.

Summary / Principal / Knowledge gain:

- Instead of expensive chemical pesticides, students will be able to learn how to make economical, useful pesticides with multiple benefits, which can protect crops.

Title of Activity

53. Understanding the importance of determining and recording the costs of farming

Syllabus reference:
Std. 6th

Standard concept / Principle:
Agriculture Science

Material required:
Notebook, pen, pencil, sketch pen, card paper, marker, writing pad, etc.

Tools required:
Paper Marker (red, black, blue and green), card sheet (A-3 size), table (2x4 ft)

Time required: 1 Hr.
No. of students in class: Max. 30 (No. of students in a group: 5-10)

Objectives of the activity:

1. To make students aware of the importance of record keeping in farming.
2. To tell the students the importance of calculating the costs of farming.

Learning concept:

- Documenting (Record keeping of) any work is one of the basic skills and a good habit. Farming is considered a dynamic enterprise.
- Farming depends on many external factors like weather, market prices, etc. Many farming activities depend on each other. Therefore, it is necessary to carry out any activity in farming in a planned manner.

Farming is the main livelihood enterprise in our country. In farming, recording is the basis of profit (earnings). Based on which we can make future plans (of activities), correct mistakes and also determine the selling price. The cost of various farming activities such as preparation of land, purchase of seeds, seed treatment, fertilizer (compost), pesticides and labor costs, etc. should be properly recorded.

Activity-1: Preparation of documentation/record sheet of school kitchen garden:

A) Making a record table of plant growth and expenditure incurred:

- Each student will record individually and will collate the recorded data in a small group.
- Tell students about the chart and create a table in the daily record book.
- Select any 05 to 10 plants from the Kitchen Garden (School Farm). Make a 'tag/ label' from card sheet and tie it to the plant with thread. Give each plant a tag number. Cover the tag with plastic paper (lamination) to protect it from water.
- Students will do the record work in their notebooks; instructors should also make their own main records separately.

Sr. No.	plant identification number/Tag no.	Date of planting	Date of recording	Plant height (cm)	Number of leaves on a plant	Number of flowers and fruits on the plant	Remarks (Any insects or spoiled fruit or leaf, etc.)
1	Vegetable-1, Tomato	10 September	20 September	15 cm	12	2	2 leaves spoiled by insects/ parasites

Note: Sample data is filled for understanding only.

B) Recording work:

- Explain the chart to students and ask them to write their daily records in a notebook.

- Write the main activities such as preparing the field, sowing seeds, applying fertilizers, applying pesticides, harvesting crops, etc. on the chart
- Note the exact time to perform the task (not the time to prepare for the activity)
- Calculate the total time taken for agricultural work (In days or in minutes) and use it in the next activity (to determine the price).

Sr. No.	Activity Name	Date of activity	Number of students involved in the activity	Time taken to complete the work	Total time taken to complete the activity	Remarks (Whether the task is completed or not)
1	Field preparation	05 to 09 September	20	20 minutes	400 minutes	Work done
2	Plant seeds	10 September	10	10 minutes	100 minutes	Work done

Activity-2: Making cost sheet of school kitchen garden:

- Before the activity, the instructor should discuss with the students about the materials and equipment required for each activity and its estimated cost. Make a separate sheet of cost of main activity like vermicompost, vertical bags, farming, etc.
- Prepare separate sheets of cost of main activities like preparation of vermicompost, making kitchen garden using vertical bags farming, etc.

Sample cost table: Cost details for seed treatment and sowing activity:

Sr. No.	Name of raw material	Quantity used	Price/ unit	Amount (Rs.)	Remarks
1	Preparing farm/ plant	400 minutes (6.6 hours)	Rs 20 per hour	133.00	Time taken for recording. Prepare chart for the activity.
2	Coriander seeds	50 grams	Rs. 200.00 /kg	10.00	-
3	Seed treatment (with ash and salt)	Ash-50 grams Salt-50 grams	Rs. 30.00 /kg	1.50	Ash will be available from around the school without any charges. Include the cost of the salt in the calculation.
4	Wages for sowing seeds	100 minutes (1.66 hours)	Rs.20.0/hour	33.00	Time taken for recording. Prepare chart for the activity
			Total cost	**177.50**	

Note: The cost amount (price) given in the table is only indicative. The actual cost should be used by teachers and students as per their expenses.

- The total cost of farming will be the sum of the expenses incurred on all activities.
- After calculating the total cost, 25-40% profit will be added to it.

- Total cost + profit is the selling price of the crop.

Table of the cost price of crop (for example):

Sr. No.	Activity Name	The amount (price) of cost incurred in each separate activity	Any other expenses	Total expense (cost) in Rs.	Remarks
1	Land preparation and sowing	177.50	5.00	182.50	Additional seeds of 25 grams will be sown, so that the loss caused by heavy rains can be com-pensated.
2	Preparation and use of fertilizers	4.00 kg fertilizer at the rate of Rs 40.00/kg	0.00	40.00	-
3	Use of organic pesticides	2 liters Rs. 10.00/liter	0.00	20.00	-
4	Destroy /Re-move weeds	20.00	20.00	40.00	Write from work time cost table
			Grand total	**282.50**	

Harvesting and production costs: table (for example):

Sr. No.	Crop name	Harvest date	Production volume	Total crop	Remarks
1	Coriander	25th October	7 kg (28 bales)	28 bundles	
2	Coriander	05th November	3 kg (12 bales)	12 bundles	Enite crop production is complete

Sales and Cost (Price) Table:

Calculate the selling price of the crop by adding profits to the total cost for sale as follows:

Sr. No.	Crop name	Total pro-duction value	Produc-tion	Pro-duction price per unit or bale	Profit per-centage	Selling price	Net Earnings (Value)	Dividend
1	Corian-der	282.50	10 kg 40 bundles	Rs. 7.06	50%	10.00	40x10= 400	Rs. 117.50

Note:

- Thus, we can see that the total profit from coriander crop in 60 days (06 September to 05 November) was Rs.117.50.
- The above tables are only samples. Students will have to fill in their actual data and fill in their own data from the table.

Overview:

- Let's write all types of records carefully. Let's observe the selected plants closely while recording them. Also, write quantitative facts like color of leaves, insects, number of fallen flowers, etc.
- Let the students compare their data with the yield data of farmers'/parents' fields to see if there is any difference or similarity.
- Write down other observation/remarks if any.

Ask questions:

1. What are the common data recorded by farmers? Students can meet farmers in group and ask them about this.
2. How is the data useful in the kitchen garden nursery of the school?

Do's and Don'ts:

1. **How to organize the activity:**
   - Form small groups of students so that there is active participation of each student and record data like plant height, number of leaves, etc.
   - Identify plants using tags. This is necessary for good data. If the tags fall or get destroyed, they should be made again and tied to the plants.
2. **When to do the activity:**
   - Whatever crop must be covered in the academic session should be done according to its crop period.
   - Number of students in the group: There will be a maximum of 5 to 10 students in each group.

Utility:

Display these nicely and neatly obtained data on the notice board and discuss them with the teacher so that the teacher can explain them in detail and give feedback.

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Title of Activity

54. Use of computers in agriculture sector

Syllabus reference and standard concept / Principle:

Std. 6th: Science Subject - Personal Computer

Std. 7th: Science Subject - Basic and advanced operations

Std. 8th: Science Subject - Internet, Email, Education

Material required:

Notebook/Copy, pen, etc.

Tools required:

Computer lab with internet connection, etc.

Time required: 2 Hrs.

No. of students in class:

Maximum 15 (No. of students in group 2 to 3. or according to the number of computers available in the lab.

Introduction:

Agriculture is a very enjoyable and growing business. It is almost related to subjects like science, mathematics, language, geography, economics, social science, etc. Information technology has an important role in the agriculture sector. Through computers, one can get new information, apply for schemes and buy and sell agricultural products.

Objective:

1. Students will be trained to enhance their skills in the use of computers in agriculture.
2. To train students in search engines, email, weather forecasting, S.H.C. (Soil health card) portal, land documents, agriculture related schemes (government programs) and other important works on the internet.
3. To train students about educational video material, agriculture assisted apps for smart phones.

- **Instructors can motivate students to develop skills in the field of agricultural work. Some of them are as follows:**

1. We can provide information to the agriculture sector through 'Science and Technology' through web content (information) such as videos, animations, learning from other communities around the world, etc.
2. We can learn the methods/approaches from other communities around the world.
3. To acquire new information about agricultural methods.
4. Avoiding middleman in purchase and sale of farm products thereby increasing our profits.

Suggestions for the activities for students:

a) To educate and train students to use basic computer skills in farming:

S.N.	Activity list	Tips/Guidelines/URL
1	Making 'name plates' for plants in school premises, farming plots, plant in the pots, etc. (On the name plate you can write the name of the school, local name of the plant and scientific name, etc.)	**Use of Software:** Making name plates for potted plants, etc. in school premises and agricultural plots using software like Microsoft Word, PowerPoint, Notepad, etc.
2	Make observation tables for agricultural activities	**Make an attempt:** Preparing graphs, tables, activity charts, etc. using software like Microsoft Excel, Word, PowerPoint, etc.

b) To train students in the use of Internet applications and search engines to collect information regarding agriculture

S.N.	Activity list	Tips/Guidelines/URL
1	Google search	Exploring farm-based experiments (http://www.wikihow.com/main-page) Find out the crops season and their locality, river and irrigation facilities, government nurseries, etc. near the school location.

S.N.	Activity list	Tips/Guidelines/URL
2	Weather forecast	Use the portal to find the latest weather and forecasts for your school's location. https://mausam.imd.gov.in/ https://www.accuweather.com/etc
3	Soil health record	Soil Health Card Mission Portal- Find your soil health standards for your location (village, block, district, state) by using- https://www.soilhealth.doc.gov.in
4	Land records	Locate local land records using- https://www.india.gov.in/e-services-land-records-0
5	Government initiative for farmers	Know about agricultural schemes in your area in various government initiatives (agriculture related government programs) https://agriwelfare.gov.in/en/Major
6	Latest rate of agricultural produce	Find the latest rates of agricultural produce of your area. https://services.india.gov.in/

c) To train students in the use of educational video materials, smart phone applications related to agricultural activities.

S.N.	Activity list	Tips/Guidelines/URL
1	Learn through Educational videos or animations	https://www.youtube.com/ Use youtube for searching.
2	Learning from smart phone-based applications	**Use the following apps from Google Play Store:** • Google Lens - Use the app to identify the plants by their names and type. • Bhuvan for Hail Storm, Weather Prediction and Forecast Warning • IFFCO Kisan - Know information about agriculture related investments. • Agri Media Videos - Videos related to farming • Plantix- Identification of plant diseases and pests.

Do's and Don'ts:

1. **How to organize the activity:**
   - Make small groups of students according to the availability of computers in the lab (maximum 03 students in a group).
   - Find out the application of computers for agricultural activities in school premises.
   - Locate Internet applications for the local area of the school campus.
2. **When to do the activity:** Anytime.
3. **Safety:** Follow all safety precautions to avoid electrical shock/danger. Keep in mind the security protocols while using the internet, social media and online money transferring applications.

Q.R.Code

Resources:

- https://www.wikihow.com/Be-safe-onthe-internet

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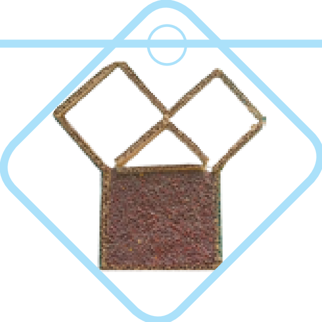
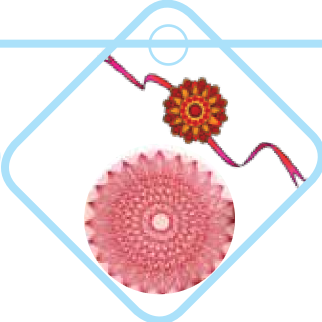



Art and Craft Section

Title of Activity

55. Learning string art

Syllabus reference:
Std. 6th, Std. 7th, Std. 8th

Standard concept / Principle:
Science - Fiber to fabric, Geometry

Material required:
Thick paper (1-2 mm thick), crepe paper, glue, tape, cotton yarn of different colours, wood board and nails (for string art using wood board and nails), etc.

Tools required:
Scissor, cutting board, ruler, hammer (for string art using wood board and nails).

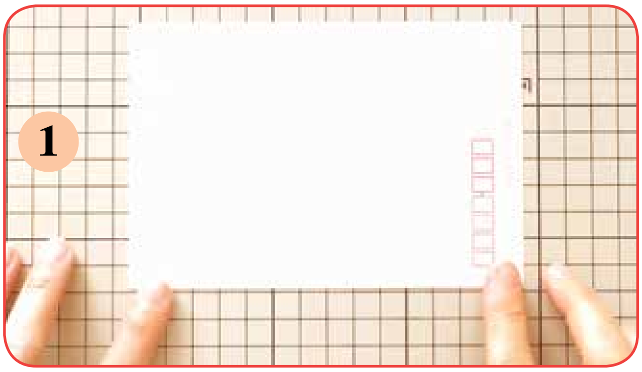
Time required: 30 Minutes
No. of students in class: Max. 10 (No. of students in a group: 2)

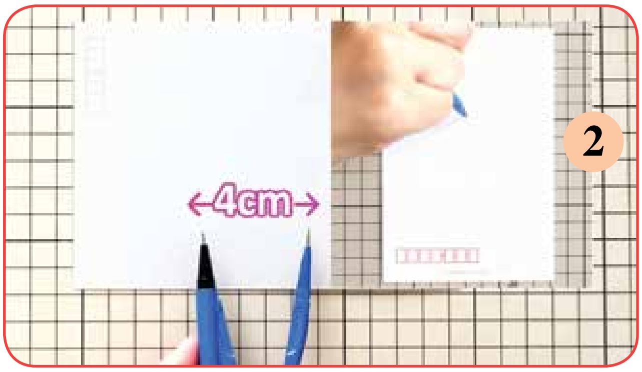
Making a DIY basic string art using a thick paper and few coloured strings.

Process:

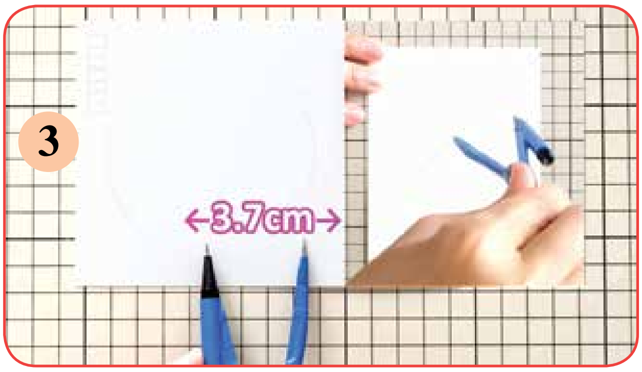
Step 1: Preparing the base.

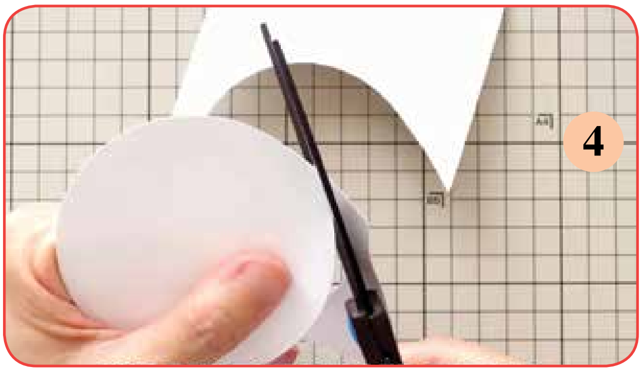
1. Obtain a thick paper of about 1mm thickness and dimensions of 10x10 cm (Picture-1).
2. Draw a circle of radius 4cm on this paper (Picture-2).





3. On the same centre point, draw another circle of radius 3.7 cm (Picture-3).
4. Cut out the larger circle (4cm radius) from the paper (Picture-4).



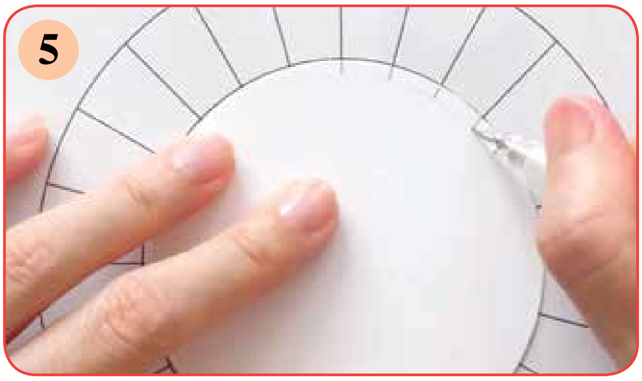


Step 2: Marking the points and preparing the base for the string art.

- Download the template using the QR code given here and print it.

Q.R.Code

- Utilise the reference print to accurately mark the necessary points on the periphery the cutout for the string art (Picture-5).
- Affix the cutout to the coloured paper using a suitable adhesive (Picture-6).
- Carefully trim any excess-coloured paper surrounding the cutout (Picture-7).
- Proceed to make precise cuts at the markings that were done using the reference print as shown in the picture. (Picture-8).



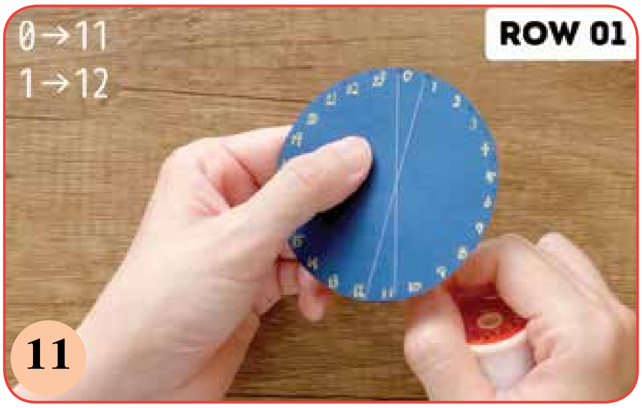
Step 3: Prepare to create the design.

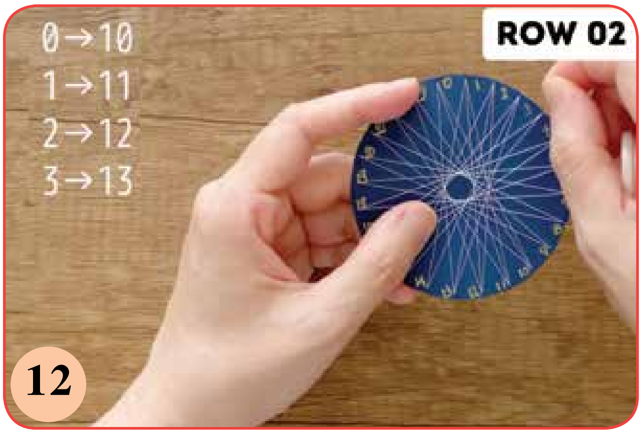
- For enhanced precision in your design, assign numbers to each cut (Picture-9).
- Select a coloured yarn and initiate the process of tying it around to form an appealing pattern.

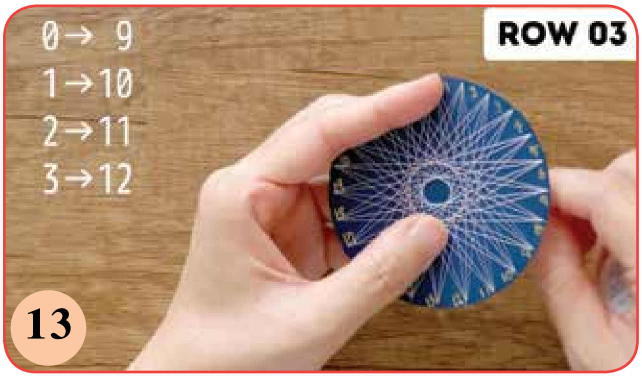
- To ensure the yarn is firmly attached, adhere it to the back of the cutout as shown in the picture (Picture-10).

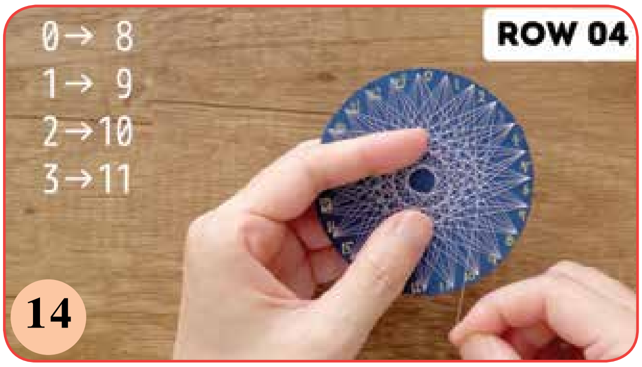
Step 4: Completing the design.

- Initiate the pattern by connecting 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 (Picture-11).
- Upon completion of the first row, affix the end of the thread to the back of the paper using tape.
- Start creating the pattern for Row 2 by connecting 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 (Picture-12).
- Construct the patterns for Row 3 and Row 4 as per the guidelines provided in Picture (Picture-13, 14) respectively. Affix the end of the thread for row 3 and 4 also with tape.
- Use different coloured 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 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.

Ask questions:

1. What materials are 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 coloured yarn?
4. How does using different coloured 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?

Do's and Don'ts:

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

Summary / Principal / Knowledge gain:

- You learn to create intricate designs using simple materials, enhancing your artistic creativity.
- The activity requires careful marking of points and cutting of shapes, teaching you the importance of precision and patience in crafting.
- You may encounter challenges such as yarn coming loose or designs not turning out as expected, which helps improve your problem-solving skills.
- You learn various crafting techniques, such as how to securely attach yarn and how to neatly finish your artwork.

Resources:

- **Video reference for making DIY Basic String art:**

  Scan the QR Code - A for the step-by-step process of DIY basic string art.

  https://youtube/uJ6gZkgdbvo?si=hlbn_z03ZZ37qg8D

Q.R.Code - A

Alternatively, you can make the string art using wood board and nails:

- **Refer the document provided by scanning the QR Code - B or following the link provided below.**

  https://www.instructables.com/DIY-Rainbow-Spirograph-String-Art/

Q.R.Code - B

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Title of Activity

56. Making cardboard and paper-craft Ganesha

Syllabus reference and standard concept / Principle:

Std. 7th - Current, conductor insulator,

Std. 8th - Introduction - Electric circuit, Power source, Battery / cells

Material required:

Cardboard sheets, A4 sheets for taking prints for paper Ganesha, paper glue, 100 RPM L shaped BO (Battery operated) motors - 1 Qty or you can use simple DC motor, 1.5V AA batteries (2 Nos), AA battery holder (2 batteries), cables, A4 paper for printing the template, etc.

Tools required:

Glue and paper tape, A4 papers, scissor, scales, blade cutter, soldering station.

Time required: 2 Hours

No. of students in class: Max. 12 (No. of students in a group: 3-4)

Materials and tools required for both activities:

Part I: Cardboard Ganesha:

Process:

Q.R.Code - 1A

Scan this QR code (QR code - 1A) to refer to the step-by-step instructions.

Step 1: Design

- Take printout of design on A4 size paper. (Visit the Instructables page for download or scan QR code - 1B).

Q.R.Code - 1B

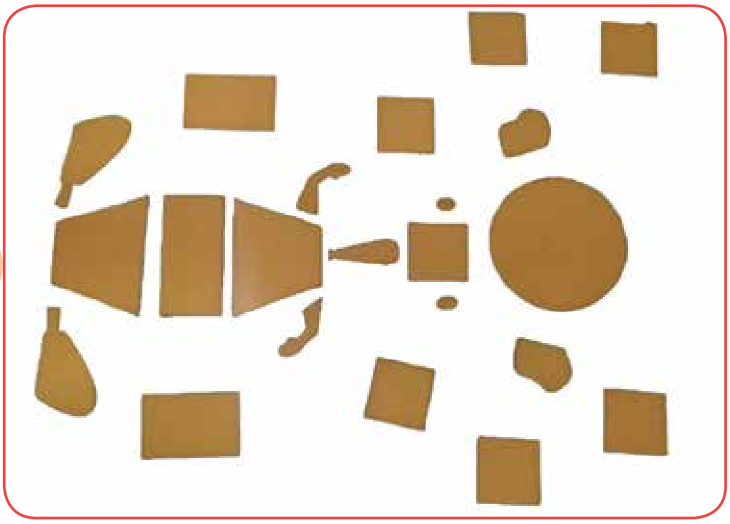
Step 2: Cut and trace

- Cut out designs and use it as stencil to trace design on cardboard.
  (You can skip this and prior step if you want to draw your design directly on the cardboard)

Step 3: Cut cardboard

- Once you have your design on cardboard cut all those cardboard pieces.

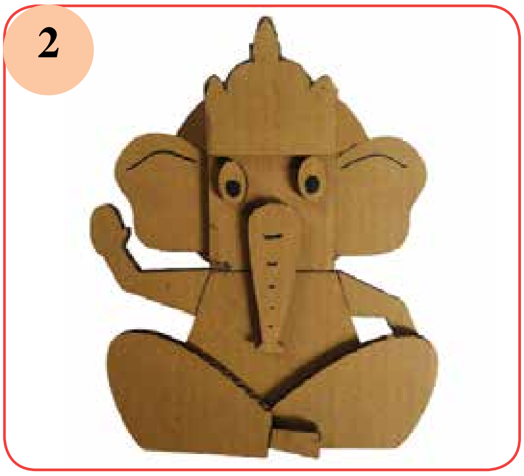
1



Step 4: Glue all pieces together

- When you are done with cutting out all pieces, assemble each piece of cardboard using glue by referring to the image of our final product as shown in the picture-2.

2



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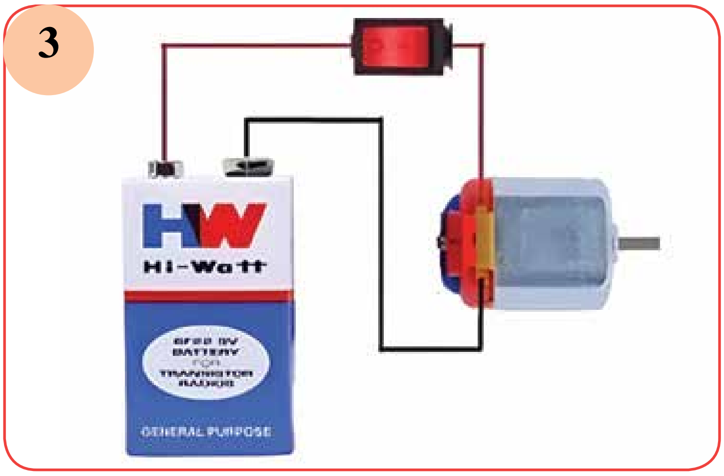


Step 5: Make a rotating wheel (chakra) for Ganesha using electronics

- Refer the circuit diagram in the picture-3 for electronic connection. Connect the Dc motor, switch, and battery accordingly. Glue cardboard wheel to motor. Attach this sub-assembly behind Ganesha's crown. It will be a rotating chakra (wheel) behind Ganesha's crown.

Step 6: Test

- Turn the switch ON to check if the wheel is rotating properly and your Ganesha is ready.

Part II: Paper craft Ganesha:

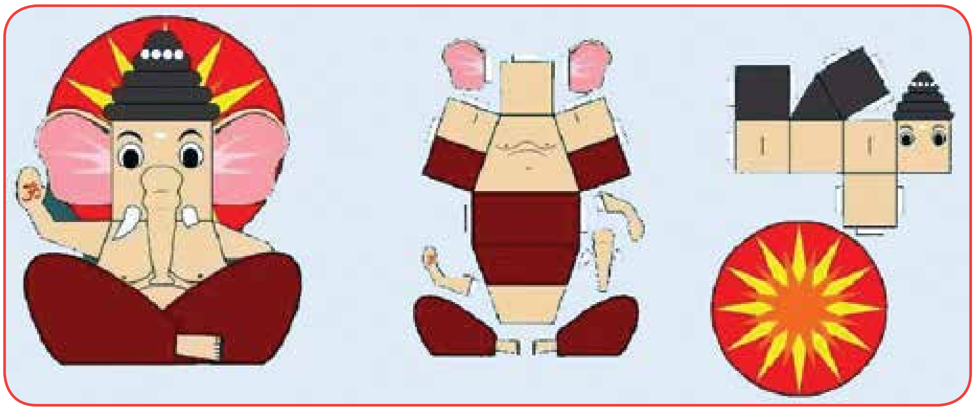
Q.R.Code - 2A

Process: Scan this QR code - 2A to refer to the step-by-step instructions.

Step 1: Printout

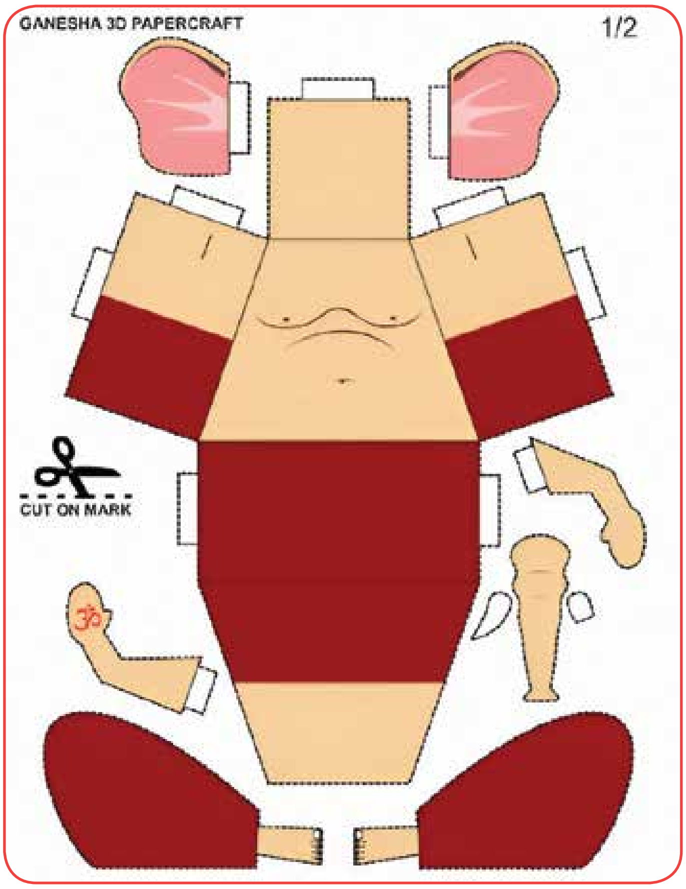
- Download and take colour print of design on A4 size paper by scanning Q.R. Code - 2B.

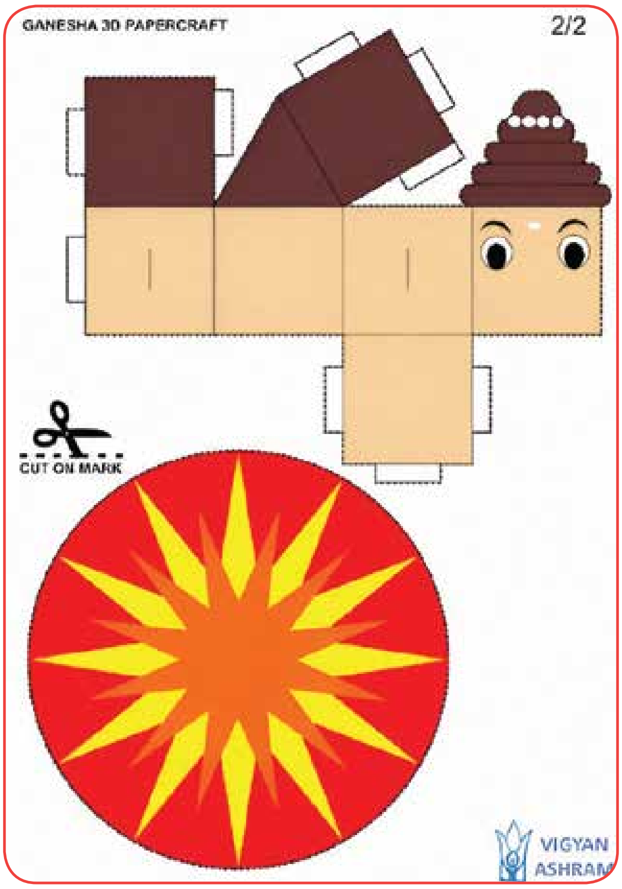
Q.R.Code - 2B



Step 2: Cut

- Cut out the design using scissor or paper cutter. Use safety gloves while using paper cutter.





Step 3: Fold

- When you are done with cutting out all these pieces, start folding the design at given marks. (Refer given image for final product.)

Step 4: Glue

- Glue the joints carefully and you are done! Your 3D papercraft Ganesha is ready.

Final Product

Ask questions:

1. In what ways can you personalize your cardboard Ganesha to make it unique?
2. What are the environmental impacts of using cardboard for this project compared to other materials?
3. What safety precautions should you take when using glue for assembling the parts?
4. Why is it important to use a printed layout for the parts of the Ganesha?
5. How does adding a motor enhance the interactive and dynamic aspects of your cardboard Ganesha project?

Do's and Don'ts:

1. **Follow safety guidelines:** • Do follow safety guidelines for using sharp tools and adhesives. • Do work in a well-ventilated area to minimize fumes.
2. **Use quality materials:** • Do use sturdy cardboard to ensure durability. • Do choose a high-quality printout for accurate representation.
3. **Plan ahead:** • Do plan the assembly process for a smooth workflow. • Do double-check measurements and alignments to prevent mistakes.
4. **Be creative:** • Do personalize your Ganesha with creative touches and decorations. • Do think creatively to make your project unique and visually appealing.
5. **Test motor:** • Do test the motor before final assembly to ensure proper functionality. • Do troubleshoot any motor issues promptly to avoid last-minute problems.
6. **Avoid rushing:** • Don't rush the assembly process; take time for accuracy. • Don't skip steps or overlook important details in the instructions.
7. **Don't ignore safety:** • Don't neglect safety precautions when using tools or materials. • Don't use excessive amounts of glue, Don't play with sharp objects.
8. **Avoid wasting resources:** • Don't waste materials; plan and cut efficiently. • Don't discard materials improperly; consider recycling or repurposing.
9. **Don't overcomplicate:** • Don't overcomplicate the project with unnecessary features. • Don't deviate too far from the initial design without careful consideration.

Summary / Principal / Knowledge gain:

In this session, we engaged in a practical project where we crafted a Ganesha sculpture using cardboard, applying a printed layout, assembling parts with glue, and integrating a motor. The process honed skills such as precision, spatial awareness, and fine motor control in children. The use of glue reinforced concepts related to material adhesion and structural stability, mirroring principles are found in science and engineering textbooks. Additionally, the incorporation of a motor provides a dynamic element, linking theoretical knowledge from physics textbooks to real-world applications. This hands-on experience not only fosters a deeper understanding of academic concepts but also allows students to creatively apply textbook knowledge in a tangible project.

Resources: • **Video reference for making different type of paper craft Ganesha - Scan the QR Code.**

Q.R.Code

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Title of Activity

57. Cardboard loom making for weaving friendship-bands

Syllabus reference:
Std. 6th, Std. 7th

Standard concept / Principle:
Science - Fiber to fabric

Material required:
Cardboard sheet, wool, beads, etc.

Tools required:
Gloves, cutter, marker, compass, pencil, ruler (scale), etc.

Time required: 1.5 Hours
No. of students in class: Max. 12 (No. of students in a group: 3-4)

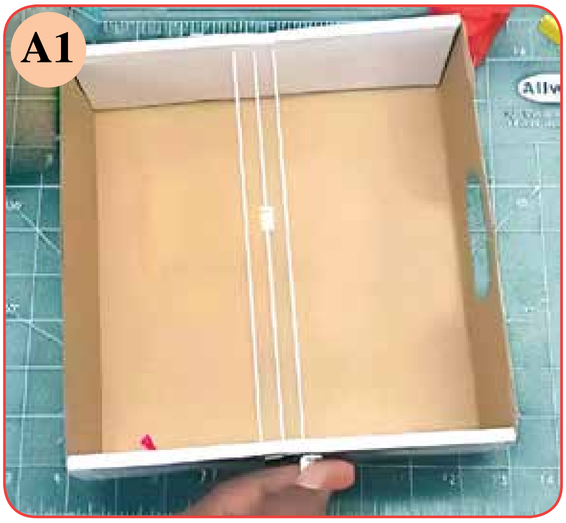
Materials and tools required for both activities:

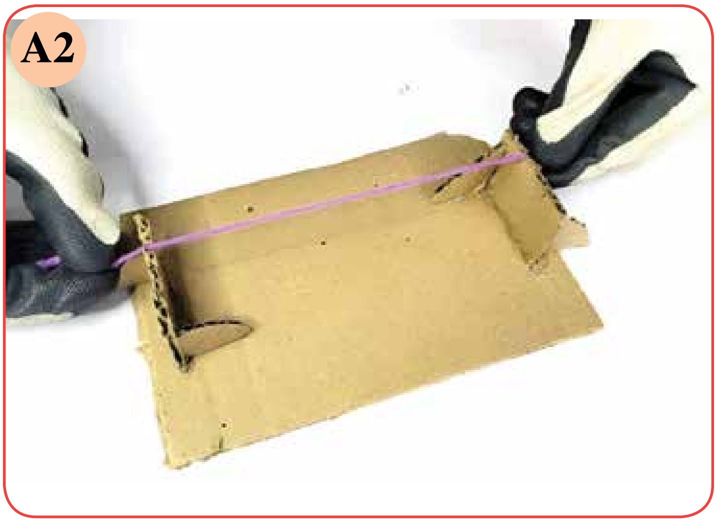
Type A. How to make cardboard loom using a box for friendship bracelet.

Process:

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 as shown in the Picture A2.





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

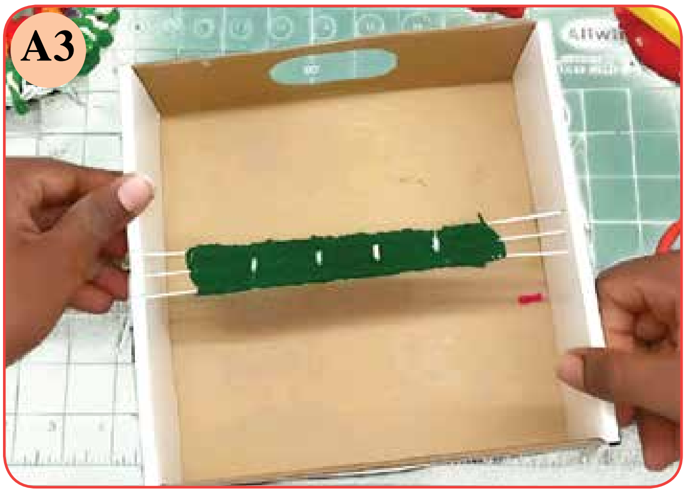
- Wind a desired color of wool around an empty spool, securing it with a tight knot at one end.

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.


A3

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 B. How to make circular cardboard loom for friendship bracelet.

Process:

Step 1: Prepare the circular cardboard loom

- Take a piece of cardboard sheet and cut it to a circular shape (Picture B1).
- Draw four lines on the cardboard, dividing it into halves both vertically and horizontally, meeting at the center (Picture B2).

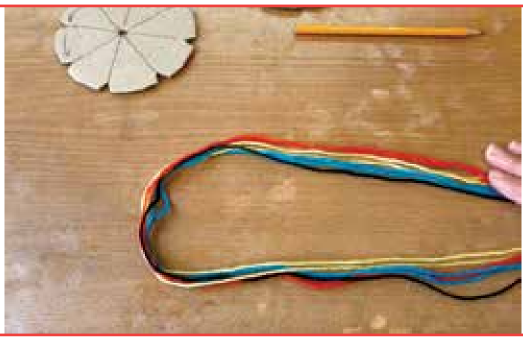

B1


B2

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

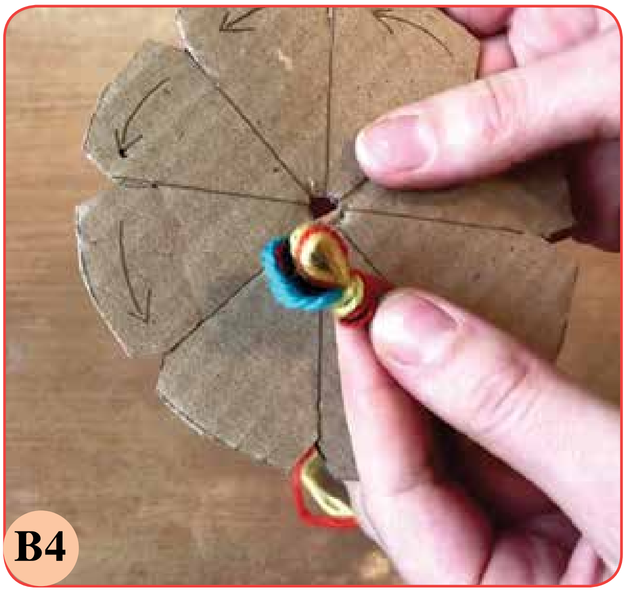
Step 3: Prepare wool strands:

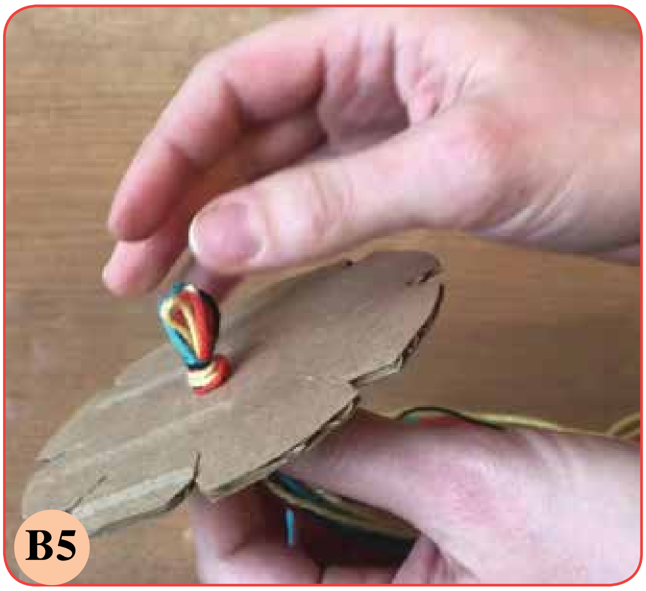

B3

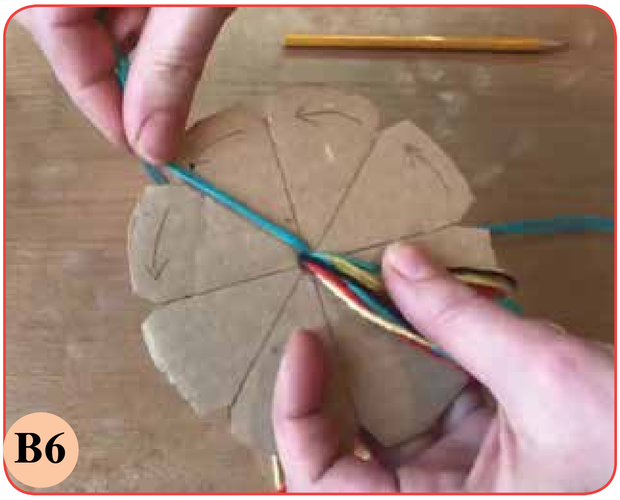
- Choose seven different colors of wool, cut them into equal lengths, and thread each strand through a separate slot on the cardboard.

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 (As shown in the Picture B5.)


B4


B5


B6

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. (As shown in the Picture B6.)

Step 6: Repeat weaving pattern:

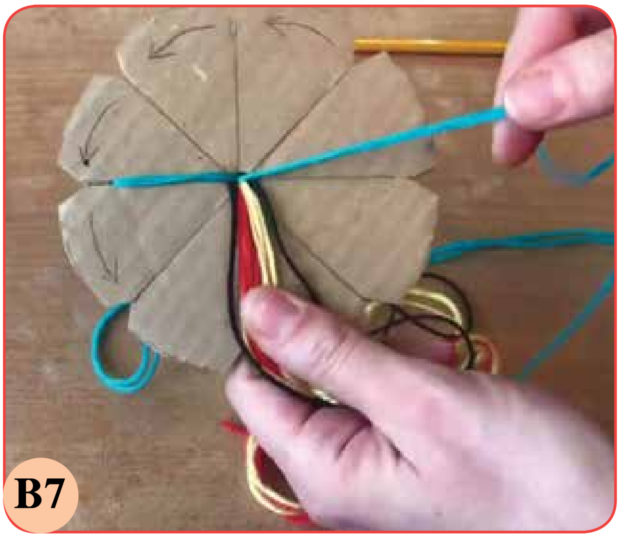
- Continue weaving until you reach the desired length, repeating your chosen pattern. Ensure that the tension is consistent for a neat finish. (As shown in the Picture B7 and B8.)

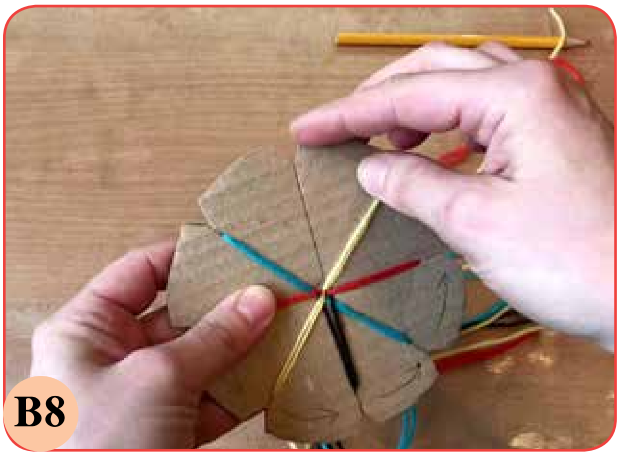
Step 7: Finishing touches:

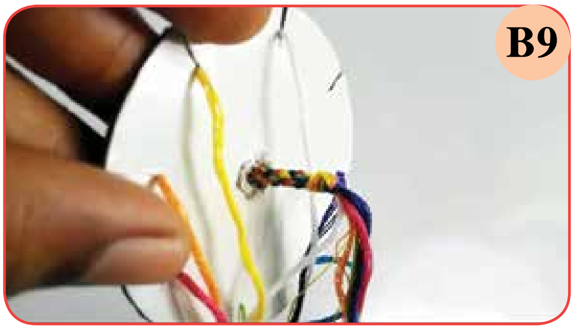
- Once you've completed the weaving, tie off the wool securely and trim any excess. Ensure the knots are tight for durability. (As shown in the Picture B9 and B10.)

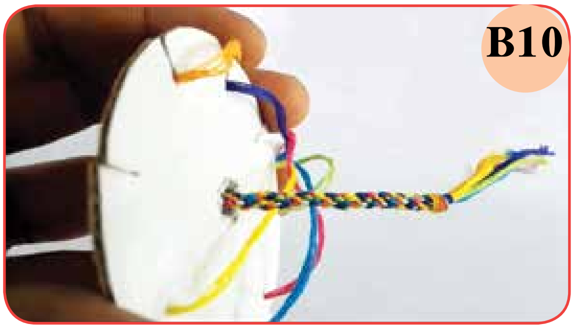
Step 8: Remove from loom:

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

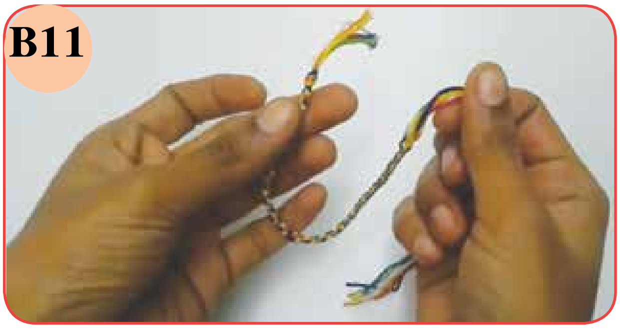

B7


B8


B9


B10

Your friend bracelet is ready. Tie knots at both the ends. (As shown in the Picture B11.)


B11

Ask questions:

1. How do you secure the wool to the cardboard loom, and why do you leave extra length for 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?

Do's and Don'ts:

1. **Do use sharp tools safely:** Use sharp tools such as scissors, paper cutters carefully and keep them away from young children.
2. **Do take breaks:** Take breaks to prevent strain or fatigue, especially during long crafting sessions.
3. **Don't rush:** Avoid rushing through the crafting process, as it can lead to mistakes and potentially unsafe situations.
4. **Do wear safety glasses if needed:** If working with materials that may splinter or produce debris, wear safety glasses to protect your eyes.
5. **How to organize activity:** Number of students in a group - You can do this activity in a group of 3-4 students.

Summary / Principal / Knowledge gain:

The handloom friendship band project offers students a comprehensive learning experience, developing skills in basic weaving techniques, fine motor skills, and coordination. Creativity is encouraged as students experiment with colors and patterns, while adherence to instructions enhances procedural understanding. Safety guidelines instill a safety-conscious approach, and overcoming challenges fosters problem-solving skills. Spatial awareness is honed through navigating the cardboard loom, and attention to detail is emphasized in knot tying. Encouraging collaboration and sharing cultivates social skills. In conclusion, completing the project instills pride in handmade creations and boosts confidence in crafting abilities.

Resources:

- **Video reference for making cardboard loom for weaving.**

Q.R.Code-1

1. **How to make cardboard loom using a box for friendship bracelet - Scan the QR Code-1.**

Q.R.Code-2

2. **How to make circular cardboard loom for friendship bracelet - Scan the QR Code-2.**

Title of Activity

58. Making automata toy using cardboard

Syllabus reference and standard concept / Principle:

Science: Std. 6th-Body movement, Std. 7th, Std. 8th-Motion and Time

Material required - Type A: Fluttering bird

Cardboard box, paper straws, paper tape, white papers, scrap pen body, binding wires.

Material required - Type B: Octopus

Cardboard sheets, bamboo skewers, white papers, straw, thermocol ball and some other accessories to decorate

Tools required:

Cutting plier, cutter, scissors, etc.

Time required: 2 Hours

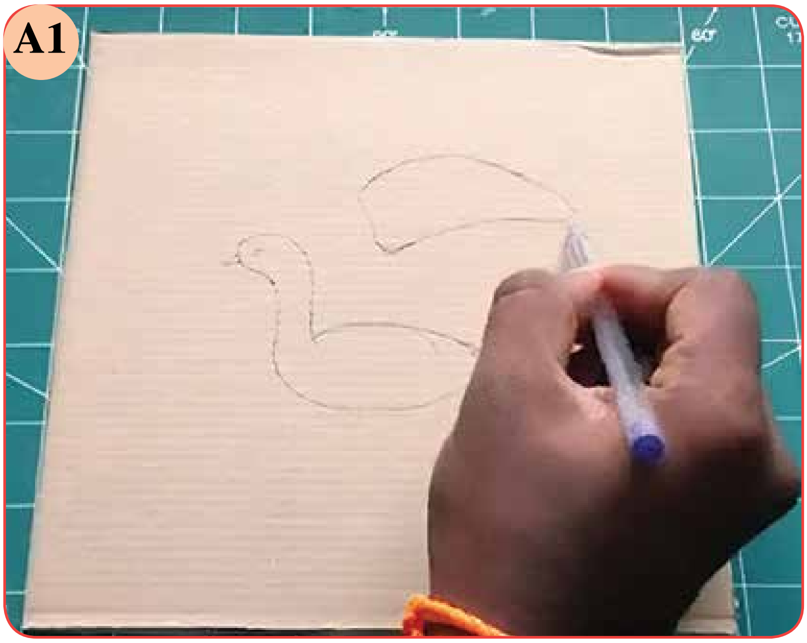
No. of students in class: Max. 12 (No. of students in a group: 3-4)

Materials and tools required for both activities:

Type A. Automata Fluttering bird using cardboard.

Process:

Step 1: Create the bird shape:



- Draw the shape of a bird on the cardboard (as shown in the Picture A1) and cut it out.
  OR
  You can find bird templates online and take print.
  OR
  Create your own design.

Step 2: Prepare the wings:

- Cut out wings 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. Do it for both the wings (refer Picture A2).

Step 4: Stabilize the wings:

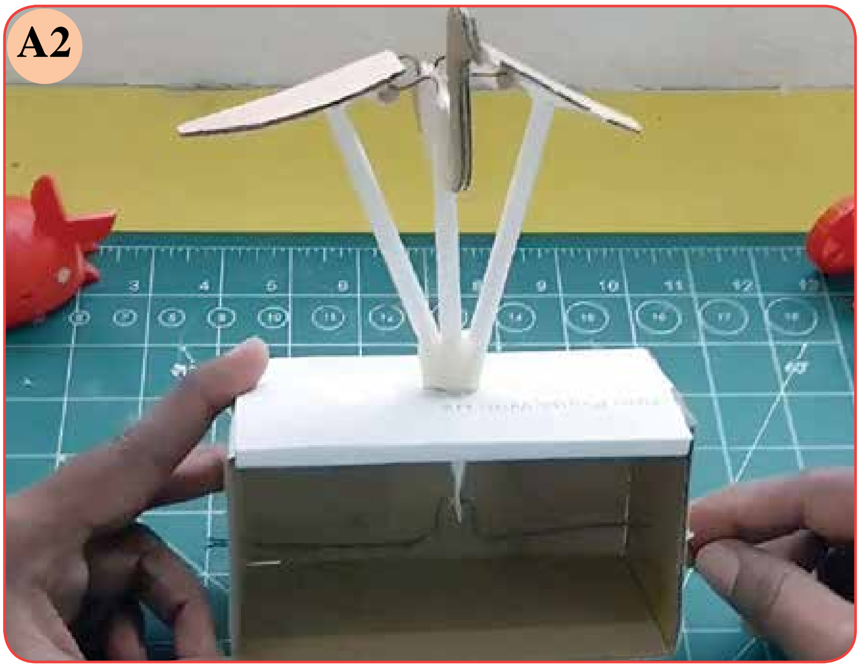
- Attach two pieces of straw to both sides of the bird's wings using paper tape so that the wings will remain stable (refer Picture A2).

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 (refer Picture A2).

Step 6: Prepare the base:

- Take a cardboard box and prepare the base according to the size you prefer. (refer Picture A2).



Step 7: Prepare the rotational power source (cam):

- Cut a binding wire a bit longer than the base and attach one end to the side of the base. Create a U-bend in the wire at the center to, which follower will be attached (refer Picture A3).
- Make a hole in the follower (straw attached to the body). Pass on the wire through this hole on the follower (refer Picture A3).

Step 8: Test the fluttering motion:

- The U-bend acts as a cam, converting rotary motion into a fluttering motion of the bird's wings. 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:

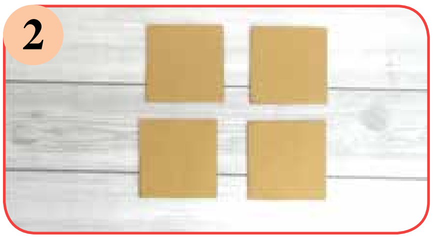
- Fine-tune the mechanism if needed. Decorate the bird and the cardboard base using markers or paint. Once you're satisfied with the fluttering motion, share your creation and enjoy watching your DIY automata fluttering bird on its cardboard base.

Type B. Automata octopus using cardboard.

Process:

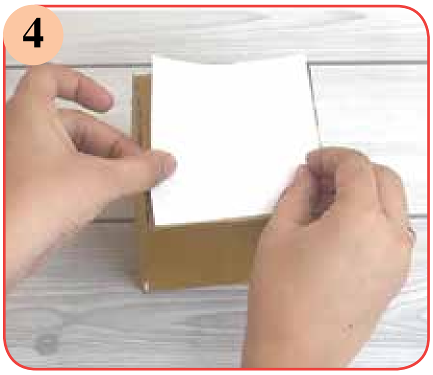
Step 1: Make a frame:

- Take a square cardboard of approx. 20 cm x 20 cm or larger. (Picture 1)



- Cut four squares of 10 x 10 cm as shown (Picture 2).

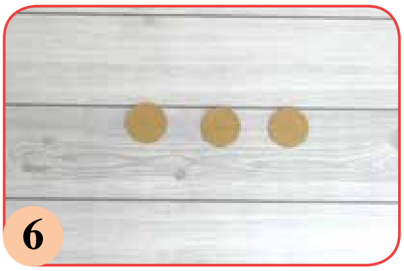
- Make a square box or a frame for automata by joining all four squares using a glue (Picture 3).



- Apply a white sheet of 10 x 10 cm on one side of frame (Picture 4).

Step 2: Make cam and follower:

- Using a circle cutter, cut a circle of diameter 5 cm. (Picture 5).



- Cut 6 such circles. (Picture 6.

- Glue 3 circles together (Picture 7. to make one cam and one follower. (Picture 8.)

Step 3: Make holes on three sides of the frame:

- Make one hole on top of the frame covered with white sheet. You can use a skewer and tip of pencil to poke hole (Picture 9).

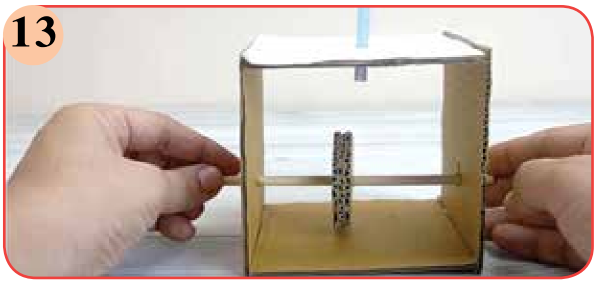
- Insert a piece of straw through the top hole (Picture 10).

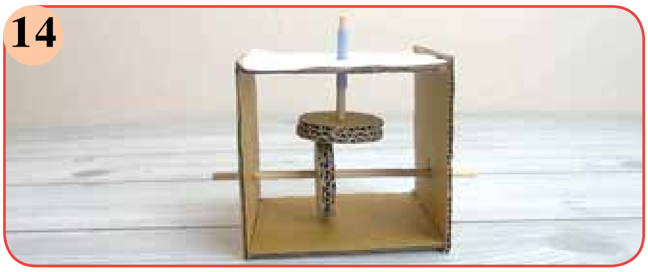
- Now make holes on two sides of the frame. Holes should be made a slight below the center point (Picture 11).

Step 4: Insert a cam and a cam follower:

- Use a bamboo skewer as a lever (axle) and insert it through one side of frame. Once it is inside the box, insert one cam on the axle. Make sure, you insert the cam on the axle at the center point of the cam to make the toy work perfectly. You can glue the cam to stabilize it (Picture 12).

- Insert a half skewer from top of the frame and attach a follower to it. Insert the follower in the skewer also at the center point of the follower. You can glue the follower on the skewer to stabilize it (Picture 13).





- Test the motion by rotating the lever (axle). (Refer Picture 14).

Step 5: Make the sculpture:

- You can make any sculpture of your wish that you want to rotate. We are making an octopus to be added on the top of the vertical skewer. To make an octopus.


15

- First take a thermocol ball and colour it. (Picture 15, 16.


16

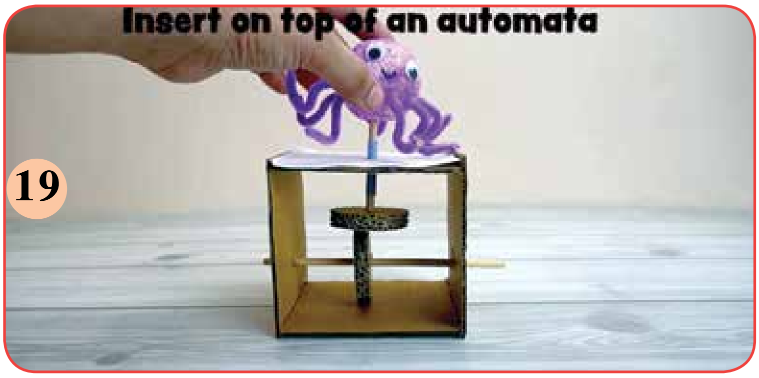

17

- Cut pipe-cleaners and give them a shape of legs. (Picture 17.

- Paste googly eyes or draw as per your wish and make a hole at the bottom. (Picture 18.


18

Step 6: Attach the sculpture and handle to the toy:



19

20

- Glue the octopus on top of the vertical skewer through the hole made in the thermocol ball (Picture 19).
- **Make a handle -** cut one more circular disc using cardboard, attach it at the end of the axle through the center point and glue the same to the axle. Cut a small part of skewer 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 (Picture 20).

- Rotate the axle using handle and see the cam-follower rotating and thus your sculpture also rotating.

Ask questions:

1. What are the different types of mechanisms we see around us like, gears, levers, pulleys?
2. Which is the type of mechanism 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 for the straw in case it's not available?

Do's and Don'ts:

1. **Do consider safety:** If using tools like pliers, handle them with care to avoid any injuries. Consider using safety gloves if necessary.
2. **Do secure wire well:** Ensure that the wire is securely attached to the vertical straw to prevent it from coming loose during use.
3. **Do adjust carefully:** Take your time to adjust the bending of the wire for the wings. Small adjustments can make a significant difference in the overall movement.
4. **Don't use excessive force:** Avoid using excessive force when bending the wire or inserting it into the straw to prevent damage to the materials.
5. **Don't neglect testing:** Always test the wings before considering the project complete. This helps catch any issues and ensures the wings move smoothly.
6. **How to organize activity:** Number of students in a group – You can do this activity in a group of 3-4 students.

Summary / Principal / Knowledge gain:

In this project, students engage in hands-on exploration of basic engineering principles such as measurement, drawing, using cutting operations, etc. They also learn creating mechanism for the bird wing using binding wire and a straw and /or mechanism for rotating octopus using bamboo skewers and cardboard cam and follower. They can make different such toys to make movements and add.

Resources:

1. **Video reference for making automata toy with fluttering bird using cardboard - Scan the QR Code-1.**

2. **Video reference for making automata toy with rotating octopus using cardboard - Scan the QR Code-2.**

Q.R.Code-1

Q.R.Code-2

❋ ❋ ❋

Title of Activity

59. Making a spinning sculpture by using DC motor

Syllabus reference and standard concept / Principle:

Std. 6th - Electric current, Std. 7th - Current, conductor insulator, Electric Current and its Effects, Std. 8th - Introduction - Electric circuit, Power source, Battery / cells

Learning concepts:

- Making a spinning sculpture to understand the working principle of DC motor (homopolar motors).

Material required: A Battery, neodymium magnets, paper (for adding creativity), copper wire used in motor winding (rub it's ends and center to remove insulation).

Tools required: Sand paper, Stripper, etc.

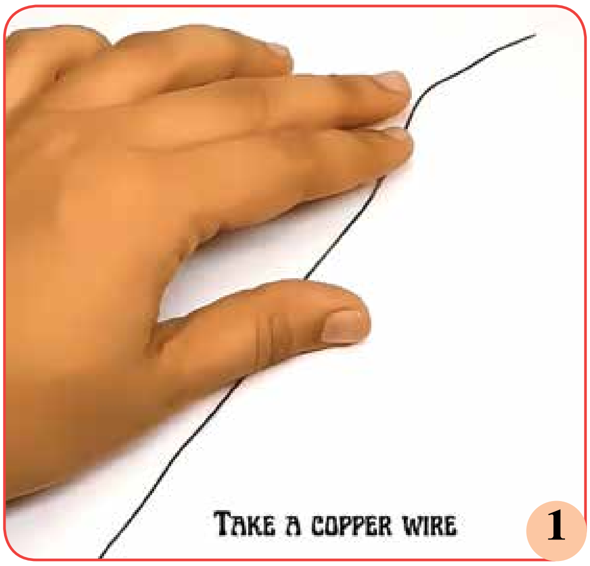
Time required: 1 Hour

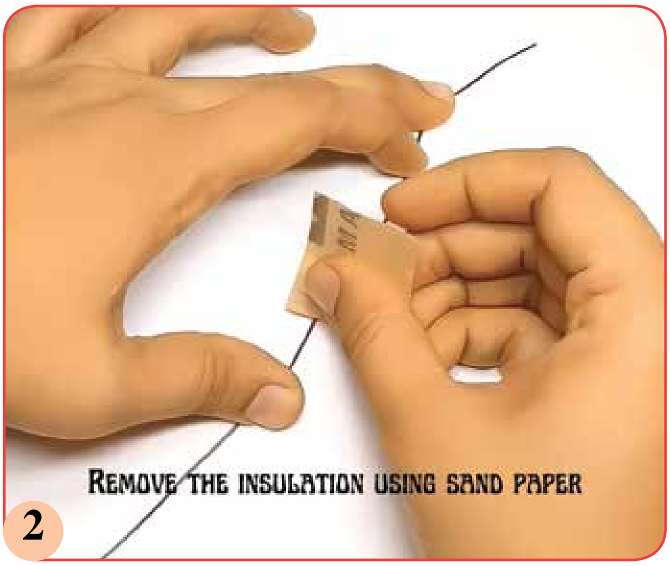
No. of students in class: Max. 12 (No. of students in a group: 3-4)

Process:

Step 1: Prepare copper wire:

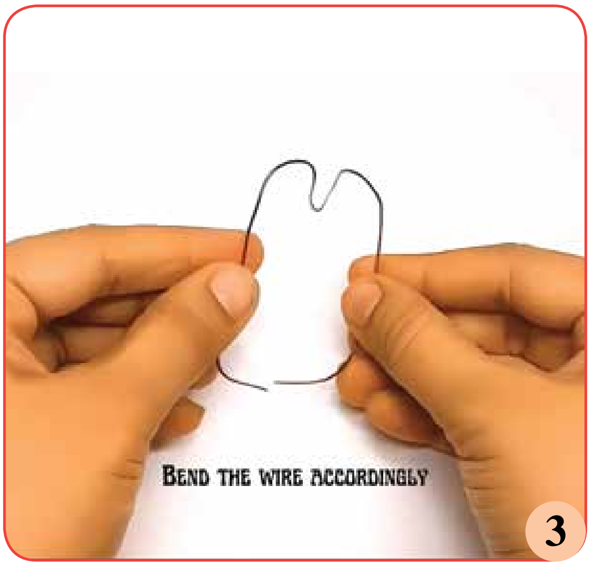
- Cut a length of insulated copper wire (the one used in motor winding), about 8-10 inches long (Picture 1). Remove the insulation from both the ends of the wire using sandpaper (Picture 2).

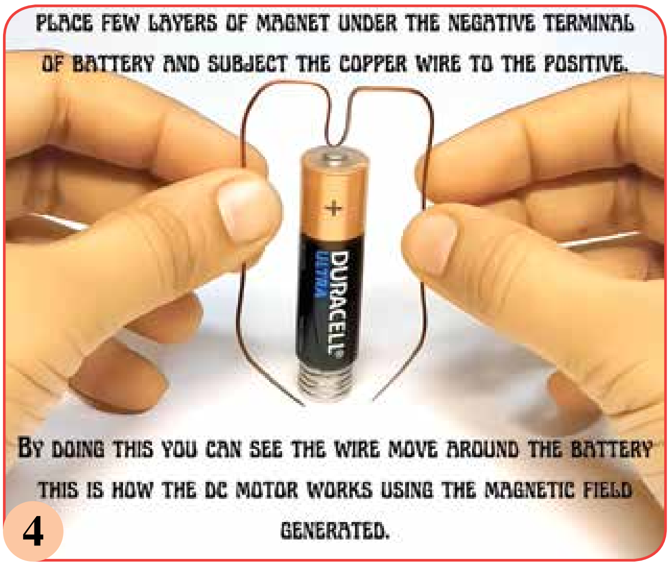




Step 2: Shape the wire:

- Bend the wire into a U-shape, as shown in the Picture 3. This will be your motor's "arm" (Picture 3).



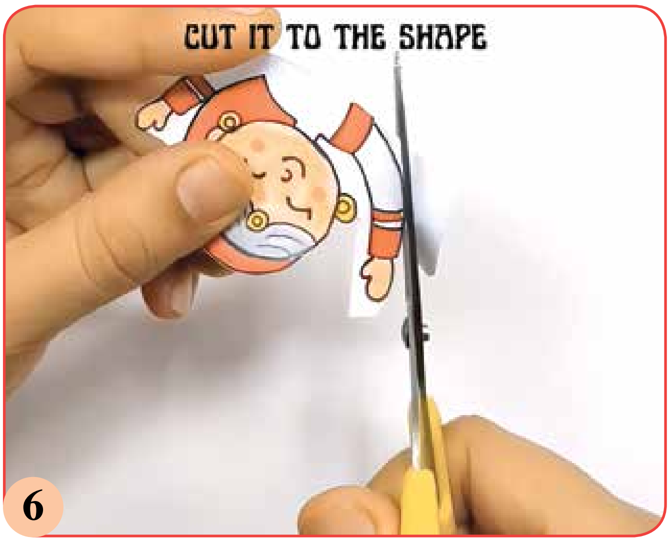


Step 3: Attach neodymium magnet and wire to the battery:

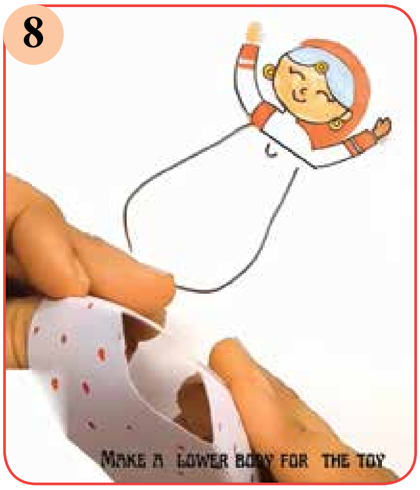
- Place 4-5 Neodymium Magnets together and place the negative terminal of battery on top of it (Picture 4).
- Now keep the U-bend part on the positive terminal of the battery and let both the free ends be within the range of magnet (Picture 4).

Step 4: Explore your creativity:

- Create your own sketch, showcasing your creative artistic talent, and cut it into your desired shape (Picture 5 and 6).



Step 5: Attach your design to the wire. (Picture 7, 8 and 9.



Step 6: Testing and adjustment of the motor.

- Gently touch the free end of the U-shaped wire to the negative end of the battery. The wire should start rotating around, creating a simple homopolar motor.
- If the wire doesn't start rotating, check the connections and make sure there's good contact between the wire and the battery. Adjust the placement of the magnet if necessary and check if you have removed the insulation on the copper wire properly.

Step 7: Final product and observation.

- As you place your toy above the battery, you can see it rotating around the magnetic field created around the battery area (Picture 10).

- Observe the motion of the wire and the magnet. You can experiment with different wire lengths and magnet positions and strength to see how they affect the motor's performance.

Ask questions:

1. What is the principle behind the operation of a homopolar motor?
2. Describe the role of the magnet in the motor. How does it contribute to the motion?
3. Explain the significance of using a neodymium magnet in this project.
4. How does the length of the wire arm affect the performance of the homopolar motor?
5. How does the homopolar motor project relate to concepts you have learned in physics or electromagnetism?

Do's and Don'ts:

1. **Research:** Understand the basic principles of a homopolar motor before starting the project.
2. **Cleanliness:** Ensure that the magnet is free of dirt or coatings to optimize its performance.
3. **Work in a well-ventilated area:** Especially when using adhesives or sanding materials, ensure good ventilation.
4. **Follow safety guidelines:** Handle small parts, wires, and batteries with care. Adhere to safety guidelines to avoid accidents.
5. **How to organize activity:** Number of students in a group – You can do this activity in a group of 3-4 students.
6. **Don't disregard environmental impact:** Properly dispose of materials especially batteries.
7. **Don't forget to secure connections:** Ensure that wires are securely taped to the battery and the magnet to prevent loose connections.
8. **Don't leave the motor running unattended:** If the motor is in motion, monitor it and avoid leaving it unattended for safety reasons.

Summary / Principal / Knowledge gain:

Through the homopolar motor project, students gain a practical understanding of basic electromagnetism and the conversion of electrical energy into mechanical motion. They learn about the homopolar motor's simplicity, relying on a direct current to induce motion in a wire loop connected to a battery. The project also fosters hands-on skills, as students assemble and adjust components to observe the motor in action. Additionally, it provides insights into magnetism, battery connections, and the impact of variables such as wire length. Beyond the technical aspects, students develop problem-solving skills by troubleshooting and refining their creations. Overall, the project serves as a engaging introduction to fundamental principles of physics and electrical engineering.

Resources:

- **Video reference for making a spinning sculpture to understand homopolar motor - Scan the QR Code.**

Q.R.Code

Title of Activity

60. Making a ‘heat convection model’ using candles and paper

Syllabus reference:

Std. 7th, Std. 8th

Standard concept / Principle:

Science - Heat

Material required:

Paper (250 GSM), glue, paper straw, chopsticks, coin candles, clay/playdough, sketch pens.etc.

Tools required:

Scissor, cutting board, geometry compass, etc.

Time required: 30 Minutes

No. of students in class: Max. 12 (No. of students in a group: 2-4)

Making a heat convection model using candles and paper.

Materials and tools required for activity:

Process:

Step 1: Material preparation.

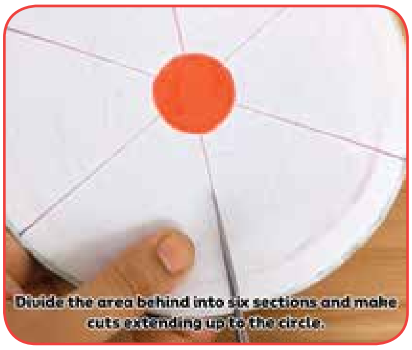
- Gather all necessary materials as mentioned and displayed in the above picture.
- This includes a paper (250 gsm), glue, paper straw, chopsticks, coin candles, clay/playdough, sketch pens, scissor, cutting board and geometry compass.

Step 2: Preparing the base.

1

- Cut out a circle of diameter 5 to 6 inch from the paper. Once the cutout is ready, you can decorate it in any way you like. Use colours, patterns, or any other creative elements to make it unique and attractive (Picture 1).
- Now, divide the area behind the cutout into six equal sections. This can be done by drawing lines from the centre of the circle to its edge and also draw a small circle at the center.
- Once the sections are marked, make cuts along with these lines starting from the edge of the circle and stopping at a small circle in the centre (Picture 2). This will create six flaps.

2



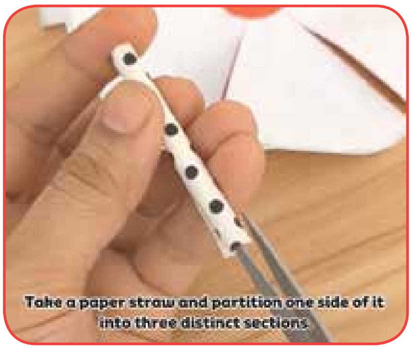
3

- Using a pencil, roll each of the six flaps to create a semi-circular fold (Picture 3). This will give the material a shape similar to a fan.

Step 3: Constructing the rotating base.

- Begin by taking a paper straw (Picture 4). This will serve as the axis for the rotation of the base.

4



Take a paper straw and partition one side of it into three distinct sections.

5

The partition should appear as follows.

- On one side of the straw, make markings to divide it into three distinct sections (Picture 5). This division will help in attaching the straw to the cutout in a balanced manner, ensuring smooth rotation.

- Now, apply some adhesive to the divided side of the straw. Carefully position the straw at the rear of the cutout, ensuring that it is centred. Press firmly to secure the straw to the cutout. Allow the adhesive to dry completely (Picture 6).

6

Paste the straw to the rear of the cutout utilizing adhesive.

Step 4: Constructing & assembling the upper component.

- Initiate this step by creating a unique design on a piece of paper using sketch pens. This design will be positioned above the base of your model, adding visual appeal and complexity to the overall structure.

7

Create a design that will be positioned above the base, and also construct an identical replica of this design for subsequent steps.

- Once your original design is complete, the next task is to construct an identical replica of this design (Picture 7). This replica will play a crucial role in the subsequent steps, so ensure it mirrors the original design as closely as possible.

- With your replica ready, proceed to paste it behind the original design. However, it's important to leave the lower portion of the replica unattached (Picture 8). This will allow for some flexibility attachment to the model.

8

Proceed to paste the replica behind the original design, ensuring to leave the lower portion unattached.

9


Paste the upper design element to the base structure.

- The step involves integrating the upper design element with the base structure. Use a strong adhesive to paste the design onto the base, ensuring it's securely attached and positioned correctly (Picture 9).

Step 5: Finalizing the model.

- To create a stand for our model, gather some clay, a chopstick, and four candles.
- Start by moulding the clay into a base. Then, vertically embed the chopstick into the clay, ensuring it remains upright.
- Lastly, arrange four candles uniformly around the stand. This setup will provide a balanced and stable platform for our model, enabling it to rotate when the candles are ignited.
- With all the components of the model assembled, it's time to appreciate the finished product.
- The circular cutout rotates seamlessly on the axis provided by the straw. When heat is applied via the candles, the model begins to rotate, demonstrating the principle of heat convection.
- As the air above the candle gets hot, it travels up because its density is low as compared to the cold air in the top. Thus, the hot air goes up and cold air comes down creating an airflow. This rotates the fan-like structure.

10


Utilize some clay, a chopstick, and four candles to construct a stand for our model.


This is how our model would look

Ask questions:

1. What is the purpose of the circular cutout in the model?
2. How does the model demonstrate the principle of heat convection?
3. What happens when heat is applied via the candles?
4. What is the principle of heat convection and how does it apply to everyday life?
5. What are some other examples of heat convection that we encounter in our daily lives?

Do's and Don'ts:

1. Do gather all the necessary materials before starting the project. This includes a paper (250 gsm), glue, paper straw, chopsticks, coin candles, sketch pens, scissor, cutting board, and geometry compass.
2. Don't rush through the steps. Each step is important and contributes to the final outcome of the model.
3. Do ensure that the straw is securely attached to the cutout. This is crucial for the rotation of the base.
4. Don't light the candles without adult supervision. Safety should always be the priority.

Summary / Principal / Knowledge gain:

- The project demonstrates the principle of heat convection, which is the transfer of heat through a fluid (liquid or gas) caused by molecular motion.
- By constructing the model, you gain hands-on experience in understanding how heat convection works. This practical approach can enhance your understanding of the concept.
- The project encourages creativity in designing the model and problem-solving skills in assembling the various components.
- The rotation of the model when the candles are lit demonstrates the application of heat convection. The heat from the candles causes the air to move, which in turn causes the model to rotate.
- The project also emphasizes the importance of safety, especially when dealing with elements like fire from the candles. It's a reminder that scientific experiments should always be conducted with safety in mind.

Resources:

1. **Video reference for making a Heat convection model: Scan the QR Code - 1 for the step-by-step process of Making a Heat convection model using candles and paper.**

   https://youtube.com/shorts/F-5Qig770kM?si=4VTn0BnMktpNY2he

   Q.R.Code-1

2. **You can make different types of Heat Convention model: Scan the QR Code - 2 or following the link provided below.**

   https://youtu.be/w1_Sw7QHw7g?si=FhYuoNJnpB8 kqBlX

   Q.R.Code-2

❋❋❋

Title of Activity

61. Making a table top model for human blood circulation system

Syllabus reference:

Std. 8th

Standard concept / Principle:

Science - Principal- Living organism characteristics and habitat

Material required:

Cardboard, 4 syringe - 10 ml, 2 pipes, water-color bottles and water.

Tools required:

Hand gloves, glue gun, pencil, scale ruler, scissor, utility cutter/ paper cutter, cutting mat, etc.

Time required: 2 Hours

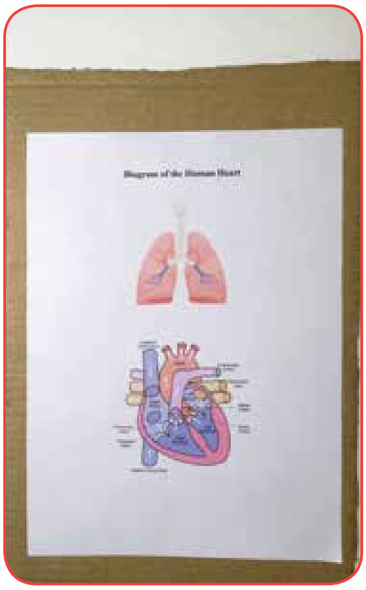
No. of students in class: Max. 12 (No. of students in a group: 2-3)

Q.R.Code-1

Process:

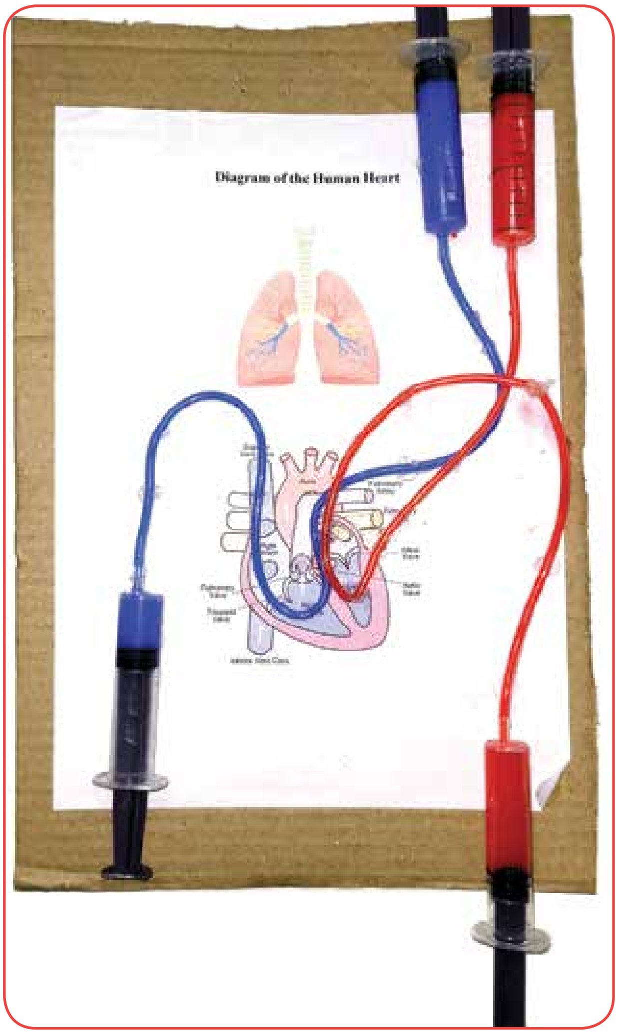
Material preparation:

- Scan the QR code-1 to download the Human blood circulation system and print it on A4 size paper.
- Stick the template on cardboard sheet.



Process:

- Take some water and mix a red color in it so that it represents oxygenated blood in the human body. Now take a syringe, fill it with the red water and connect its nozzle with a pipe. Take the second syringe, remove air from it before connecting its nozzle to the pipe and ultimately to the first syringe.
- Take some more water and mix a blue color ink in it so that it represents de-oxygenated blood in the human body. Now take one more syringe, fill it with the blue water and connect its nozzle with a pipe. Take the fourth syringe, remove air from it before connecting the pipe and ultimately to the third syringe.
- Now connect the syringe and pipe assembly on the template as shown below. Human blood circulation system is ready.



Ask questions:

1. How does the Human blood circulation system work?
2. What is the importance of blood circulation in our body?
3. What are the various parts/ sections of the heart?
4. What is the difference between oxygenated and deoxygenated blood?
5. How does blood in our body get separated?

Do's and Don'ts:

1. Use hand gloves and safety goggles while using the glue gun and drill machine
2. Instructors should help students to use drill machines and glue guns.
3. Do not touch the tip of the glue gun bare handed as it is very hot.
4. Use of stripper and utility knife should be under supervision.
5. If you are using a utility knife for the first time then use gloves for safety.
6. **How to organize activity:** Number of students in a group – You can do this activity in a group of 2-3 students.

Summary / Principal / Knowledge gain:

In this experiment we learned about the human blood circulation system and how it works. Different sections of the human heart. What part do the lungs and heart play in our body. The valves prevent mixing of deoxygenated blood in the right side of the heart with oxygenated blood in the left side of the heart.

Resources:

Q.R.Code-2

- **Video reference for making table top model for human blood circulation system - Scan the QR Code - 2.**

❋ ❋ ❋

Title of Activity

62. Learn some geometry by making models using cardboard & other material

Syllabus reference and standard concept / Principle:

Std. 8th Maths: Right-angled Triangles and Pythagoras Theorem

Material required - Type A:

Cardboard, nut and bolts of 5 mm outer diameter, rubber bands, etc.

Tools required - Type A:

Blade cutter, ruler scale, pencil and eraser, battery operated drill machine/hand drill, etc.

Material required - Type B:

Cardboard, Pythagoras theorem template, OHP sheet, mustard seeds.

Tools required - Type B:

Scissor, ruler scale, pencil and eraser, adhesive glue, protractor, blade cutter, glue gun

Time required: For each activity 2 Hours

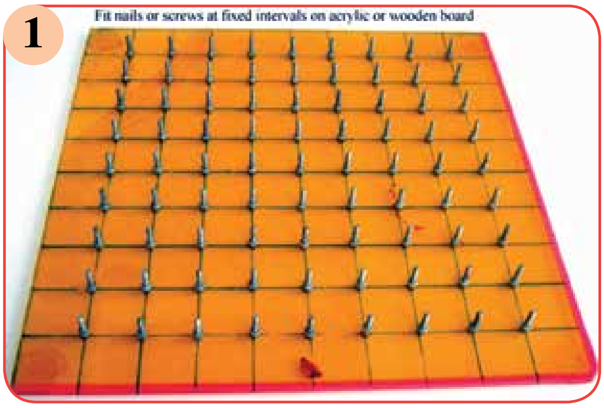
No. of students in class: Max. 15 (No. of students in a group: 4-5)

Type A. Making Geoboard:

Materials and tools required for activity:

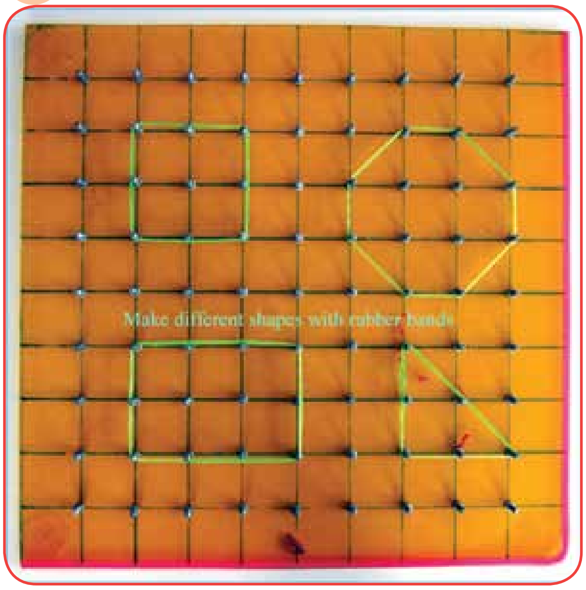
Process:

1



- Take a square cardboard sheet of 250 mm x 250 mm. Drill the holes of 5 mm diameter with a drill machine. Distance between two holes should be 25 mm (Picture 1).
- Now, tighten the nut and bolt in these holes. Our geoboard is ready to try.
- You can make any geometrical shapes on these boards. Also, you can prove a Pythagoras theorem on this board. (Picture 2 and 3).

2



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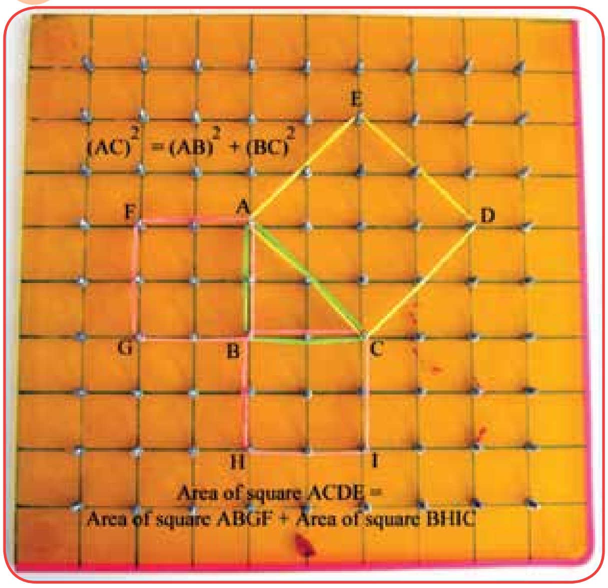
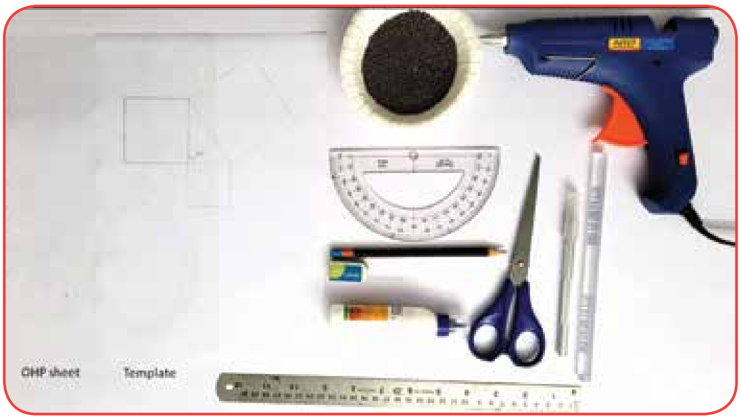


Type B. Making Pythagoras theorem working model:

Materials and tools required for activity:



Process:

Q.R.Code-1

- Scan the QR code - 1 to download the Pythagoras theorem template and print it on A4 size paper. Stick the template on cardboard sheet.

- Cut the cardboard according to the shape in the given template.

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

- Now, join all the parts with glue as shown in the image- 5.

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

- As you rotate the model, the mustard seeds from the biggest of the squares (Say a side of length 'c' cm) will now be completely accommodated in the other two squares (One square of side 'a' cm and other with 'b' cm). Pythagoras theorem proof of concept in this activity-
  - Here 2 congruent squares represent sides and the biggest square represents the hypotenuse of the right angle triangle.
  - When we rotate the model, mustard seeds from a bigger rectangle fill the other 2 rectangles.
  - Hence it proves that the area of the biggest square is equal to the sum of the areas of other 2 squares.
  - That is

Hypothesis square (C^2) = Sum of square of remaining 2 squares (a^2+b^2)

  - In this way the Pythagoras theorem is proved by this model.

Ask questions:

1. What are the various geometrical shapes you know ?
2. What is Pythagoras theorem ?
3. How does pythagoras theorem get proved in the second activity ?

Do's and Don'ts:

1. Use hand gloves and safety goggles while using the glue gun and drill machine
2. Instructors should help students to use drill machines and glue guns.
3. Do not touch the tip of the glue gun bare handed as it is very hot.
4. Use of blade cutter should be under supervision and use of cutting mat is compulsory.
5. If you are using a blade cutter for the first time then use gloves for safety.
6. **How to organize activity:** Number of students in a group – You can do this activity in a group of 4-5 students.

Summary / Principal / Knowledge gain:

In these activities we learned Geometry. We have learned to use drill machines safely. We have proven Pythagoras theorem. We have understood what nuts and bolts are and how can they be used in various applications.

Resources:

Q.R.Code-2

- **Website for making Geoboard - Scan the QR Code - 2.**

Q.R.Code-3

- **Video for making Pythagoras theorem using cardboard model. - Scan the QR Code - 3.**

❋ ❋ ❋

Title of Activity

63. Making various fun instruments by knowing the theory of sound

Syllabus reference:

Std. 7th

Standard concept / Principle:

Science - 14. Sound

Material required:

Rubber band, thick straw/ small piece of tube, balloons, plastic bottle, etc.

Tools required:

Cutter, scissors

Time required: 1 Hour

No. of students in class: Max. 12 (No. of students in a group: 2-3)

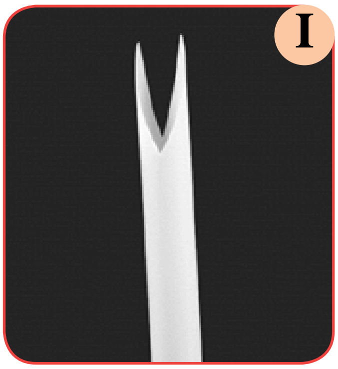
Instrument 1: Balloon whistle:

Process:

- Take a bottle and cut it in half. We will use the upper half. (refer image - 1)
- Take a balloon and cut it at the bottom. Attach that part over the mouth of the bottle with the help of rubber bands. Balloon should be stretched tightly over the mouth of the bottle. (refer image - 1)
- Take the small piece of tube/ straw and attach it to the mouth of the balloon with the help of rubber bands. (image - 1)
- Now hold the bottle in your hand as shown in the image - 2, stretch the balloon to one side and blow into the tube. Sound will start coming from the instrument.
- Try making variations in this. Make the balloon lose/ tight, change the height of the bottle and see if this changes the sound of the instrument.

Instrument 2: Straw flute:

Process:

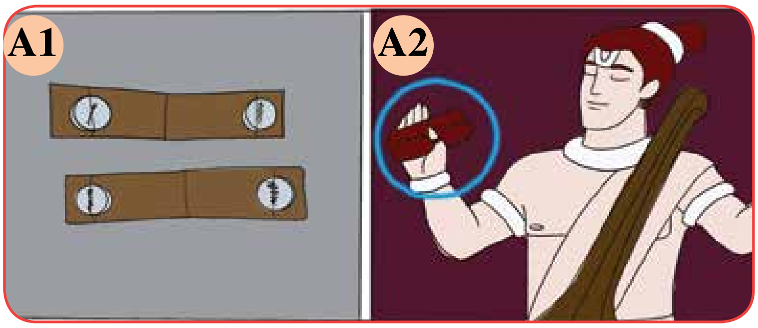


(Ref.: 'Pressure' booklet-Jnana Prabodhini, Pune.)

- Take a straw and cut its one end in a 'V' shape as shown in the image - I. And press it firmly.
- Keep this V part between your lips with each flap touching each lip.
- Press down gently and blow into the straw. The straw will start making sound like whistle. Adjust pressure of lips if the sound is not coming. (refer-image - II)
- Now, make holes in the straw at various distances, as you may have seen in a flute.
- Again, blow in the straw and close various holes alternatingly. Doesn't this sound just like a flute?

Here are some more simple ideas to make various types of musical instruments!

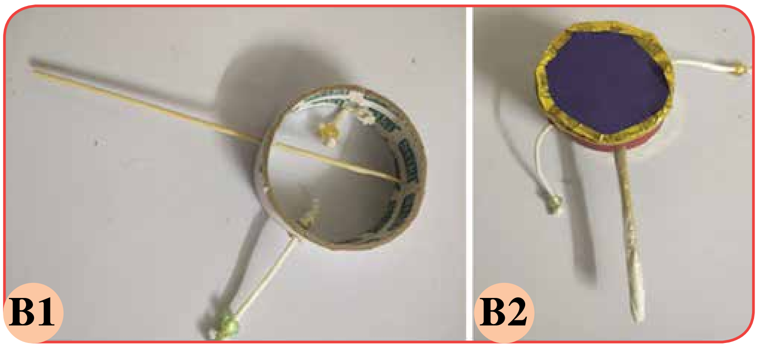
A. Kartal:



Process:

- Take cardboard strips, tie bottle caps to them using rubber bands.

B. Damaru:



Process:

- Take cardboard ring of cello-tape.
- Make holes on two sides and attach two pieces of strings with beads on them.
- Take a stick and stick it inside the ring as shown in the picture-B1.
- Glue paper disks on the circles of the ring from both sides. Spin the stick holding it with your palms. Damaru is ready!

C. Drums:

Process:

- Take a plastic cup/ container.
- Stretch a balloon over its mouth tightly.
- Take two wooden sticks and start playing the drums!

D. Ektara:

Process:

- Take two 15 cm long wooden sticks and keep the over each other. In that position, glue their one end together.
- Take a cup and glue other two ends of the sticks on the cup, one on each side.
- Make a hole at the bottom of the cup and pass a cut rubber band through it. Tie one end of the rubber band to the cup and the other to the top of the sticks.
- Make sure the rubber band is tight.
- Now, pluck the rubber band. Ektara is ready!

Ask questions:

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 measured?
5. What are various types of musical instruments? List a few instruments.

Do's and Don'ts:

1. **Safety:** Cutter and scissors should be used carefully.
2. **How to organize activity:** Make groups, distribute material, and give instructions to students. Ask them to change various parameters and check its effect on the sound.
3. **When to take activity:** Any time.

- **Use:** The musical instruments work on same principals as flute. If the holes are made at right distances, actual music can be played on it.

Summary / Principal / Knowledge gain:

When anything vibrates very fast, the air around it is pushed and pulled with it. The object pushes air and that air pushes air in front of it and so on. This creates high- and low-pressure areas in the air. This disturbance travels through the air. When this disturbance hits our ears, we hear it as sound.

If the object vibrates faster, the air will also vibrate faster and a sound of high pitch will be generated. Alternatively, if the object vibrates slower, a sound of lower frequency will be generated.

If the object vibrates with great force, the air will be pushed more and loud sound will be heard. Alternatively, if the object vibrates with low force, soft noise will be heard.

Resources:

Q.R.Codes

- https://www.youtube.com/watch?v=b0TuHyd2cCI

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Title of Activity

64. Learning to make rakhi

Syllabus reference:
Std. 6th, 7th and 8th

Standard concept / Principle:
E.V.S. - Lesson No. 7 and 8

Material required:
Glue, scale, scissors, silk strings, stars, beads, coloured paper, silk threads, thin sponge, pin, Raksha Sutra, etc.

Tools required:
Cutter, Scissors

Time required: 1/2 (half) Hour
No. of students in class: Max. 20 (No. of students in a group: 4-5)

Introduction:

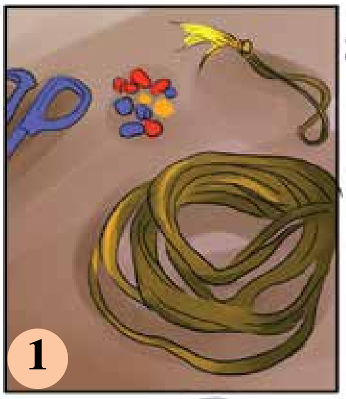
Celebrate the love and bond of Raksha Bandhan by making your own beautiful Rakhi. In this fun and easy activity, you'll learn how to braid silk threads, decorate them with colourful paper, stars, and beads, and create unique designs. Explore the meaning of Raksha Bandhan, discover the joy of crafting, and maybe even sell your creations at your school.

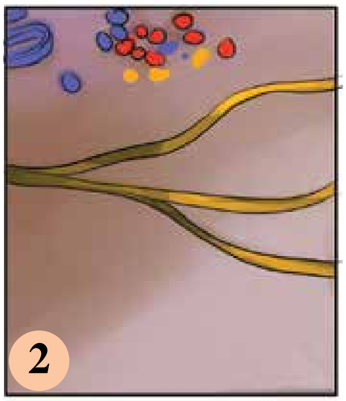
Purpose of the activity:

- To enhance the creativity of children.
- To tell children about cleanliness.
- To make children aware of the environment.
- Children gain knowledge about different content.
- To teach children the importance of Indian festivals.
- To instill confidence in children.

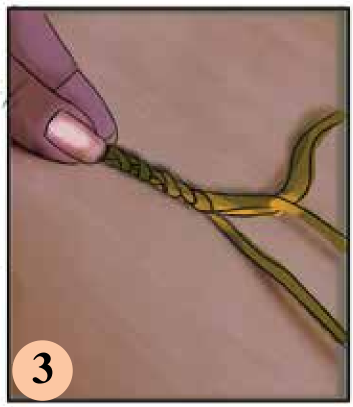
Process:

- First, check all the necessary equipment and materials.
- Take the Silk thread.

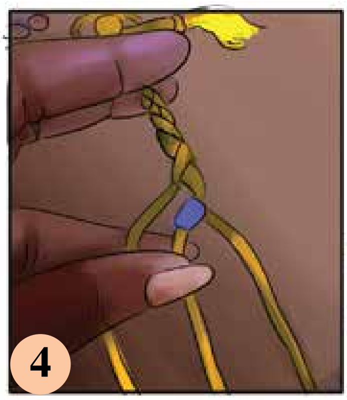


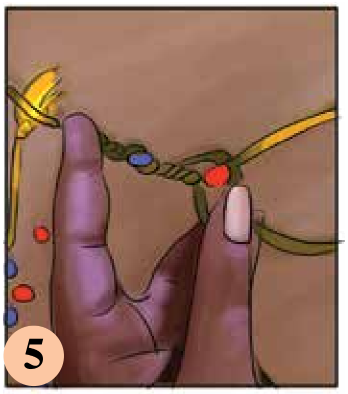


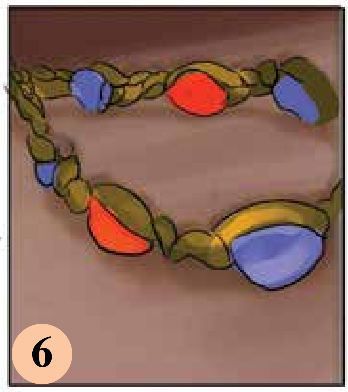
- Braid the silk thread like a plait. (As per figure 1)
- Wrap the thread to close both ends. (As per figure 2)
- The base of Rakhi is ready, cut a thin layer of sponge round and stick it on this base. (As per figure 3)



- Cut a round piece of coloured paper similar to the size of the sponge and glue it to the sponge. (Figure 4).
- Decorate the top of the paper with stars or beads. (Figure 5).
- Your Rakhi is ready! (Figure 6).







Overview:

- Is Rakhi making an art?
- How much time does it take to make a Rakhi?
- What materials are required to make a Rakhi?
- Make a cost chart for making Rakhi and figure out the selling price. Ask your teacher for help.
- Any other thoughts?

Ask questions:

1. To whom do we tie Rakhi?
2. When is the festival of Raksha Bandhan celebrated?
3. Why is Raksha Bandhan celebrated?
4. Make a list of items to be purchased related to each festival (at least four festivals).

Do's and Don'ts:

1. **Safety:** Use Scissors & blades under teacher supervision.
2. **How to organize activity:** 15 to a maximum of 20 (Number of students in a group: 4-5).
3. **When to take activity:** Any time.

Summary / Principal / Knowledge gain:

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. All Indian festivals create attachment and awareness towards the culture and folk traditions. Making a list of festival items helps students learn about different festivals. This activity teaches students how to make Rakhi, sell them, and understand the meaning of Raksha Bandhan.

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Title of Activity

65. Embroidery work on clothes

Syllabus reference:
Std. 6th, 7th and 8th

Standard concept / Principle:
E.V.S.

Material required:
Thread, needle, embroidery thread, embroidery needle, colour, pencil, ruler, etc.

Tools required:
Cutter, scissors

Time required: 2 Hours
No. of students in class: Max. 15 (No. of students in a group: 2-3)

Introduction:

In this activity we will learn how to do embroidery on clothes. Generally, there are following 6 types of prevalent embroidery -

1.	Kantha Embroidery	2.	Chikankari	3.	Phulkari
4.	Zardozi	5.	Kashmiri Embroidery	6.	Sindhi Embroidery

Chikankari or Chikan embroidery is quite popular in Lucknow and Uttar Pradesh.

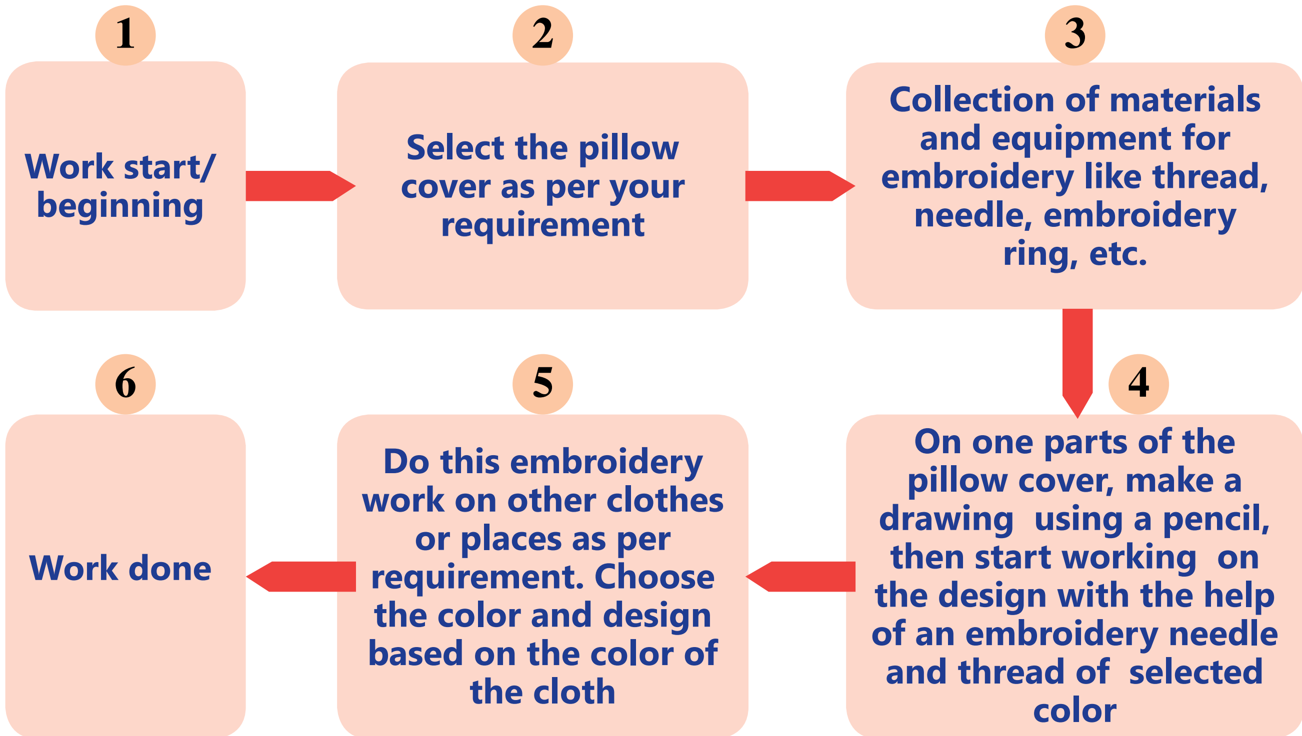
Two types of threads commonly used in embroidery are -

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

Now, we will learn how to do embroidery work on pillow covers. To learn how to do embroidery on a pillow cover, we will use the following flow chart:



Overview:

Observe the embroidery work/activity by yourself after a model prepared and presented by an expert instructor. The teacher should carry out the activity keeping the following issues in mind:

- Time taken for the embroidery work.
- Basis selection of color and thread used in embroidery work.
- Size of design used in the embroidery work.

Ask questions:

To increase children's interest in embroidery work and to find out the level of learning assimilation of the work learned, ask the following supplementary questions:

1. Where can you use this embroidery works?
2. How to use jute sack to make the doormat attractive?
3. How can embroidery work be made a means of livelihood?

Do's and Don'ts:

1. Use the needle carefully in embroidery work.
2. Carefully draw the embroidery design on the selected area.
3. Work carefully on the embroidery design only.
4. **Safety:** Use Scissors and needles under teacher supervision.
5. **How to organize activity:** Maximum 15 (Number of students in a group: 2 to 3.
6. **When to take activity:** Any time.

Summary / Principal / Knowledge gain:

Through this work of embroidery, we would teach children to make their own designs using their skills and a 'means of livelihood'. Through this activity, children will be able to develop qualities like concentration, superiority in selection and decision-making ability.

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Title of Activity

66. Knowledge of textile workmanship-Art of textile manufacturing

Syllabus reference:
Std. 6th, 7th and 8th

Standard concept / Principle:
Home Science, E.V.S.

Material required:
Threads, cloth, colours, etc.

Tools required:
One inch tape, finger caps, milton chalk, milton cloth needles, brushes, buttons, scissors, frames, embroidery accessories, etc.

Time required: 2 Hours
No. of students in class: Max. 20 (No. of students in a group: 4-5)

Introduction:

In practical terms, students have to learn how to cut a cloth according to measurements, do different types of stitching on it, do embroidery and make simple items of cloth from it.

The instructor should give information related to clothes, different types of clothes, their uses and their price to the children. Which designs are more in trend recently and how do people like fashion more? Apart from this, you should know about the types of clothes because there are many different types of clothes. While preparing, the instructor will have to understand all these things well and get information about them. Fabrics are prepared by knitting, crossing, knotting, weaving, tatting, felting and braiding. The work of sewing and cutting clothes is a systematic work. To do this work successfully and conveniently, various tools and equipment are required.

The person doing sewing work should have proper knowledge of these tools and equipment:

1. Cutting:

- In this, mainly the work of cutting the edges of clothes is done, in this, children will be taught to cut clothes according to the correct measurements so that they can cut handkerchiefs, tablecloths, pillow covers, etc. properly.

2. Drawing a blueprint:

- Before embroidering the clothes, a blueprint is drawn. For this work colors and tracing paper have to be purchased. It takes a lot of time and effort to do this work.

3. Embroidery:

- There are many types of embroidery. The most tiring work is when a large part of the garment has to be filled with embroidery. In the second type of embroidery, crochet embroidery is done on clothes. In this children will learn to embroider a handkerchief.

4. Button fastening:

- Many types of buttons and hooks are placed at designated places on clothes. In this sequence, children will be taught to fasten buttons as per requirement at prescribed distances.

Ask questions:

1. What tools are used for sewing?
2. What is the difference between Milton chalk and Milton cloth?
3. Why is it necessary to measure clothes before cutting them?
4. How many types of stitching are there?
5. Where is hand sewing used?
6. What is called Turpan or Turpayi?

Do's and Don'ts:

1. Keep all sewing equipment out of the reach of children.
2. Use scissors carefully. (The scissors should be small enough for children to use).
3. Fold clothes after using them.
4. Always keep the pin in a box.
5. By keeping the machine covered and adding oil to it from time to time, it remains protected from dust and work properly.

Summary / Principal / Knowledge gain:

Through this activity, children will learn that different types of embroidery are done by skilled individuals to enhance the beauty of clothes. This is a simple, low-cost and elegant work. The tools used are:

1. Embroidered Fabric
2. Different colored embroidery threads
3. Needles
4. Pencil
5. Carbon Paper
6. Frame or base for embroidery.

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Title of Activity

67. Exploring local craftsmanship: Meeting regional artisans

Syllabus reference:
Std. 6th, 7th and 8th

Standard concept / Principle:
Home Science, Moral Education, E.V.S.

Material required:
Pen, notebook, etc.

Tools required:
Request the artisan to bring the tools they require along with them.

Time required: 3 Hours
No. of students in class: Max. 20 (No. of students in a group: 4-5)

Introduction:

The school teacher or headmaster should invite one of the artisans from the local area like weaver, goldsmith, blacksmith, carpenter, tailor, potter, etc., to showcase their art in the school. Request the artisan to bring the tools they needs along with them.

Process Example:

Weavers come to the school to demonstrate their art.

- The weavers will explain in detail to the children about their art such as zari, zardosi, chikankari, and other embroidery techniques.
- Weavers will discuss the history of all these arts and their use in ancient times and the changes in them in modern society.
- Students will take notes and ask weavers and artisans questions regarding their work.

Similarly, other artisans can also be called in the school one by one as per the time and to get information about their works. Provide this information to students. So that students can gain knowledge of the tools used by these artists, their history, influence and impact on their works in modern times. In this way, knowledge of design principles, weaving techniques, color palettes, and garment making, will also be easily obtained.

Note:

The language teacher should motivate the students to write a report of this meeting in regional language or English and publish it through news/essay, etc.

WEAVERS WORK SAMPLE

Ask questions:

1. Tell us about your business, its specialties and history.
2. What is the format of your business?
3. What kind of materials do you use?
4. How many days does it take to complete an order?
5. What tools are used in your work?
6. How did you learn this skill?

Do's and Don'ts:

1. Treat the artisan's tools and materials with care.
2. Do not harm the tools brought by the artisans.
3. Do not use the materials unnecessarily or cause any harm.
4. Listen carefully to the artisan.
5. **How to organize activity:** 15 to a maximum of 20 (Number of students in a group: 4-5.
6. **When to take activity:** Any time.

Summary / Principal / Knowledge gain:

Through this activity, children will not only become familiar with their local artisans and their craftsmanship but will also learn that local art forms are part of their cultural heritage. Children will also get knowledge about design process for weaving, jewelery design, wooden toy work, clay toy work, brass utensils, etc. Students will also be introduced to the science related to the artisan's work.

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Title of Activity

68. Preparation of natural colours

Syllabus reference and standard concept / Principle:

Std. 6th, 7th - Home Crafts

Material required:

According to local areas availability, various flowers (rose, marigold, hibiscus, palash flowers), green vegetables (spinach, coriander), beetroot, turmeric, food colour, corn-starch/talcum powder/gram flour, water, etc.

Tools required:

Gas stove, table spoon, vessel for heating water, knife for cutting vegetables, strainer, etc.

Time required: 2 Hours

No. of students in class: Max. 30 (No. of students in a group: 7-10)

Introduction:

The seven colors of the rainbow are red, orange, yellow, green, sky blue, blue and violet are basic colours. The most natural source of origin of colors is sunlight.

Colors have a special impact in our lives. We cannot even imagine our life without colors. Infants recognize objects with the help of colors. Be it the greenery of nature or the blue of the sky or the blackness of clouds, we have colors everywhere.

In old times, people used natural colors. As the need for colors increased, chemical colors were used in various items as well as in festivals. In India, colors have special importance in Holi and other festivals. During this time people use a lot of colors. Chemical colors are very harmful to the skin. They can cause water pollution, air pollution and soil pollution. Keeping these issues of pollution in mind, it is necessary to use natural colors instead of chemical colors.

Purpose of the activity:

1. To introduce students to creating natural colors and their benefits compared to chemical alternatives.
2. To give information about different types of colors.
3. To teach the use of measuring instruments while making colors.
4. To know useful vegetables, fruits, plants, etc. for creating color in the surrounding premises.

Process:

- Form groups of students. (Number of students in a group: 7 to 10.
- Collect flowers, fruits, vegetables from the school premises or nearby areas or from the students' homes.
- Collect all the necessary tools for cutting vegetables and fruits at one place.

Method of preparing pink color:

1. First of all, take one beetroot to make pink color.
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 two glasses of water. Boil the mixture put in water on gas for 5 minutes. As soon as the color of the water turns pink, keep the water aside to cool. Drain the boiled water through a strainer.
5. Take two small tablespoons of corn-starch and add filtered beetroot water to it. Add colored water until its color turns pink.

6. Since the pink colored mixture prepared is wet, keep it in the sun for some time to dry.

Method of preparing green color from green leafy vegetables:

1. First of all, 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 made is wet, keep it in the sun for some time to dry.

According to the above method, we can prepare different types of natural colors from other flowers or from food colors available in the market.

We can also prepare yellow color from turmeric which is used at home.

Ask questions:

1. What things are necessary to make colour?
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?

Do's and Don'ts:

1. While cutting vegetables, use the knife carefully and in the presence of the teacher.
2. While boiling flowers in water, make the students stand at a distance.
3. Keep some chemical colors in the class to show the students and identify the difference.
4. **When to take activity:** Any time. However, if you conduct the activity during festivals like Holi. That is, when the nature also has different colored flowers around us.

Summary / Principal / Knowledge gain:

- Students will get information about different types of fruits and vegetables.
- Students will get information about different types of chemical and natural colors available in the market.
- You will get information about which components natural colors are made from.
- Students will get information about the harm caused by chemical colors.

Resources:

Q.R.Codes

Material And Tool List
for Makerspace in Secondary Schools

Engineering					
Sr. No.	**Particular**	**Specification**	**Unit**	**Qty**	**Make**
Measuring Equipment					
1	Steel Ruler	150 mm, 300 mm	Set	1	Kristeel
2	Measuring Tape	3 Meter	No.	1	Freemans
3	Spirit Level Bottle	0.01 - 0.05 mm/Meter	Set	1	Taparia
4	Tri-Square (Casting Base) (Construction And Carpentry)	Blade Size 120 mm	No.	1	Generic
5	Vernier Caliper	150 mm	No.	1	Aerospace
Carpentry Hand/ Cutting Tools /Equipment					
6	Scriber		No.	1	Taparia
7	Claw Hammer	500 Grams with Handle	No.	1	Taparia
8	Mallet Plastic	Medium	No.	1	Taparia
9	Wood Saw	18"	No.	2	Generic
10	Wood Saw small size	12"	No.	2	Generic
11	Hacksaw Frame Pipe Frame	12", Fix Frame	No.	2	Taparia
12	Hacksaw Blades	12"	No.	10	Taparia
13	Hacksaw Frame Pipe Frame	6"	No.	2	Generic
14	Hacksaw Blades	6"	No.	10	Generic
15	Pliers: 4-5 Inch	External Straight Plier	No.	1	Taparia
		Nose Circlip Plier	No.	1	Taparia
		Long Nose Plier	No.	1	Taparia
		Combination Mini Plier	No.	1	Taparia
		Bent Nose Plier	No.	1	Taparia
		Needle Nose Pliers	No.	1	Taparia
16	Tweezer Set	Non-Magnetic 6"	No.	6	Generic
17	Allen Key Set	Ring Imperial Allen Hex Key	No.	1	Taparia
18	Half Round Wood Rasp File	10"	No.	1	Taparia
19	Flat File Rasp	10"	No.	1	Taparia
20	Flat File Rough	12"	No.	1	Taparia
21	C-Clamps (For Carpentry Use)	2", 3", 4"	Set	1	Taparia
22	Iron Plane	5", 7"	No.	2	Generic
23	Firmer Chisel	1/2" Flat, 1" Flat, Length -10" with handle	No.	1	Taparia
24	Mortise Chisel	1/4", Length -10" with handle	Set	1	Taparia
25	Pairing Chisel	10" with handle	Set	1	Taparia
26	Hand Drill Machine	Portable	No.	1	Generic
27	Cutter	Small, Big	Set	1	Taparia
28	Carboundum-Stone (Emery)	6" X 2.5" X 2"	No.	1	Generic
29	Auger Bit	1/2", 1/4"	Set	1	Generic

Sr. No.	Particular	Specification	Unit	Qty	Make
Drilling, Tapping, Threading Hand/ Cutting Tools/ Equipment					
30	Center Punch		No.	1	Taparia
31	Tap Wrench	200 mm	No.	1	Taparia
32	Oil Can	250 ml	No.	1	Taparia
33	Machine Vice	75 mm Steel Body	No.	1	Taparia
34	Hammers B.P. (Ball Pein) with Handle	500 Grams	No.	1	Taparia
35	Hammer C.P. (Cross Pein) with Handle	500 Grams	No.	1	Taparia
36	Flat Chisel	6"	No.	1	Taparia
37	File Handle - 5"or 6"	5" or 6"	No.	7	Taparia
38	Flat Smooth File	12"	No.	1	Taparia
39	Triangular Files	12"	No.	1	Taparia
40	Round Basted File	8"	No.	1	Taparia
41	Open End Wrench/ Spanner Set	6 mm -18 mm (Sizes mm: 6x7, 8x9, 10x11, 12x13, 14x15, 16x17)	8 Pc Set	1	Taparia
42	Ring Spanner Set	6 To 18 mm	Set	1	Taparia
43	Flat File Rough	8"	No.	1	Taparia
44	Sledge Hammer	1 Kg with handle	No.	2	Taparia
45	Screw Driver	6" / 8" /10" insulated 2 in 1	No.	1	Taparia
Safety Equipment (Engineering)					
46	Safety Goggle	Free Size	No.	15	Generic
47	Hand Gloves Pairs	Small	Pairs	10	Generic
48	First Aid Box	Big box for 10 persons	No.	1	St. John
Energy and Electronics					
49	Digital Multimeter	-	No.	3	Mastech
50	Wire Gauge	-	No.	1	Kristeel
51	Measuring Tape	15 m	No.	1	Generic
52	Linesman Pliers	8"	No.	2	Taparia
53	Side Cutting Player	Diagonal Cutting Plier	No.	2	Taparia
54	Screw Driver Set / Electrician-Wiremen Set	-	No.	1	Taparia
55	Tester	-	No.	6	Taparia
56	Wire Stripper	-	No.	2	Taparia
57	Razor Blade Knife (Utility Knife)	-	No.	2	Taparia
58	Hack Saw- Mini Hacksaw	-	No.	2	Taparia
59	Masonry Drill Bits (Concrete Drill)	4 mm to 10 mm (4, 5, 6, 8, 10 mm)	5 Pc Set	1	Taparia
60	Electric Soldering Iron	35 Watts	No.	6	Soldron
61	Soldering Stand	250 Grams	No.	3	Sonal
62	Soldering Wire 20/22	AWG With Rosin Core Flux 100 Grams	No.	6	Generic

Sr. No.	Particular	Specification	Unit	Qty	Make
63	Hot Glue Gun	Works with standard 0.5- inch glue sticks. Temperature - 230 to 280 degree Celsius	No.	4	Mario
64	Adapter	DC Power adapter with 5V, 2A	No.	2	Generic
65	Adapter	DC Power adapter with 12V, 2A	No.	2	Generic
66	Electrical Hand Drill Machine	13mm Fiber Body Drill Machine.	No.	1	Bosch
Safety Equipment (Energy and Electronics)					
67	Fire Extinguisher CO2	ABC (2 Kg) Powder - Extinguisher Blanketing	No.	1	ABC Powder
Arduino Kit					
68	Arduino UNO + Cable	-	No.	5	
69	Breadboard (Medium Size) 400 Points	-	No.	5	Generic
70	LDR Sensor 5 mm	-	No.	5	Generic
71	Thermistor	Arduino Compatible DHT11	No.	5	Generic
72	Ultrasonic Sensor	HC-SR04	No.	5	Generic
73	IR Sensor	Arduino Compatible	No.	5	Generic
74	Soil Moisture Sensor	Arduino Compatible	No.	5	Generic
75	LM393(Sound Sensor)	Arduino Compatible	No.	5	Generic
76	Gas Sensor (MQ 2) Module	MQ -2	No.	5	Generic
77	Jumper Wires (M-M, F-M, F-F)	1 Bundle Each of 20 Wires	No.	5	Generic
78	BOX Plastic	Storage Box	No.	3	Generic
79	Min Max Thermometer	To Record Environ Temp	No.	1	Zeal
80	Wet Bulb Dry Bulb Thermometer	Humidity Measurement	No.	1	Zeal
81	0-13mm Drill Bits Set	-	No.	1	BOSCH
82	AA Battery Holders (2 Battery)	-	No.	10	Generic
83	9V Batteries 20	-	No.	20	HW
84	9V Battery Connectors	-	No.	20	Generic
85	DC Toy Motors	-	No.	20	Generic
86	Geared DC Motors	BO Motor	No.	10	Generic
87	DC Power Adapters (12V and 9V)	Each	No.	3	Generic
88	LEDs- White	-	No.	35	Generic
89	LEDs - Red	-	No.	35	Generic
90	LEDs - Yellow	-	No.	35	Generic
91	LEDs - Green	-	No.	35	Generic
92	LEDs - Blue	-	No.	35	Generic

Sr. No.	Particular	Specification	Unit	Qty	Make
93	Buzzer	-	No.	35	Generic
94	Flat Ribbon Cable	Meters	No.	10	Generic
95	Copper Foil (Single Side Tape)	6 mm wide	No.	2	Generic
96	Resistors	Mix of resistors	No.	10	Generic
97	Capacitors	Mix of capacitors	No.	10	Generic
98	Transistors	-	No.	1	Generic
99	Diodes	-	No.	1	Generic
100	BO Motor Wheels	7 cm	No.	8	Generic
101	Motor Controller	L293D	No.	2	Generic
102	Solar Panel Small	70 mm x 70 mm	No.	5	Generic
103	9V Battery Clip with DC Jack	-	No.	5	Generic
Agriculture					
104	Kitchen Gardening Tool Set-Set of 6 Light Weight Tools	Set of 6 pieces	Set	1	Miti Dhan
Art And Craft					
105	Pin Cushion and Pins	-	Set	1	-
106	Sewing Box	Box	No.	1	-
107	Trimming Scissors	-	No.	1	-
108	Seam Ripper	-	No.	2	-
109	Pinking Shears	-	No.	2	-
110	Sewing And Embroidery Scissors	-	No.	1	-
111	Thread	12 Different Colours	Set	1	-
112	Needles	-	No.	50	-
113	Crochet Needles	-	Set	2	-
114	Wool Bundle +Ribbon	-	No.	5	-
115	Colored Craft Papers	A4 Size- (5 Different Mixed Colors) Each	Set	2	Classmate
116	Art And Craft Scissor	Mixed (Small, Medium, Large)	No.	3	Cramly
117	A3 Cutting Mats	Polyvinyl	No.	2	-
118	Glue Bottles	100 gm	No.	5	Fevicol
119	Double Sided Tape	1/2 inch wide, 3 Meters	No.	2	-
120	Acrylic Color	2 Sets of 10 Bottles Each	Set	2	-
121	Coloring Brush	Mix of Different Sizes (DOMS Set of 7 Pcs)	No.	3	DOMS
122	Color Pallet	Flower Dish	No.	2	-
123	Paper Quelling Kit	-	No.	1	-
124	Jewelry Making Kit	-	No.	1	-
125	Paper Cups	Small +Big White	Set	2	-
126	Paper Straws	Paper Straw	Set	1	-

Sr. No.	Particular	Specification	Unit	Qty	Make
127	Cardboard Sheets	Thickness 2mm, 3mm- A3 Size	No.	10	-
128	Plastic Straws	Mix of Plastic Straws	Set	1	-
129	Paper Dishes	Mix of Paper Dishes- 9 In Dia	Set	1	-
130	Ice-Cream Sticks	Mixed Colored Sticks	Set	2	-
131	Crayons	Boxes of 12 Crayons	No.	20	Camel
132	Water Colors	12 Color Shade Boxes	Set	5	Camel
133	Canvas	Mixed Sizes 4"-8"	No.	20	-
134	Bamboo Skewers	Mix 6" Long +12" Long	Set	2	-
135	Sketch Pens	Mix 12 Shades	No.	10	Classmate
Lab Infrastructure					
1	Steel Almirah	6.5 Ft Powder Coating, Plain Shelf Medium Gauge	No.	2	-
2	Working Tables	1.5 Inch Metal Frame With 18mm Table Top	No.	2	-
3	Multi Display Board	MDB-500	No.	1	-
4	Vinyl Sticker Posters	Designed Lab Wall Poster	No.	6	-

Notes

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