

# Kaushal Bodh

Vocational Education Activity Book for Grade 8



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NCERT

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्  
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

**0885 – KAUSHAL BODH**

Vocational Education Activity Book for Grade 8

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## FOREWORD

The National Education Policy 2020 envisages a system of education in the country that is rooted in Indian ethos and its civilisational accomplishments in all domains of human endeavour and knowledge, while at the same time preparing the students to constructively engage with the prospects and challenges of the twenty-first century. The basis for this aspirational vision has been well laid out by the National Curriculum Framework for School Education (NCF-SE) 2023 across curricular areas at all stages. Having nurtured the students' inherent abilities and touching upon all the five planes of human existence, the *pañchakośhas*, in the foundational and the preparatory stages have paved the way for the progression of their learning further at the middle stage. Thus, the middle stage acts as a bridge between the preparatory and the secondary stages, spanning three years from Grade 6 to 8.

The NCF-SE 2023, at the middle stage, aims to equip students with the skills that are needed to grow, as they advance in their lives. It endeavours to enhance their analytical, descriptive, and narrative capabilities and to prepare them for the challenges and opportunities that await them. A diverse curriculum, covering nine subjects ranging from three languages, including at least two languages native to India, science, mathematics, social science, art education, physical education and well-being, and vocational education, promotes their holistic development.

Such a transformative learning culture requires certain essential conditions. One of them is to have appropriate textbooks in different curricular areas as these textbooks will play a central role in mediating between content and pedagogy—a role that will strike a judicious balance between direct instruction and opportunities for exploration and inquiry. Among the other conditions, classroom arrangement and teacher preparation are crucial to establishing conceptual connections both within and across curricular areas. The National Council of Educational Research and Training (NCERT), on its part, is committed to providing students with such high-quality textbooks. Various Curricular Area Groups, which have been constituted for this purpose, comprising notable subject experts, pedagogues, and practising

teachers as their members, have made all possible efforts to develop such textbooks.

*Kaushal Bodh*, the activity book of vocational education for Grade 8, is one of these. Its content comprises projects related to three work forms— life forms, machines and materials, and human services. The projects will help students to develop knowledge, skills, attitude and values alongside ecological sensitivity, gender sensitivity, digital skills, and life skills. For all practical purposes, it has, to my mind, succeeded in its curricular goals: first, to foster natural curiosity among students through a proper selection of project; and second, develop among them the core competencies, such as communication, creativity, critical thinking, and green skill and vocational skills, such as application of tools, and procedures for design and developing products by intelligently designing various activities, thereby seamlessly integrating content and pedagogy within meaningful contexts. However, in addition to this textbook, students at this stage should also be encouraged to explore various other learning resources. School libraries, laboratories and workshops play a crucial role in making such resources available. Besides, the role of parents and teachers will also be invaluable in guiding and encouraging students to do so. With this, I express my gratitude to all those who have been involved in the development of this activity book and hope that it will meet the expectations of all stakeholders. At the same time, I also invite suggestions and feedback from all its users for further improvement in the coming years.

DINESH PRASAD SAKLANI

*Director*

National Council of Educational  
Research and Training

New Delhi  
June 2025

## ABOUT THE BOOK

*Kaushal Bodh*, the activity book of vocational education for Grade 8 is developed in alignment with the vision of the National Education Policy (NEP) 2020 and the National Curriculum Framework for School Education (NCF-SE) 2023.

In the NCF-SE 2023, work has been categorised under three broad forms: Work with Life Forms, Work with Machines and Materials, and Work in Human Services. The intent at this stage is to provide vocational exposure to the students through a wide range of activities categorised into three forms of work. To achieve this, students are expected to take up nine projects across Grade 6 to 8, i.e., three projects in each grade and one from each form of work.

Curricular goals, competencies, and learning outcomes have been the guiding principles while developing the Activity Book. The following Curricular Goals (CG) given in the Activity Book cover a range of competencies.

**CG-1:** Develops in-depth basic skills and allied knowledge of work and their associated materials or procedures;

**CG-2:** Understands the place and usefulness of vocational skills and vocations in the world of work;

**CG-3:** Develops essential values while working across areas; and

**CG-4:** Develops basic skills and allied knowledge to run and contribute to a home.

The activity book contains six illustrative projects, two for each form of work, intended to cover the above curricular goals. The choice of projects is left entirely to schools. One project may be taken up by students or preferably, the school can design other projects based on local considerations. The NCF-SE 2023, and indeed this activity book, encourages schools to select projects based on local considerations and availability of resources. Annexure 1 provides a template for designing a project other than those in the book.

The illustrative projects are described as follows:

**Project 1** is on developing Hydroponics: Growing Plants without Soil. Students will engage in establishing and maintaining hydroponic units in school. They will draw on their learning in Science classrooms

about conditions for plant growth and extend this understanding to scientific alternatives. They will learn about environmentally friendly practices that can be used for plant propagation.

**Project 2** is on Feeding and Caring for Farm Animals. Students will engage with animals to develop sensitivity towards their well-being. They will appreciate the diversity of domesticated animals that support human life. This project will enhance their observational skills related to animal behaviour and its interpretation. It will also instill a sense of care and the importance of preserving the well-being of animals.

**Project 3** is on Working with Wood and Bamboo. In this project, students will explore various techniques used for working with wood and bamboo. They will learn to use tools and materials to create functional or artistic items, fostering creativity, problem-solving, and technical skills. This project will encourage innovation and creative thinking, preparing students for potential careers in design.

**Project 4** is on Home Automation. It will introduce students to the fundamentals of electronics and programming. They will learn to automate simple systems in their surroundings. This project will enhance their technological proficiency, creativity, and logical thinking.

**Project 5** is on Water Audit for Water Management. Students will engage with real-life data to learn how to draw conclusions and make simple predictions. They will collect primary data using estimations based on scientific principles. They will also engage with secondary data, learning how to acknowledge sources. This project will develop sensitivity towards the needs of all as well as a sense of environmental stewardship.

**Project 6** is on Advertising for Small Businesses. In this project, students will reflect on the role of advertisements in our life. They will identify elements of advertisements to understand both the marketing and ethical dimensions. They will learn about small businesses and make advertisements for them using different media. This project will develop discernment to review advertisements and other media of communication for veracity.

As the culmination of the work done through the year related to vocational education, a *Kaushal Mela* will be held at the end of the year to both showcase the products students have created and the services they have learnt. It will also be an opportunity for students to share

their experiences and learnings. Community members and education functionaries may be invited to the *Kaushal Mela*. Planning, being an important outcome of vocational education, a section is devoted to helping students plan and design the *Kaushal Mela*.

Finally, annexures include a project planning template, competencies and learning outcomes to be achieved in Grade 8, **suggestive projects in each of the forms of work in some detail**, and mapping of learning outcomes with time required for each of the illustrative projects.

Cross-cutting themes, such as Indian Knowledge Systems, values, heritage, gender sensitivity, and inclusion have been integrated into all the projects. Reflective and thought-provoking questions included under different activities are engaging and they promote joyful learning along with assessment as and for learning. Students are provided opportunities to do different things, record small successes, take and give feedback, work with peers, try and re-try, answer-questions, reflect, in short, and experience the values related to work. Illustrations have been designed depicting the context to enhance learning. In-text questions are also included to assess comprehension of the activities. The end of the project questions given in 'Think and Answer' are designed to encourage critical thinking, reasoning, responding, and analysing.

Students can access the additional resources provided in the Quick Response (QR) code for each project.

We sincerely hope that the students will enjoy doing these projects and that these will help in developing the desired and intended competencies.

VINAY SWARUP MEHROTRA  
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## NOTE FOR SCHOOL HEADS AND TEACHERS

Teachers are pivotal to achieving the goals set out in the National Education Policy (NEP) 2020. The National Curriculum Framework for School Education (NCF-SE) 2023 introduces vocational education as a distinct subject starting in Grade 6. The purpose of this subject is to promote 'learning by doing', 'dignity of labour', and the development of vocational capacities through exposure to a wide range of work. Successful implementation will aid in developing responsible and confident adults who value all professions. Vocational Education in schools also offers a robust medium for holistic learning by offering students opportunities to apply conceptual learning in other curricular areas to real-life situations.

In Grade 8, students will take up one project in each of the 'Forms of Work'. The sequence of these projects is not important, so long as all the projects are completed within the academic year. These projects can be taken up at the same time or one after the other. Groups of students may also take up different projects, which depends on the nature of the project and other factors, such as the number of students, resources available, and so on. Please note that it is important to identify concepts across curricular areas that students need to know (e.g., seed germination for agriculture related projects in life forms) and ensure that they have been covered before starting the project.

In this Activity Book, the projects are designed as per the Learning Outcomes for Vocational Education in Grade 8. The focus is on the following:

1. Using physical tools/equipment for carrying out different processes to perform authentic tasks.
2. Gaining clarity about what is to be done and reaching the final outcome through breaking down the task into smaller activities.
3. Understanding how to prepare materials and use tools and equipment, while following safety measures and protocols.
4. Connecting the activities done in school to the world of work.
5. Assessing work done in terms of quantity and quality.
6. Applying what is learnt in school to daily life.
7. Working collaboratively in groups while ensuring individual participation in each activity.

In doing the above, students will be able to develop values related to work, particularly respect for all work. They will realise the importance of the dignity of labour, which means that no work is considered superior and therefore, no work or person should be discriminated against on any basis.

The projects in the Activity Book are illustrative. Schools can choose to take up any one or design their own projects from each form of work.

Annexure 1 provides guidelines for designing a project in alignment with curricular goals, competencies and learning outcomes.

**Annexure 3 has details of five additional projects in each form of work.**

Thus, for each form of work, schools may (i) select one project from each form of work; (ii) design their own projects; and (iii) further detail out any one of the additional projects given in the Activity Book.

## Pedagogy and Assessment

Projects comprise a set of activities that are generally expected to be completed in a group or individually, as required. Resources for projects (e.g., tools, equipment, materials, use of workspaces, etc.) and resource persons or master instructors (e.g., mechanics, farmers, craftspersons, artisans, persons working in technology, and experts in the field) must be drawn from the community. Exposure visits and interactions with professionals are built into the project to enable students to observe and understand work in real settings.

The total time allotted to vocational education is 110 hours or 165 periods in one academic year, excluding time for assessment, school events, bagless days and similar activities (Section 4.3 of the NCF-SE 2023). These periods may be distributed across the week as two blocks of two periods on week-days and one period on Saturday.

Each project is expected to be completed in about 30 hours (approximately 55 periods of 40 minutes each). This duration is to ensure a long-term engagement that allows students to complete a set of interrelated activities. It also gives them time for trial and error, to try out things differently, and to extend their learning into other activities.

The focus of the projects must be creativity and demonstration of skills, and the process of 'doing' rather than the 'product' or outcome. Working in groups and observing people with expertise is important to foster an appreciation for teamwork, creativity, sensitivity, persistence, and other important values related to work.

Students must be active throughout, as they take up activities that are directly connected to real life and the world of work. They must be able to integrate learning from other curricular areas into the projects. Prevalent biases must be addressed, for example, by assigning work roles to diverse gender and to students from all social groups. All students must participate in all activities. To ensure the participation of *divyang* students, projects can be adapted or an entirely different project may be developed.

The activity book is designed to enable continuous assessment by teachers, as well as self and peer-assessment by students. The questions and formats for recording require students to assess their own progress, share their learning and reflections, and record their answers as they move from one activity to the next.

Students must also maintain a portfolio in order to help them see their own progress, and record the processes and products related to the projects. It may contain any work done by students, including additional notes, presentations, sketches or photographs (besides those in the activity book) related to the project, and products they have created.

Assessing the inculcation of values related to work (e.g., initiative, persistence and focus, responsibility, discipline, eye for detail, curiosity and creativity, empathy and sensitivity, and willingness to do physical work) is particularly important. Students must be observed while at work to assess the same. Checklists and rubrics that outline specific behaviours and attitudes related to work values may be developed by the teachers. Annexure 2 contains the competencies to be developed across the middle stage and the learning outcomes to be achieved in Grade 8.

While this is true for all subjects, the role of feedback is particularly important in Vocational Education. Students must be encouraged and motivated by recognition of their work and their creativity. This approach ensures that all students are able to complete their work successfully through ongoing guidance, which in turn is motivating.

Summative assessment for Grade 8 can, for example, comprise a viva voce, presentation, role-play, simulation, group discussion, and the review of students' responses to prompts or questions in the activity book. If you wish to use a paper-pencil test, it could include situational questions, concept maps, flowcharts, questions related to learning from visits, and multiple choice questions. Each project also has a set of questions in the last section. These questions address key aspects of learning and concepts that are strengthened while doing the activities. To reiterate, the focus must be on assessing capacities and understanding of processes. Weightage to the theoretical aspects is suggested as 20 per cent and 80 per cent for the practical aspects.

A suggested weightage and marking scheme for assessment and evaluation is given below:

| Mode of Assessment                       | Weightage |
|------------------------------------------|-----------|
| Written Test                             | 10%       |
| Oral Presentation/Viva Voce              | 30%       |
| Activity Book                            | 30%       |
| Portfolio                                | 10%       |
| Teachers' Observations during Activities | 20%       |

## Criteria for Project Selection

The activity book is meant for students, and therefore 'speaks' to them. There are various components in each project, as indicated by the headings of sections (please refer to Annexure 1). These components are aligned with the competencies defined for Vocational Education in the NCF-SE 2023 (please refer to Annexure 2). Therefore, any project other than those in the activity book must include the same components. **The illustrative list of projects given in Annexure 3.**

The projects in this activity book are not mandatory, therefore schools are free to choose any one of these from each form of work or design an entirely different project. Students must also be encouraged to come up with ideas for projects.

If the school decides to choose a project other than those in the Activity Book, the following must be kept in mind for all the forms of work:

1. Is the project appropriate for students in Grade 8?
2. Does the project help students use learning from other subjects?
3. Is the project related to the work the students see around them?
4. Will the students be able to interact with persons who are experts in the work related to the project?
5. Will the students be able to get hands-on experience?
6. Will students be able to take up different kinds of activities within the project?
7. Will students find the activities within the project challenging and interesting?
8. Will students learn something they can use at home?
9. Will it develop the values related to work, particularly the dignity of labour?
10. Will the project help students acquire vocational capacities for their daily living (e.g., using technology, consciousness of environmental concerns and sustainability, taking care of oneself, doing small tasks at home, and the like)?

The proposed time allocation and connection of each section of the project to the learning outcomes for Grade 8 are given in Annexure 4. This may be referred to while developing a project other than those in the activity book.

Please note that suggestions for the use of technology, including Artificial Intelligence (AI) tools, are placed in boxes throughout the Activity Book. AI is a branch of computer science focused on creating systems or machines that can perform tasks that typically require human intelligence. The suggestions may be taken up if

suitable resources are available. Suggestions for Internet search are also included. Due precautions must be taken to ensure the safety of students. Students must work in groups and the use of Internet by them must be supervised by the teacher or an expert.

## **Who will teach?**

Since the purpose of vocational education in the middle stage is to provide vocational exposure to students, and till such time that teacher education programmes offer specialisation in vocational education, existing teachers will take up this subject in the Middle stage (Grade 6 to 8), with the support of resource persons/master instructors. A teacher of any subject can take the lead in organising activities for projects in which they have some understanding and expertise.

The Head of the School may nominate a “Teacher Coordinator” among the existing teachers to coordinate and schedule the activities of different projects to be undertaken at the Middle stage.

## **Safety Measures**

Due care must be taken to ensure safety at all times. Safety measures must be demonstrated to students, who must, in turn, also demonstrate their understanding of how to keep themselves and others safe. Where necessary, use of certain tools and materials by students may be supervised in small groups. Due safety during field visits, ranging from transportation to orientation of resource persons must receive necessary attention.

Internet safety or cyber safety is critical when students are accessing the Internet or using AI tools. Students must be made aware of the consequences and implications of sharing private information, visiting sites that are not approved by the teacher, or sharing of passwords.

## NOTE FOR STUDENTS

Dear Students,

This activity book will help you learn about different kinds of work and how to do work yourself.

When you think about work, you must remember two things: (i) all work is important; and (ii) people work not only to make a living, but also to make life more joyful and interesting. In daily life, you see people doing various kinds of work. Some of the work is related to running a household while some is related to earning a living.

*Vocational education prepares you to deal with practical things related to daily life and understand the world of work. This will happen through projects that you will do in school. These projects will give you an opportunity to work with your hands, work in groups with your peers, and learn the skills which help you become self-dependent in life.*

### How to use the Activity Book?

Read through the introduction of the project to get an idea of what you will be doing.

### Materials Needed

Gather all the materials listed at the beginning of each activity.

### Follow the Steps

1. Each activity has clear, numbered steps. Follow them to complete each task. Take your time and make sure you understand each step before moving on. Take notes during field visits or interaction with experts.
2. Complete all the questions and tables given in the activity book; this will help you to both learn and check your understanding.

### Check Your Work

After completion of the task, reflect on what you have learnt and what else you want to learn. Questions have been included to help you both think and write about what you are doing. Write in your own words,

use simple language, and share your observations and thoughts. After finishing an activity, review your work. Make sure you have completed all the steps and check your answers.

If the space in the activity book is not enough, please use a different notebook or loose sheets, which you can add to the portfolio.

## **Ask for Help**

If you are unsure about any part of an activity, do not hesitate to ask a teacher, parent, or peers for help. Ask as many questions as needed if something is unclear. Collaboration and discussion can make learning more fun and effective.

You can also get help from Internet searches or using AI tools. AI tools make our tasks easy by helping us find things or do something quickly. Some examples of AI tools are ChatGPT, tools for translation or for finding information about something. Please note that AI is not necessary for your projects; you can use it if you want.

## **Take Short Breaks**

Do not rush through the activities. If you start feeling tired, take a short break during the activities.

## **Be Creative**

Some activities may have open-ended questions or ask for your creative inputs. Let your imagination flow and write about your ideas and experiences.

## **Stay Positive**

Learning new things can be challenging. Stay positive and remember that practice makes you perfect.

## **Reflect**

Think about what you have learned from each activity. Share your progress with peers and teachers and ask for their feedback.

## Design Your Projects

Think about how you can continue to build on your learning to do other things.

Try out different things, and do activities other than those in the activity book. There may be a new way of doing something or maybe different materials can be used. If you face any difficulty or want to try out something different, reach out to others or consult library books. But do remember to discuss this with your group and the teacher. You may want to work beyond school hours and do some of the activities at home. You can even help your family and friends with what you learnt.

If you have any ideas for projects other than the ones suggested here, you can share them with your teacher, who will help you design your project.

## Internet Safety

If you use Internet searches or AI tools or both, please do so under supervision of an adult. You need to be careful of what you are accessing on the Internet. Just as there are places in and around your school and home where you will not go without an adult, there are places on the Internet that are not safe for anyone, neither you, nor adults. You must take care, and whenever in doubt, ask someone you trust.

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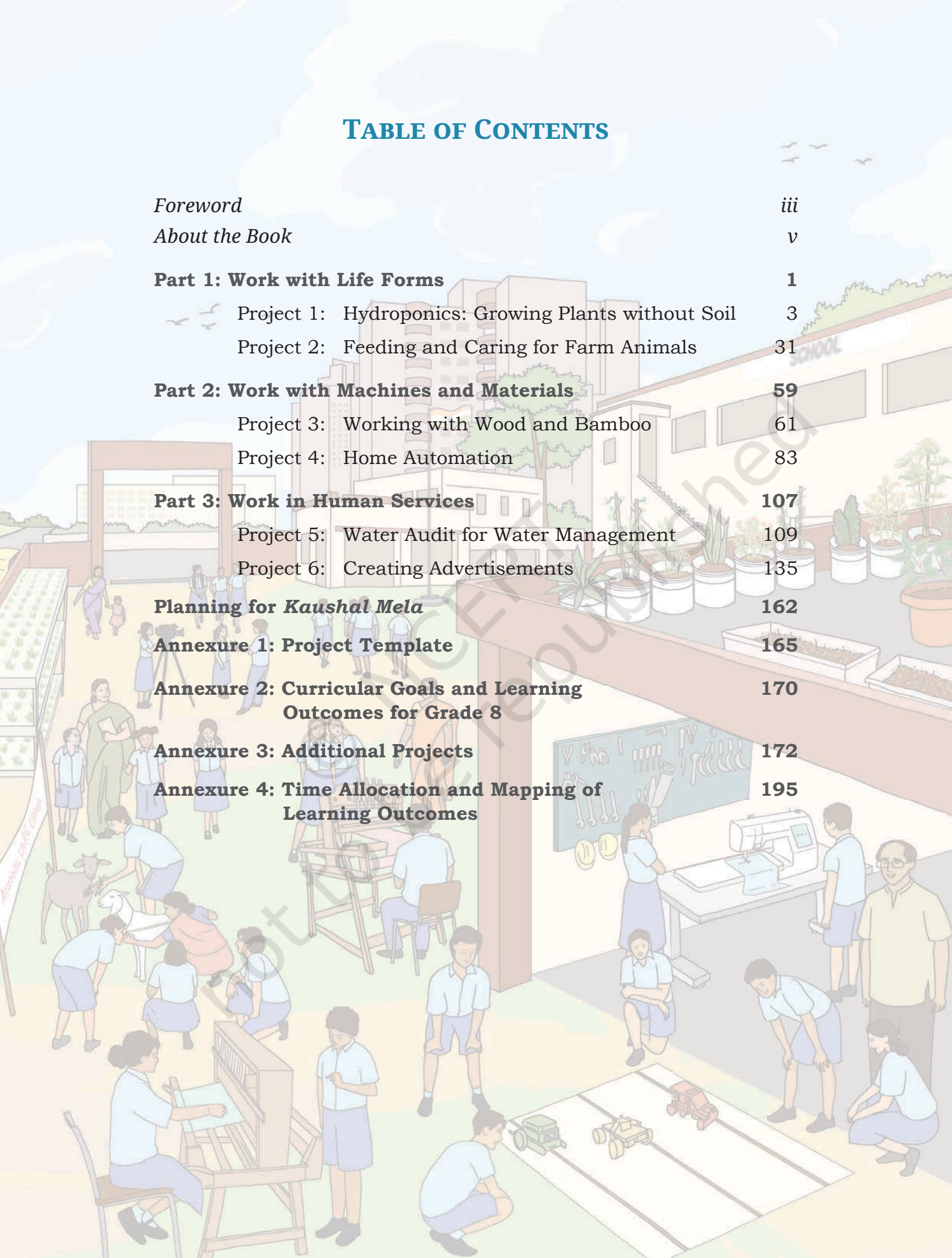
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# THE CONSTITUTION OF INDIA

## PREAMBLE

**WE, THE PEOPLE OF INDIA**, having solemnly resolved to constitute India into a <sup>1</sup>**[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC]** and to secure to all its citizens :

**JUSTICE**, social, economic and political;

**LIBERTY** of thought, expression, belief, faith and worship;

**EQUALITY** of status and of opportunity; and to promote among them all

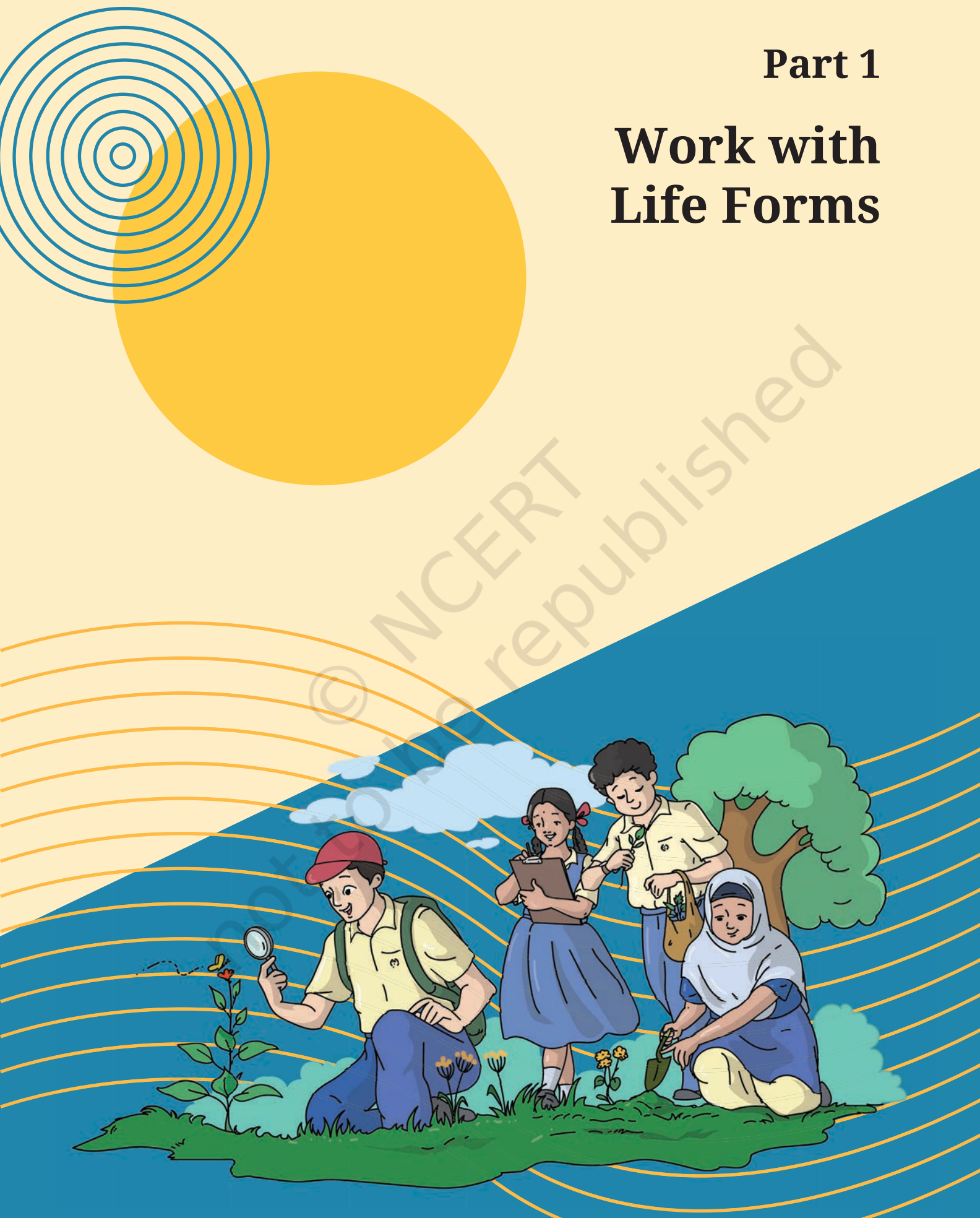
**FRATERNITY** assuring the dignity of the individual and the <sup>2</sup>[unity and integrity of the Nation];

**IN OUR CONSTITUENT ASSEMBLY** this twenty-sixth day of November, 1949 do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.**

1. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Unity of the Nation" (w.e.f. 3.1.1977)

Part 1

# Work with Life Forms



‘Life forms’ include all living things on earth. They include human beings, mammals, birds, fish, plants, insects, reptiles and even bacteria and viruses. Projects on “Work with Life Forms” will help you work with living things in different ways. You can take up projects related to growing plants in various ways, recording the biodiversity around you, surveying medicinal plants, learning to care for domestic and farm animals, and maintaining a nature journal. It is up to you to imagine all that you can do in the activities with your peers.

Two examples of projects are given in this section, which are Hydroponics: Growing Plants without Soil and Feeding and Caring for Farm Animals. You can either choose one of these projects or you can design a project of your own choice with the help of your teacher.

## Project 1

# Hydroponics: Growing Plants without Soil



0885CH01

Experts work towards finding agricultural solutions that will meet the demand for healthy food grown in an environmentally friendly manner. Hydroponics is one of the solutions that allows plants to be grown without soil or using a small amount of soil. This project is about developing a hydroponic unit in school.

***As part of the project you will be able to:***

Develop and maintain essential growth conditions through hydroponics

Grow healthy microgreens

Establish and maintain simple hydroponic unit

Prepare liquid organic manure

Maintain pH of water in hydroponic unit



Figure 1.1: Do-It-Yourself Hydroponics

Farmers put a lot of effort into growing healthy food in the shortest period. But as the world population grows, the demand for food also increases. More and more land is needed to meet this demand — this land is taken from forests, leading to deforestation. Deforestation leads to the loss of biodiversity and contributes to climate change.

Another challenge is that, as the same land is used over the years to grow plants, it loses its nutrients, which is known as soil degradation. Heavy use of fertilisers to compensate for the loss of nutrients further degrades the soil quality due to the chemical component of most fertilisers. Besides loss of nutrients, erosion caused by wind and rain, water pollution due to industrial drainage, land degradation due to mining activities and even excessive water for irrigation, all contribute to the reduction of the land available for farming and the quality of produce.

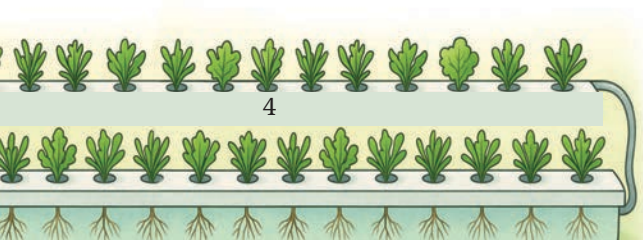
The Government of India is encouraging farmers to use hydroponics through the Mission for Integrated Development of Horticulture, Ministry of Agriculture and Farmers Welfare. Technologies like hydroponics, and aeroponics in which plants are not in direct contact with soil, are being promoted under this mission.

In India, nearly 33% of the Total Geographical Area (TGA) is affected by soil degradation. This means we are losing our fertile farming land. Nearly 109 million hectares of land is facing declining soil quality.

The focus of agricultural scientists, nutritionists, engineers and environmental experts has been to help farmers adopt sustainable farming practices. Sustainable farming aims to produce food that is healthy for humans with minimum negative impact on the environment.

The term hydroponics is derived from the Greek words ‘hydro’, that is, water, and ‘ponos’, that is, labour or toil.

Hydroponics is a method of growing plants in a nutrient-rich water solution instead of soil (Figures 1.1 and 1.2). Plants in a hydroponic unit receive nutrients directly from the water



solution, allowing the farmer to ensure that they receive the precise amount. Therefore, it is also referred to as a ‘precision farming technique’.



Figure 1.2: Hydroponic setup in a polyhouse

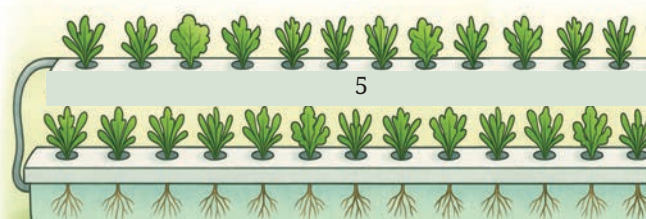
You can have multistorey (vertical) farming in hydroponics to utilise vertical space and produce more food in less space. Similarly, recirculating (reusing) water and fertilisers, controlling climatic parameters like temperature, humidity and light for photosynthesis and maximising plant growth is possible in hydroponics (for example, the hydroponic unit could be placed in a polyhouse). Hydroponics is also used for growing crops in cities, which is known as “urban farming”.



### What will I be able to do?

At the end of the project, you will be able to:

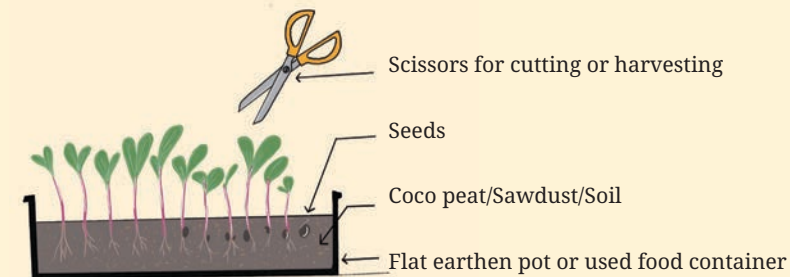
1. Grow healthy microgreens using a basic hydroponics system.
2. Establish hydroponic unit using wick-based, Deep Water Culture (DWC), and Nutrient Film Technique (NFT).
3. Prepare organic liquid manure for hydroponics.
4. Improve the quality of water by varying pH.



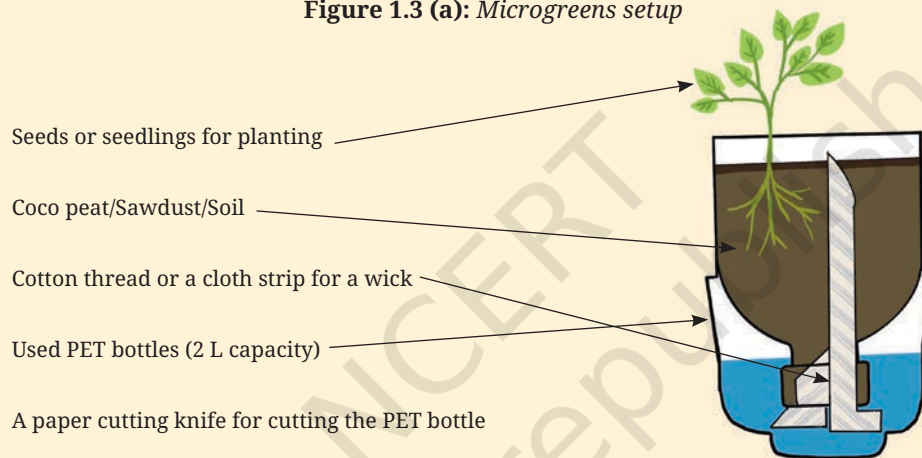


## What will I need?

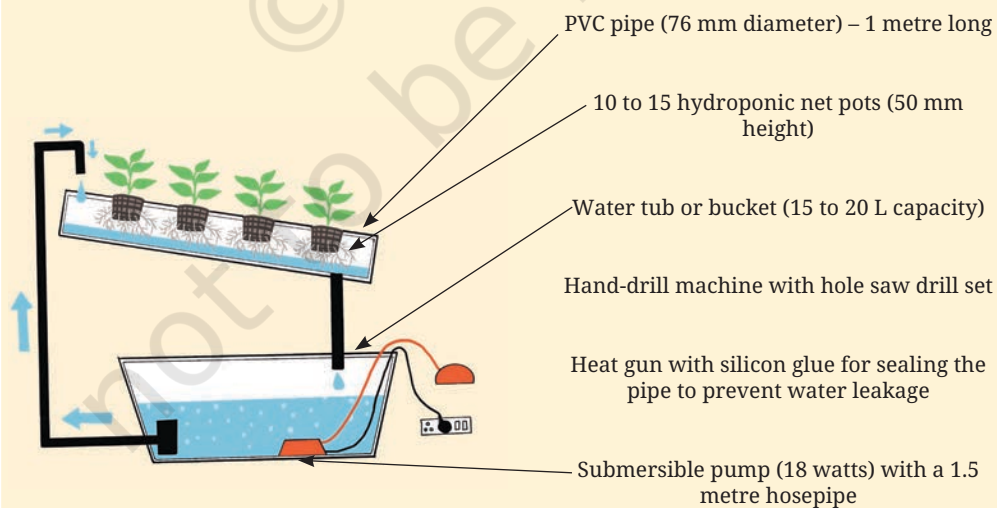
You will need different equipment and materials for various methods of hydroponics, as listed in Figure 1.3 given below.



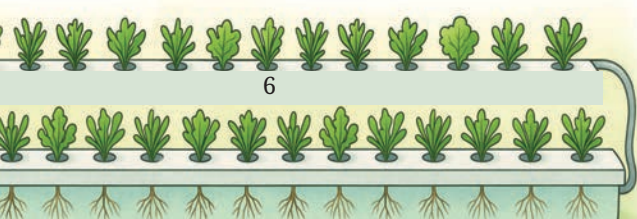
**Figure 1.3 (a): Microgreens setup**

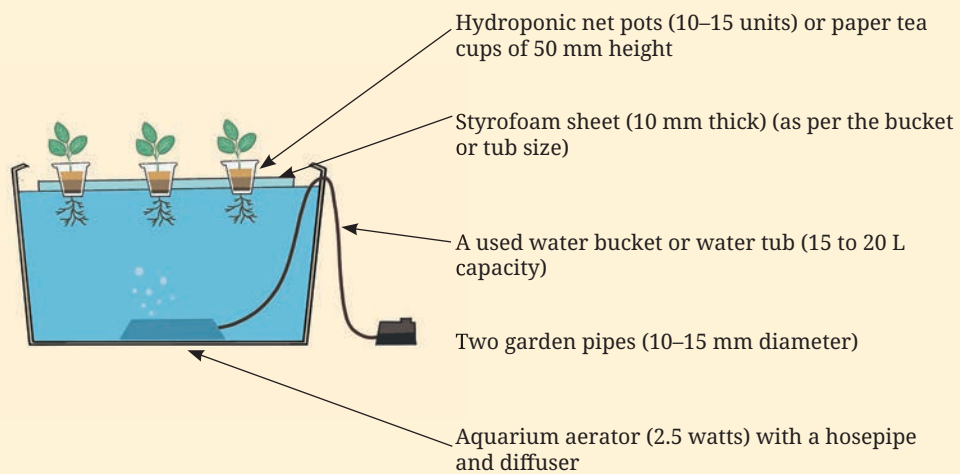


**Figure 1.3 (b): Wick hydroponic setup**

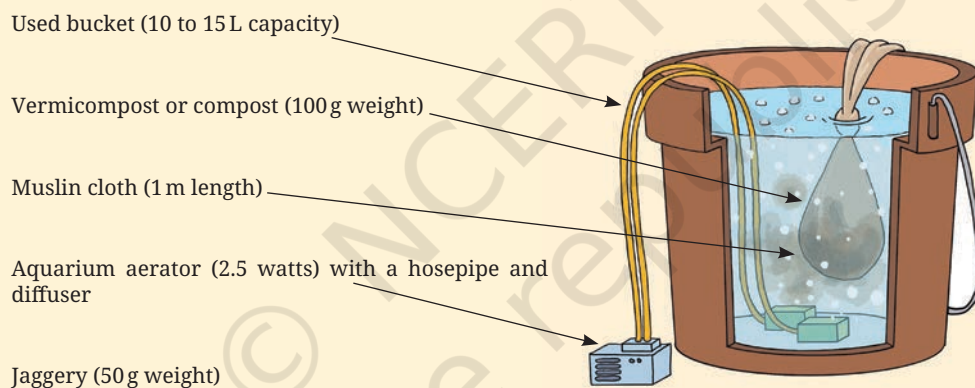


**Figure 1.3 (c): NFT hydroponic setup**

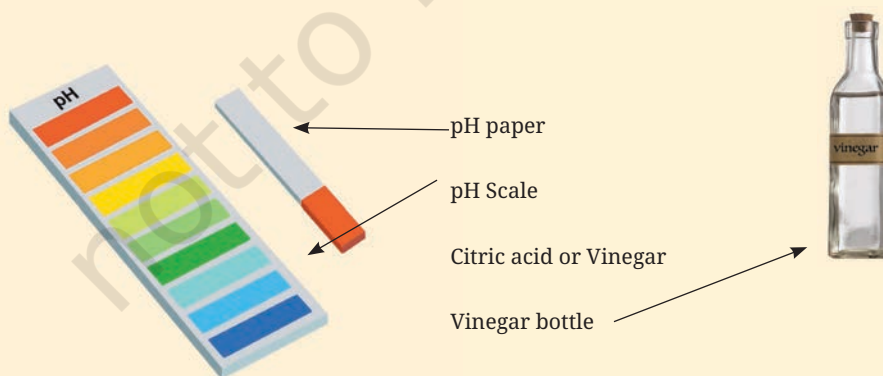




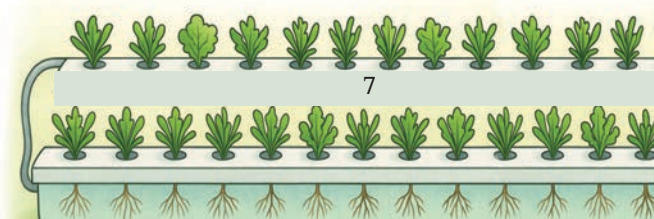
**Figure 1.3 (d): DWC hydroponic setup**



**Figure 1.3 (e): Compost Tea setup**



**Figure 1.3 (f): Materials required for adjusting the pH**





## How do I keep myself and others safe?

Some key precautions to be followed while working in hydroponic farming are as follows:

- 1. Safety while using tools and materials:** Wear gloves when handling tools, and pay attention during demonstrations to understand the correct techniques for using tools. Take special care when using sharp tools and power-driven machines like a drill machine and a submersible pump.
- 2. Safety while using electrical gadgets:** Be careful while working with gadgets like aerators and submersible pumps. Work only under the supervision of the teacher or expert.



**Internet safety:** Ask your teacher for help while using the Internet. Be careful not to upload or download anything without checking. Do not share personal information with anyone.

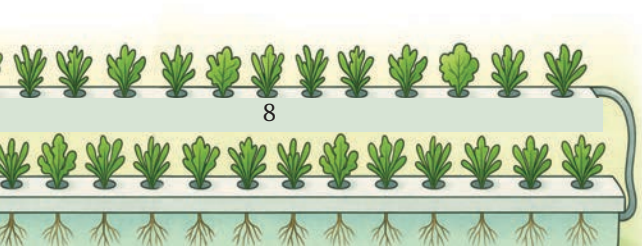


## What do I need to know before I start?

You have learnt in Science as well as in Vocational Education that plants require certain essential conditions to grow. Air, temperature, humidity, carbon dioxide, nutrients, soil and water are necessary for the growth of plants.

Try to use waste materials for your project. So, use scrapped plastic bottles and cups, Styrofoam sheets, and pipes to build hydroponic systems.

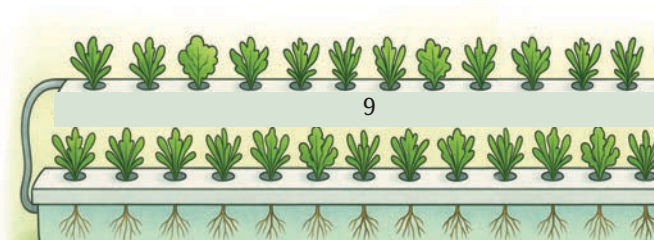
Now, reflect on whether these needs can be fulfilled even without soil. Record the details in Table 1.1.



**Table 1.1: Conditions for plant growth and how they can be fulfilled**

| Conditions for plant growth | How are they fulfilled when planted in soil?                                               | Can we replace soil and ensure conditions are fulfilled?                                                                                                        |
|-----------------------------|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Germination of seeds        | Seeds absorb water and start the germination process.                                      | Yes. Seeds can be soaked in water to germinate just like we make sprouts.                                                                                       |
| Physical support for plants | Roots hold soil to provide support to plants.                                              | In hydroponics, plants are placed on floating sheets or net pots to hold them above water, thus providing the required support.                                 |
| Sunlight for growth         | Plants absorb sunlight to make their food through photosynthesis.                          | Sunlight and artificial light are both used in hydroponics.                                                                                                     |
| Nutrients for plant growth  | Plant roots absorb minerals in the soil.                                                   | In hydroponics, minerals (nutrients) are added to water in the required quantity and absorbed by plant roots.                                                   |
| Any other specific need     | Plants or crops are sown directly in the soil with the addition of compost or fertilisers. | Growth media are used instead of soil. Some common growth media are coco coir, coco peat, gravel, sand, red-brick or clay, pebbles, rockwool, and vermicompost. |

In addition to the above, plants also need help from microbes. You are probably aware that microbes are organisms that cannot be seen without a microscope. Microbes do multiple things useful for plants, like breaking down complex organic matter into simpler compounds so that plant roots can absorb them easily, suppress diseases and help in communication with neighbouring plants. However, care needs to be taken to ensure that only microbes that help plants grow are added to the water.



Therefore, any hydroponic unit must fulfil all these needs for the healthy growth of plants.



### Did you know?

Indian Space Research Organisation (ISRO) has successfully sprouted cowpea seeds in its PSLV-C60 POEM-4 mission. The experiment for creating 'space gardens' is a crucial step towards the establishment of space stations and permanent human colonies in space.

### Activity 1: Field visit to a farm

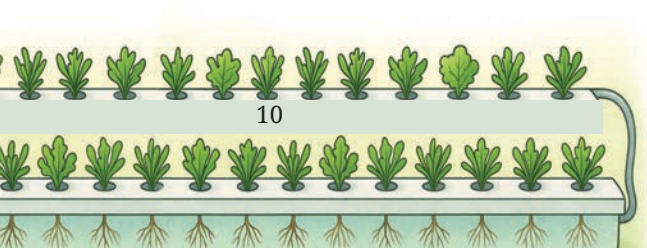
Before you start, it would be best to visit a place with a hydroponic unit—it could be a large unit or a small one run in a home.

You can try to find a hydroponic farmer or home gardener nearby. You can also contact the *Krishi Vigyan Kendra* (KVK) in your region, an agricultural university, college or a research centre.

Record your observations in Table 1.2.

**Table 1.2: Record of observations during field visit**

| i. Date of visit: .....                                                                                                                                                                                  |              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| ii. Name of the agri-clinic /KVK/farm:<br>.....                                                                                                                                                          |              |
| New technologies related to<br>liquid nutrients, use of artificial lights instead<br>of sunlight, simulating moisture in a dry area,<br>protection from light and wind, control of<br>water supply, etc. | Observations |
|                                                                                                                                                                                                          |              |
|                                                                                                                                                                                                          |              |
|                                                                                                                                                                                                          |              |





You can watch hydroponic videos on the Internet. Such videos can be searched using the following keywords:

- Basics of hydroponics + school student
- (DIY) hydroponics + instructions + home
- Hydroponic system + beginner

Try to find videos created by the Indian Council of Agricultural Research (ICAR) or Agricultural Universities.

Your questions to experts may include the following:

1. What are the advantages and disadvantages of the hydroponics system?

.....

.....

.....

2. Is there any difference in the method or tools used for harvesting, transport, and storage?

.....

.....

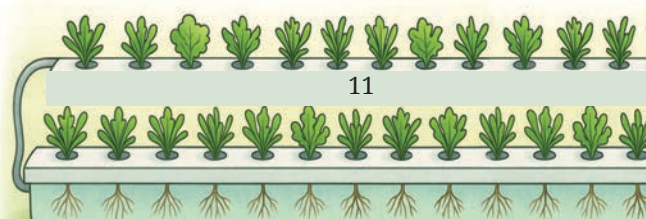
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## What do I have to do?

You will grow microgreens, vegetables and flowering plants using the hydroponic technique.

Plants need time to grow. Hence, you need to plan activities so that you will be able to harvest plants on time. Table 1.3 will help you to prepare a plan. You will also learn to record plant growth like vegetative growth (of stems and leaves), root growth, and the effect of changing water pH.



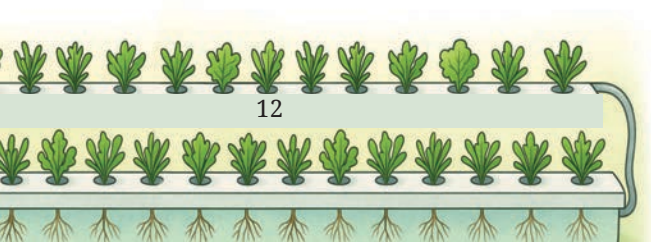


Table 1.3: Schedule for growing plants using different methods

| Week 1                     | Week 2                                 | Week 3                                           | Week 4                                          | Week 5                                          | Week 6                                                   | Week 7                                                         |
|----------------------------|----------------------------------------|--------------------------------------------------|-------------------------------------------------|-------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------------|
| Build a microgreen system. | Observe microgreen growth.             | Harvest microgreens<br>Record the yield.         | Record the growth of plants in the wick system. | Observe the growth of plants in the DWC system. | Experiment with compost tea applications.                | Record the effect of compost tea and water pH on plant growth. |
|                            | Build a wick method hydroponic system. | Observe the growth of plants in the wick method. | Start making compost tea.                       | Build NFT hydroponic system.                    | Observe the growth of plants in the DWC and NFT systems. | Maintain DWC and NFT systems.                                  |
|                            |                                        | Build DWC hydroponic system.                     | Observe the growth of plants in DWC.            | Compost tea is ready for use.                   | Experiment with water pH change.                         | Harvest and record the yield.                                  |



### Did you know?

*Dal* lake in Srinagar, Jammu and Kashmir with its floating farms (Figure 1.4), 'Phumdis' made in Loktak lake of Manipur, and the floating garden of coastal Odisha are some of the other ancient farming methods that can be linked with hydroponic farming.



**Figure 1.4:** *Dal Lake in Srinagar with floating farm*

### Activity 2: Growing microgreens for preparing a healthy salad.

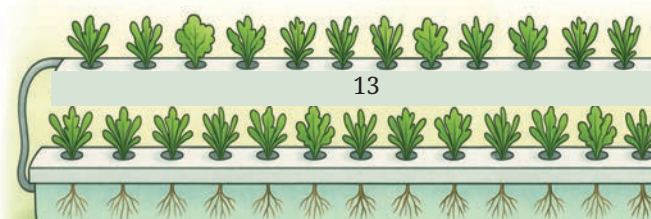
Microgreens are young seedlings of vegetables and herbs. They are harvested just after the emergence of the initial 2–4 leaves (size 1–3 inches). Producing microgreens is an easy and quick way of producing healthy sprouts in a compact space. People find microgreens tasty and consume them raw. They use them for garnishing salads, soups and sandwiches. Microgreens are a rich source of vitamins C, E, K, and A, and carotenoids. They can be produced from various vegetables like cabbage, beetroot, fenugreek, mustard, spinach, coriander, and wheat.



You can use the Internet to find out different methods of growing microgreens. You can search using the following keywords:

- Do-It-Yourself (DIY) + methods of growing microgreens
- DIY + beginners + growing microgreen,
- Instructions + self-watering microgreens
- Instructions + beginners + microgreens with artificial light

Figure 1.5 shows the process of creating a microgreen producing system.





**Step 1:** Use a plastic tray or a flat earthen pot (ideally, dimensions should be 10 cm×30 cm). You can also use old plastic-food-packaging containers, office trays, and flat planters to grow microgreens. Make holes at the bottom of the tray to drain extra water.



**Step 3:** Uniformly moisten the soil by adding water.



**Step 5:** Usually, seeds will start germinating within 2–3 days. Keep trays in a moist and humid place. Observe plant growth daily. You can place the trays near a window for sunlight or in racks with artificial light, like a white tubelight or a Light Emitting Diode (LED) bulb.

Cut the microgreens with scissors just above the soil surface. Gently rinse with water. You can eat them raw, use them for garnishing salads, or make sandwiches and pizza.



**Step 2:** Fill the container with soil or cocopeat — about 2 inches deep.

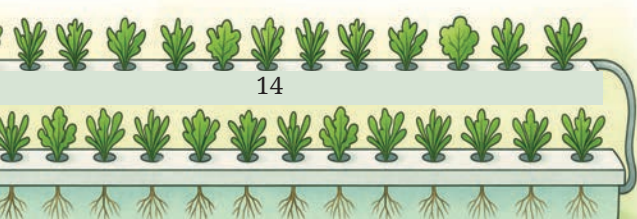


**Step 4:** Spread the seeds in the container and cover them with a thin layer of soil or cocopeat.



**Step 6:** Harvest microgreens when you see a set of first true leaves (about 5 to 7 cm height). True leaves emerge after the initial seed leaves appear. For most microgreens, this is approximately 10 days after planting.

**Figure 1.5:** Steps for growing microgreens





### Did you know?

Sprouts are generally grown without light and provide extra nutrients. They are consumed raw along with roots in 2–5 days.

Microgreens are grown with light, and extra nutrients can be added. They are consumed raw or as a garnish without roots in 10–15 days.

Record the details of the activity in Table 1.4.

The first leaves that appear when a seed germinates are called “seed leaves”. Seed leaves are part of the seed that contains stored food, which the developing plant uses for nourishment until it can start making its food through photosynthesis. The leaves that appear after the seed leaves are called “true leaves”.

**Table 1.4: Recording details of growing microgreens**

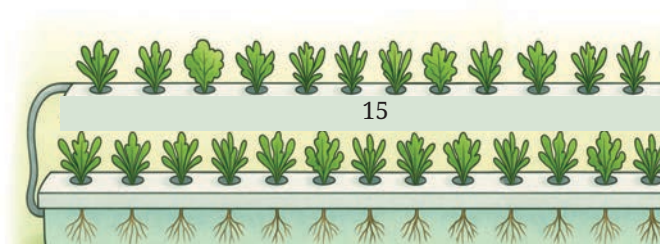
|                                                                            |  |
|----------------------------------------------------------------------------|--|
| Date of start of the activity                                              |  |
| Materials used (tray size, types of seeds, quantity of soil used in grams) |  |
| Number of trays prepared                                                   |  |
| Number of days required for sprouting                                      |  |
| Number of days required for the emergence of the initial pair of leaves    |  |
| Date of harvest                                                            |  |
| Quantity harvested per tray in grams                                       |  |
| Significant challenges or difficulties you faced during the activity       |  |

### Reflect on your learnings

1. What are the advantages and disadvantages of growing microgreens using hydroponics?

.....

.....



2. Have you used the microgreens? How did you use them (raw salad or as a garnish)?

.....  
.....  
.....  
.....

3. Can this method be applied to all crops? What are the probable limitations of microgreen production?

.....  
.....  
.....  
.....

### Activity 3: Building a hydroponic system using “Wick Method”

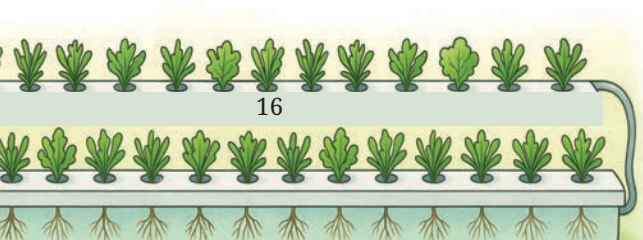
Plants are grown in microgreen systems for 1–2 weeks only. However, hydroponic systems are designed for the full growth of plants. A simple hydroponic system can be made from used (polyethylene terephthalate) PET bottles. It is a useful way to recycle waste into useful hydroponic planters.



You can watch hydroponic videos on the Internet. Such videos can be searched using the following keywords:

- Do-It-Yourself (DIY) + methods of wick hydroponics
- DIY + beginners + wick hydroponics
- Instructions + wick hydroponics
- Wick hydroponics + school learning activity

Figure 1.6 shows the process of growing plants using wick method.

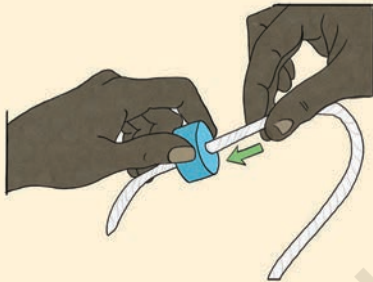




**Step 1:** You can use any PET bottle. Take a used PET bottle of 2L capacity. Cut the top (10–15 cm) with a cutter or knife under the teacher's supervision.



**Step 2:** Flip the top upside down to rest on the larger bottom part. The top part will be used as a planter while the bottom will be used as a water reservoir. Using a screwdriver or scissors, make a hole in the bottle cap.



**Step 3:** Attach a wick of any waste cotton cloth or thread through the hole.



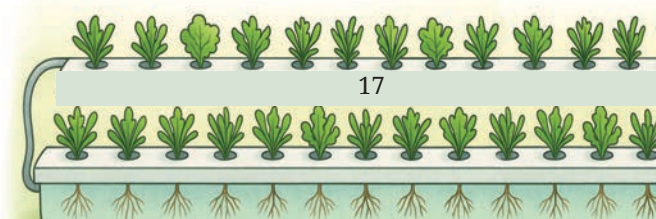
**Step 4:** Fill the bottom reservoir with water. Place the cap on the bottle and fill the latter with growth medium.



**Step 5:** Once the soil gets soaked, plant seeds or seedlings.

You can paint your hydroponic planters. Place a thread for hanging on wall or windows. You can also use PET bottles of different shapes and sizes to decorate a wall or window in school.

**Figure 1.6:** Growing plants using wick method



**System maintenance:** Wick method does not require much maintenance as it does not have a water pump, or electrical equipment, like an aerator. You need to add water in the reservoir, check wick functioning, and remove dead or older plants on a regular basis.

Record the details of the activity in Table 1.5.

**Table 1.5: Details of growing plants using wick method**

|                                                           |  |
|-----------------------------------------------------------|--|
| Number of wick bottles prepared by your class             |  |
| The quantity of soil used in grams                        |  |
| Number of seeds/seedlings planted                         |  |
| Number of plants survived                                 |  |
| Plant growth record (average height increased by 15 days) |  |

On the basis of the activity, respond to the following questions:

1. Which seeds, seedlings or plant cuttings did you use for the system?

.....  
 .....

2. Were you able to observe the soil getting wet in the upper pot?

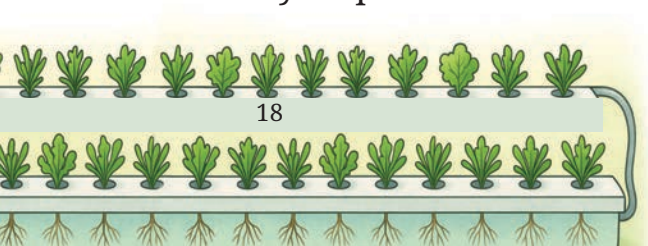
.....  
 .....

The action is similar to getting pumped up by the wick. This is called ‘capillary action’. Capillary action is the process by which liquid moves through a narrow space, like the fibres of a wick without the help of external forces like gravity.

3. List three key difficulties you experienced while building the system. What did you do to overcome them?

.....  
 .....

Now, move on to the following method of growing plants using hydroponics.



## Activity 4: Building a hydroponic system using Deep Water Culture (DWC) or Bucket method

The Deep Water Culture (DWC) is one of the easiest and commonly used hydroponic methods. In this method, plant roots are suspended in water containing essential nutrients. Expanded Polystyrene (EPS), thermocol, or styrofoam sheets are used as a float for plants (Figure 1.7). Plants can be placed in plant cups, net pots, or on top of a bucket if styrofoam is unavailable. Net pots are used for planting seeds or seedlings. A bucket or water tube can be used as a water reservoir for small systems with plant nutrients.



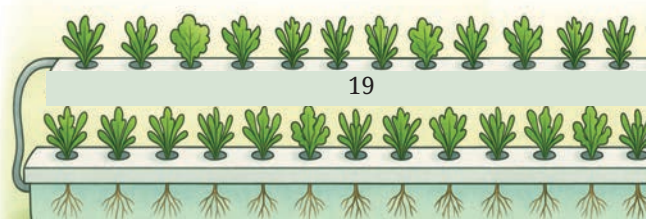
Figure 1.7: DWC hydroponics



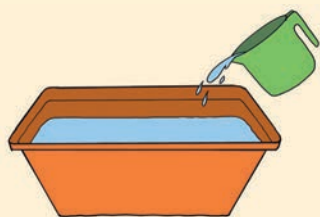
You can use the Internet to find different methods for building a hydroponic system using the DWC method. You can search using the following key search words:

- Do-It-Yourself (DIY) + methods of DWC hydroponics
- DIY + beginners + DWC hydroponics
- Instructions + DWC hydroponics
- DWC hydroponics + school learning activity

Oxygen is required for healthy root growth. When you aerate water, oxygen present in air gets dissolved in water. This dissolved oxygen is used for plant growth and by other living organisms.



Now, build a DWC hydroponic system for cultivating spinach or any other leafy vegetable (Figure 1.8).



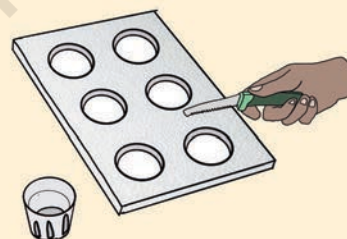
**Step 1:** Get a bucket or water tub (10–15 L capacity). You can use any recycled bucket or water tub. Just ensure that it does not leak.

**Step 2:** Make a lid for the bucket or tub using a plastic sheet (a wooden or styrofoam sheet can also be used).



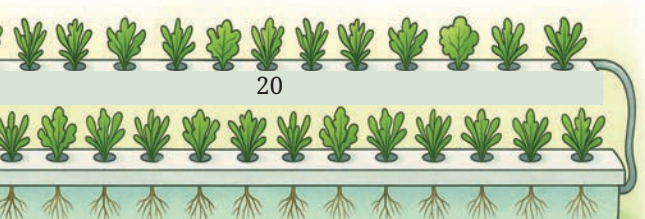
**Step 3:** Now, make holes in the lid to place the plant cups (net pots). You can use tea or coffee cups as net pots by making holes or vertical slits.

**Step 4:** Fill growth medium like cocopeat, coco-coir, or sand in the plant cup along with 2–3 seeds or seedlings of spinach. A net cup needs to fit the hole firmly. You can keep a space of 5–10 cm between the cups.



**Step 5:** Add water in the reservoir such that it just touches the base of the net pot. Place an aerator in the water tub and observe plant growth regularly.

**Figure 1.8:** Growing plants using DWC hydroponic system



**System maintenance:** Ensuring the working of the aerator is important for healthy root growth. Healthy roots should be white. If roots are brown, they may be starving due to lack of dissolved oxygen (DO). Similarly, water should be free from green algae. Covering the water surface with a styrofoam sheet prevents the entry of sunlight in to the water, preventing algae growth that may otherwise hinder plant growth.

Harvest vegetables regularly and replace old plants with new seedlings.

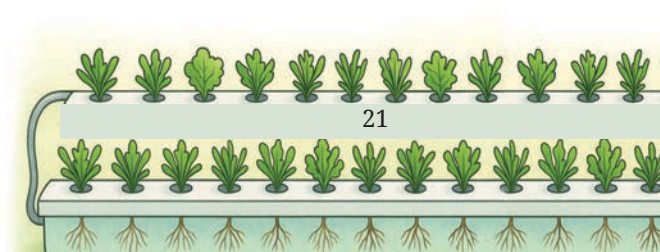
Complete Tables 1.6 and 1.7 based on your work.

**Table 1.6: Details related to setting up the DWC hydroponic system**

| System component      | Approximate cost (₹) |
|-----------------------|----------------------|
| Water reservoir       |                      |
| Planting cups         |                      |
| Plant cup holder      |                      |
| Air blower or aerator |                      |
| Growth media          |                      |
| Plants                |                      |
| <b>Total cost</b>     |                      |

**Table 1.7: Observing growth of plants in DWC hydroponic system**

|                                        |  |
|----------------------------------------|--|
| Name of the crops (plants) used        |  |
| Date of planting                       |  |
| Number of plants planted in the system |  |
| Increase in height of plants per week  |  |
| Increase in root length per week       |  |
| Date of harvesting                     |  |
| Quantity of harvest                    |  |



List three key challenges you faced during the construction and maintenance of the system. What will you do differently next time?

.....

.....

### Activity 5: Building a hydroponic system using Nutrient Film Technique (NFT)

In the DWC hydroponic method, plant roots are suspended in standing water. The DWC system uses horizontal space. Vertical stacking of water tubs is complex due to the heavy load of the water reservoir. So, what if we take water near the root zone instead of placing the roots in standing water? This allows you to increase the number of plants while using lesser amount of water and utilise the vertical space. In this method, plants stand in a shallow stream of water. Water flows in the form of a thin film containing plant nutrients. As water continuously flows in a stream, NFT does not require an air pump to increase dissolved oxygen.

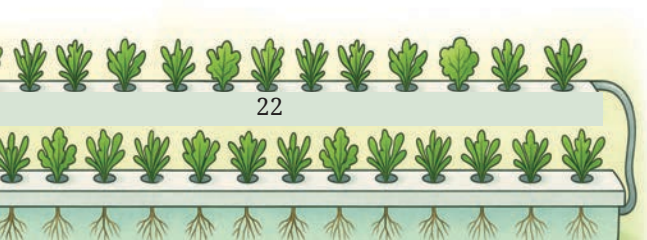
You can build an NFT system in different shapes and sizes, like horizontal or vertical stacking of pipes, a-frame or pyramid stacking, etc. You can select the shape based on space, material and convenience.

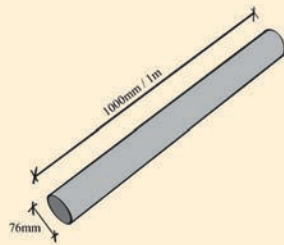


You can use the Internet to find different methods for building a hydroponic system using the NFT method. You can search using the following key search words:

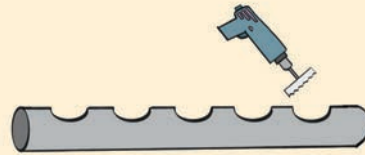
- Do-It-Yourself (DIY) + methods of NFT hydroponics
- DIY + beginners + NFT hydroponics
- Instructions + NFT hydroponics
- NFT hydroponics + school learning activity

Follow the steps in Figure 1.9 to build the NFT system using Polyvinyl Chloride (PVC) pipes.

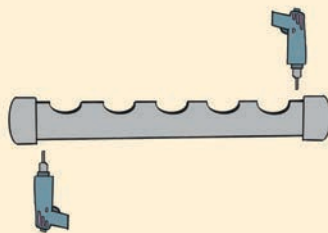




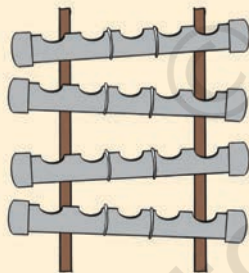
**Step 1:** Use a PVC pipe of 3 inch (76mm) diameter and 1 metre length. You can plant 6 to 7 plants in a metre-long pipe. You can make stacks of 4–5 pieces.



**Step 2:** You will also need two end caps to close both ends of the pipe. Make holes at equal intervals in the PVC pipe using a saw drill. You must be careful to ensure that the size and distance of the holes accommodate the net pot and keep equal space between the plants.

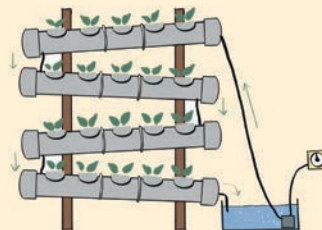


**Step 3:** You can get the help of an expert (metal fabricator or carpenter) to drill a hole in the PVC pipe. Place the end caps at both ends of the pipe. Drill water inlet and outlet holes at the side of the end caps. You will need to seal these holes with a silicone glue gun after placing the water pipe.

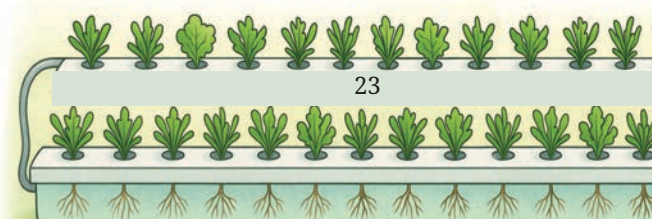


**Step 4:** Make a structure using wooden or bamboo sticks or a metal rack to place the PVC pipe vertically.

**Step 5:** You can use a water bucket or a tub as a water reservoir. Add a water pump to the water inlet while connecting all the outlets to the NFT beds. You can attach a simple on-off timer for controlling water flow. An on-off timer is a device that automatically turns on or off an electrical appliance at pre-determined times.



**Figure 1.9:** Growing plants using NFT hydroponic system



Complete Table 1.8 and 1.9 based on your work.

**Table 1.8: Details relating to setting up the NFT hydroponic system**

| System component  | Approximate cost (₹) |
|-------------------|----------------------|
|                   |                      |
|                   |                      |
|                   |                      |
|                   |                      |
|                   |                      |
|                   |                      |
| <b>Total Cost</b> |                      |

**Table 1.9: Record of observations related to growth of plants using the NFT system**

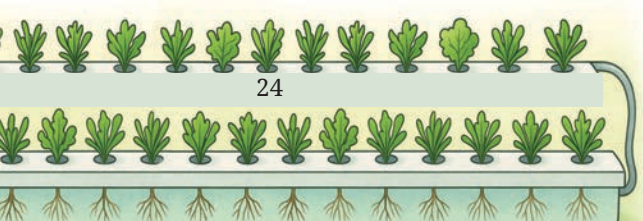
|                                                                                                                               |  |
|-------------------------------------------------------------------------------------------------------------------------------|--|
| Name of the crops (plants) used                                                                                               |  |
| Date of planting                                                                                                              |  |
| Number of plants planted in the system                                                                                        |  |
| Observe the plant leaves for any colour change—this could be the symptom of disease, pest infestation or nutrient deficiency. |  |

**System maintenance:** You may need to adjust the water level in the pipes. Water level in the pipes should be around half of pipe diameter. Water level should not be too low (e.g., plant root not reaching water) or high (e.g., overflowing from pipes). To ensure there is no overflow from the pipes, adjust the slope of the pipes.

1. Why did you use an aerator in the DWC system but not in the NFT system?  
.....
2. Make a comparative chart for DWC vs NFT systems—you can compare aspects such as ease of construction, plant growth, etc.



You can use the Indian Council of Agriculture Research (ICAR) AI-DISC mobile application to identify plant diseases, pests, and nutrient deficiencies.

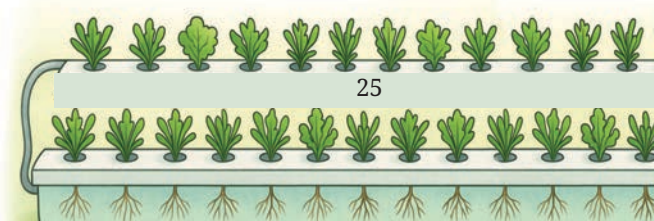
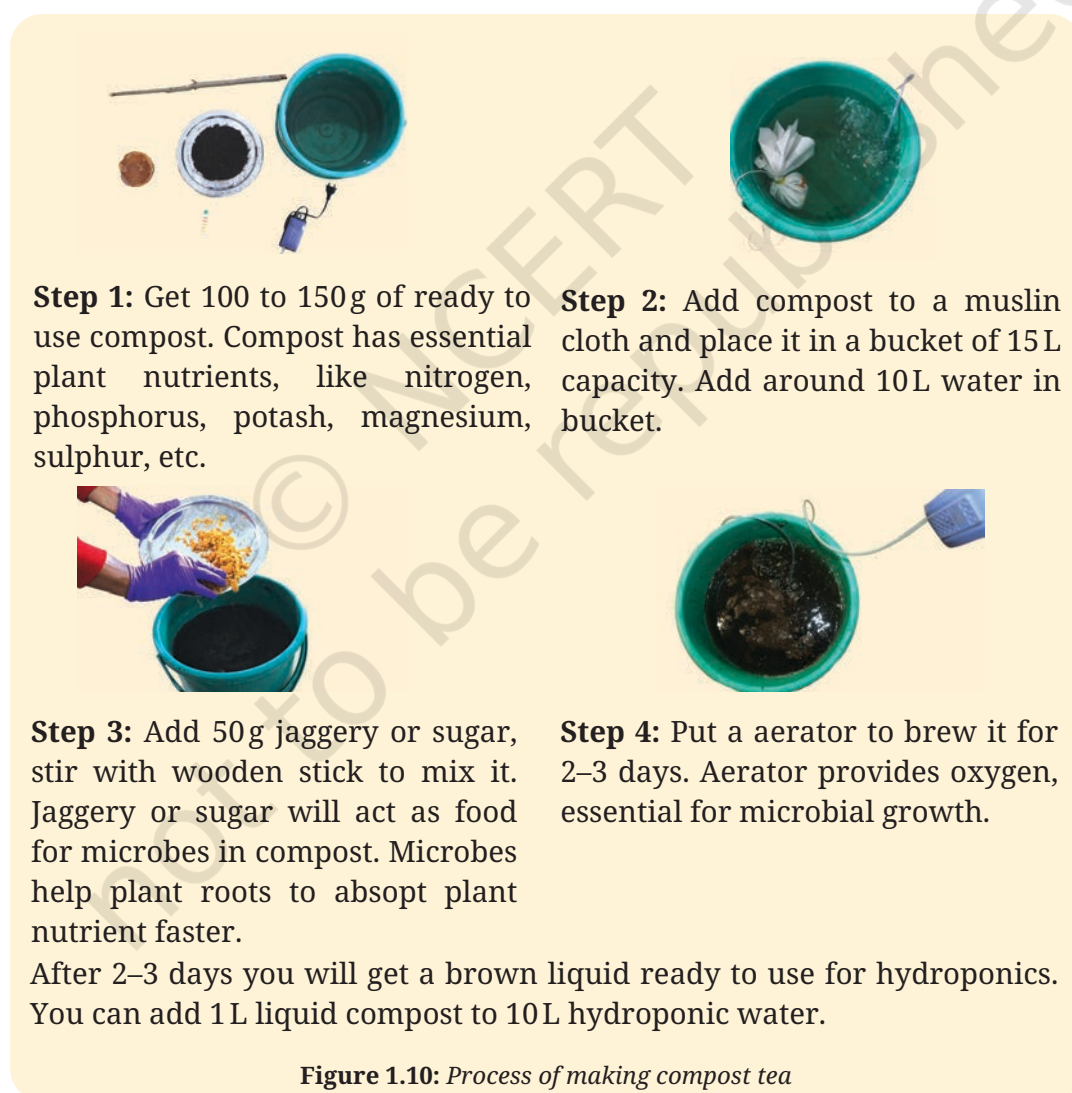


### Activity 6: Making compost tea

You might have probably used compost or vermicompost while working with plants. Compost is made of decaying plants, food waste or manure. You will need liquid compost for a hydroponic system.

To make liquid compost, also known as compost tea, you will need a good quality compost from kitchen/garden waste. You can also use animal manure to make liquid manure. A good compost is dark brown to black with a pleasant earthy smell and crumbly (like tea leaves) texture.

You can make compost tea by following the steps as shown in Figure 1.10.



Write your observations in Table 1.10.

**Table 1.10: Record of observations during process of making compost tea**

| Parameter                                    | Your observation | Usual observation                                                                                          | Remark/ Probable reason                                                                                                            |
|----------------------------------------------|------------------|------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Colour of compost tea                        |                  | Compost tea is usually dark brown.                                                                         | If it is very dark, dilute it by adding water in a 1:3 proportion.                                                                 |
| Smell of compost tea                         |                  | Compost tea should smell earthy.                                                                           | If it smells bad, it may be due to poor aeration, too much compost, poor microbial balance, lower water use, or water evaporation. |
| Any other observations or difficulties faced |                  | Foam formation on the surface, growth of maggots, mosquito larvae, and fungal growth on the water surface. | Sometimes, during aeration, foam forms on the surface of compost tea. It can occur due to microbial growth.                        |

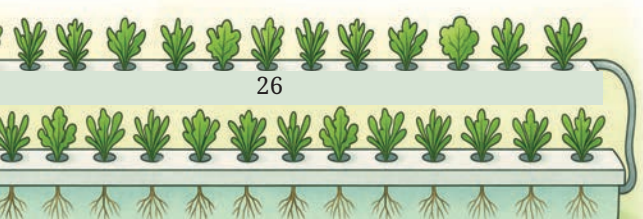


### Did you know?

Apart from water pH, Dissolved Oxygen (DO), i.e., amount of oxygen dissolved in water, Total Dissolved Solids (TDS), i.e., concentration of all kinds of mineral, salts, metals and other impurities, water hardness, i.e., dissolved calcium and magnesium in water, Electrical Conductivity, i.e., ability of water to conduct electricity, which depends on dissolved ions, are some critical water quality parameters.

### Activity 7: Maintaining water pH

Maintaining water quality parameters in hydroponics is very important for healthy plant growth. One of the critical water quality parameters for plant growth is pH. You have learnt about pH in your Science textbook in Grade 7; pH is the acidity or basicity of water.

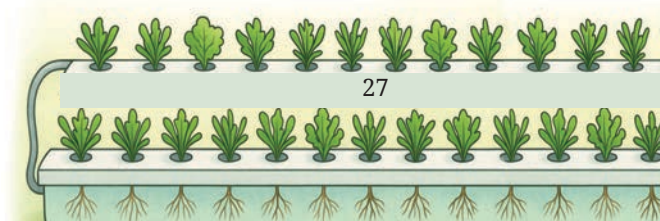
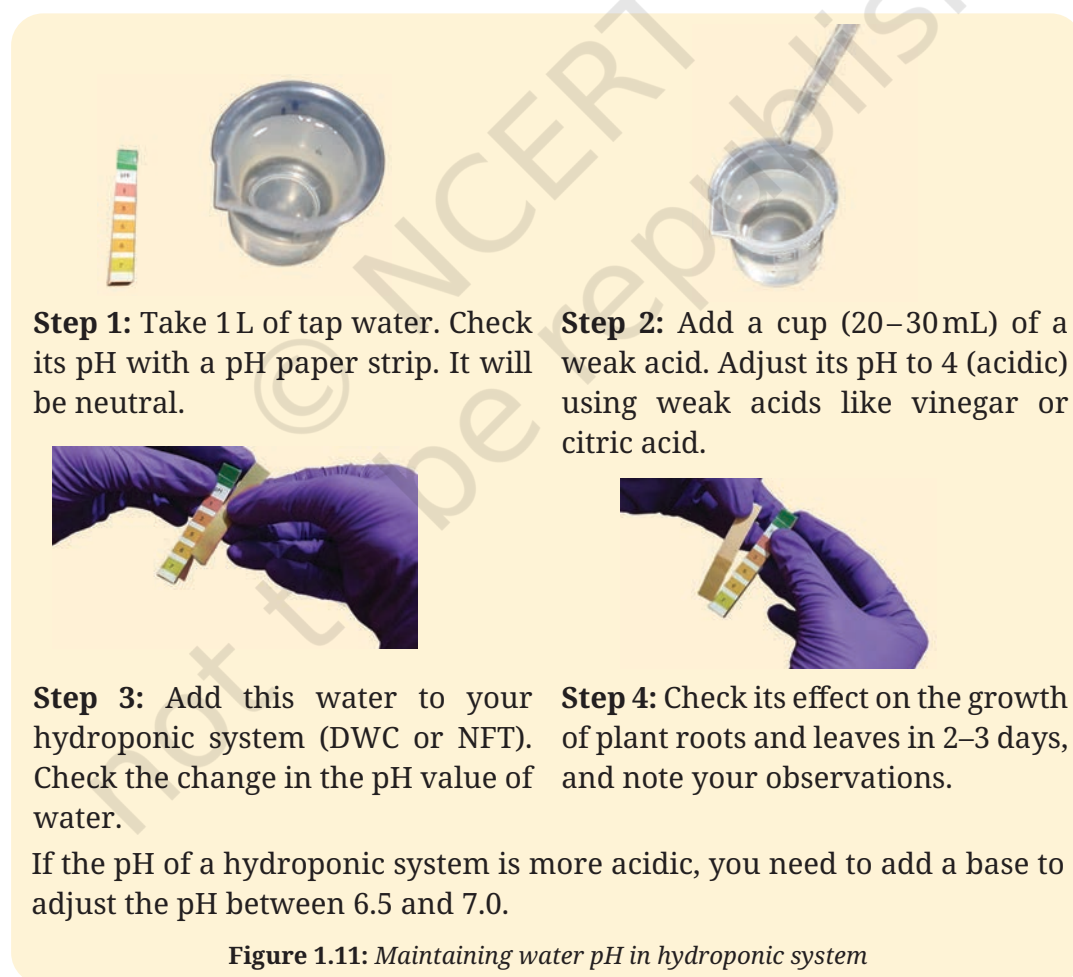


Nutrient mobility (transport of nutrients from water to the plant body) is best when water pH is in the range of 6.0 to 7.0. If the pH is 7, then water is neutral. But if pH is more than 7, this means the water is alkaline. You need to add acid to reduce the pH so the value is between 6.5 and 7.0.

Let us check the pH of your hydroponic system. For this, you will need a strip of pH paper. Check the pH of your hydroponic system using the pH paper.

Generally, if the pH is more than 7, then you need to reduce the pH of hydroponic water by adding a weak acid like Acetic acid (Vinegar) or Citric acid (lime juice).

Check the pH of water by following the steps given below in Figure 1.11. Note your observations after the experiment with the hydroponics system in Table 1.11.





### Did you know?

**Difference between Strong and Weak Acids:** Hydroponic farmers/gardeners can use strong or weak acids to reduce the pH of water. Strong acids (for example, phosphoric acid, sulfuric acid, nitric acid) are required in lower quantities but are challenging to handle. Weak acids (citric acid, acetic acid, monoammonium phosphate) are easier and safer to handle.

Record your observations in Table 1.11.

**Table 1.11: Results of pH test of water before and after adding acid**

| Date | Activity                                                                                               | Observation |
|------|--------------------------------------------------------------------------------------------------------|-------------|
|      | What is the pH of your water?                                                                          |             |
|      | Which acid did you use?                                                                                |             |
|      | What is the water pH of the system after adding the acid?                                              |             |
|      | After 4 days of adding acid, what is the effect of the change in pH of water in the hydroponic system? |             |



### What did I learn from others?

1. Have you come across any other advanced farming technology in your locality? If yes, describe the technology.

.....

.....

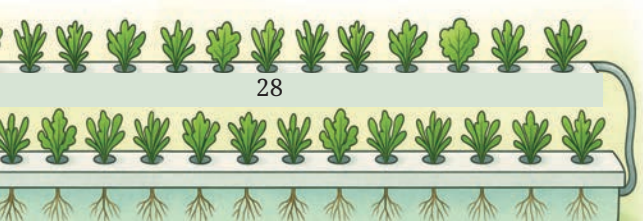
.....

2. Name any three things that you learnt while setting up the hydroponic system.

.....

.....

.....





## What did I do and how long did it take?

It is important to understand how much time is required for an activity to be completed.

Calculate the approximate number of hours you spent on each activity. Mark them on the timeline below. If you did more than the activities suggested in the book, please add the number and time taken.

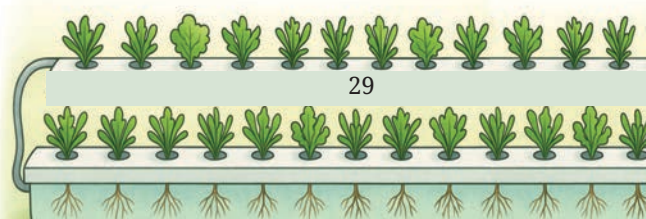
| Activity             | 1   | 2   | 3   | 4   | 5   | 6   | 7   |
|----------------------|-----|-----|-----|-----|-----|-----|-----|
| Time taken (Periods) | --- | --- | --- | --- | --- | --- | --- |



## What else can I do?

The following are some of the things you can try to expand your learning:

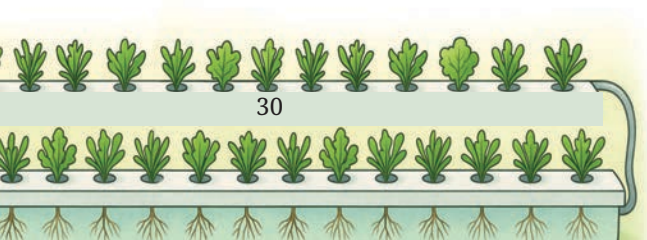
1. You can use the camera of a mobile phone to take photos or videos of the steps followed for the microgreen and hydroponic system production. You can make a photo-story using time-lapse photography or a short video of your systems.
2. You can paint wick-hydroponic bottles with attractive colours and gift them to school visitors and guests.
3. Try growth media you have not used for the different systems, for example, soil, sand, cocopeat, a mixture of all these, or anything else the experts recommend.
4. Find out the difference in temperature, humidity and light intensity, inside and outside a nursery. You can use a mobile-based application like 'MAUSAM' for the live weather report. You can also check the intensity of sunlight by using a lux meter application on a mobile phone.
5. Display hydroponic-farming models and posters of what you learned during the *Kaushal Mela*.





## Think and Answer

1. What did you enjoy doing the most?
2. What were the challenges you faced?
3. What will you do differently next time?
4. Do you think it is economical and practically feasible to grow all crops using hydroponics? Give reasons for your response.
5. Identify a few examples of jobs related to the work you just did, for example, a gardener, botanist, forest officer, farmer, or agricultural scientist. Look around, speak to people and write your answer.



## Project 2

# Feeding and Caring for Farm Animals



0885CH02

Farm animals, like cattle, sheep, goats, pigs and poultry, play an essential role in our lives. Like all living beings, including humans, they too need care. This project is about essential practices related to feeding and caring for farm animals.

*As part of the project you will be able to:*

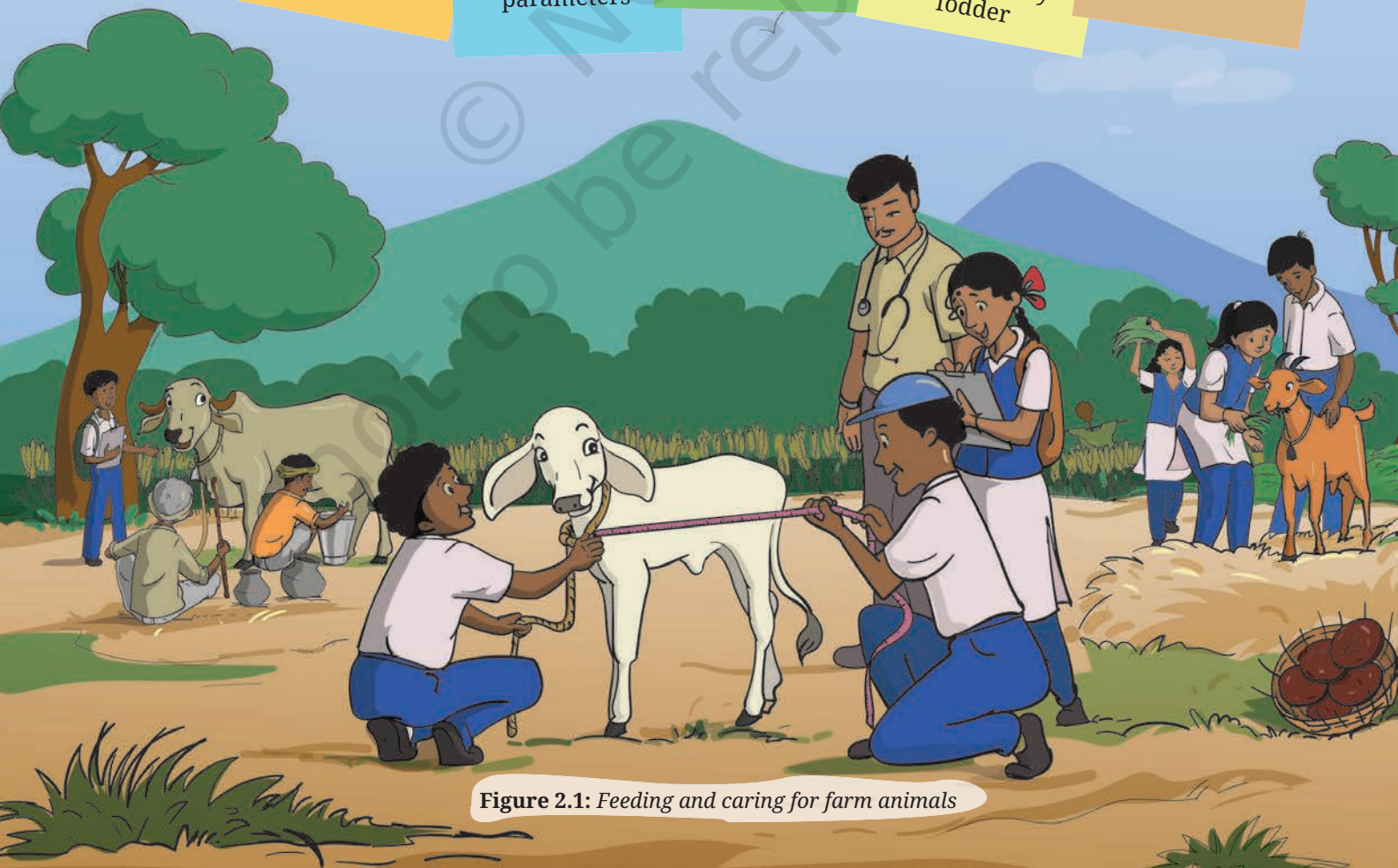
Identify local farm animals

Observe their health parameters

Estimate their weight to decide their feeding requirements

Prepare green fodder silage and treat dry fodder

Design a first-aid box for livestock



**Figure 2.1:** Feeding and caring for farm animals

Domestic animals have been helping us with transport, obtaining quality food, wool and manure, and performing farm operations (for example, ploughing, carrying loads) for a long time (Figure 2.1). Poultry birds, cattle, buffaloes, bulls, sheep, yaks, mithun (*gayal*), pigs and camels are reared by farmers for food, wool, transportation, and to provide labour for farm operations. They are also crucial for soil fertility as they provide organic manure.

Domestic animals on a farm are collectively called livestock and comprise a large part of farmers' wealth, and contribute regularly to their income. Besides farmers, herders specialising in one kind of livestock, for example, shepherds, goatherds, swineherds, and cowherds, also have a large number of livestock.

Besides the economic benefits, animals respond to love and care, and become a part of the family, even providing emotional support to individuals or families. Therefore, their care is an essential part of the farmers' work. Nutritious food, clean water, proper shelter, and vaccination are necessary for the good health of livestock.

Paintings in the *Bhimbetka* caves in Madhya Pradesh show evidence of the relationship between humans and animals. Decorated bulls, grazing animals, and human riding horses and animals suggest that domesticated animals have been our companions for more than 10,000 years (Figure 2.2).



**Figure 2.2:** *Bhimbetka caves showing humans riding on horses*

In our culture, we have always expressed gratitude towards livestock through different festivals and rituals. Every Indian state and culture has festivals dedicated to animals, for example, *Bendur* or *Pola* in Maharashtra, *Kanuma* in Andhra Pradesh and Telangana, *Khaturva* in Uttarakhand and so on. Are you aware of any other similar celebrations of livestock?



**Figure 2.3:** Cows and Goats are some of the commonly found livestock in India

The management and care of livestock is known as animal husbandry (Figure 2.3). This field also includes ethical farming practices to ensure animals are treated well and kept in a healthy environment. Ethical practices also include treating animals with respect, providing them with basic needs for good housing, feed and water, timely medical treatment and caring for their well-being.

This project will introduce you to some practices of animal husbandry.



### **What will I be able to do?**

At the end of the project, you will be able to:

1. Identify important farm animals in your locality and record their health parameters.
2. Estimate the weight of an animal based on its body measurements to prepare a feeding chart.
3. Prepare silage and a healthy, dry fodder mixture for farm animals.
4. Design a first-aid box for livestock with homemade *Ayurvedic* medicines.



### **What will I need?**

You will need the following tools, equipment and materials for various activities of the project (Figure 2.4):

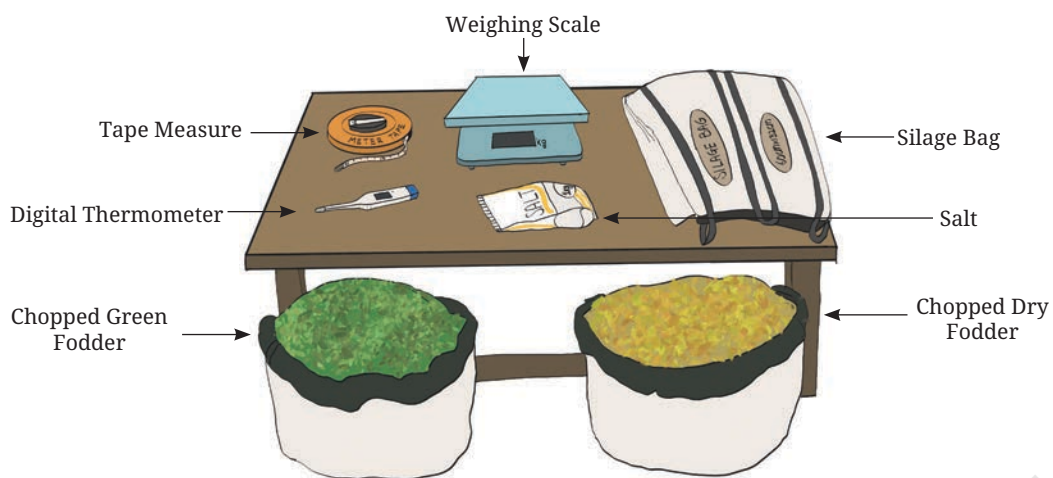


Figure 2.4: Tools and materials to be used for various activities



## How do I keep myself and others safe?

Some key precautions to be followed while feeding farm animals and caring for them are as follows:

1. Farm animals can get disturbed due to the presence of unfamiliar people. They may become aggressive. So, do not disturb or excite the animal while recording your observations. You need to stay calm and avoid making abrupt gestures. Also, speaking to the animal and offering feed helps reduce animal stress and aggression.
2. Tie animals and maintain a safe distance. Never stand behind a large farm animal, as it may kick you, if disturbed.
3. **Interact with animals only when you are accompanied by a teacher, farmer or a veterinary professional.** Follow the instructions they give while approaching an animal.



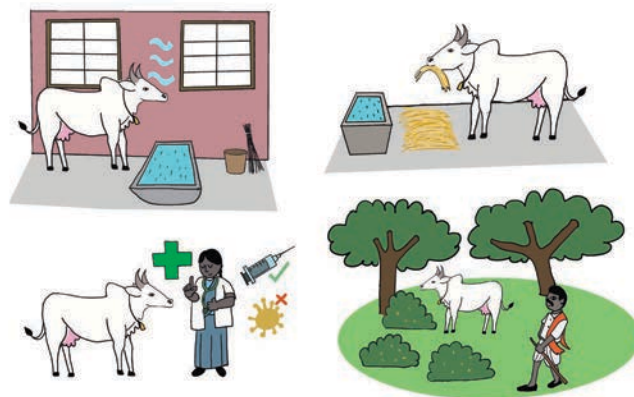
**Internet safety:** Ask your teacher for help while using the Internet. Be careful not to upload or download anything without checking. Do not share personal information with anyone.



## What do I need to know before I start?

Livestock need proper housing (cleanliness, ventilation, shelter from weather and predators), feed (clean water and fodder),

healthcare (vaccination and medicine), and a safe environment for healthy growth and optimum productivity (Figure 2.5). You will learn some of the critical practices related to animal care in this project.



**Figure 2.5:** Proper housing, shelter, feed, healthcare and clean environment are essential for animals

### Activity 1: Visit to a farm

Livestock is an integral part of the daily life of many farmers/animal owners and their families. The first step, therefore, will be to talk to a farmer/animal owner to learn about their animals' healthcare routine and maintenance.

If you are rearing livestock in your home or family's farm, you can record your observations based on your experiences. If not, you can visit a farmer or animal owner in your vicinity. You can also visit a nearby cow shelter/*gaushala*, stable/*tabela* or meet a horse owner (for example, *Tangewala*) to record your observations.

1. Name of the place or farmer/animal owner visited.  
.....
2. Types and number of animal owned.....  
.....
3. Important activities of the day.....  
.....

4. Number of people involved in the activities.....

5. Describe daily activities.....

.....

Refer to Table 2.1 to answer the questions related to the care aspects for farm animals. Record your observations in your diary or logbook.

**Table 2.1: Questions for recording the care aspects of farm animals**

| Care aspect          | Questions to answer                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Feeding              | <ul style="list-style-type: none"><li>• What kind of food is given?</li><li>• Where is the food sourced from?</li><li>• How are the animals fed (grazing, in-shelter, both)?</li><li>• How much food is given and what does it cost?</li><li>• How many times are the animals fed daily?</li><li>• Is a feeding container used?</li><li>• Is the food free or purchased?</li></ul>                                                       |
| Water                | <ul style="list-style-type: none"><li>• Where is the water sourced from?</li><li>• How often is the water changed?</li><li>• Is the water clean?</li><li>• How is animal waste collected and stored?</li><li>• What is it used for?</li></ul>                                                                                                                                                                                            |
| Bathing and cleaning | <ul style="list-style-type: none"><li>• How are farm animals bathed?</li><li>• How often are they bathed?</li></ul>                                                                                                                                                                                                                                                                                                                      |
| Shelter              | <ul style="list-style-type: none"><li>• Is the shelter temporary or permanent?</li><li>• How many farm animals are kept there?</li><li>• How is the number of animals to be kept in the shelter decided?</li><li>• Is there enough light and air?</li><li>• What is the floor made of?</li><li>• Who cleans the shelter?</li><li>• How often is it cleaned?</li><li>• How are the animals protected from heat, cold, and rain?</li></ul> |

|                                |                                                                                                                                                                                                                                                                                                     |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Health                         | <ul style="list-style-type: none"> <li>• What are the common diseases of the farm animals?</li> <li>• Do animals need any medicine?<br/>If yes, which ones and why?</li> <li>• Are any home remedies used?</li> <li>• Who gives medical help?</li> <li>• Are there any regular vaccines?</li> </ul> |
| Use of waste                   | <ul style="list-style-type: none"> <li>• How is waste collected?</li> <li>• What is done with the waste?</li> </ul>                                                                                                                                                                                 |
| Any other specific observation | Anything else interesting or important you noticed.                                                                                                                                                                                                                                                 |

### Reflect on your learnings

1. The relationship between the farmer/animal owner and the animal is essential for its well-being. For example, does the animal recognise its owner? How does it react to the presence of the owner?

.....  
 .....

2. Does the farmer/animal owner have a specific name for the animals? What criteria were used for naming animals? How do they recognise individual animals?

.....  
 .....

3. What are the reasons for keeping animals on the farm (e.g., farm labour, dairy, wool)?

.....  
 .....

4. Talk to a farmer/animal owner or your friends, and find a story about the relationship between a farmer/animal owner and the animal. You can also find any local poem or a folk song about farm animals.

.....  
 .....





### Did you know?

Apart from a caring approach, the environment in which animals live also plays an important role in the well-being of livestock. For example, research by scientists has concluded that playing music in cow sheds has a calming effect. The result is an increase in milk production. This is due to the masking of noises (e.g., of farm machinery).

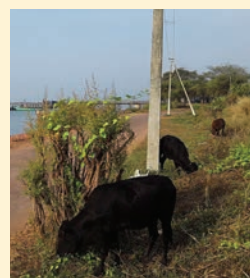
## Activity 2: Field visit to a veterinary clinic/animal healthcare centre

Just like humans, domestic animals have healthcare requirements. Animal healthcare centres or veterinary clinics provide necessary healthcare services to livestock.

Veterinary practitioners also need specialised training and certification. The Veterinary Council of India (VCI) is the nodal authority that decides how veterinarians should be prepared to work with animals.

Visit a veterinary centre in a village or nearby town to learn standard healthcare practices and treatment required by livestock. You can also invite a veterinary doctor or practitioner to your school to learn about basic healthcare requirements.

India ranks number one in the world for its cow and goat population. We are the largest producer of milk and also have the highest diversity among cows, with 43 registered native breeds. Breeds indicate various types of animals within the same kind, e.g., *Kasargod* cattle from Kerala are a dwarf breed that grows up to an average height of 1 metre (Figure 2.6). It produces high quality milk at low maintenance cost. *Siri* cattle from parts of Sikkim, Darjeeling and Bhutan have long, powerful legs that are helpful in the mountains; they are used as draught animals. Therefore, breeds are chosen based on the kind of work they will do.



**Figure 2.6:** *Kasargod Dwarf Cattle*

Gather information about the livestock in your vicinity with the help of the expert, and fill Table 2.2.

1. What are the most common livestock in your locality?

.....

.....

.....

2. List the important breeds of livestock in your locality. Try to find out whether they are indigenous or were brought from other places.

.....

.....

.....

.....

You can follow the example in Table 2.2 to record these details:

**Table 2.2: Record of information about local farm animals**

| My locality                   | Common farm animal in my area | Common breeds                                                                                                                            | Common use                                                                                |
|-------------------------------|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Shirur block of Pune district | Cow, goat, poultry            | <b>Cow:</b> <i>Khilari</i> ,<br>Holstein Friesian (HF) cross.<br><b>Goat:</b> <i>Sangamneri</i><br><b>Poultry:</b> Broiler, <i>Deshi</i> | <b>Cow:</b> Milk production<br><b>Goat:</b> Meat/Milk<br><b>Poultry:</b> Chicken and eggs |
|                               |                               |                                                                                                                                          |                                                                                           |
|                               |                               |                                                                                                                                          |                                                                                           |
|                               |                               |                                                                                                                                          |                                                                                           |

3. Which fodder crops or food sources are used for livestock in your area (some examples are given in Table 2.3)?

.....

.....

.....

.....



**Table 2.3: Information about food and fodder**

| Animal        | Food                                                                                                                                                                                                | Food availability                                         |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| Cow           | <b>Green fodder:</b> Maize, Napier, Berseem, Lucerne<br><b>Dry fodder:</b> <i>Jowar, Bajra</i> , Wheat, Paddy straw<br><b>Concentrates</b> (grains, oil cakes, bran) and <b>Mineral supplements</b> | Fodder grown on farms<br>Feed from cooperatives<br>Silage |
| Goat          | Open grazing (grasses, weeds)                                                                                                                                                                       | Stalled, semi-stalled, open grazing                       |
| Poultry birds | Food grain, (maize, wheat), poultry feed<br><b>Protein:</b> Soya meal, fish meal<br><b>Kitchen waste and grains</b> from home                                                                       |                                                           |

### Activity 3: Participation in vaccination or health check-up drives for animals

Vaccination is vital to protect humans against infectious diseases and to prevent the spread of contagious diseases among them. Similarly, livestock also need regular vaccination to avoid infection from bacterial and viral diseases.

Every year, vaccination drives are organised by the Department of Animal Husbandry and Dairying (DAHD), under the Ministry of Fisheries, Animal Husbandry and Dairying (Figure 2.7).



**Figure 2.7: Animal vaccination drive in the community**

Participating in a farm animal vaccination drive and interaction with the veterinary doctor in your locality will help you better understand the need for animal vaccination. If a veterinary clinic is not easily accessible, visit a farmer, a *gaushala*, or a *tabela* nearby to understand the importance of immunisation.

On the basis of your discussion and observations, answer the following questions:

1. List the common infectious diseases that affect livestock.  
.....  
.....
2. List three major difficulties farmers face while vaccinating their livestock.  
.....  
.....
3. What are the other standard healthcare measures farmers take to protect their animals besides vaccination?  
.....  
.....
4. Are there any beliefs associated with vaccinating livestock among farmers (for example, there is a belief that milk or meat becomes poisonous after vaccination)? Try to find out the reasons behind these beliefs. Ask the veterinary practitioner about them.  
.....  
.....  
.....
5. Are there any homemade medicines or home-based remedies for livestock reared by farmers or animal owners in your locality? List any three with their uses.  
.....  
.....  
.....
6. What medical facilities are available for animals in the area? (For example, a veterinary clinic with a residential doctor, or visiting doctor, and medical shops.)  
.....  
.....  
.....



7. Record the yearly vaccination schedule for the livestock in Table 2.4 (one example is given).

Table 2.4: Annual vaccination schedule

| Name of the disease          | Associated farm animal                | Vaccination schedule                                  | Remarks                                                |
|------------------------------|---------------------------------------|-------------------------------------------------------|--------------------------------------------------------|
| Foot and Mouth Disease (FMD) | Cattle, buffalo, sheep, goat and pigs | Every six months (for animals aged 4 years and above) | Available free of cost in the animal healthcare centre |
|                              |                                       |                                                       |                                                        |
|                              |                                       |                                                       |                                                        |
|                              |                                       |                                                       |                                                        |



### What do I have to do?

You have learnt about important farm animals in your locality, their breeds and healthcare requirements, like housing, food and vaccination. Next, you will learn to record important body health parameters of livestock and calculate their weight to determine their feeding requirements. You will also prepare healthy feed for cattle or goats, and homemade remedies for common ailments.

You can work in a group of 5–6 students. Each group will identify a farmer or animal owner near the school to support these activities. You can take the help of veterinary professionals.

#### Activity 4: Preparing a health record of the selected animal

Understanding primary health parameters is very important. For example, when you visit a doctor for any illness, they do a wellness check up first with routine tests, like body temperature, pulse rate, wetness of eyes, abdominal condition or food digestion. Humans can talk and express their feelings clearly, but animals cannot express themselves. Thus, a responsible farmer or animal owner assesses their vital body parameters from time to time, and maintains a record.

In this activity, you will learn to record important health parameters of selected livestock. Select at least two animals for this activity. You need to work in a group of 5–6 students. You can visit a nearby farmer/animal owner or ask them to visit your school with their animal(s).

The following should be considered while selecting the animal(s):

1. It is better to choose small and friendly animals that are easy to handle, such as a goat or sheep, instead of a bullock, buffalo or cow. Do remember that bucks/bully goats or male goats are more aggressive than females.
2. **Ensure that the teacher/farmer/animal owner or a veterinary professional is present before approaching the animal.**
3. Stand at a distance from the animal, and take care not to stand behind the animal.
4. You will do a visual observation and check the respiration rate.

### Visual Observations of the Animal

Visual observations will help you assess the health of the animal without any medical tests. Observe the following:

1. **Eyes:** Should be bright, moist and clean.
2. **Nostrils:** Should be clean, wet and without any discharge.
3. **Skin:** Should be glossy, clean and free from parasites (e.g., tick, mite, lice, etc.).
4. **Behaviour:** Should be alert, inquisitive, and interested in its surroundings.
5. **Appetite:** Should have a good appetite and no signs of diarrhoea.

### Checking Respiration Rate

1. Respiration rate is recorded with visual observation. You will need to identify the flank region of the animal (Figure 2.8). This is the area of flesh on either side of the body, between the rear leg and the last rib.

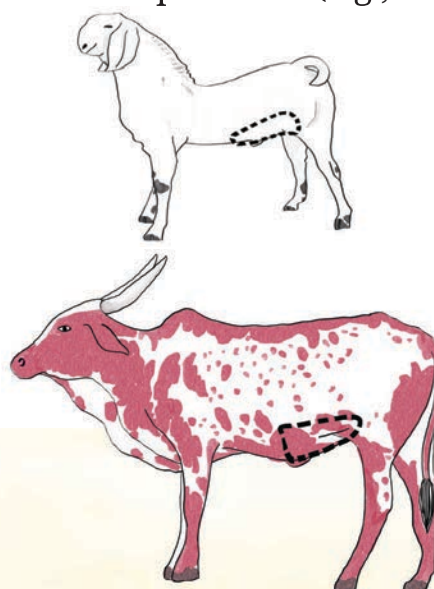


Figure 2.8: Flank region of a goat and a cow

2. Count the number of either falls or rises of the flank region in one minute using a stopwatch. Never count both rises and falls of the flank for respiration rate.
3. Normal respiration of a cattle is about 25 to 50 breaths per minute, and that of a goats is about 12 to 25 breaths per minute.

Record the observations in Table 2.5.



### Did you know?

All animals (farm, pet and wild) are protected in India under the Cruelty to Animals Act (1960). The Act gives rights to all animals for prevention and protection from cruelty, unnecessary pain, overwork, torture and abuse.

### Recording the body temperature (*measurement to be done by a veterinary professional*)

1. A digital thermometer is used to record the body temperature of animals. Ensure it is set to the minimum level (zero digit).
2. The thermometer is inserted carefully into the rectum so that its bulb comes in contact with the animal's mucous membrane.
3. The thermometer is kept in this position for one minute.
4. Then, the thermometer is removed from the rectum, cleaned with cotton and antiseptic, and the temperature reading is noted.
5. Record your observations in Table 2.5 (minimum 2 animals per group). Also, ask the expert for the normal range of body temperature and respiration for the animal selected, and record it.
6. How do respiration rate and body temperature relate to animal health? Explain it in relation to your own health.

.....  
 .....

**Table 2.5: Recording health parameters**

| S. No. | Animal details<br>(name, species,<br>breed, age) | Visual<br>observations<br>(eyes, nostrils,<br>skin) | Body<br>temperature | Respiration<br>(rate/minute) |
|--------|--------------------------------------------------|-----------------------------------------------------|---------------------|------------------------------|
| 1.     |                                                  |                                                     |                     |                              |
| 2.     |                                                  |                                                     |                     |                              |
| 3.     |                                                  |                                                     |                     |                              |

### Activity 5: Estimating the weight of farm animals

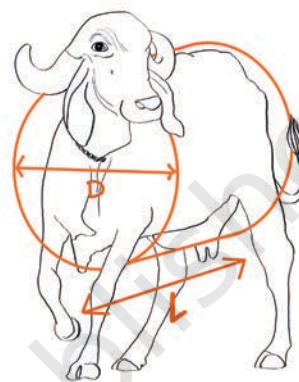
Body weight is a significant health indicator for livestock, just like humans. It affects feed requirements, disease treatment, production levels (milk, eggs, and weight gain), and selling price. You can use a regular weighing scale for small animals, like poultry, whereas a suitable scale may not always be available for larger animals, like cattle, goats, camels, and horses. To solve this problem, you can estimate their body weight by measuring their dimensions.

You already know the connection between volume, density, and weight. Using these, you can calculate weight with a simple formula:

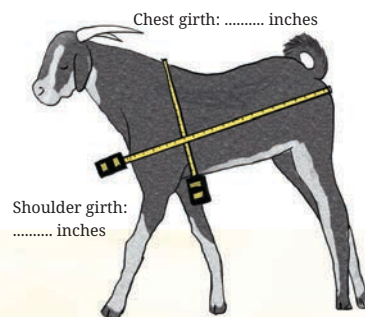
$$\text{Weight} = \text{Volume} \times \text{Density}$$

This simple equation is the basis for calculating the weight of a farm animal. You will need to take body measurements of the farm animal (Figures 2.9 and 2.10). Now follow the steps given below to calculate the weight of an animal using the formula:

1. Select a small and friendly animal which is easy to handle,



**Figure 2.9:** Taking body measurements of large farm animals to estimate weight



**Figure 2.10:** Taking the body measurements of a goat

such as goat and sheep. You can also take measurements of a larger animal which is gentle and calm.

- Length and girth should be measured in inches (1 inch = 2.54 cm), and body weight in kilograms.
- The dividing factor (i.e., 600 or 300) is used as a constant factor.
- This formula is known as *Schaeffle's Formula* of body weight estimation.
- Since the animal does not stand directly on the weighing scale (or balance), this is an indirect estimation of body weight. This estimation can have a 10 to 15% error due to variations in body measurements.

2. Take the help of a farmer/animal owner or veterinary professional before approaching the animal. Note your observations in Table 2.6.

**Table 2.6: Body measurement of animal**

| S. No. | Animal | Length measurement (inches) | Girth measurement (inches) |
|--------|--------|-----------------------------|----------------------------|
| 1.     |        |                             |                            |
| 2.     |        |                             |                            |

After taking body measurements, calculate body weight using the following formula:

1. Live body weight for goat =  $\text{Length} \times \text{Girth}^2 / 600$
2. Live body weight for cow/buffalo  
=  $\text{Length} \times \text{Girth}^2 / 330$

Record your calculations in Table 2.7.

**Table 2.7: Record of weight of animals using body measurement**

| S. No. | Animal | Length (inches) | Girth (inches) | Estimated weight (kilograms) |
|--------|--------|-----------------|----------------|------------------------------|
|        |        |                 |                |                              |
|        |        |                 |                |                              |

Are there any other methods farmers or animal owners use for weight estimation? Do they feel this is an important activity in animal care? If not, ask them the reason.

## Activity 6: Preparing a feeding chart

Like humans, livestock also need carbohydrates, protein, fat, minerals, and vitamins for their growth and productivity. A proper feeding schedule and providing quality feed are important for the health of animals. The feed requirement of an animal depends on the type of digestive system (ruminant versus non-ruminant), feeding habits, and productivity.

Ruminant livestock (cow, buffalo, goat, sheep) have four chambers in the stomach. Ruminants can digest low-quality grass compared to non-ruminant (horses, pigs, poultry) animals. Cattle and buffalo prefer grass as feed, while goats and camels prefer tender leaves from shrubs and weeds.

Feed requirement is determined by weight and Dry Matter (DM) requirement. You have already estimated the weight of two animals. DM is simply the non-water portion of animal feed. Generally, DM equal to 2–3 per cent of the animal's live body weight is required by an adult animal everyday.

The feed requirement of animals is directly related to their weight (Table 2.8). In an earlier activity, you had estimated the weight of two animals.

Table 2.8: Feed requirements of goat

| Weight of the animal      | DM = 3 % of the weight of the animal             | Concentrate feed = 25 % of DM     | Total fodder (Wet+dry) = 75 % of DM | Dry fodder = 25 % of total fodder | Green fodder = 75 % of the total fodder | Actual green fodder requirement |
|---------------------------|--------------------------------------------------|-----------------------------------|-------------------------------------|-----------------------------------|-----------------------------------------|---------------------------------|
| 32 kg goat, i.e., 32000 g | $32000 \text{ g} \times 3\% = 960 \text{ g/day}$ | $960 \times 25\% = 240 \text{ g}$ | 720 g                               | $720 \times 25\% = 180 \text{ g}$ | $720 \times 75\% = 540 \text{ g}$       | $540 \times 5 = 2735 \text{ g}$ |

Let us assume one of the animals was a goat weighing 32 kg.

- It will need 3% DM per day, that is 960 g per day.
- To ensure the goat's health, 25% of the total DM should be from protein-rich concentrate and 75% from green and dry fodder.



- Fodder can be divided into dry fodder (25%) and green fodder (75%).
- Green fodder has 80% water content. So, the quantity in Table 2.8 is increased by 5 times. Otherwise, the goat feels hungry just like you feel hungry after having only fruit juice or rice in your meal.

Therefore, the total DM requirement and feeding options will be as illustrated in Table 2.8.

- The feed should be given to the goat 2–3 times daily in equal quantities. For example, at dawn, midday, and early evening.

Following this example, calculate the feeding requirement of your selected animals. The first step is to estimate the weight, then the DM requirements, and then different feeds, such as concentrate, green and dry fodder.



### Using a Mobile Application for Animal Feed Calculation

You can also use mobile applications designed to calculate the feeding requirements of farm animals. The Indian Council of Agriculture Research (ICAR) has developed a ‘feeding chart’ mobile application for milking cows and buffaloes in collaboration with the National Institute of Animal Nutrition and Physiology (NIANP).

Similarly, the Central Institute for Research on Goat (CIRG) has developed a mobile application for goat farming.

Prepare a feeding chart for at least two animals using Table 2.9. Compare the actual feed given by the animal owner versus your calculated feeding need (Table 2.9).

Table 2.9: Feeding chart for animals

| Particulars | Weight of the animal | Given DM % | Concentrate feed | Dry fodder | Green fodder | Actual green fodder requirement. |
|-------------|----------------------|------------|------------------|------------|--------------|----------------------------------|
|             |                      |            |                  |            |              |                                  |
|             |                      |            |                  |            |              |                                  |

## Activity 7: Feed formulation – Making silage and cost calculation

Silage is the preserved feed for ruminant animals, like cows, goat, and sheep. It is prepared from green fodder to maintain it without losing its nutritional value. The word silage is derived from ‘silo’ meaning a pit or container with stored food.

You will learn to make silage from green fodder, with controlled fermentation in an anaerobic (without oxygen) environment.

### Science of Silage Making

For example, we make a pickle from mango or any other fruit or vegetable; silage is a pickle of green fodder for ruminants. You are using a naturally controlled fermentation process for silage making. It is like making pickles of cucumber or curd from milk. In this process, sugar content in green fodder gets converted into lactic acid by the action of ‘fermentative lactic acid bacteria’. These bacteria grow in anaerobic conditions. Due to bacterial growth, the temperature of the silage increases during the initial 2 to 8 days and acidity increases due to lactic acid (pH decreases up to 4.0 to 3.8) in 15 to 20 days.

You can make silage from green fodder by following the steps in Figure 2.11:

Collect approximately 30–50kg of green fodder (any green fodder, like maize, sugarcane leaves, Napier grass can be used for silage).



**Step 1:** Chop it using a fodder chopping machine to 2–3cm. You can collect chopped fodder from a farmer/animal owner or do this activity directly in the fields.

Chopping of fodder is essential so that we can compact it in a silage bag. If silage bags are unavailable, use any polyethene or High-Density Polyethene (HDPE) bag or container.





Compacting or pressing chopped fodder in the bag removes air (oxygen).



**Step 2:** Fill the chopped fodder into the silage bag while pressing it firmly with your foot.



**Step 3:** Tie the upper end of the bag firmly with a thread. You can also seal it using adhesive tape to minimise air entry.

The silage-making process gets completed in 2–3 weeks. During this process, do not open the bag. After 2–3 weeks, when you open the bag, the silage should have:

- No fungal or mould growth
- Golden brown colour
- Pleasant fruity aroma
- Free-flowing and non-sticky texture
- Mildly acidic taste with an optimum pH of around 4.0–4.5 (add 25 g of silage to 100 mL of water; check pH after 15 minutes).

**Figure 2.11:** Making silage from green fodder

Once the silage is ready, you can use it to feed a goat, sheep (1 to 1.5kg per day), and a cow, buffalo (10 to 15kg per day) after taking the approval of the farmer/animal owner. **Do not feed the animal without permission.** If you observe mould of white or black colour, or observe a bad smell, throw away this silage and do not feed it to the animal. It will lead to food poisoning, serious illness and even death of the animal.

Silage bag (polyethylene bag) acts as an air-tight container. It does not allow air (containing oxygen) to enter the silage so that anaerobic bacteria grow and form an acidic condition for preservation. Cement tanks or stainless-steel containers are also used for large-scale silage making.

On the basis of the activity and interaction with farmers/animal owners, respond to the following:

1. Have you seen storage spaces for green fodder in farms or animal shelters? How do farmers/animal owners store green fodder? Do they use fresh fodder everyday?

.....  
.....  
.....

2. How is the fodder requirement calculated? Is there any wastage of fodder? Approximately how much green fodder gets wasted daily? What are the reasons for wastage?

.....  
.....  
.....

3. What are the key challenges in gathering green fodder, silage bags, and chopping? Do farmers/animal owners think silage is useful in overcoming these challenges?

.....  
.....  
.....

4. What were the key difficulties you faced while making silage? What, in your opinion, would you do differently next time?

.....  
.....  
.....



## Activity 8: Feed formulation – Making a healthy dry fodder mixture

Like green fodder, dry fodder is also an essential feed for livestock. Dry fodder provides the necessary Dry Matter for fulfilling appetite, helps in the better functioning of the digestive system and provides critical minerals to animals.

The digestibility of dry fodder can be increased by adding a mineral mixture (which can be collected from a local veterinary clinic) and jaggery. This is a simple yet effective treatment for improving the palatability and digestibility of dry fodder, especially during harsh summer or dry season.

You can do this activity directly in a farmer's field or ask farmers/animal owners to help you do the activity in school. You can help them get dry fodder at school.

You can treat dry fodder by following the steps shown in Figure 2.12.



**Step 1:** Collect chopped dry fodder (5 to 10kg). It can be rice, wheat, *jawar*, hilly grass straw, or any legume crop stubble that farmers usually burn in the fields after crop harvest.

**Step 2:** Add 3% jaggery (300g for 10 kg fodder) and common salt 1% (100g for 10kg fodder) in 5L of water. If jaggery is unavailable, you can use the waste flour of wheat, rice, *jawar*, etc. You can also add 100g of mineral mixture (optional).



**Step 3:** Spread the chopped fodder on the floor and sprinkle the jaggery-salt-mineral mix with your hands. Ensure the mineral mixture is spread equally and sticks to the chopped fodder.

**Step 4:** Make a heap of fodder and then fill in the polyethylene bag as before, or press the fodder towards the corner of the wall and cover it with a polythene sheet.



After 2–3 hours, the treated feed is ready.

**Figure 2.12:** *Preparing dry fodder mixture*

On the basis of the activity and interaction with farmers/animal owners, respond to the following:

1. How do farmers/animal owners store dry fodder? Do they chop dry fodder before feeding it to the animals? If not, why?

.....  
 .....  
 .....

2. Do you see any advantages of chopping dry or green fodder? Explain your response.

.....  
 .....  
 .....

3. What were the key difficulties you faced while making dry fodder? What, in your opinion, would you do differently next time?

.....  
 .....  
 .....

### **Activity 9: Offering feed to animals and observing their response**

You have prepared silage and treated dry fodder to increase its palatability. Just like us, livestock are also sometimes choosy about



their food. See if your selected animal likes the feed you prepared by offering it to them. **While feeding the animal, ensure that the owner is close by.**

1. Open the silage bag and check the quality (free from mould and not smelling bad). **Ask the farmer/animal owner to confirm your assessment of the quality of the fodder.**
2. Take a handful and place it in front of the animal.
3. Observe if the animal appears to like it and is ready to eat.
4. Follow the same process with dry fodder treated with jaggery and salt.
5. Note your observations.

On the basis of the activity, respond to the following questions:

1. Does the animal accept the silage and treated dry fodder? If yes, do you think it was consuming it happily or just finishing it because it was hungry? If the animal is not accepting the feed, ask the farmer/animal owner for the probable reason.

.....  
.....  
.....

2. What was the farmer/animal owner's reaction or feedback on the fodder you prepared? Does the farmer/animal owner find it useful? If not, what are the reasons?

.....  
.....  
.....

### Activity 10: Preparing home remedies for livestock

You have learnt about vaccination and some common diseases of farm animals during your visit to the vaccination centre or a veterinary professional guidance session. You may have also noticed the farmer/animal owner using home remedies and *Ayurvedic* medicines to treat common illnesses.

For example, one of the common challenges with livestock is infection due to ticks and other external parasites (ectoparasites).



Ticks feed on animal blood and also spread diseases. Farmers/animal owners use local herbs, like *neem*, lantana leaves and turmeric to prevent parasites.



### Did you know?

Different geographical regions in India have unique shepherd communities. For example, *Brokpas* in Ladakh and some parts of Arunachal Pradesh herd mostly yak and sheep. *Raika/Rabari* in Rajasthan, *Fakirani Jats* in Haryana and *Maldharis* in Gujarat mainly herd camels and sheep. *Dhangar* in Maharashtra and *Kurubas* in Karnataka are known for sheep rearing. By tradition, these nomadic communities rear different livestock and often travel with them for food and shelter.

If a local herder community is in your locality, ask them about their lifestyle and love for their animals. Also, ask them about challenges they face, including those related to the health of their animals, and how they overcome them.

Another common health problem in cows and goats is indigestion.

Farmers sometimes use 10 betel leaves (*paan*), 20 g ginger, 10 g pepper, 10 g garlic, and 50 g rock salt for home-based treatment of indigestion in cows. All these ingredients are pounded and mixed in lukewarm water. The remedy can be given every 6 hours for large animals (body weight 200 kg and above).

Ask farmers/animal owners in your vicinity about typical home-based remedies they use. You can also ask elders in your locality about common home remedies for cows, goats, and other animals.

Note your observations in Table 2.10.

**Table 2.10: Preparation of home diseases**

| Symptoms/<br>Disease | Ingredients<br>used in the<br>home remedy | Preparation method | How to use? |
|----------------------|-------------------------------------------|--------------------|-------------|
|                      |                                           |                    |             |
|                      |                                           |                    |             |



## Using Mobile Application to Identify Pests and Diseases

You can also use mobile applications designed to identify diseases among livestock.

The Indian Council of Agriculture Research (ICAR) has developed apps to give early warnings of outbreaks of livestock diseases and to identify early signs of disease, among others.

You can prepare some of the home remedies, suggested by the farmer/animal owner/elder, and gift them to a person who needs or asks for them. Do remember to inform them of the exact ingredients and precise measures to be used.

On the basis of the activity, respond to the following questions:

1. Design a first-aid medical box for livestock. List the materials you will add to the box, with ingredients and precise measures.

.....

.....

.....

2. Do you use similar home remedies at home? List a few examples.

.....

.....

.....



## What did I learn from others?

1. What did you learn from farmers/animal owners and friends while doing the project?

.....

.....

.....

2. Name any three skill that you have learnt while working with the experts.

.....  
.....  
.....



### What did I do and how long did it take?

It is essential to understand how much time is required for an activity to be completed.

Calculate the approximate number of hours you spent on each activity. Mark them on the timeline below. If you did more than the activities suggested in the book, please add the number and time taken.

| Activity             | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Time taken (Periods) | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |



### What else can I do?

You can try the following things to expand your learning:

1. You can prepare a daily feeding chart for selected farm animals in your locality and check if it benefits the farmer/ animal owner.
2. You can make a small video presentation, a reel or a slide presentation on traditional folk songs, poems and stories on animal-human relationships. Try incorporating local stories and heart-touching moments from farmers/ animal owners in your presentation.



## Think and Answer

1. What were the challenges you faced?
2. What will you do differently next time?
3. In your opinion do we provide proper care and health treatments to our farm animals? Do we have appropriate technologies and infrastructure (veterinary clinic, hospitals) to care for farm animals?
4. How has the role of farm animals changed with changes in human society (for example, the use of farm machinery, reduced animal-based transport requirements)?
5. Identify a few examples of jobs related to the work you just did, for example, a veterinarian, scientist, herder, or farmer. Look around, speak to people and write your answer.

## Part 2

# Work with Machines and Materials



Machines make our lives easy, and materials are all around us. Projects on Work with Machines and Materials will help you work with different machines and tools to create new things with different kinds of materials, and to repair and maintain things. You can take up projects related to making electronic toys, carpentry products from wood and bamboo, and pottery products (with and without using a wheel), sewing clothes, decorating fabrics, using computers and smartphones to make games and animations, and using waste materials to make toys or even instruments for a school band. It is up to you to imagine all that you can do with your peers.

Two examples of projects are given in this section, which are Working with Wood and Bamboo and Home Automation. You must take up only one project. You can either choose one of these projects or you can design a project of your own choice with the help of your teacher.

## Project 3

# Working with Wood and Bamboo



0885CH03

You can do many things with natural materials like wood and bamboo. You can cut these materials according to a design, assemble the parts and convert them into useful products. This project is about working with wood and bamboo to make useful objects.

*As part of the project, you will be able to:*

Learn about working with wood and bamboo

Use basic carpentry tools

Build a prototype as per design

Make useful products using soft wood and bamboo



Figure 3.1: Making useful products with wood

Have you ever noticed that wood and bamboo are indispensable to our lives? From the wooden doors of our homes to fruit and vegetable carts, from school benches to cricket bats, wood baskets, fences, jewellery and toys—they are everywhere (Figure 3.1). They are also seen in the handles of our kitchen tools, bookshelves and even fishermen's boats and oars.

India is known for its ancient buildings and architectures. These buildings have stood the test of time. Most were built of wood, stone and other naturally occurring materials. From the *Hidimba Temple* in Manali, *Rumtek Monastery* in Sikkim and *Vishrambaagh Wada* in Pune—these buildings are renowned for their architecture and intricate decorative woodwork. Another example is the *Padmanabhapuram Palace* in Tamil Nadu, one of Asia's largest wooden palaces (Figure 3.2). It was built four hundred years ago and is spread over 6.5 acres.



Figure 3.2: Padmanabhapuram Palace

Wood is used as fuel in some parts of the country. It is also used as construction material for making houses, tools, weapons, furniture, packaging, artworks, and paper.

Craftsmen and carpenters have shaped wood into beautiful and functional objects for generations. Think of the carved wooden pillars in old temples, the sturdy bullock carts that travel through villages, or even the simple wooden ladle used to stir *daal* and curries. Humans have used this material in many imaginative ways for their benefits.

Even when many different materials are available, wood is still used in many ways. Wood and bamboo are increasingly preferred over concrete and bricks for building houses and schools as they keep rooms cooler in summer and warmer in winter (Figure 3.3). Sports like cricket, badminton and hockey rely on strong wooden materials. In some places, even bridges and equipment in playgrounds are made from these materials because they are strong and last long.



Since trees can be planted to replace the ones that have been cut, wood is considered a renewable resource. However, its use is not sustainable if its consumption exceeds the number of new trees planted. It must be noted that there are certain areas, such as those at high altitudes in the Himalayas, where trees do not grow easily. Once cut, entire forests disappear. Therefore, wood must be used judiciously. Ideally, the wood of a tree should be used after it has completed its lifecycle on earth—this is a sustainable approach compared to cutting off younger trees for wood.

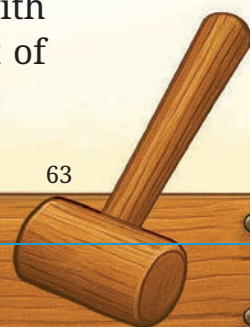
This approach is in alignment with our culture and traditions. While using natural resources, our ancestors used to pray to the earth. For example, the *Atharva Veda* says, “Whatever we dig out from you, O Earth! May that have quick regeneration. May we not damage our vital habitat and earth.”



**Figure 3.3:** A traditional south Indian house with wood used for building roofs, doors, windows and pillars

Substitutes like engineered wood or bamboo can be used instead of wood. Examples of engineered wood around you include plywood and Medium Density Fibreboard (MDF). Engineered wood is usually made using recycled wood, sawdust (fine particles or dust produced when wood goes through different processes in the production of objects), tiny wood particles, and wooden fibre.

Bamboo, on the contrary, is a perennial grass and grows back when cut (Figure 3.4). There are several species of bamboo in India, and these are grown in many parts of the country, with the maximum amount being grown in the north-eastern part of India.





**Figure 3.4:** Bamboo grows in almost all parts of India, except for the extremely hot and cold desert regions of Rajasthan and Ladakh, respectively

In this project, you will make products using either wood or bamboo. Adult supervision is required since you will be doing hands-on carpentry, including shaping, joining and sanding. You should **collaborate with a carpentry instructor or a local carpenter** to understand proper tool handling and safety measures.



### What will I be able to do?

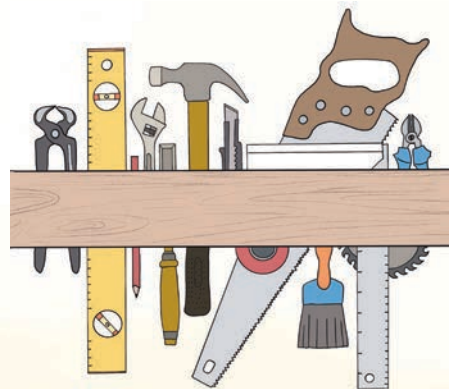
At the end of the project, you will be able to:

1. Safely use tools, like a hammer and saw, to cut, join and assemble materials.
2. Design a product and make a prototype.
3. Build a functional object using basic carpentry hand tools and materials.
4. Apply finishing techniques to make objects durable and attractive.



### What will I need?

**Tools required:** Tri-square, hand saw, wood file, plane, claw hammer, measuring tape, steel ruler, bench vice, brush, clamps, hand drill, and cutter.



**Figure 3.5:** Tools used for woodworking

**Materials required:** Nails, screws, pencil or chalk, wood glue, sandpaper, varnish, softwood and/or bamboo, cardboard, synthetic resin adhesive, and cellophane tape (Figure 3.5).



### How do I keep myself and others safe?

- **Handling tools:** Use all the cutting tools carefully. Learn the proper techniques to hold and use tools. Use masks and safety goggles to protect your eyes from wood dust.
- **Workplace safety:** Keep the workspace organised and free from any unnecessary dust and wood cuttings. Keep tools in their proper place after use.

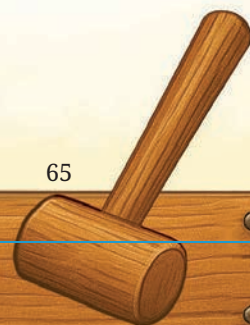


**Internet safety:** Ask your teacher for help while using the Internet. Be careful not to upload or download anything without checking. Do not share your personal information with anyone.



### What do I need to know before I start?

Natural wood is available in hard and softwood, depending on the kind of tree. Wood from different trees is used for different purposes. For example, hardwood from *babool* and mango trees is used for construction (making houses, bridges, window frames, flooring, etc.), while the jackfruit tree is used for making furniture and small objects, like *pooja* stands, handicrafts, etc. Softwood from pine and *deodar* is used for making lightweight furniture, shelves and packing boxes, while eucalyptus (*Nilgiri*) is used for making paper. Wood from the teak (*Sagawan*) tree is used for building ships and outdoor furniture.



As you may have guessed from its name, hardwood can be challenging to work with, requiring stronger tools and specific techniques. Softwood is easier to cut, shape and finish, making it more suitable for you to work with. Bamboo is also easy to work with. You can even use plywood or recycled wood from old wooden furniture or objects.

Look at the wooden objects around you and check if they are made of soft or hardwood using the fingernail test.

The test is simple—press your thumbnail against a wooden surface and pull it along. If it leaves a scratch mark, it's softwood; if not, it's hardwood.

### Activity 1: Visit a Local Woodworking/Bamboo Workshop

Have you ever wondered how raw wood or bamboo becomes useful, like a chair or a table? What is the first step in turning a simple piece of wood or bamboo into a finished product?

By visiting a carpenter's workshop, you will discover how carpenters take decisions at each stage—from choosing the right materials to designing, shaping, cutting, and assembling the final product. Think about what you want to ask the carpenter(s) about their process of creating products and the things they take care of at every stage.

#### Record of the Visit to the Carpenter's Workshop

Name of the carpenter .....

Number of persons employed in the workshop (if applicable) .....

Qualification of the carpenter and other persons in the workshop .....

Follow the checklist in Table 3.1 to observe, ask and document key details about the carpenter's work. Add or remove questions as suitable.



**Table 3.1: Record of details about the Carpenter's work**

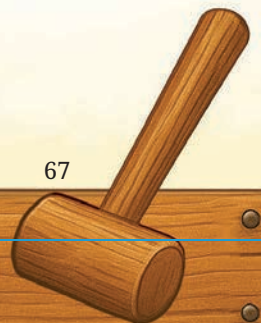
| S. No. | Questions                                                                                                                                | Observation |
|--------|------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 1.     | What kind of carpentry work is done in the workshop (e.g., furniture making, house construction and repairs)?                            |             |
| 2.     | What types of wood are used to make different products?                                                                                  |             |
| 3.     | How do you decide the type of wood to use for a particular purpose?                                                                      |             |
| 4.     | What tools and machines do you use to make products?                                                                                     |             |
| 5.     | What are the basic techniques used to make products from wood? For example, measurement, drawing a design on wood, cutting, and joining. |             |
| 6.     | What safety precautions do you take while working?                                                                                       |             |

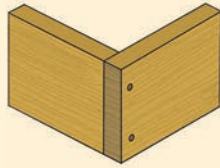
### **Activity 2: Understanding Bamboo or Wooden Products**

Look at the objects made up of wood/bamboo around you and pick any one of them.

You will find that different parts of a wooden object are joined in various ways. Any wooden object is generally made of different parts 'assembled' (or joined) together. Thus, joints are essential in making any wooden or bamboo product.

Figure 3.6 shows common joints used in wooden products. Of course, there are other ways of joining parts of an object, for example, with nails, screws, wood glue or with bamboo string (also known as twine).





**Butt Joint**

**What it is:** Joints in which straight edges join at the corners.

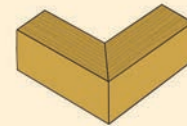
**When used:** For simple connections where strength is not a major concern.

**Applications:** Basic furniture like small tables or picture frames.

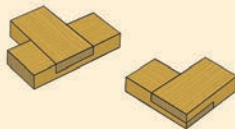
**What it is:** Joints in which pieces come together at a 45° angle.

**When used:** For simple connections where strength is not a major concern.

**Applications:** Basic furniture like small tables or picture frames.



**Mitre Joint**



**Lap Joint**

**What it is:** Pieces overlap each other with one piece sitting on top of the other.

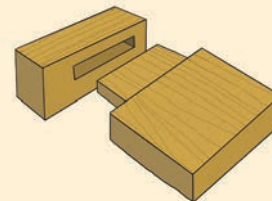
**When used:** For joining two pieces of wood that need extra surface contact for strength.

**Applications:** Shelves, simple boxes, and frames where durability is needed.

**What it is:** A joint where a protruding tenon on one wood piece fits into a mortise, a corresponding slot, on another piece.

**When used:** Ideal for strong, durable connections in areas needing to support heavy loads.

**Applications:** Common in making doors, window frames, furniture like tables, chairs, and bookshelves, and in building timber frames.



**Mortise and Tenon Joint**

**Figure 3.6:** Common joints used in wooden products



### Joining parts using nails and screws

Nails, screws, nuts, and bolts are also called fasteners. They are used to join parts—nails are fixed using a hammer, and screws are fixed using screwdrivers. You need to make a small dent in the wood to place the screw tip. Using a screwdriver will help. Different types and sizes of nails and screws are used in woodwork.

Besides nails and screws, nuts and bolts are also used—these are fastened through a hole drilled with a hand or power drill.

### Joining moving parts

In some objects, the parts move, like windows, doors, cupboards, chests, and similar objects. Hinges join these moving parts. Hinges are used for smooth movement and allowing parts like doors or lids to open and close easily. This provides durability to wooden objects, so that they last a long time. Different hinges are suited for various purposes depending on the use, as shown in Figure 3.7.



**Figure 3.7:** Hinges allow movement while ensuring the durability of wooden objects

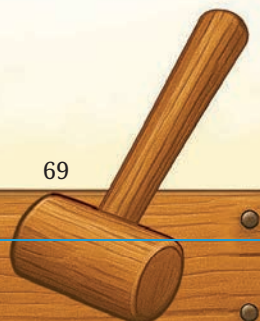
Record observations for the object you selected below:

1. Which object did you select?

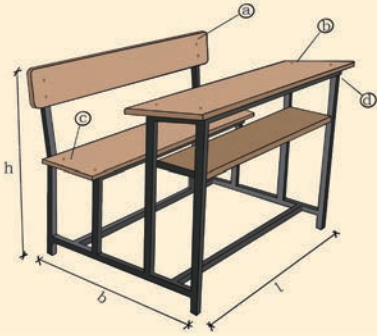
.....  
.....

2. What is it made of (for example, wood, bamboo, etc.)?

.....  
.....



**Table 3.2: Understanding the dimensions of an object**

|                                                                                                                                                                                                                                                              |                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|
| <p>Sketch the object. Label each part and indicate the kind of joint used.<br/>For example: School bench.</p>                                                               | <p>Draw a sketch of the object selected by you.</p> |
| <p>What type of material is it made of?<br/>For example: The bench is made of hardwood.</p>                                                                                                                                                                  | <p>.....</p>                                        |
| <p>Is it made of a single piece of wood or bamboo?<br/>If not, how many parts can you count?<br/>For example: The school bench.<br/>There are four different parts and a metal frame on which they are fixed; the parts are joined using nuts and bolts.</p> | <p>.....<br/>.....<br/>.....</p>                    |
| <p>Did you see any of the joints shown in Figure 3.6?<br/>No, there are no wooden joints – metal and wood are joined together using nuts and bolts.</p>                                                                                                      | <p>.....<br/>.....<br/>.....</p>                    |

### Activity 3: Making a Prototype of a desired object or product

You have observed different carpentry tools at the workshop and studied wooden/bamboo objects or products. Now, decide on the product you want to make (Figure 3.8).

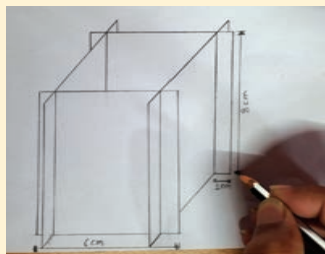


**Figure 3.8:** Simple objects for making prototypes

Since you are doing it for the first time, it is better to make a prototype of the object. A prototype is the first model of the product for checking your design. Since you are working with wood/bamboo for the first time, use cardboard or waste softwood

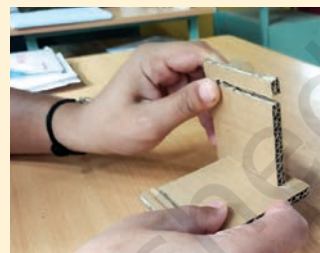
to make a small model of your chosen object. Remember, use the cardboard/softwood wisely, with minimum wastage.

Figure 3.9 shows the steps in making the prototype of an object or product.



**Step 1:** Sketch a three-dimensional object with dimensions.

**Step 2:** Collect material (cardboard/waste softwood, cutter, pencil, scale) and carefully mark the design on it. Ensure that the design is as per the sketch. Cut the material as per dimensions.



**Step 3:** Assemble the project using glue and see whether it has come out as per your original design.

**Figure 3.9 :** Basic steps for making a prototype of an object

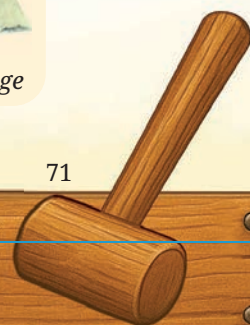
Prototyping is an integral part of working with materials. It has many advantages—a few of them are listed below:

1. With the selected material, you can get an idea whether the design is appropriate or (while good on paper) unrealistic to make in three dimensions.
2. It reduces the chances of making errors while making the actual object.
3. You can modify the design at a low cost since you used cardboard or waste wood.

**Hint:** You can use glue instead of nails while working with cardboard, or you can also use cellophane tape. You can make hinges by piercing pieces of old wire into the cardboard (Figure 3.10).



**Figure 3.10 :** Prototype of a hinge



Review your process and respond to the following questions:

1. Were you able to measure and cut the material accurately?  
If not, what would you do differently next time?

.....  
.....  
.....

2. How did you join the parts? Any difficulty in joining them?  
What would you do differently next time?

.....  
.....  
.....

3. Were you able to recreate your sketch in three-dimension (3D)?

.....  
.....  
.....

4. Show your model to your peers. What feedback did you get?

.....  
.....  
.....

#### Activity 4: Making a product from wood

Now, you can make your own product using wood.

Select suitable wood. You can use scrap wood pieces. For your first product, you should choose softwood or plywood.

Start with something simple yet functional, like a wooden coaster (Figure 3.11). A coaster is a small flat piece of wood used to place cups or glasses to protect surfaces from heat or liquid.



You can also make different objects, like a wall hanging, key chain, key holder, chalk duster for your classroom, a phone stand to keep your mobile upright, a nameplate for your desk or door, a small wooden toy or something else (Figure 3.12).



Figure 3.11 : Wooden coasters

Remember, how you made the prototype in Activity 3. Whatever you decide to make, first sketch the object and make a prototype. You can look at similar objects to get an idea of the dimensions and parts, and how they can be joined, or you can get help from an expert.



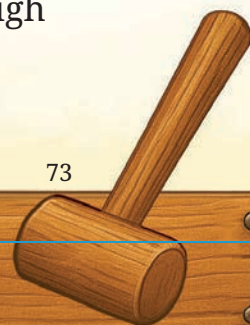
Figure 3.12: Designs that you can use for making coasters

Through this activity, you will learn basic carpentry skills like measuring, cutting, sawing, sanding, and finishing, which will help you make other wooden objects.

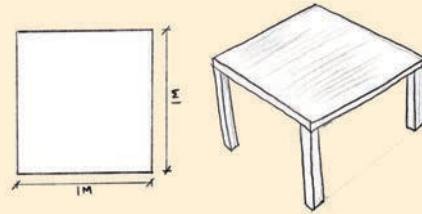
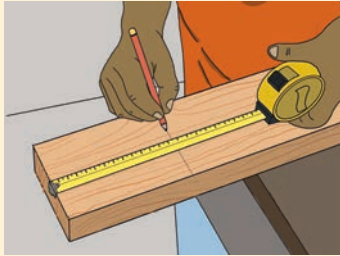
### Basic skills for working with Wood

Figure 3.13 shows basic skills for working with wood/bamboo. You will practice these skills as you build your product.

Remember to ask an expert or search for information through books or the Internet in case you need any support.



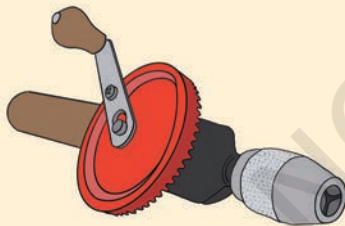
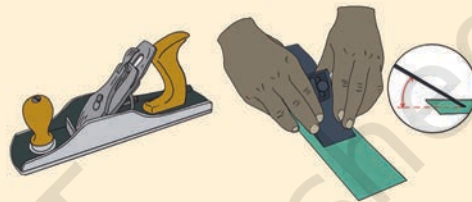
**Sketching and planning:** Sketch the object you will make (you can draw a simple outline on paper). Collect required materials and tools.



**Measuring and marking:** Use a measuring tape and pencil to mark where to cut.

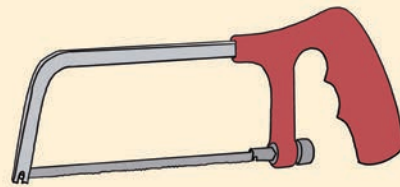
**Planing (smoothing the wood):**

Plane is a tool to shave thin and uneven strips from wood surface. It creates a smooth surface by removing high spots. It also evens out any rough edges. Use a plane to smoothen the surface of wood.



**Drilling:** Drills are used to create holes in wood to fix screw, nails, etc., using a hand drill. Keep the drill perpendicular to the wood where you want to make the hole for fixing pieces. Select the right type of tool, ensuring that it is fixed in the tool holder.

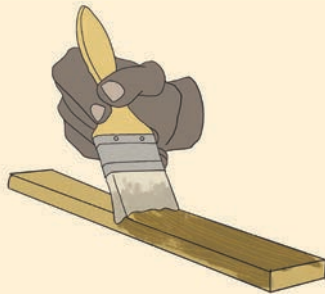
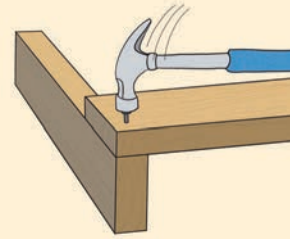
**Cutting:** Hacksaw is an important tool used to cut wood. Before you start cutting the wood, ensure that the piece is secured tightly in the bench vice. Mark a line to cut and make a small cut at the point the line begins. Check if the line is straight, else do necessary corrections.



**Sanding:** Sanding is done to smoothen the surface or smoothen the edges using sandpaper for a polished finish.



**Assembly:** Join the parts as per the sketch. You can press fit the joints made for the purpose. You can also use nails or nuts, bolts, and screws to join different parts.



**Varnishing/Painting:** Varnish is a solution of resins, oil and solvents. It is applied to form a protective layer on the wood surface. It becomes scratch resistant and also enhances appearance and durability.

You can decorate the object to make it look attractive, if you wish.

**Figure 3.13 :** Steps for making products from wood

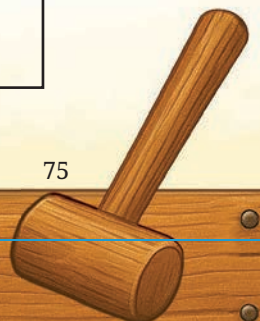
Once you have practised the processes, respond to the following questions:

1. Which object are you going to make?

.....

.....

2. Sketch the object you plan to make with dimensions.

A large empty rectangular box with a black border, intended for a student to draw a sketch of a wooden object and include its dimensions.

3. Write down the process you followed in making your object. Which tools did you use to make your object?

.....  
.....

4. Did you face any difficulties while making it, and how did you overcome them?

.....  
.....

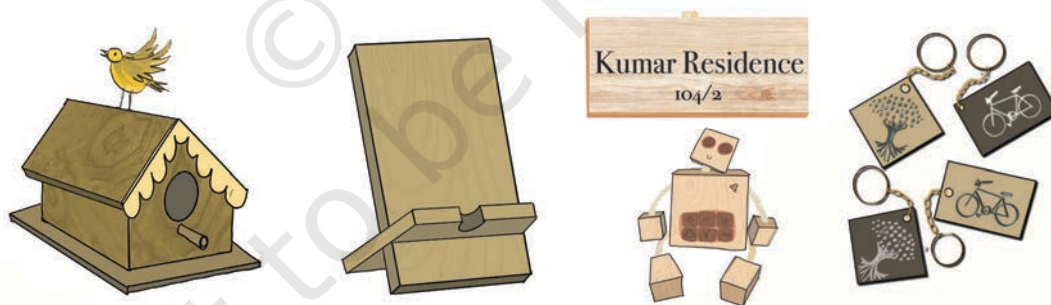
5. What did you do to make the product look attractive?

.....  
.....

Now, you have learned various steps in making wooden objects. The more you practice, the more you will master making them.

You can be creative when designing a small item (Figure 3.14). Here are few examples:

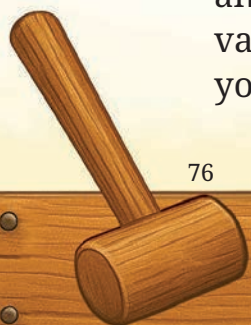
i. Bird house; ii. Mobile phone holder; iii. Name plate; iv. Wooden toy; and v. Keychains.



**Figure 3.14:** Small items that you can make out of wood

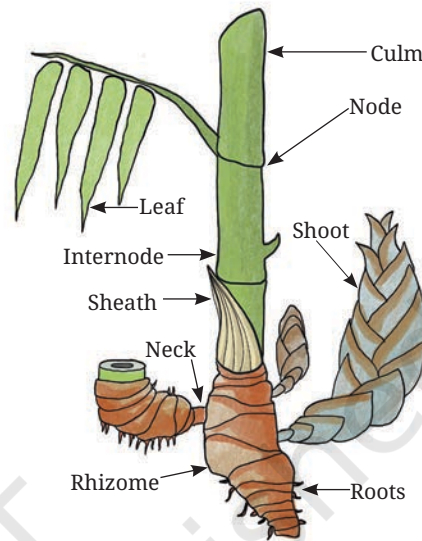
### Activity 5: Make a bamboo product

As you read earlier, bamboo is a strong, lightweight, eco-friendly and readily available material that you can use to create many valuable items. Since you have already made a wooden coaster, you can make some other creative bamboo products.



The most striking feature of a bamboo plant is the stem, which emerges from the ground as a tender shoot and grows quickly into a tall and woody culm. The culm is a hollow cylinder tapering towards the top. It is the most commonly used part of the bamboo plant. A bamboo plant system consists of many culms. The stem is covered with a sheath (leaf-like structures that protect the developing plant) and has multiple nodes, as indicated in Figure 3.15.

The culm is the part of the bamboo plant generally used for making products (Figure 3.16). It is a hollow cylinder segmented by solid nodes. Culms with smooth texture are used for making handicrafts and bamboo utensils.



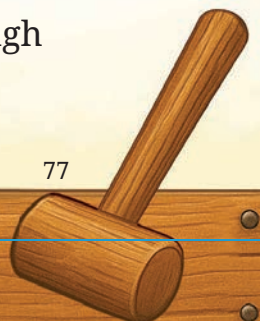
**Figure 3.15:** Structure of bamboo



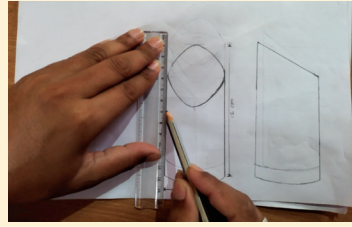
**Figure 3.16:** Objects made of bamboo

Once you have decided on the object you want to make, the steps listed in Figure 3.17 will guide you to move from raw material to the final product.

Remember to ask an expert or search for information through books or the Internet if you need any support.



**Sketching and planing:** Sketch the object you will make (you can draw a simple outline on paper). Remember to label important measurements (width, height, thickness). Collect required materials and tools.



**Measuring and marking:** Use a measuring tape and marker to mark where to cut.

**Cutting the piece you want:** Cut the internodes from a length of bamboo using a hacksaw, and then cut the parts required according to the sketch. Remember to use a bench vice.



**Smoothing:** Scrape off the outer skin and smoothen the surface area of the bamboo piece.

**Assembly:** Join the parts as per the sketch. You can use a hand drill. You can also use nails or nuts and bolts, or screws to join the different parts.



**Sanding:** Sanding is done to smoothen the surface or smoothen the edges of the product using sandpaper for a polished finish.

**Varnishing/Painting:** Varnish is a solution of resins, oil and solvents. It is applied to form a protective layer on the surface. It is scratch resistant and also enhances the product's appearance and durability.



**Figure 3.17:** Steps for making products from bamboo



## Reflect on your learnings

1. Which object are you going to make?

.....

2. Sketch the object you are going to make with dimensions.



3. Write down the process you followed in making your object. Which tools did you use to make your object?

.....  
.....  
.....

4. Did you face any difficulties, and how did you overcome them?

.....  
.....  
.....

5. What did you do to make the product look attractive?

.....  
.....  
.....

## Activity 6: Costing — How much did you spend?

To decide the selling price of the product, we need to calculate the costs incurred in manufacturing the product. Please list all the materials and tools (in case the school purchased/rented them), and the cost incurred in Table 3.3.

Next, think of your labour—the time you spent making the object. Estimate the number of hours you spent making the product.



**Table 3.3: Estimate of cost of making product**

| Materials         | Quantity | Cost per Item (₹) | Total Cost (₹) |
|-------------------|----------|-------------------|----------------|
| Wood/bamboo       |          | ₹                 | ₹              |
| Nails             |          | ₹                 | ₹              |
| Paint/Varnish     |          | ₹                 | ₹              |
| Sandpaper         |          | ₹                 | ₹              |
| Other materials   |          | ₹                 | ₹              |
| <b>Total Cost</b> |          |                   |                |

Try to find out the price of a similar product in the market. (You may check with a local market or an online marketing platform).

### Activity 7: Basic repairs Around the School

Like other objects, wooden objects also need maintenance. Most routine maintenance include tightening nuts, nailing the loose part, or painting the object. Some wooden objects may need sanding of worn-out parts. If objects are not maintained in time, their life gets reduced. Use your carpentry skills to repair wooden items in your school or home, such as benches, cupboards, and desks. One example is given in Table 3.4; add the details of what you did.

**Table 3.4: Record of repair and maintenance work**

| Repair task                      | Was it fixed properly? How?    | Does it feel strong? (Yes/No) | Any final improvements needed?                                               |
|----------------------------------|--------------------------------|-------------------------------|------------------------------------------------------------------------------|
| The wooden top of a school bench | Yes, the screws were tightened | Yes                           | Smoothen the edges of the wood by sanding, which is done by using sand paper |
|                                  |                                |                               |                                                                              |
|                                  |                                |                               |                                                                              |
|                                  |                                |                               |                                                                              |
|                                  |                                |                               |                                                                              |
|                                  |                                |                               |                                                                              |





## What did I learn from others?

1. Name three things you learned from the carpenter/experts/teachers during the project.

.....

.....

.....

2. What was the most difficult step in making your product? How did speaking to others (e.g., peers, teachers, experts, family, community members, etc.) help?

.....

.....

.....



## What did I do and how long did it take?

It is important to understand how much time is required for an activity to be completed.

Calculate the approximate number of hours you spent on each activity. Mark them on the timeline below. If you did more than the activities suggested in the book, please add the number and time taken.

| Activity             | 1   | 2   | 3   | 4   | 5   | 6   | 7   |
|----------------------|-----|-----|-----|-----|-----|-----|-----|
|                      |     |     |     |     |     |     |     |
| Time taken (Periods) | --- | --- | --- | --- | --- | --- | --- |



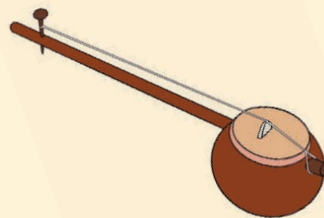
## What else can I do?

Create a mini orchestra using simple handmade wooden instruments, like an *Ektara*, a wooden shaker (filled with seeds or beads), a clapper made from two pieces of flatwood, or a mini drum using a wooden container and cloth (Figure 3.18).



### Make Your Own *Ektara* and Explore Other Musical Instruments

An *ektara* is a simple, one-stringed musical instrument used widely across India. It is easy to make using everyday materials, like bamboo, coconut shell, or hollow cylinders.



#### Other Musical Instruments You Can Make

Figure 3.18: Making an Ektara

**Bamboo Flute:** Use a hollow bamboo piece, drill small holes for notes, and blow across the opening.

**Damaru (Hand Drum):** Use two small wooden bowls joined together with a string and beads to create rhythmic sounds.

**Chipli/Ghungroo Salangai/Ghungur (Bells):** Attach small bells to a piece of wood to create a musical instrument.

You can reuse old wood to make something new, like turning a broken drawer into a shelf or using small scraps to create art, gifts, or other fun objects. Look around your home or school for waste wood and try building or fixing things. This way, you can help the planet while having fun.



### Think and Answer

1. Did you enjoy doing this project?
2. What did you like, and what would you do differently next time?
3. Wood has been a part of human civilisation, and part of the life of humans. It is present in almost every moment and every step of human life. Find out whether it is mentioned in literature and scriptures. Quote the words that talk of wood and provide translation, if needed.
4. Some examples of jobs related to your work are carpentry, interior design, etc. What other jobs are related to the project? Look around, speak to people, and write your answer.



## Project 4

# Home Automation



0885CH04

Home automation enables you to operate devices at home automatically with the help of technology. In this project, you will learn how to make electronic circuits and write simple programmes.

*As a part of the project, you will be able to:*

Learn about  
electronic  
components  
and circuits

Make simple  
programmes  
and circuits

Select  
appropriate  
sensors

Make an  
automation  
system and test it



**Figure 4.1:** Making things operate automatically using circuits and programmes

Automation means using technology to control everyday devices automatically. Instead of switching things on and off by hand, automation uses sensors, controllers and simple computer programmes to run these tasks independently (Figure 4.1).

Imagine a classroom where all students and teachers leave immediately after the final bell. The lights and fans often remain on because no one remembers to switch them off. This wastes electricity and increases electricity bills.

Automation can help in such situations. If the classroom has an automated power system with a motion sensor, the lights will automatically turn off when no motion is detected. This simple change can save energy and reduce costs.

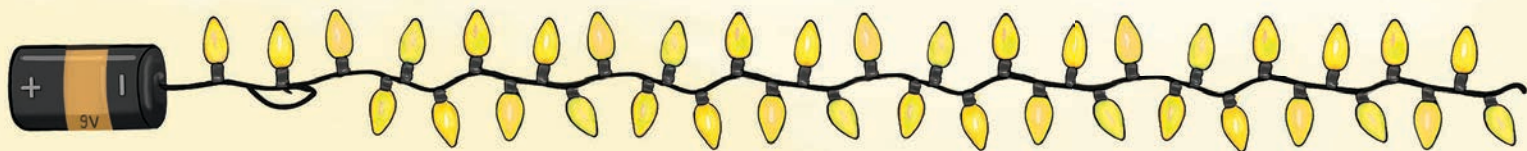
Another example of automation is an automatic garden irrigation system, where a moisture sensor is installed in the soil. When the soil becomes too dry, the sensor sends a signal to a water pump. The pump then automatically turns on and waters your plants. Once the soil has enough moisture, the system turns the pump off. This saves you from having to check the garden every day and helps conserve water by watering plants only when needed.

Automation is not a new idea — it has always been a part of our world. Nature had already perfected automation before humans started creating machines to automate tasks.

Look at the human body. Without thinking about it, your heart beats automatically to pump blood, your lungs breathe in oxygen and release carbon dioxide, and your stomach digests food after eating. All these functions happen without conscious effort, just like an automated machine. The body uses signals, such as nerve impulses and hormones, to decide when and how to act, just as an intelligent system uses sensors and controllers.

If we look around, nature itself is in automation mode. Like modern automation, nature follows systems that work independently, using signals and patterns.

- **Sunrise and Sunset:** The sun rises and sets daily without any action on our part.
- **Water Cycle:** Water evaporates from lakes and oceans, forms clouds, and falls back as rain, following a natural cycle.

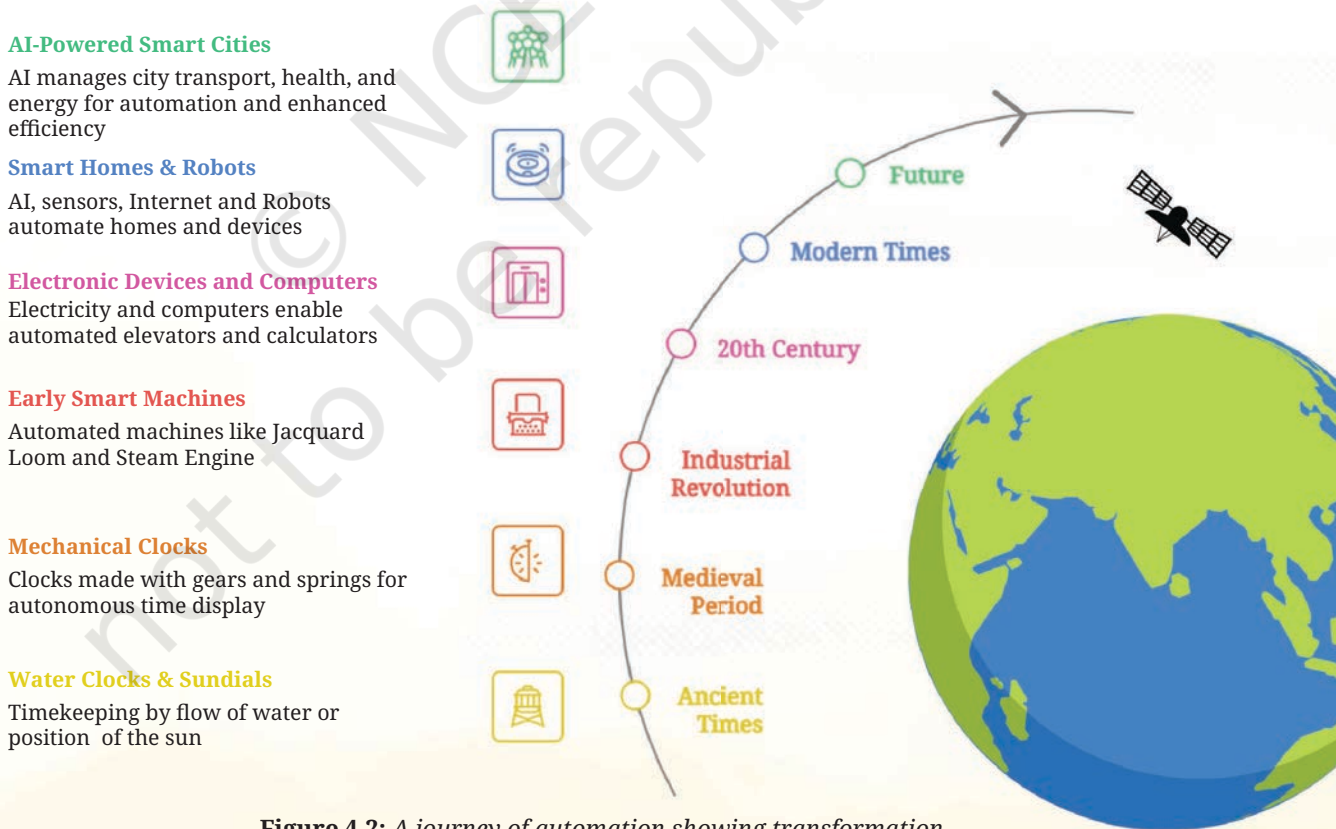


- **Animal Instincts:** Birds migrate without Global Positioning System (GPS), generally used by humans. Flowers bloom at the right time, and bees build perfect honeycombs without being taught.

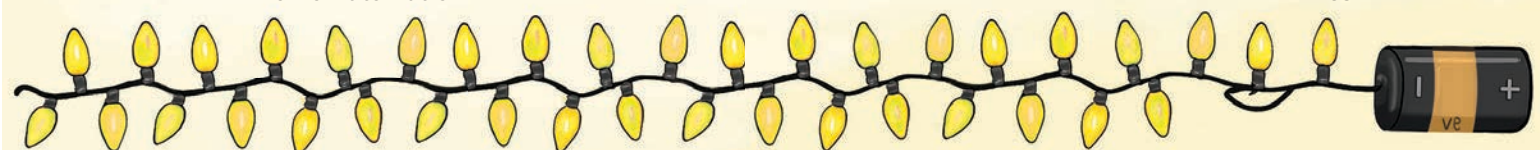
From our bodies to the natural world, automation has always existed. Humans have been inspired by automation in nature and made automated things to make life easier. For example,

- A thermostat is a device that automatically adjust the heating or cooling system, adjusts the temperature in a room, just like our body regulates heat by sweating when we are hot.
- A motion sensor turns on lights when someone enters in a room, just like the pupils of the eyes adjust to brightness automatically.

Humans have always been fascinated by making things that work automatically. Over the centuries, these have evolved from simple devices to complex machines. A journey of automation is shown in Figure 4.2.



**Figure 4.2:** A journey of automation showing transformation from manual tasks into automated systems



In this project, you will learn how to build similar systems using simple electronics and a microcontroller. You will observe how a tiny sensor can detect movement, how a computer chip can think and send commands, and how a light or a fan acts on those commands.

By exploring automation, you will learn about electronics and programming, and how these ideas can be used in your homes and classrooms to save energy and improve comfort. Enjoy the journey into this exciting world of innovative technology!



## What will I be able to do?

By the end of this project, you will be able to:

1. Identify electronic components used in automation systems.
2. Read and draw electronic circuits.
3. Design an automation system for a home or a school.
4. Select appropriate sensors and programme them.
5. Install automation systems and test them.



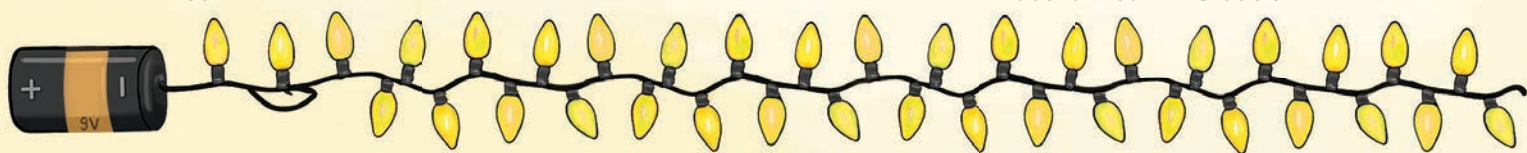
## What will I need?



Figure 4.3: Electrical and electronic components

## Electrical and Electronics Components

1. **Breadboard:** Metal strips inside the breadboard allow electronic components to be connected without soldering. This makes it possible to test circuits.

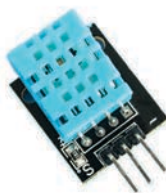


2. **Microcontroller:** A microcontroller like Arduino Uno or Raspberry Pi can be programmed using a computer to control various devices, like Light Emitting Diodes (LEDs), buzzers, motors, and sensors.
3. **Light Emitting Diode (LED):** A small electronic component that emits light when electricity passes through it. It has two legs—the longer one is positive (anode) and the shorter one is negative (cathode).
4. **Liquid Crystal Display (LCD) Display:** It is a small screen that can display 16 characters per row and has 2 rows, connected to Arduino with multiple wires. It is used to show messages, sensor readings, and data from an Arduino project. It requires a small potentiometer to adjust its brightness.
5. **Buzzer:** A tiny electronic component that produces a sound when electricity flows through it. They are commonly used in alarms, timers and notification systems.
6. **Battery:** A portable power source that stores electrical energy and provides Direct Current (DC) power to circuits.
7. **Printed Circuit Boards:** Hard boards made of insulating material with thin copper tracks. These tracks connect different electronic components, like resistors, LEDs and microcontrollers, making a permanent circuit.
8. **Adapters:** Device that converts high-voltage AC power (from a wall socket) into low-voltage DC power that electronic devices like Arduino can use. It ensures a steady power supply and prevents damage to sensitive components. A common adapter for Arduino provides 9V or 12V DC output.
9. **Arduino Cables:** They are used to connect an Arduino board to a PC.
10. **Jumper Wires:** Small insulated wire used to connect components on a breadboard or circuit without soldering. It helps transfer electricity from one point to another.
11. **Digital Multimeter (DMM):** An electronic measuring tool used to check voltage, current, and resistance in electrical circuits. It is commonly used by engineers, electricians, and hobbyists to test and troubleshoot circuits.





Motion Detection Sensor



Temperature sensor



Sound sensor

Figure 4.4: Sensors used in automation

## Sensors

1. **Motion Detection Sensor:** It senses infrared radiation (heat) from objects like humans and animals. When someone moves in front of it, the sensor detects the heat change and sends a signal to trigger an action.
2. **Sound Sensor:** It detects sound levels in the surrounding environment. It converts sound vibrations into electrical signals, which can be used to control devices like LED lights or buzzers.
3. **Temperature Sensor:** It measures the temperature of air, water, or any surface. One popular type is the DHT11, which provides accurate temperature readings in degrees Celsius.

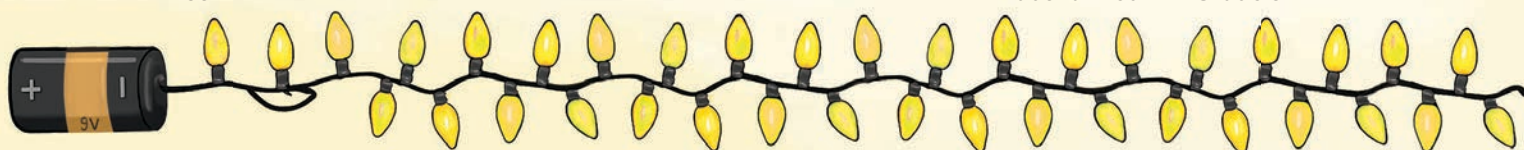
**Other Material and Tools:** Soldering iron, soldering metal and flux, multimeter, screwdriver, wire stripper, and laptop/computer.



## How do I keep myself and others safe?

Some key precautions to be followed while working with electronics are as follows:

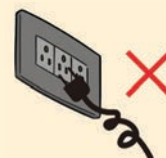
1. **Safety from electrical gadgets:** Avoid short circuits and check for loose connections.
2. **Soldering precautions:** Use safety goggles, avoid inhaling fumes and keep your hands away from the hot soldering iron.
3. **Handling tools:** Use wire cutters and strippers carefully to prevent injuries.
4. **Workplace safety:** Keep the workspace organised and free from unnecessary wires.





**Internet Safety:** Ask your teachers for help while using the Internet. Be careful not to upload or download anything, and do not share personal information anywhere online.

**Important Note:** Most of the home appliances use '230 V, AC supply'. Electronics circuits we include in our activities work on 'DC supply'. It would be dangerous to connect electronic circuits directly to AC Mains. Only make circuits using DC batteries when you are a beginner.



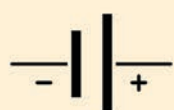
**Figure 4.5:** It is harmful to connect Electronic circuits directly to the AC Mains



## What do I need to know before I start?

Before beginning this project, it will help if you remember some ideas from Science:

- Basic understanding of simple circuits.
- Simple circuit diagrams—draw and read simple circuit diagrams and their components, as well as basic electronic components and their functions.
- Basic symbols used in electrical and electronic circuits are given below:



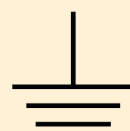
**Battery**

Provides electrical energy



**Resistance**

Limits current flow



**Earthing**

Provides a safe path for excess current



**Switch**

Controls the circuit



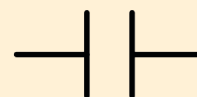
**Diode**

Controls the circuit and direction of the current flow



**LED**

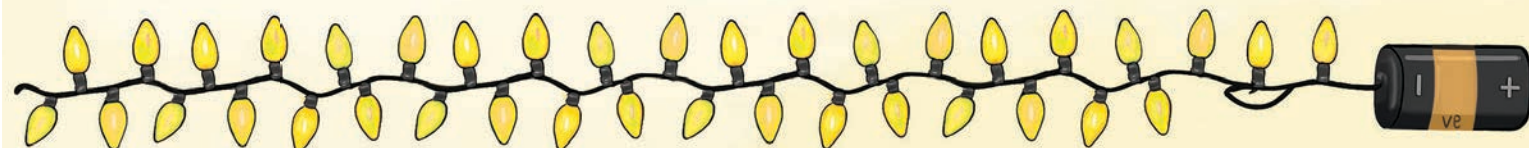
Light Emitting Diode used in lighting



**Capacitor**

Stores electrical energy temporarily

Before you start working on automation systems, explore the automation systems around you.



## Activity 1: Exploring Automation in Our Surroundings

Look around your classroom, home, car, train, nearby market place and community, or even in films and television. Look carefully for things that work automatically. Note your observations in Table 4.1.

**Table 4.1: Record observations for the automated systems**

| Place/<br>Location | What is<br>Automated?                  | What is<br>Happening?                                                       | How Do You<br>Think It<br>Works?              | Notes                        |
|--------------------|----------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------|------------------------------|
| Refrigerator       | Cut-off in case<br>of voltage<br>surge | If there is a<br>voltage surge,<br>the refrigerator<br>gets switched<br>off | A sensor<br>detects a<br>change in<br>voltage | Protects the<br>refrigerator |
|                    |                                        |                                                                             |                                               |                              |
|                    |                                        |                                                                             |                                               |                              |
|                    |                                        |                                                                             |                                               |                              |
|                    |                                        |                                                                             |                                               |                              |
|                    |                                        |                                                                             |                                               |                              |

### Reflect on your learnings

1. Why do you think automation is required?

.....

.....

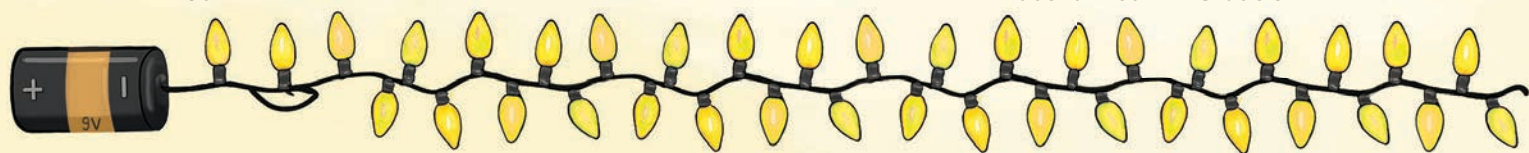
.....

2. What excites you the most about the automated systems you observed?

.....

.....

.....



3. Brainstorm ideas you may have to make life easier and free of drudgery (for example, to help your parents or complete any laborious activities). Let your imagination run free.

.....  
.....  
.....



## What do I have to do?

### Activity 2: Exploring circuits using a simulation platform

Have you ever played car racing games on a computer or mobile phone? If you have done that, then you were not driving a real car but a simulation.

Do you know how pilots learn to fly a plane? Besides learning about aeroplanes and their functioning and flying with an instructor, they also use ‘simulators’. Simulators allow pilots to experience flying without actually being in a plane. Similarly, there are simulation platforms where you can try different electronic circuits without physically building them. You can draw circuits on a computer screen and test them to check if they work successfully.

Simulation platforms help you prepare for building physical systems. In such case, you will not be making mistakes when you make ‘real-life’ circuits.

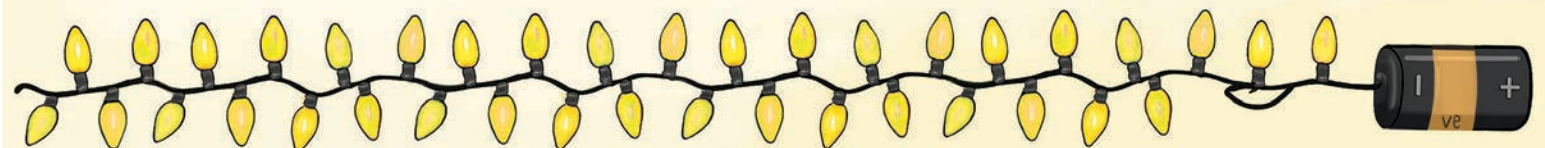
In this activity, you will work on circuit simulation software to build and try out simple circuits.



Tinkercad is a simulation platform. You can explore other platforms using the following search words:

- Simulation for building circuits for beginners
- Platform for making circuits

You can search for tutorials for simulations. For example, you can use the search keywords, ‘Tutorial for making electronic circuit + Tinkercad’.

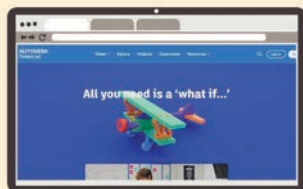
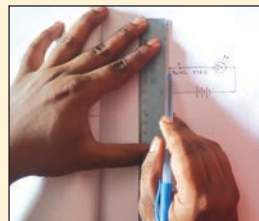


Now, make a simulated circuit using the following components:

- LED, 220 ohms resistor, DC battery 9V, switch
- Buzzer, 220 ohms resistor, DC battery 9V, switch

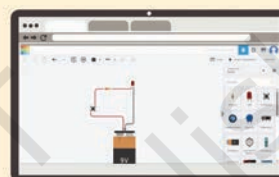
Follow the steps in Figure 4.6 to make and test circuits.

**Step 1:** Draw the circuit you want to test.



**Step 2:** Open Tinkercad or any other simulation platform.

**Step 3:** Open workplace and place the required components.



**Step 4:** Make connections and test the circuit.

**Figure 4.6:** Using simulation to build and test circuits

Now, design a few circuits on your own and try them out. Answer the following questions based on the circuits you designed on the simulation platform.

1. Which software did you use?

.....

.....

.....

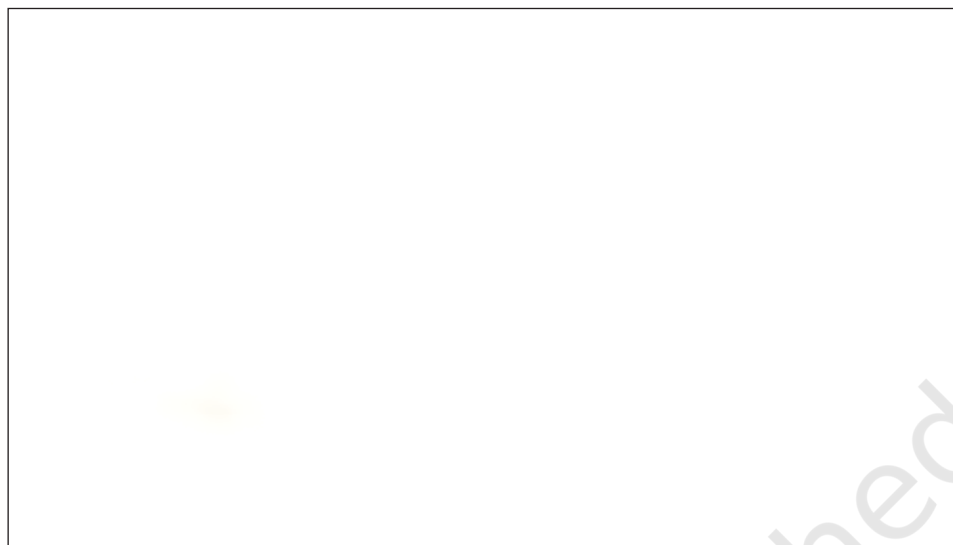
2. Did your circuits work? Try different components, such as other batteries and resistance values. Write down your observations of changes as a result of these trials.

.....

.....

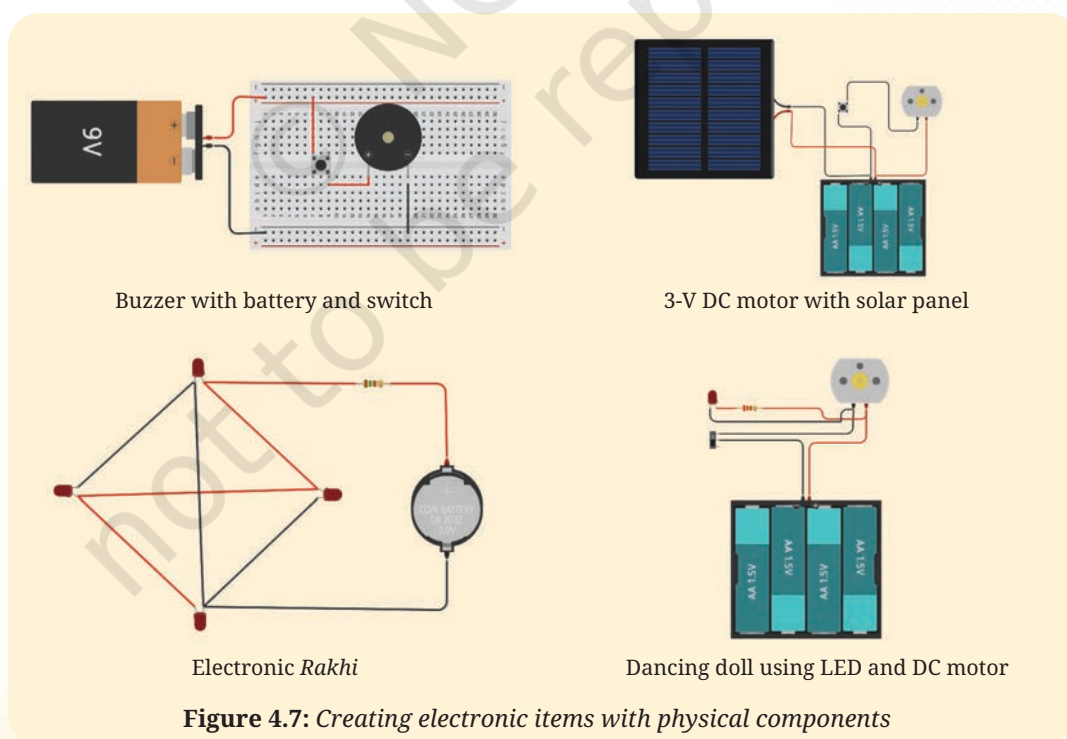


3. Draw the diagrams of the circuits you designed.



### Activity 3: Building circuits using physical components

You have tried out different circuits on the simulation platform. Now, build a circuit using physical components. Figure 4.6 has some suggestions.





You can search for other circuits online using the following keywords:

- DIY circuits for beginners
- Electronic projects for beginners

### Reflect on your learnings

On the basis of the activity, answer the following questions:

1. Which circuit did you make?

.....

.....

.....

2. Which components did you use? Write their specifications.

.....

.....

.....

3. Draw circuit diagrams of the circuits you designed.

### Activity 4: Making the circuit smart

In the activities so far, circuits are controlled by a switch. You can turn a switch either ON or OFF. This allows you to control the flow of electricity to operate the circuit. But you need to manage the switch manually.

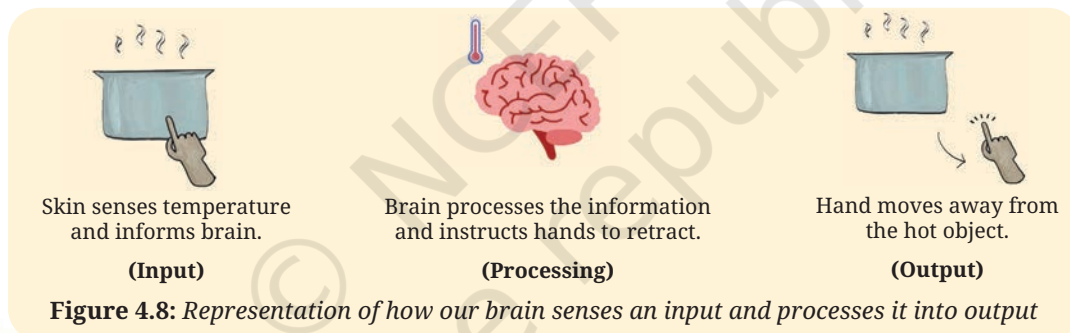


Now, what if you want to make the circuit smart? You want your circuit to switch the circuit 'ON' when it is dark or switch the electric pump 'OFF' when the tank is full.

When it becomes dark at night, our eyes sense the darkness, or when water starts overflowing from a tank, our ears hear that sound. Our sensing organs are the eyes, ears, tongue, nose, and skin. They inform our brains about things happening around us. Now, to inform an electronic circuit that it needs to become automatic, it needs to sense things. This is done by components called 'sensors'.

### How automation works?

When we touch something hot, our skin senses the temperature (input). It sends a signal to our brain (process). Our brain signals our hand to move away from the hot object. A representation of how one brain senses an input and processes it into output is given in Figure 4.8.



Similarly, automation follows a simple cycle that allows machines or systems to perform tasks without constant human control. This cycle consists of three key steps:

#### 1. Input (Sensing)

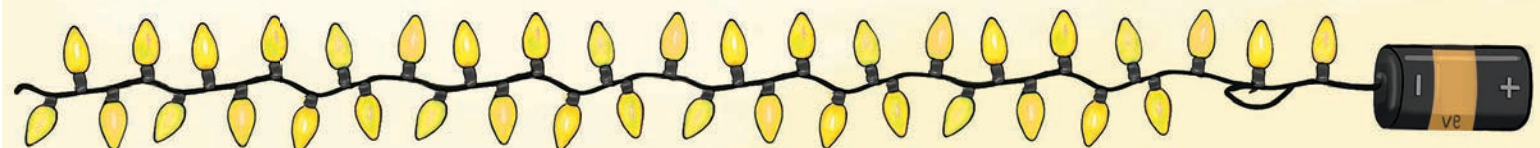
- Sensors detect changes in the surrounding, such as motion, temperature or light.

*Example:* A motion sensor detects movement in a room.

#### 2. Processing (Decision making)

- A microcontroller or processor analyses the input and decides what action to take.

*Example:* If movement is detected, the processor turns the lights on.

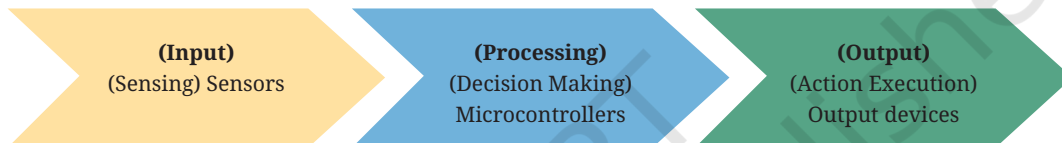


### 3. Output (Action/Execution)

- The system carries out the action based on the decision.  
*Example:* The lights turn on automatically whenever motion is detected.

This cycle continues as long as the system is active, making automation an efficient way to reduce manual work and improve efficiency in daily life.

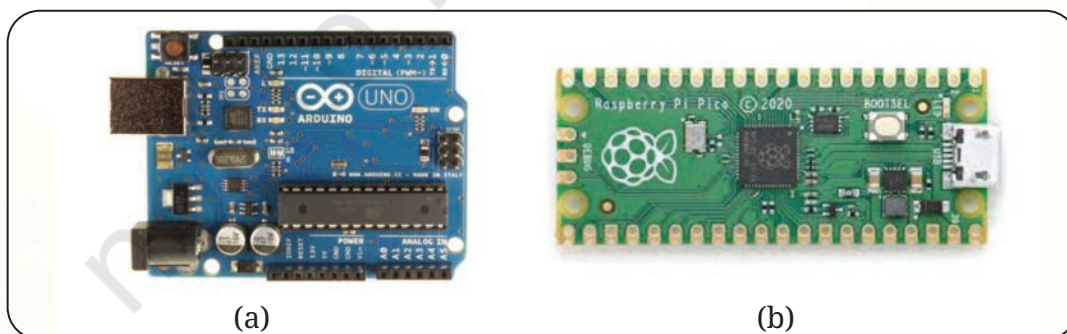
The microcontroller is the brain of the circuit (Figure 4.8). It processes the sensor information and asks the output devices to act. You need to give instructions to get the desired response from the microcontrollers (Figure 4.9). This set of instructions given to the microcontroller is called a ‘programme’.



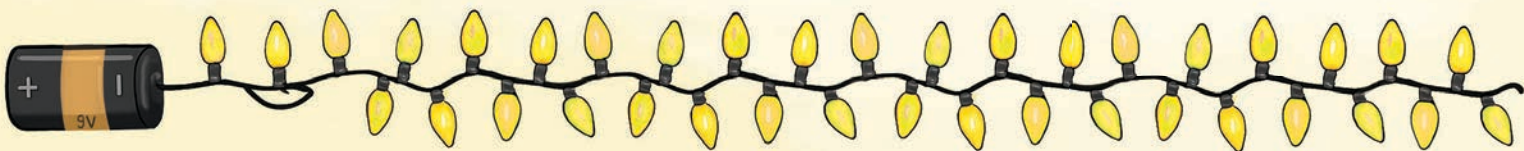
**Figure 4.9:** Microcontroller handles both input and output to make decisions

These microcontrollers are like small computers. Depending on their processing power and functions, different types of microcontrollers are available in the market. You need to choose the microcontroller depending on your application.

Figure 4.10 shows examples of microcontrollers that are commonly used by beginners—Arduino Uno and Raspberry Pi Pico (Figure 4.10).



**Figure 4.10:** Arduino Uno (a) and Raspberry Pi (b) microcontrollers



## Output Devices

An output device is any piece of hardware item that takes commands from a microcontroller to perform specific tasks. Typical examples of output devices are LEDs, buzzers, DC motors, servo motors, stepper motors, relays, LCD, and speakers. Output devices can exist with or without sensor-like input devices. A person can operate the output device through a sensor or from the signal received from a microcontroller.

## Making simple circuits using microcontrollers

You learnt about input devices, microcontrollers and output devices. Now, let us connect them to make a smart circuit. You can use a breadboard to connect different components without soldering them. This will help you to test the circuit quickly. If something does not work, you can rearrange the parts. The breadboard is only for prototyping, a model used to test the circuit (Figure 4.11). Once your circuit is tested and working, you must solder the components and make the circuit permanent.



Figure 4.11: A breadboard

**Microcontrollers:** You can create an automation system using a microcontroller. Each microcontroller has a different number of pins. Each pin is for a specific purpose, such as connecting the power supply, ground, and input and output devices.



You can search online using keyword, 'Understanding Pin Configuration of – Name of the microcontroller'.



Arduino Uno is shown in Figure 4.12.

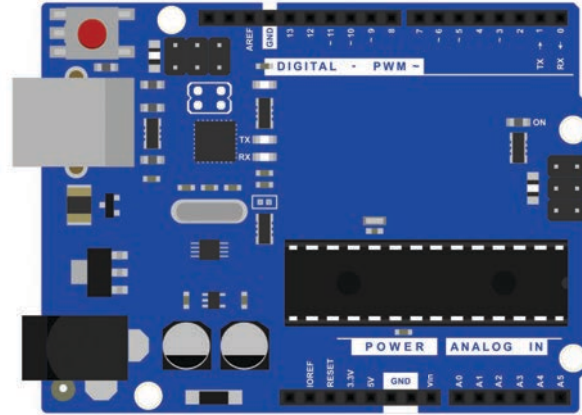


Figure 4.12: Arduino Uno

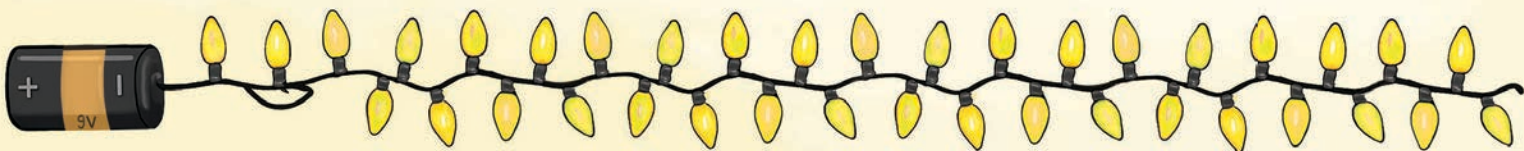
- **Analog pins (labelled A0 to A5):** Connect input or output devices, such as parts like LEDs, sensors, and motors.
- **Digital pins (labelled 0 to 13):** To give an ‘On–Off’ signal. They control LEDs, buzzers, motors (On/Off signals), etc.
- **Universal Serial Bus (USB) port:** Connects to a computer for programming.
- **Power supply:** A USB cable or a battery can power the microcontroller.
- **Reset button:** Restarts the programme running on the board.
- **GND:** GND stands for ‘Ground’. It is a reference point of voltage in circuits and protects the circuit and the person working the circuit.

You can try the following activities using microcontrollers, breadboard(s) and sensors.



#### **Glowing LED bulb using a microcontroller (for example, Arduino Uno)**

1. Search for an online tutorial using the search keywords, ‘Tutorial + beginner + microcontroller’ (e.g., Arduino Uno).
2. Connect the LED, battery, and Arduino pins with the help of your teacher. Download the Arduino IDE programme from the official Arduino website.
3. Start the Arduino IDE programme on the computer; go to File ⇒ Examples ⇒ Basics ⇒ Blink. This will open a new window with the Blink programme.



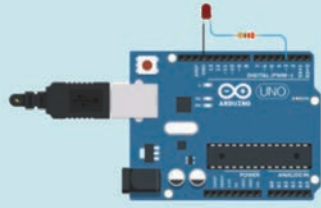


Figure 4.13: LED off

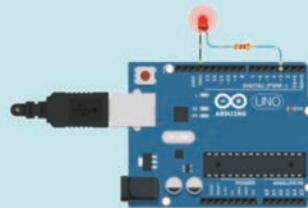


Figure 4.14: LED on

4. Now, connect the Arduino board to the computer using its cable. Then open the tools menu on the computer, go to the port and select Arduino Uno Com (com number will be selected automatically by computer).
5. When done, click on the arrow under the file menu. This will upload the programme to the Uno board. This should blink the Uno onboard LED every second.
6. 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 programme again.

You can also try the following:

1. On/Off LED
2. Reduce or increase the blinking time of LED
3. Add multiple LEDs and blink them

### Activity 5: Exploring automation cycle

Now, you know how to connect a microcontroller and programmes it using a computer; you also know how to give it power. Now, connect input and output devices to try the automation cycle.

All automation processes have an input, a process and an output (Figure 4.15).

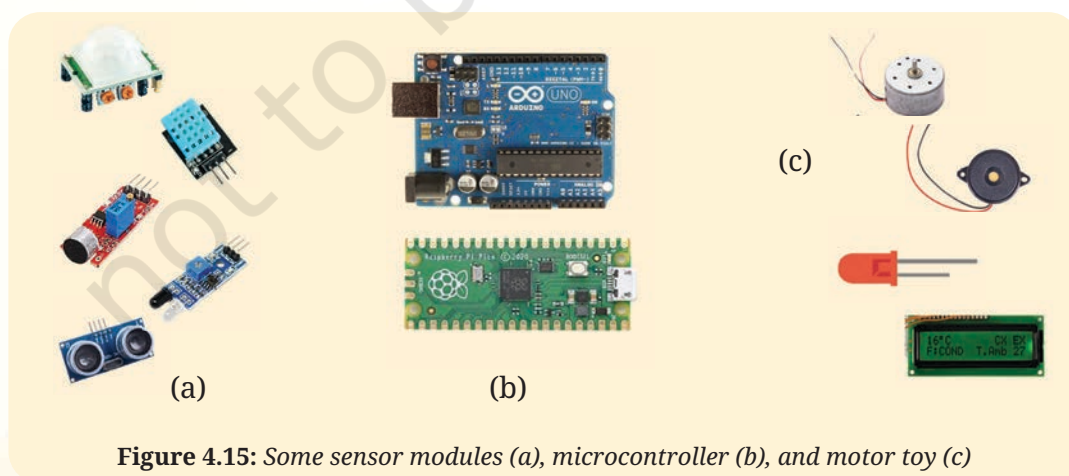
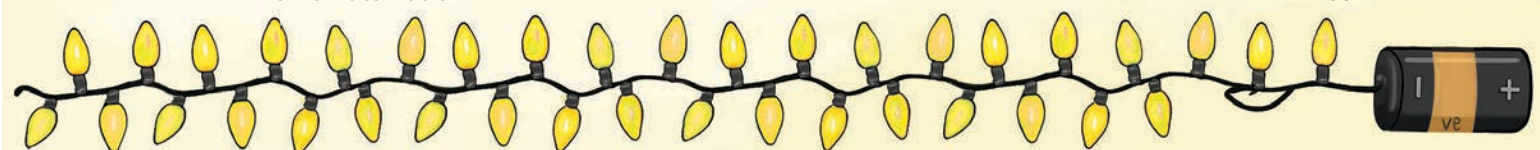
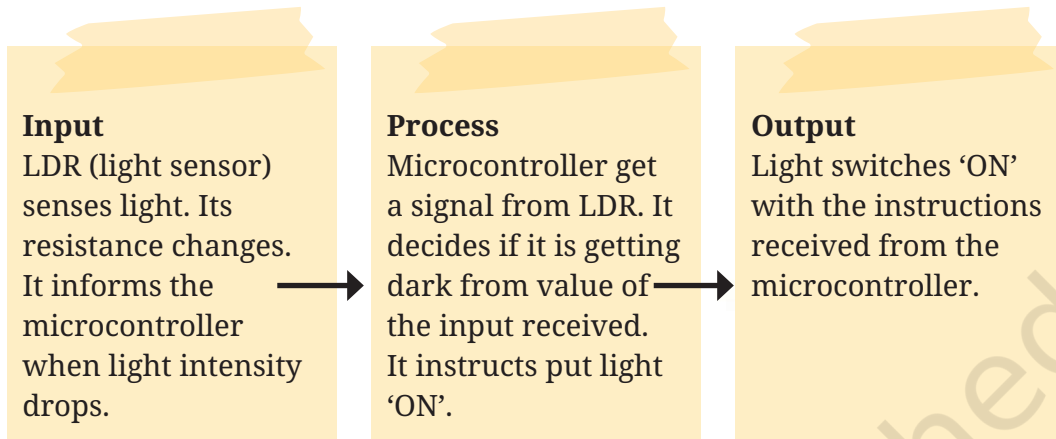


Figure 4.15: Some sensor modules (a), microcontroller (b), and motor toy (c)

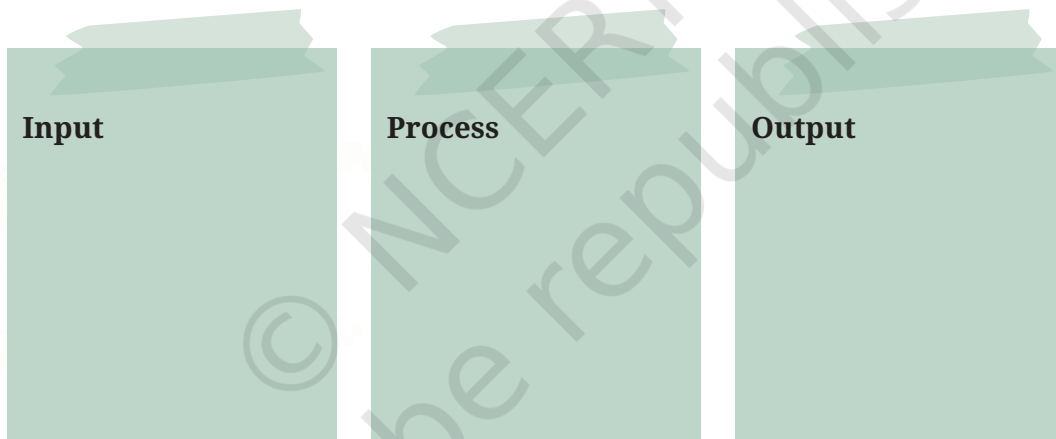


What can be the input, process and output for each digital device?  
One example for automatic street light is given below. Complete the details for water sprinkler and any device of your choice.

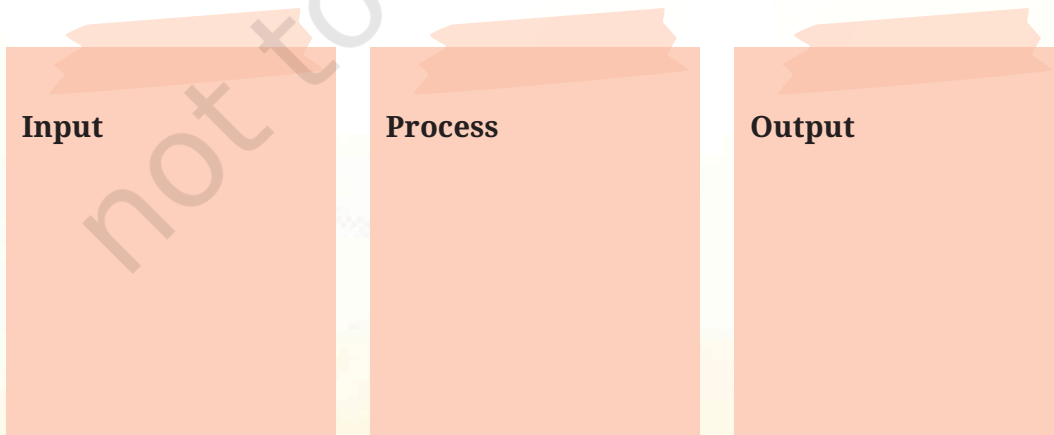
### Automatic Street Light



### Automatic Water Sprinkler System



### An Automation Device of Your Choice





You can search online for tutorials or circuits. You can use search keywords, 'Tutorial + automated + streetlight (or your Mobile/Laptop) + (Your microcontroller, for example – Arduino)'.

Now, make a small automation system using microcontrollers.

**Automation System:** Smart light system using a microcontroller.

**Function:** If some movement happens in the room, then the light will switch 'ON'.

**Microcontroller:** Arduino Uno

**Materials:** The microcontroller (Arduino Uno), PIR motion sensor, 5 mm LED, 220-ohm resistor, breadboard, jumper wires, USB cable, computer with Arduino IDE installed.

**Circuit Diagram:**



**Process:** Open the Arduino IDE and write/modify the code. Test the circuit.

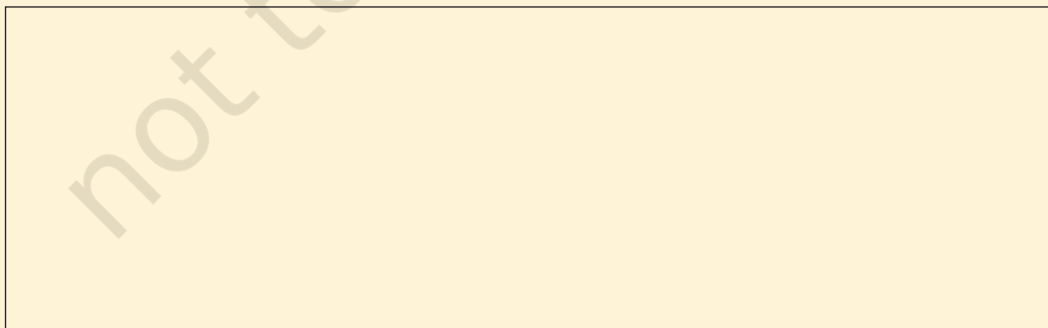
**Automation System:** .....

**Function:** .....

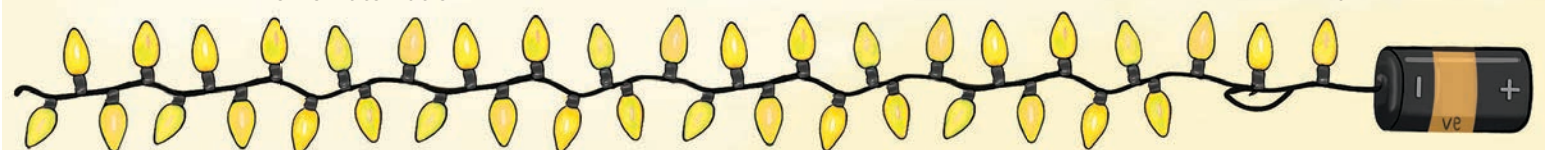
.....

**Microcontroller:** .....

**Circuit Diagram:**



**Process:** .....



Did your circuit work the first time? If not, please write down what you need to fix.

.....

.....

.....

### Activity 6: Make your own automation system using a microcontroller

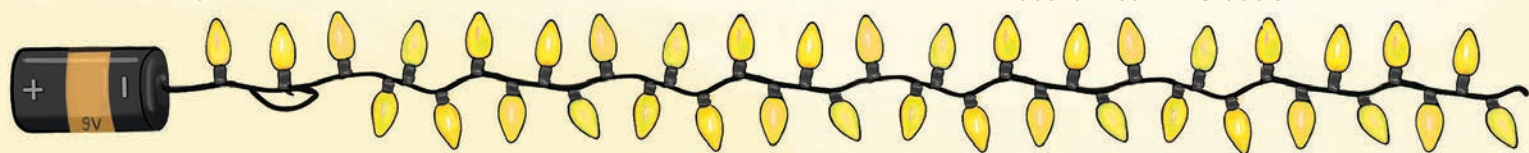
You have learned about microcontrollers, their connections and how they are connected with sensors and output devices. Use this knowledge and skills to make an automation system of your own.



Following are examples of few automation systems. You can search for their tutorial online by putting them in the 'search words'.

- Instructions + automatic plant watering system + using Arduino (or any microcontroller)
- DIY + automatic obstacle detecting system + using Arduino (or any microcontroller)
- DIY + beginners + automatic fire alarm system + using Arduino (or any microcontroller)
- DIY + automatic + gate opening system
- DIY + automatic + theft detection alarm system
- Instruction + smart fan + (or any microcontroller)

If not exactly, then you can get programme or instructions close to your application. You can take it as a reference and build on it to make programme for your application.



## Reflect on your learnings

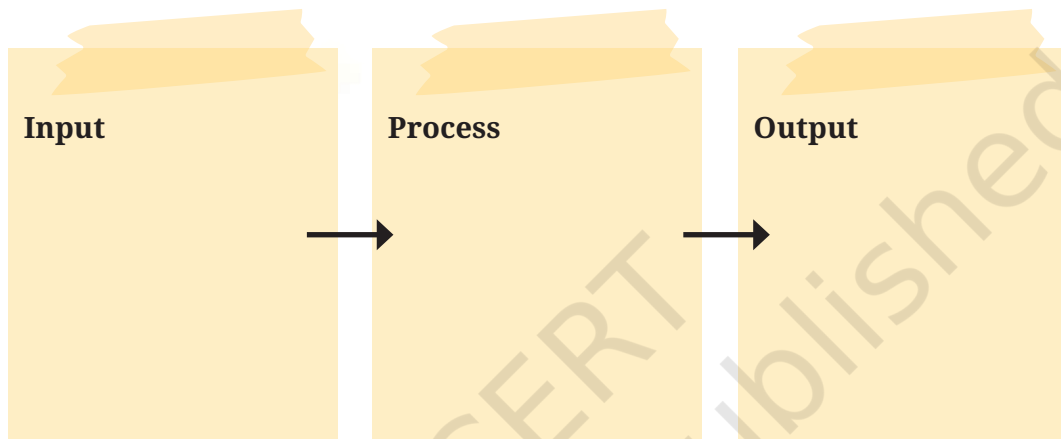
1. What automation system do you want to make? What is the process?

.....

.....

.....

2. Write about the Input, Process and Output of your project.



3. What are the materials required by the automation system?

.....

.....

.....

4. Did you modify the code received from other sources? Mention the site, the information you got, and the modification you made.

.....

.....

.....



5. Draw the block diagram/sketch/circuit of your automation system.



6. Did your automation system work as per the plan? If not, what are the reasons? What will you change next time?

.....

.....

.....

.....



### What did I learn from others?

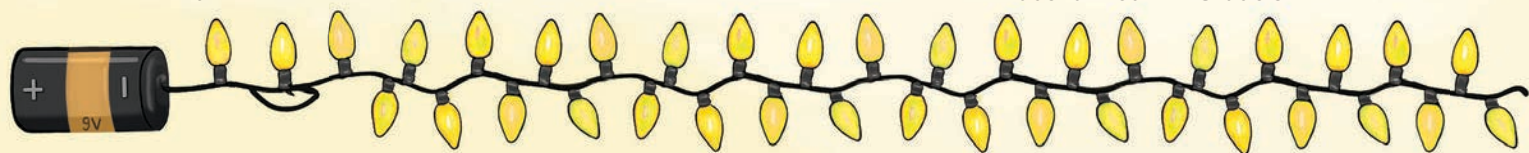
1. What are the precautions to be taken to protect the circuits from electricity fluctuations?

.....

.....

.....

.....



2. Did you take help from experts or peers? What are the three most important things you learned about home automation?

.....

.....

.....



### What did I do and how long did it take?

It is important to understand how much time is required for an activity to be completed.

Calculate the approximate number of hours you spent on each activity. Mark them on the timeline below. If you did more than the activities suggested in the book, please add the number and time taken.

| Activity             | 1   | 2   | 3   | 4   | 5   | 6   |
|----------------------|-----|-----|-----|-----|-----|-----|
| Time taken (Periods) | --- | --- | --- | --- | --- | --- |



### What else can I do?

So far, you have provided power supply through a computer USB port to the Arduino board. But to make circuits independent of the computer, you need to package them with batteries or power adapters. Arduino boards take power from the laptop/computer. To deploy your system in the field, you need to package it with batteries.

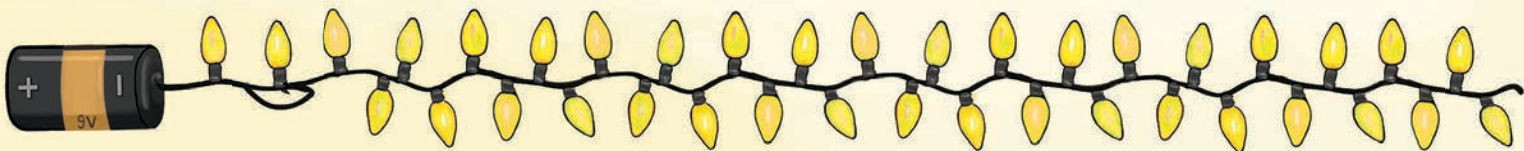
The Arduino board needs Lithium-Ion batteries. It also needs DC connector cables to connect the batteries to the Arduino board. You can make a casing using a 3D-printer or use any other available materials to make a suitable casing.





## Think and Answer

1. Did you enjoy doing this project?
2. What did you like, and what would you do differently next time?
3. Compare sensors and human sense organs. What can humans do with their senses that sensors cannot? What capabilities do humans have that automated systems do not? For example, can systems be designed to respond to human emotions.
4. Examples of jobs related to the work you did are automation engineer, technical support specialist, programmer, etc. What other jobs are related to the project? Look around, speak to people, and write your answer.



## Part 3

# Work in Human Services



Human Services are about serving people and interacting with them in different ways. Projects on Work in Human Services will help you learn how to work with people. You can take up projects related to taking care of your health and that of your family and others, you can make interesting videos and audio clips on various topics, or take up making a budget for your family, applying *Mehndi* on people's hands, or developing a comic book; it is up to you to imagine all that you can do with your peers.

Two examples of projects are given in this section, which are Water Audit for Water Management and Creating Advertisements. You must take up only one project. You can either choose one of these projects or you can design a project of your own choice with the help of your teacher.

## Project 5

# Water Audit for Water Management



0885CH05

A water audit is a systematic process through which data about water usage and wastage within a building or household is examined. This project is about collecting and analysing data using different tools for water audit.

*As part of the project, you will be able to:*

Collect data for tracking water use and wastage

Analyse data to estimate water use

Apply simple strategies to reduce water use and wastage

Use data to predict future needs for water



Figure 5.1: Carrying out a water audit in the community

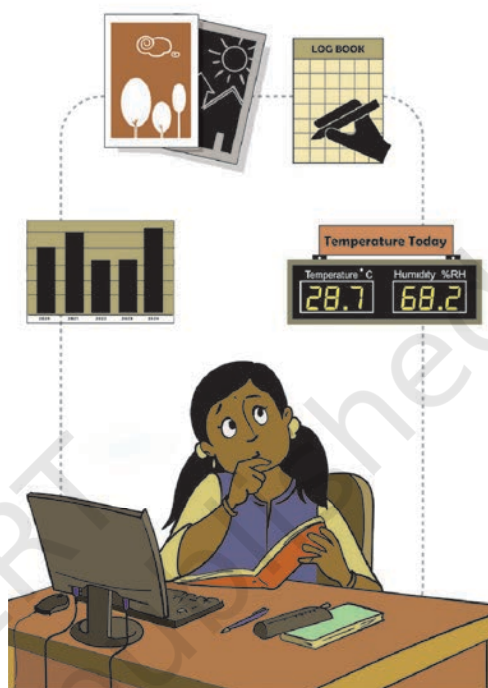
Have you ever wondered how the meteorological department predicts the arrival of the monsoon or warns us about upcoming cyclones, rainfall, heat waves, and snowstorms? They make these predictions based on past data, assuming that similar trends will continue.

Data is any information collected for a specific purpose in the form of facts, figures, photographs, videos, and so on (Figures 5.1 and 5.2). After collection, the data is organised so that we can interpret it and draw conclusions. For example, suppose we have data about temperature, humidity, and rainfall over a period of time. In that case, we can predict the chances of rain, given specific conditions of temperature and humidity.

Imagine a village where farmers usually grow crops that need water. However, if past data on temperature and humidity show that a particular summer will be hotter and the rains will arrive late, the weather forecast can help them plan better. Instead of planting the usual crops, they can either delay sowing or choose crops that need less water. This way, they can avoid losses and better use their resources.

In today's age of information technology, data is considered an essential asset since it provides crucial information to make informed decisions.

Data helps us in everyday life, for example, by estimating travel time or finding an allergy to some food in our diet. It enables government departments to plan water release schedules from dams, or prepare for traffic control during significant events.



**Figure 5.2:** Data is information in many forms collected for a specific purpose



In this project, you will collect data on water usage in your locality. You will conduct a water audit by systematically examining its uses and identifying sources of wastage. The data collected on water usage will be used to estimate water usage in different scenarios.

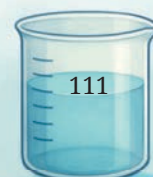
To get accurate results, the data collected has to be correct and authentic (e.g., if you are collecting data on red cars passing a traffic signal in one hour, then a car of any other colour will not be included), reliable (e.g., even if two people are collecting data on red cars, they must come up with the same data), and obtained by experiment or from a source that can be trusted (e.g., before data collection, observers decide the colour will be considered red). This process will also prepare you to analyse different kinds of data.

### **Water in India: A big challenge**

India has only four per cent of the world's freshwater but nearly eighteen per cent of the world's population. At the same time, water is not available equally everywhere in the country; some places face floods, while others experience droughts.

Droughts are often seen as natural disasters, but in reality, they are primarily caused by human activities, such as deforestation, poor agricultural practices, and over-extraction of groundwater. They are also due to mismanagement and misuse of water at the micro (household) and macro (district/state) levels.

Did you know that leaving a tap running for five minutes can waste 45 litres of water? Are we using our water carefully? Or are some of us using water irresponsibly and wasting others' share of water? Some people struggle to get water, depending on water tankers or walking long distances to fill a single bucket. At the same time, thousands of litres are wasted due to leaks and careless use.



The good news is that there are various people's initiatives for water conservation, such as rainwater harvesting, recycling water, restoration of water bodies, and so on. Several government efforts have also been initiated, including the *Jal Jeevan Mission* and *Jal Shakti Abhiyan*, to provide access to and conserve water through people's participation.



### What will I be able to do?

By the end of this project, you will be able to:

- Measure and calculate water availability, usage and wastage.
- Collect data on total water availability and trends in water consumption.
- Analyse and compare data related to water usage.
- Identify and implement practical ways to reduce water wastage.



### What will I need?

To do this project, you will need the following:

- A notebook and pen
- Measuring jar (to be replaced by an equivalent like a one litre bottle)
- Basic plumbing tools – wrench, spanner, pipes
- Bucket, mug
- Consumables for plumbing
- Stopwatch or timer (mobile app can be used)
- Survey form for asking questions (can be written or printed)
- Calculator (mobile calculator app can be used)
- Computer and connectivity for online research, data calculations and analysis; and use of digital spreadsheets and programming languages.





## How do I keep myself and others safe?

- **Handling Tools:** Use all tools, especially plumbing tools, carefully. Follow all safety precautions as prescribed for the use of tools.
- **Outdoor Safety:** Always take permission before entering someone's home or property for the survey. Be careful around slippery areas or water sources. Stay hydrated and avoid working in extreme heat.
- **Internet Safety:** Ask your teachers for help while using the Internet. Be careful not to upload or download anything; do not share your or anyone's personal information anywhere. Use data only from reliable sources, like Government Departments, websites and National Research Institutes.



## What do I need to know before I start?

To carry out a water audit, you need to know the water consumption in your community. For this, you need data. You will collect primary data related to water consumption in the community and secondary data related to the availability and supply of water.

### Primary and Secondary Data

Data that is collected first-hand is called primary data. It can be collected by survey, experimentation, interviews, observations – any method that involves direct collection of data. For example, the data you collect during your science experiments or while surveying the community for projects.

Secondary data is the data that is obtained from other reliable sources. For example, population data from government websites, water bodies in the region from government reports, area of a village from a government office, etc.



Once collected, you will need to tabulate the data. To do this, you can use tools, such as computer spreadsheets, to enter the data.

Before you start, you need to prepare for collecting water-related data. You need to decide about methods and units of water measurement.

### Activity 1: Water measurement methods

You have learned in Science about units of measurement of liquids. Water is measured in millilitres (mL) for small quantities, but litres (L) are more suitable for household use, and cubic metres ( $\text{m}^3$ ) for larger quantities, like municipal supply or water storage (Figure 5.3). One cubic metre of water equals 1,000 litres.

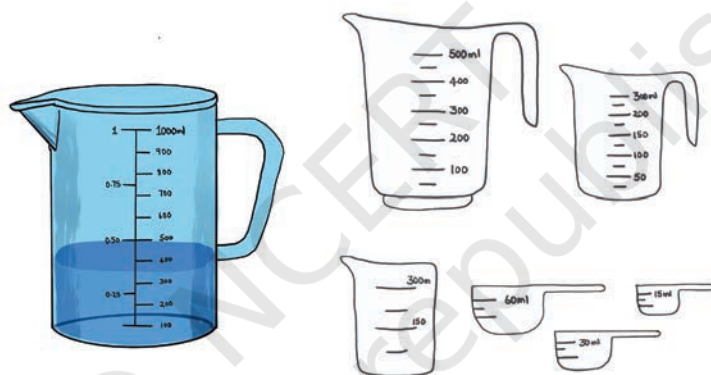
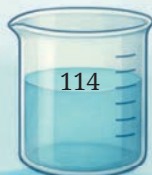


Figure 5.3: Graduated cylinders and cups for measuring water

Operating manuals of machines, such as washing machines and reverse osmosis (RO) water purifiers, provide you specifications of the amount of water they use of machines using water (e.g., washing machines and RO machines) indicate the amount of water consumed during their functioning. However, the challenge is to estimate the amount consumed while bathing, washing utensils, and so on.

Using tools like a graduated cylinder each time for recording observations is not convenient. Hence, we need to use common utensils (e.g., bottles, glass, etc.) to measure water usage in daily life. Generally, the amount of water in litres is printed on plastic



buckets or cans. If not, the amount of water stored in utensils in your home or school can be measured using any other utensil for which the storage capacity in litres is known (e.g., a 1 L bottle). This will help you collect data from people, for example, how many buckets of water they consume to wash clothes.

Calculate the water flow rate (measured in L/minute) for taps and showers. To measure the water flow from the tap, let it flow into a bucket for a minute. Measure the amount of water collected in the bucket.

Now, you can measure the amount of water consumed by noting how long a person keeps the tap running (when the tap is 'ON') while washing utensils. You can calculate the water consumed using the flow per minute you measured.

$$\text{Amount of water used} = \text{Water flow rate of the tap} \\ (\text{L per minute}) \times \text{Time tap is kept 'ON'}$$

Fill in the blanks for utensils at your home in Figure 5.4. You can substitute any object that is not used in your home.

|                      |                                                                                     |                                                                                      |                                                                                       |
|----------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Utensil              |  |  |  |
| Capacity/ Water flow | ____ L                                                                              | ____ L                                                                               | ____ L                                                                                |
| Utensil              |  |   |  |
| Capacity/Water flow  | ____ L                                                                              | ____ L per minute<br>(capacity of flush tank)                                        | ____ L per minute<br>(water flow)                                                     |

**Figure 5.4:** Using utensils to collect data on water usage

Applying this method, you can calculate the capacity and flow of any utensil or water tap/shower/water pipe in the house.

## Water storage capacity in the society

You can calculate the capacity of the big water tanks (Figure 5.5) in the locality by using the dimensions marked on them, calculating the volume and then converting it into litres. You can also talk to the water supply officer of your area to find out the quantity of water supplied to the society.



Figure 5.5: Water tanks store water and taps supply it to the community

## Reflect on your learnings

1. What is the water storage capacity of the water tank in your locality?

.....  
.....

2. How much water is supplied daily to your locality? (You can get this information from the local municipal corporation, *Gram Panchayat* office or water supply authority.)

.....  
.....  
.....

3. How many people use this water? (You need to know the population of the locality; you can get this information from the local municipal corporation, *Gram Panchayat* office or water supply authority.)

.....  
.....  
.....



## Sources of Water

Water received from rains comes to us through natural as well as manmade water sources – rivers, wells, borewell, tanks, etc. (Figure 5.6). It gets stored in big and small dams. Water from dams or storage tanks comes to us through canals, pipelines, etc. Knowing where your water comes to you and how much population is dependent on this water is necessary for your audit.



Figure 5.6: Mapping water sources in a locality

## Activity 2: Interview with an official of the water supply department

Usually, the water supply to our homes is managed through the *Gram Panchayat* office, Municipal Corporations, water supply department, ward office, and similar bodies. You can visit these offices to understand the water supply system of your locality. It is essential to prepare a list of questions before the visit. Some questions are given; please add or remove questions if you wish.

1. What is the source of water for our locality?  
.....  
.....  
.....
2. How much water does each household receive per day?  
What is the amount of water allotted per day per person?  
.....  
.....  
.....
3. Do you face any challenge in supplying sufficient water to all? What are those challenges?  
.....  
.....  
.....

4. How does rainwater contribute to water availability in your area? What efforts have been made to store rainwater for later use?

.....  
.....

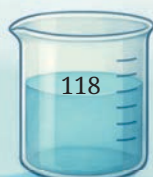
5. Are there any seasonal changes in water availability in the locality?

.....  
.....

6. Any suggestions for water management by individuals?

.....  
.....

7. Create a simple neighborhood map showing water sources, like wells, tanks, or water delivery points. Ask the official for help if needed.



By learning these basics, you will be better prepared to conduct the water audit and take actions. These activities will also help you understand the water situation around you more clearly.

### Activity 3: Estimating average consumption in a household

It may not be possible for you to collect data from each household in the locality. Therefore, you can select a few houses.

You can plan to collect data from a minimum of ten families. If you are working in a group of five students, this will collectively become data from 50 families. This will also help you understand water consumption in your home.

It will be convenient to record the data in your notebook. After returning to school, prepare a table in a spreadsheet on the computer. You can apply formulae in the spreadsheet. This will help you analyse data and present it in different forms, like graphs and pie charts. If you do not have a computer, you can make tables to enter data in your notebook, and use a calculator.

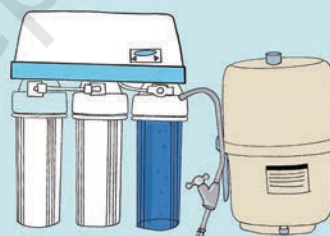


#### Did you know?



**Figure 5.7: (a) Washing machine**

(a) Washing machine consumes approximately 70 L per cycle. You can check online from the website of the manufacturer.



**Figure 5.7: (b) RO filter specifications indicate the amount of water used**

(b) RO water filter wastes approximately 3 L of water per every 1 L of treated water.

Table 5.1 contains a sample of a form you can use to collect data from the field. You can change it to suit your purpose or use it as it is.

**Table 5.1: Form to collect data on water usage from a family**

|                                                                                                                                                                                                                                                             |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Name of the family                                                                                                                                                                                                                                          |  |
| Number of people in the family                                                                                                                                                                                                                              |  |
| How much water is stored in the house in a day (e.g., one tank of 1000 L capacity, one earthen pot of 5 L capacity, one copper vessel of 15 L)?                                                                                                             |  |
| How much water does the family consume per day for washing clothes (e.g., water used in a washing machine, number of buckets used)?                                                                                                                         |  |
| How much water does the family consume per day for washing utensils (e.g., water flow of the tap and average time spent on washing utensils, buckets used)?                                                                                                 |  |
| How much water does the family consume for drinking and cooking (e.g., amount of water stored in bottles and average number of bottles used)?                                                                                                               |  |
| How much water does the family consume for bathing (e.g., buckets used the water flow of tap or shower and time used for bathing)?                                                                                                                          |  |
| Do they face any water shortage? How do they manage in case of water shortage?                                                                                                                                                                              |  |
| Do they have any machines/appliance that consume water? How much water is consumed by each of these appliances (e.g., washing machine/RO filter)?<br><i>Note: Not to be repeated if covered in questions related to washing clothes and drinking water.</i> |  |
| Any other use of water (e.g., for washing vehicles, in the garden)?                                                                                                                                                                                         |  |
| Do they have any other source of water (e.g., well/borewell/purchased water)?                                                                                                                                                                               |  |
| What do they do with the water if the stored water is not consumed on the same day? Do they recycle it or throw it away?                                                                                                                                    |  |



|                                                                         |  |
|-------------------------------------------------------------------------|--|
| Do they receive a water bill?                                           |  |
| If yes, how much is it generally?                                       |  |
| Is there any other observation concerning water availability and usage? |  |

The family will give you the estimates. You need to calculate the amount of water used in terms of the capacity of buckets, mugs, bottles, and so on. You will also need to calculate water flow from taps, showers, and water pipes in case of water usage for gardening for each home you visit.

If a person uses water from an overhead tank, you need to talk to them and estimate water usage based on their lifestyle. For example, taking a bath twice on a daily basis or washing two buckets of clothes daily.

Once you have collected the data, you must tabulate it in a spreadsheet or notebook. You can decide the categories for data based on water consumption for activities, like washing clothes, RO water use, car washing, and so on, based on your observations, information gathered and logical reasoning.

The accuracy of your analysis will depend on the primary data. Hence, it is necessary to maintain the ‘integrity’ of the data; it should be as accurate, reliable and consistent as possible. You may have collected some data that is not in the form of numbers. This cannot be used for the calculations. Tables 5.2 and 5.3 show examples of using formulae in Excel to analyse the data.

Table 5.2: Using formula in Excel to analyse data

| SUM    ▾    :    ✖    ✔ <i>fx</i> ▾    =SUM(C2:F2) |        |             |                   |                     |                                  |                                          |
|----------------------------------------------------|--------|-------------|-------------------|---------------------|----------------------------------|------------------------------------------|
|                                                    | A      | B           | C                 | D                   | E                                | F                                        |
|                                                    | Sr. No | Family name | Number of members | Bathing (in Liters) | Cooking and Drinking (in Liters) | Washing utensils and clothes (in Liters) |
| 1                                                  |        |             |                   |                     |                                  |                                          |
| 2                                                  | 1      | Goyal       | 6                 | 15                  | 6                                | 20                                       |
| 3                                                  | 2      | Mishra      |                   |                     |                                  |                                          |
| 4                                                  | 3      | Ray         |                   |                     |                                  |                                          |
| 5                                                  | 4      | Singh       |                   |                     |                                  |                                          |
| 6                                                  | 5      | Pathan      |                   |                     |                                  |                                          |
| 7                                                  | 6      | Kaif        |                   |                     |                                  |                                          |
| 8                                                  | 7      | Dutt        |                   |                     |                                  |                                          |

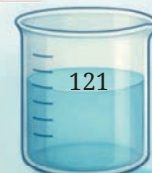


Table 5.3: Using formula in Excel to analyse data

|   |        | SUM         |                   |                     |                                  |                                          |                              |   |   |
|---|--------|-------------|-------------------|---------------------|----------------------------------|------------------------------------------|------------------------------|---|---|
|   |        | =SUM(C2:F2) |                   |                     |                                  |                                          |                              |   |   |
|   | A      | B           | C                 | D                   | E                                | F                                        | G                            | H | I |
|   |        |             | Number of members | Bathing (in Liters) | Cooking and Drinking (in Liters) | Washing utensils and clothes (in Liters) | Total (in Liters)            |   |   |
| 1 | Sr. No | Family name |                   |                     |                                  |                                          |                              |   |   |
| 2 | 1      | Goyal       | 6                 | 15                  | 6                                | 20                                       | =SUM(C2:F2)                  |   |   |
| 3 | 2      | Mishra      | 5                 | 15                  | 6                                | 18                                       | SUM(number1, [number2], ...) |   |   |
| 4 | 3      | Ray         | 4                 | 14                  | 5                                | 15                                       | 38                           |   |   |
| 5 | 4      | Singh       | 5                 | 16                  | 5                                | 16                                       | 42                           |   |   |
| 6 | 5      | Pathan      | 3                 | 14                  | 4                                | 12                                       | 33                           |   |   |
| 7 | 6      | Kaif        | 4                 | 14                  | 5                                | 16                                       | 39                           |   |   |

Can you find out the average consumption per person from your data?

**Hint:** When you divide values in the G column from those in the C column, Excel will answer you automatically.

To add the total, you can use formulae like “= Sum(A1:A5)” in MS Excel. Explore other formulae by searching online or asking your teacher. You can add, subtract, divide, and multiply using formulae to save time. However, a calculator is as effective!

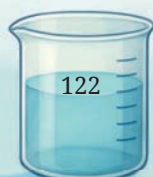
All the data is to be recorded in litres only.

- Find out the average consumption per person from your data. You can use the formulae in a spreadsheet.

.....  
 .....  
 .....

- Are there any families that are consuming more water than average? If yes, what is the reason?

.....  
 .....  
 .....



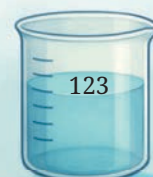
#### Activity 4: Rainwater availability in your district/town/village/ward (secondary data collection)

When you obtain data from other sources, it is called secondary data. As mentioned earlier, you must use the information from a reliable source – a government website or report, or officials working in the Municipal Corporation/*Gram Panchayat* or water supply office. You must also reference the site or document. This activity will help you learn how to estimate the rainwater available in a geographical area using secondary data.

Use Table 5.4 to record the findings of your survey (it contains an example).

**Table 5.4: Recording data to estimate rainwater availability**

| Examples                                                                                                                                                                                                                                                                                                        | About your district/town/village/ward | Reference/source of information | What does the data tells us?                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------|-------------------------------------------------|
| Population: District/Town / Village/Ward For example, Pune District: 9,429,408                                                                                                                                                                                                                                  |                                       |                                 | Number of people dependent on water sources     |
| Area of District/Town: For example, Pune District: 15,643 square km                                                                                                                                                                                                                                             |                                       |                                 | Area that will receive rainfall                 |
| Rainfall of the district in the year<br>For Pune District rainfall in 2023: 446 mm ~ 0.446m                                                                                                                                                                                                                     |                                       |                                 | Rainwater availability                          |
| Total water availability: Area in $\text{m}^2 \times \text{Rainfall in m}$ ( $1 \text{ m}^3 = 1000 \text{ L}$ ; $1 \text{ km}^2 = 1000000 \text{ m}^2$ )<br>Total water availability in Pune District: $15643 \times 10^6 \times 0.446 = 6977 \times 10^6 \text{ m}^3 = 6977 \times 10^6 \times 1000 \text{ L}$ | Calculation:                          |                                 | Water received in the district through rainfall |



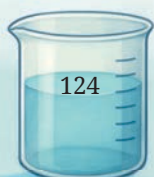
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------------------------------|
| <p>Generally, 70% of total rainwater is required for agriculture (including farm animals), 20% for industry and 10% for domestic consumption. On the basis of this, rainwater available for consumption your district.</p> <p>For example, rainwater available for domestic use in Pune District=<math>6977 \times 10^6 \times 1000 \times 0.1 = 697.7 \times 10^6 \text{ L} \times 1000</math></p> <p>Per capita rainwater availability = <math>697.7 \times 10^6 \times 1000/9,429,408 = 73,991 \text{ L}</math></p> <p>Per day rainwater availability per person = 202 L/day</p> | <p>Calculation:</p> | <p>Rainwater available for different purposes</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------------------------------------|

The above information will help you understand rainwater availability, usage and scarcity in your geography.

Calculating water availability based on a district's geography and rainfall may not give you an accurate picture. All rainwater flows into rivers. The entire population, from the origin of the river up to the point where the river meets the sea, depends on river water. Some of these areas have high rainfall, and some have less rainfall. However, the water in the river basin belongs to the entire population.

### Activity 5: Compare and analyse the data

The data speaks for itself. What did your data say? Table 5.5 will help you compare the average consumption versus the prescribed consumption. You may recall that you estimated average consumption in Activity 3.





Suppose you want to refer to secondary data. The person who is listening to you, or reading a report you have written, must know where the data is from so that they can refer to it. They would also like to be assured that the data is reliable. Since data keeps on changing (e.g., population numbers change, climatic parameters change), you must mention the year the data was reported. In which case, for example, you will say/write as follow:

The Government of India, through *Jal Jeevan Mission*, is trying to provide 55 L of tap water per day for rural populations. This secondary data has been obtained from a release of the Press Information Bureau of India dated 14 Aug 2024, which is available on the website: <https://pib.gov.in/PressNoteDetails.aspx?NoteId=152025&ModuleId=3&reg=3&lang=1>

If you are giving information from a book or report, then you must mention the name of the book or title of the report, and who has published it and in which year (this information is available in the first few pages of the book/report).

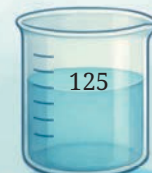
Now, try to obtain data from similar reliable sources. You can search the library, newspaper reports, magazines and publications to get the data. Alternatively, use online search with following key words:

- Rainfall + Year + *name of district*
- Population + *name of the district* + census
- Water availability per person + *name of the district*
- Ministry of Statistics + Govt of India + Water
- NITI Aayog + water report

**Table 5.5: Record of average consumption versus prescribed consumption**

| Average consumption per person per day (primary data) | Water available per person per day as per secondary data (calculations done by you) | Prescribed usage per person by <i>Jal Jeevan Mission</i> *      |
|-------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------|
|                                                       |                                                                                     | 55 L per day for rural areas and 135 L per day for urban areas. |

*\*This is the prescribed usage in 2025; you can look up the prescribed consumption on the Ministry of Jal Shakti website.*



Water availability can be increased in the following ways:  
i) planting trees; ii) reducing pollution to increase rainfall;  
iii) reducing wastage of water; iv) recycling water and  
v) water conservation methods like rainwater harvesting.

### Activity 6: Identify wastage points and amount of wastewater

This activity involves inspecting areas where water is wasted, such as leaking taps or overflowing tanks. You can focus on areas that need immediate attention by identifying wastage points. Often, leakages need a little attention to fix them.

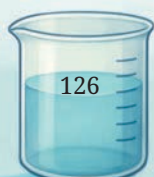
Inspect common areas where water gets wasted, such as taps in your school or home, pipelines, or overhead tanks. Look for signs, like dripping taps (Figure 5.8), wet patches under pipes, or overflowing tanks. Record your findings in a notebook. Note down the location and type of problem. You can record the wastage of water by using a bucket and a stopwatch.

1. Start the stopwatch when water starts to waste.
2. Stop it when the wastage ends.
3. Note the time duration.
4. Repeat the process. You can calculate the volume also.

Now, share your observations. You can take simple steps to reduce wastage (Figure 5.9).



Figure 5.8: Recording wastage of water due to a dripping tap



**1. Fixing a leaking tap:** Start with easy solutions, like tightening the tap and changing the washer. You can invite a local plumber to learn about the tap mechanism and tools like plumber tape and wrench. You will have to turn the water mains off before you start work.



Using a spanner, take off the tap's cover to remove the handle. You will probably find this under the hot or cold sign.



Undo the screw and remove the handle. If the tap has a metal cover, unscrew it by hand, or use a wrench or tap spanner.



Unscrew the tap bonnet, and completely remove the headgear. You should see a large body washer, o-ring and jumper valve. The jumper valve should fall out.

Replace the body washer, the o-ring and the jumper valve with new parts. Apply a tap lubricant to the spindle and valve for better sealing and smoother tap operation.



Refit the bonnet and spindle. Be careful not to over-tighten the nuts.



Put the tap back together, turn it off, and turn the water back on. Now, check the tap to make sure it is no longer leaking. Now, you can step back and admire the proper job done, knowing you are not wasting a drop.

**Figure 5.9:** Steps to fix a leaking tap

- 5. Reduce the use of water:** Most of us have a habit of opening the tap at full throttle. You can restrict the water flow per minute by using aerators or flow caps available in the market. You can also simply open the tap partially when using water (Figure 5.10).



**Figure 5.10:** Comparison of water flow with and without flow cap and aerator

### Groundwater recharge

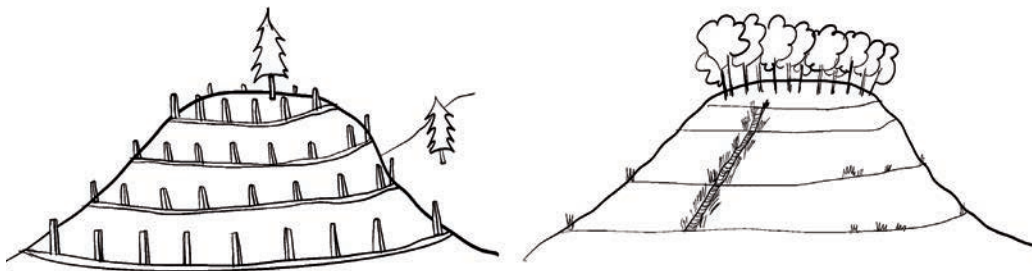
You have learnt about groundwater in Science. As you know, well water and borewell water are essential water sources. One advantage of storing water underground is that evaporation losses are minimal.

Unfortunately, due to uncontrolled groundwater extraction, water levels are depleting alarmingly. While many efforts are being made through various water conservation programmes, there are efforts that communities can make to help rainwater percolate into the ground. You can participate as volunteers in programmes around you.

The basic principles of water conservation and an example of how they can be applied are:

- 1. To hold the water in the field:** This can be done by making contour bunds on the ground (Figure 5.11). Contours are lines connecting points at equal elevation. Bunds, made up of earth to prevent water from running off the slope, on contour lines hold the water at the same level. This also helps in reducing soil erosion.





**Figure 5.11:** Contour lines hold the water at the same level

2. **To reduce the speed of runoff water from the field:** A small check dam can be built on the water stream (Figure 5.12).



**Figure 5.12:** Check dam on a water stream used for irrigating fields

3. **To let the water percolate inside the ground:** This can be done by making a percolation tank, dam, borewell recharge, etc. (Figure 5.13).



**Figure 5.13:** Percolation tank for groundwater recharge

## Activity 7: Reusing water

When we use water for cleaning, bathing, and other activities, it gets contaminated with dirt, oil particles, and other impurities. It is possible to reuse the water by removing impurities. When water flows through the river, weeds like hyacinth absorb minerals that are mixed into water; oxygen mixed in water decomposes organic matter; and sunlight kills harmful bacteria. Through these natural processes, river water becomes clean when it flows.

Wastewater from domestic use, like wastewater from sinks, baths, washing machines, and kitchens, is called greywater. Instead of letting this water go to waste, it can be reused for some purposes, such as irrigation, cleaning, or even groundwater recharge. As a part of our efforts to reuse water, you can try any of the following greywater recycling systems:

- 1. Wastewater from washing vegetables or cooking is used to water plants:** Runoff water from a hand pump or a washing sink (to ensure the water is not too soapy) can be used to water the kitchen garden (Figure 5.14).



**Figure 5.14:** Using left over water for watering plants



Grey water can be used for flushing toilets.  
You can search online with the following keywords:

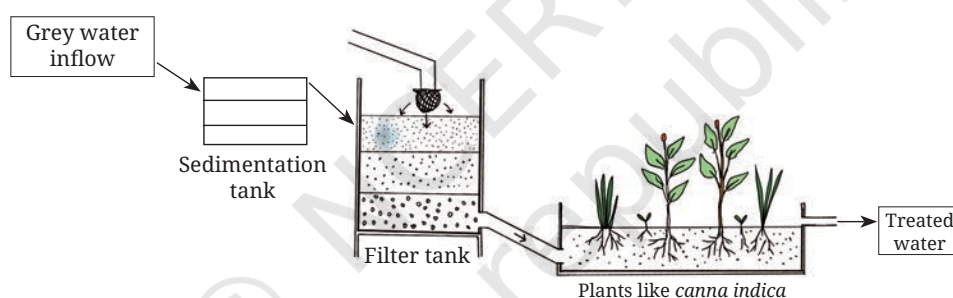
- DIY + grey water system + Indian toilet
- DIY + grey water system + toilet flush



**2. Installing a reed bed grey water system at your school, or visiting a grey water recycling system:** You can make a reed bed system for wastewater from your school (Figure 5.15 and 5.16). This follows a natural filtration mechanism. Grey water is collected in a tank to settle the suspended particles. This is called the sedimentation tank. Water from the sedimentation tank passes through the roots of plants, like *Canna indica*, *Colocasia*, and many other local water loving-plants, which absorb the organic pollutants and heavy metals (Figure 5.16).



**Figure 5.15:** Reed bed setup



**Figure 5.16:** Reed bed system for reusing wastewater



You can search on the Internet using the keywords:

- 'DIY + grey water system'
- 'Grey water system treatment + design'

## Reflect on your learnings

On the basis of the water-saving activities (reducing consumption/ reusing water) carried out in school, answer the following questions:

1. What initiative have you taken to reduce water usage?  
.....  
.....
2. Write down details of the activity you carried out.  
.....  
.....
3. Amount of water saved per day (estimated).  
.....  
.....

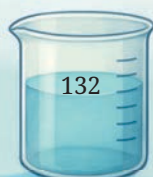
### Activity 8: Estimate future water requirement

You have used primary data to estimate average consumption of water. You have used secondary data to learn about water availability in your locality. You are now ready to estimate future water requirements in different scenarios. Respond to the questions in Table 5.6 and 5.7.

1. What is the increase in the demand for water if a housing society of 100 homes is constructed near your village? You can estimate four people per family.

Table 5.6: Record of data on increased demand in scenario 1

| S. No. | Number of families | Total number of members in the family | Average consumption per family | Total increase in consumption | Increase in overall consumption in your locality |
|--------|--------------------|---------------------------------------|--------------------------------|-------------------------------|--------------------------------------------------|
| 1.     |                    |                                       |                                |                               |                                                  |



2. What will be their water requirement if a college hostel has one thousand students?

Table 5.7: Record of data on increased demand in scenario 2

| S. No. | Number of additional consumers of water | Average consumption per person | Total increase in consumption | Increase in overall consumption in your locality |
|--------|-----------------------------------------|--------------------------------|-------------------------------|--------------------------------------------------|
| 1.     |                                         |                                |                               |                                                  |



### What did I learn from others?

Identify what you learned during field trips, online and offline interactions with experts, family and friends, community members, and other sources.

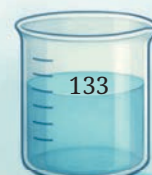
1. Name any one thing that you found surprising where use of water is concerned.
2. Write any three things you learnt that will help you save water in your life.



### What did I do and how long did it take?

It is important to understand how much time is required for an activity to be completed.

Calculate the approximate number of hours you spent on each activity. Mark them on the timeline below. If you did more than the activities suggested in the book, please add the number and time taken.





## What else can I do?

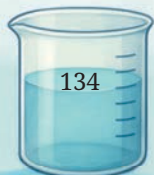
After finishing your project, here's what you can do next:

1. You can use computer programming to write a programme to help users estimate water requirements and consumption patterns.
2. You can write a letter to government officials informing them of your findings and suggestions, like promoting grey water for the garden, fixing leakage taps, or recharging the borewell near the hand pump or rainwater harvesting.
3. As you did a water audit, you can also carry out a grocery, food waste in the kitchen or electricity audit.
4. Study about a solar water tank that stores hot water heated by solar thermal collectors. Also, study how it is being used for residential and commercial purposes.



## Think and Answer

1. Did you enjoy doing this project?
2. What did you like, and what would you do differently next time?
3. Using a map, trace the path of the river closest to your locality. Look at the adjoining districts the river path passes through in your state. Identify those dependent on the river. Which areas are drought-prone or have surplus rain? Are there any dams on the river? How do you think the river impacts people's lives?
4. Examples of jobs related to the work you did are environmental scientist, environmental engineer, industry professional, social worker, auditor, etc. What other jobs are related to the project? Look around, speak to people, and write your answer.



## Project 6

# Creating Advertisements



0885CH06

Advertisements persuade people to take specific actions related to a social cause or to pay for a product or service. This project will help you design and make an advertisement for a small business in your locality.

*As a part of the project, you will be able to:*

Explore  
different  
kinds of  
advertisements

Identify  
elements  
of an  
advertisement

Plan and  
prepare an  
advertisement

Design and  
make the  
advertisement



**Figure 6.1:** Advertisements are creative and fun ways of communicating messages

You have learnt about markets and their functioning in Social Science in the chapter on ‘Understanding Markets’ in Grade 7. You know that a critical part of the chain is ensuring that sellers can reach buyers. Advertising plays a very important role in completing this part of the chain. However, the role of advertising is not limited to simply selling a product or service; it is also a means of communicating important social messages.

Remember how you heard about a film that you wanted to see, a place you wanted to visit, something you wanted to eat or buy, just anything you wanted to do. Also, think about how you heard about campaigns, like the *Swachh Bharat Mission* or the polio vaccination drive. There are various ways of hearing about things from friends, family, books, magazines, newspapers, and social media—the list is long. Among this list are ‘advertisements’.

Advertisements are meant to persuade you to do something. For example, a board outside a small shop describing its products is intended to tempt you to enter; sometimes, this job is done by persons outside the shop loudly describing their products. Another example is posters or clips on television or radio that urge citizens to keep their surroundings clean, to vaccinate themselves and their children, or to avail different services provided by the government, such as small savings schemes. Thus, advertising can be of two broad varieties—commercial and social, depending on the message conveyed.



### Did you know?

The first few newspaper advertisements in India appeared in 1780 in the Bengal Gazette.

In 1780, the first English language newspaper in India was published from Kolkata, known as *Bengal Gazette*. It was founded and edited by James Augustus Hicky. The Bengal Gazette was popularly referred to as Hicky’s Bengal Gazette. Figure 6.2 shows an advertisement for the well-known local hair oil ‘Jabakusum,’ which was published in the newspaper.



Figure 6.2: An advertisement from late 18th century



Historically, India had a system of informers who used to announce important messages by beating drums or *dhindora*, a practice popularly known as '*Dhindhora Pitna*' in Hindi (Figure 6.3). Also called town criers, they would act as advertisers, announcing important messages in villages and informing people of the arrival of merchants and the goods they were carrying. This practice is similar to that of a person announcing events or promoting products/services using with a loudspeaker, moving around the city on a bike, auto rickshaw or jeep.



**Figure 6.3:** Using a drum to draw attention and providing information

Some of these practices continue to date, for example, door-to-door vendors use bells or shout out phrases to inform people of their arrival and the goods they offer. You may have also seen hand-painted signboards and murals conveying promotional messages in marketplaces (Figure 6.4). Street performances like '*nukkad natak*' (street plays) and folk songs also increase awareness about products and services, and communicate social messages.

However, even today, many people rely on word-of-mouth advertising, especially owners of small businesses that run out of homes or workshops, small retail shops and street vendors. For example, people from a town you visit will tell you—'Buy sweets from this shop, mangoes from that, and traditional crafts from there'. Community gatherings and events during festivals (e.g., *melas* or fairs organised for the sale of different products) are also used to advertise products and services so that word-of-mouth advertising spreads. However, word-of-mouth advertising does not always work and is usually limited to a specific locality. Suppose someone can offer products and/or services distant from their immediate locality. In that case, they should be able to reach more people and get the opportunity to state exactly what is unique about their product and why people should prefer it over other products.





**Figure 6.4:** Hoardings for advertisement in market place

While various media have been used for advertising, ranging from hoardings, flyers, brochures, and mass-messaging tools like radio and television, social media platforms have become popular for advertising products and services.

This project will help you explore how advertisements are made. You will design an advertisement to convey messages about products and services offered by local businesses that are an integral part of our culture and economy, for example, bakeries, tailors, *diya* sellers, bamboo craftsmen, and so on, to the larger community.



### What will I be able to do?

By the end of this project, you will be able to:

1. Identify key elements of an advertisement.
2. Identify key selling points of a product or service.
3. Design and make an advertisement to sell a product/service.



### What will I need?

To complete this project, you will need:

1. Stationery material, including basic art supplies, such as chart paper, markers, and glue for creating posters.
2. Computer/tablet with Internet connectivity.
3. Camera for capturing images and videos; if not available, you can borrow a smartphone from a teacher or parent.





## How do I keep myself and others safe?

To ensure your safety and the safety of others while working on this project, you should:

1. Always inform a parent, guardian, or teacher before visiting a small business, and choose public and well-lit areas for interviews and interactions.
2. Respect the privacy and consent of small business owners when taking pictures or recording videos.
3. Be mindful of cultural sensitivities, and show respect towards the small business owners and their work.
4. Ethical advertising – It includes truthfulness, fairness and should be socially responsible. You should take care of the following:

- (a) **Copyright:** Ensure that you use original content, or if using someone else's work (images, music, text), obtain permissions. Do not simply copy content from the Internet without mentioning the source. The process of copying content as such is called plagiarism.
- (b) **Fake Advertising:** Never make false claims about a product or service. Your advertisement should reflect the real features and benefits of the product.
- (c) **Cultural and Gender Sensitivity:** Avoid stereotypes or offensive content.



**Internet Safety:** Ask your teachers for help while using the Internet. Be careful not to upload or download anything without permission; and do not share personal information anywhere.



## What do I need to know before I start?

Advertising is not just about selling a product or communicating a social message. The key elements of advertisements are storytelling, creating connections, and making an impact.

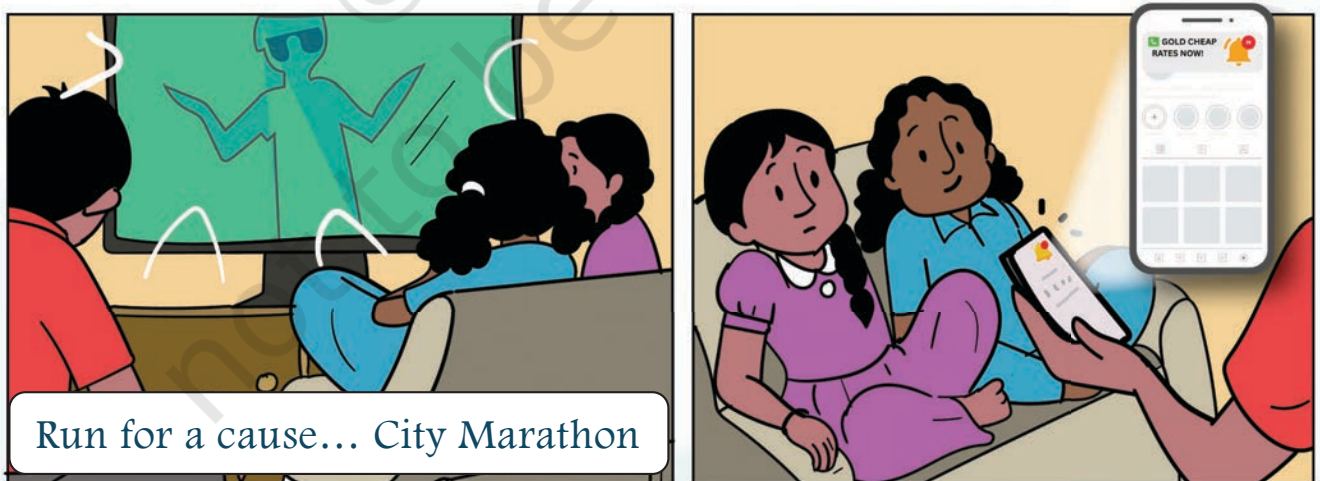
Before you start designing and making your advertisements, you must understand the key elements of advertisements.



## Activity 1: Understanding types of advertisements

Meet Ruchi who lives with her grandparents, parents, and a younger sibling. Her best friend is Priti, whom she plans to visit today. The comic below shows how often Ruchi is exposed to advertisements in different mediums.





You saw a day in the life of Ruchi. How many advertisements could you identify in the description of Ruchi's day?



Categorise them in Table 6.1, also include examples of advertisements you see frequently in each of the categories.

**Table 6.1: Record of examples of different categories of advertisements**

| Kinds of advertisement                                                                                | Examples |
|-------------------------------------------------------------------------------------------------------|----------|
| Print (e.g., using newspapers, flyers, magazines)                                                     |          |
| Social media (e.g., using social media platforms, e.g., Facebook, Instagram, X etc.)                  |          |
| Advertising using radio, and television                                                               |          |
| Outdoor advertising (e.g., displays on buildings, vehicles and public transport; billboards, posters) |          |
|                                                                                                       |          |

Can you count the number of advertisements you saw/heard today? Thus, we are surrounded by advertisements. Most of them have an impact on our choices in day-to-day life. Sometimes, we are not even aware of the influence advertisements have on us.

### Activity 2: Elements comprising advertisements

Before beginning to explore how advertisements are made, an important question is—how do advertisements influence us? Sometimes we are even persuaded to do something against our will (e.g., taking a COVID-19 vaccine even though most of us are afraid of needles)? And why do some advertisements become so much a part of our everyday life that we even start associating some things with them (e.g., we think of a product as soon as we hear a jingle)?

Advertisements are deliberately designed to be attractive and pleasing, thus enabling people to build associations. There is also an attempt to ensure people associate the product or service with a specific visual or phrase. This activity will help you explore the essential elements that make-up advertisements.



## Logos and Taglines/slogans

A logo is a visual element, often a symbol or a combination of words and images, used to represent a brand or product. A tagline is a short memorable phrase that represents a brand or product.

Most often, logos and taglines/slogans are used across different advertisements of the same organisation or campaign to help people associate the products/services with them. For example, the logo of the polio vaccine campaign is shown in Figure 6.5. Note the change of tagline/slogans, while the logo remains the same.



Figure 6.5: Advertisement for polio vaccine campaign in different languages.

Creating a recognisable logo and using the same or similar tagline is part of 'branding', which can be understood as creating a unique identity for a product or service.

Think of advertisements you have seen, and respond to the following questions:

1. Which logo and tagline/slogan do you like and why?

.....  
.....

2. How many words does a tagline/slogan have?

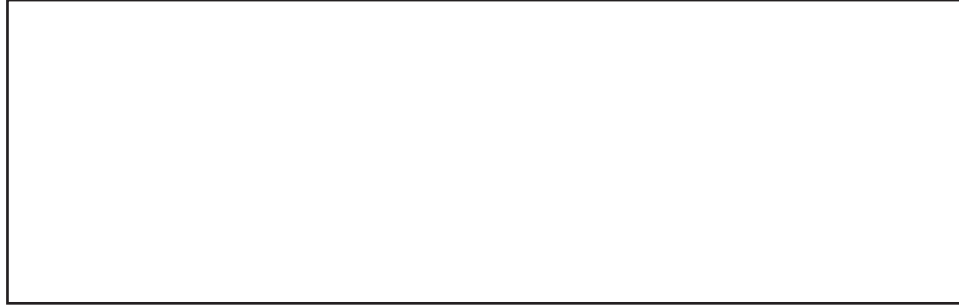
.....  
.....

3. Write your favourite product's tagline/slogan in the space below. Why do you like this tagline/slogan?

.....  
.....



4. Draw the logo in the space below—whatever you like or remember.



## Visuals

Advertisements are generally eye-catching, colourful and attractive. Look at Figure 6.6—what are the visual elements you can see?

You must have also noted that text is kept to a minimum (usually limited to taglines and slogans) and placed with care (e.g., text is distributed across the advertisement, and most of the visuals are visible)—this is also part of the visual design of advertisements.



Figure 6.6: Visual elements of an advertisement

Think of the advertisements you like, and respond to the following questions:



1. Which visual elements can you identify (e.g., human or animal figures, shapes, colour scheme, logo design, font used, change in light in case of a video, shadows)?

.....  
.....

2. Do the visuals convey a 'mood'? For example, happy, excited, adventurous, etc. If yes, how (e.g., location, expression of people, backdrop, colours)?

.....  
.....

3. Draw the visual elements from your favourite advertisement. What do you find interesting about these elements?



.....  
.....

### **Audio and Audio-Video advertisements: Music and jingles, and duration**

Audio (e.g., on radio) or audio-video (e.g., on television, social media) advertisements are usually accompanied by striking music. Sometimes, jingles (short, catchy rhymes) are used to describe the brand in a catchy manner.

Just as a single poster can be used to advertise a product/service, the time used in audio-video advertising is short. This is because the person listening/seeing the advertisement does not get bored. You may even get irritated if the advertisement interrupts you while watching a film or a match.



Since time is short, it becomes essential that the logo, visuals, and jingle be created carefully.

Listen to any advertisement on the radio or see it on the television:

1. How long was the advertisement (note the time it starts and when it ends)?

.....

.....

.....

2. Was the time sufficient for you to understand the message of the advertisement?

.....

3. How would you describe the music and the jingles? For example, do they make you feel good, is it catchy and upbeat, or is it dramatic and makes you want to know what comes next?

.....

.....

.....

4. Does the advertisement have any dialogue? What do you think is the purpose of the dialogue?

.....

.....

.....

5. Write the jingles and play the music using the desk, pencil boxes, pencils, and any other 'instruments' you find.

.....

.....

.....



## Connect to emotions

We tend to recall what touches our emotions—hence, advertisements are designed to connect to people’s emotions (Figure 6.7 and 6.8).



Figure 6.7: Advertisement designed to inspire young people to join the army



Figure 6.8: Advertisement that reminds us of road safety by emphasising that life is precious

Think of at least two of your favourite advertisements and respond to the following:

1. What is the ‘story’ in these advertisements? For example, are they about families, about people helping each other, or are they about friends? Do they introduce an interesting story about people? Do they make you aspire for something?

.....  
.....



## Call to action

Every advertisement is meant to persuade people to do something. For example, some advertisements ask people to buy something, or do something for themselves or others. The call to action in advertisement ‘tells’ the audience what they are expected to do after seeing the advertisement (Figure 6.9).



Figure 6.9: Advertisements that inspire people to act, to go and cast their vote

## Reflect on your learnings

Think of at least two of your favourite advertisements and respond to the following:

1. What is the call to action given by these advertisements? How is this call to action conveyed to you? Do both advertisements use the same or different strategies?

.....

.....



In the advertisement below (Figure 6.10), identify the elements discussed so far: logo and tagline/slogan, visuals, connect to emotion, and call to action. Do you agree with the labeling? If not, discuss why?



Figure 6.10: An advertisement with different messages

### Activity 3: Meeting an expert

You have explored advertisements on your own. It is time to meet an expert and learn more about advertisements.

Invite an expert from the field of advertising or marketing. This could be (i) a shopkeeper who is advertising in your neighbourhood by distributing pamphlets, putting up exhibitions, organising sales, etc.; (ii) a person who designs billboards and boards for shops; (iii) a teacher from a management and business school; or (iv) someone who works in advertising. Discuss what you have learnt with them? A few questions you can ask them are given below – these are examples; please add them to the list (or remove any questions you don't want to ask).

1. What, in your opinion, makes an advertisement interesting and easy to remember?

.....  
 .....



2. Why is so much money spent on advertisements? What is the effect of advertisements on audiences? Please give some examples.

.....  
.....  
.....

3. How is the medium for advertising chosen (e.g., print, radio, television, social media)?

.....  
.....  
.....

4. What are the disadvantages or issues with advertisements?

.....  
.....  
.....

#### Activity 4: Identification of client

To design and make an advertisement, a ‘client’ is needed. To identify a client, you must first list small businesses around the school—they may even be ‘in’ the school (e.g., a school, a stationery shop or a small outlet of a bank inside the school).

Once you have prepared this list, you need to decide amongst yourselves which group will approach which businesses. Follow the steps below to initiate the work towards developing an advertisement.

**Step 1:** Speak to classmates, teachers, and neighbours to identify local small business, such as bakers, tailors, *diya sellers*, toy makers, bamboo product makers, hairdressers, fruit and vegetable sellers, and so on near your school.



**Step 2:** Prepare a questionnaire for the prospective small business before meeting them. Please note:

- Before asking questions, greet them and provide a brief explanation of what you are trying to do. Request them to spare 20–30 minutes to interact with you. Visit with your teacher, parents, neighbour or any known adult with a rapport with the business owner.
- Before you dive into the questions, ensure that each member of the group has been introduced.

A few questions are given below—please add/change these questions as you wish.

1. What is the name of your chosen business, and what do they sell?

.....

.....

.....

2. Mention 2–3 reasons why you have selected this business.

.....

.....

.....

3. Has the selected business accepted the proposal for the marketing campaign? (Yes / No)

.....

If yes, write a simple contract with the business owner—both the owner and the entire group will have to sign the agreement. You can refer to the sample of the contract format in the box given in the following.



## Contract

I, \_\_\_\_\_ (name of the owner) owner of/profession \_\_\_\_\_, hereby mutually agree to work with Grade 8 students from \_\_\_\_\_ school situated at \_\_\_\_\_ towards creating an advertisement for the stated business/product/service.

### Agree on the following:

- Students can use photographs of the product/owner related to the business after approval from the owner.
- The owner will decide with students upon mutually agreed dates and time for getting information with respect to creation of advertisement.
- Students will share the progress and findings with the owner on a regular basis.
- Interaction between students and owner should be in the presence of teacher/parent.

Signature

(Name of the students)

Signature

(Name of the owner)

## Activity 5: Understanding the small business

Once you have identified the business and the contract has been signed, you must learn more about the small business to create the logo and tagline that truly represents it. This will help you identify what to highlight related to the product and service. Remember, the advertisement must connect to emotions as well. Try to find some aspects of the making of the product, the setting up of the business, and the loyal customers—any aspect you feel will persuade the audience that this is a small business that they can trust.



You have learnt about interviews in your previous grade language textbooks. Use this understanding to interview the small business owner. Some questions are given below – please add or remove as needed.

### **Product/service related questions**

Examples of questions you may consider asking the small business owner are given below.

1. What is the nature of the products/services you are offering?
2. Since how long have you been doing this work?
3. What is special about your small business or its product/service? What makes it unique?
  - (a) Is it the price that makes it unique?
  - (b) Is it the materials you use?
  - (c) Does the product last longer than other products from other shops?
  - (d) How does it compare to products/services offered by others?
  - (e) Does the owner provide delivery?
  - (f) Does the environment of the shop or office (e.g., cleanliness) make it different from others?
  - (g) Do you offer after sales service?
  - (h) Any other?
4. Which is the most selling product/service?
5. What is the price range of the product/service?



### Customer (target audience) profile-related questions

1. Who usually buys this product/avails of the service? Specify the following:
  - (a) Age
  - (b) Location (distance from the shop/business)
  - (c) What are their areas of work?
  - (d) Have they ever given feedback on the product/service? If yes, what improvements have you made?

Based on the above, decide the form of advertisement. Use the examples in Table 6.2 to make your own choices.

**Table 6.2: Factors affecting decision on the form of advertisement**

| Form of advertising     | What can you do?                              | Cost/Resources required                     |
|-------------------------|-----------------------------------------------|---------------------------------------------|
| Posters                 | Handmade poster/digital posters               | Colours/paper, for computer–design software |
| Video advertisement     | Make a video/Reel<br>Act in the advertisement | Video making camera/<br>mobile phone        |
| Lables/pamphlets/banner | Hand drawn/using computer                     | Paper/colours, for computer-design software |
|                         |                                               |                                             |
|                         |                                               |                                             |

### Activity 6: Designing the advertisement

Now that you have adequate information, it is time to start designing the advertisement. Remember, whatever the medium, some elements will remain common.

Discuss this amongst your group members and start filling in the table below. Remember, you have stated in the contract that you will share progress with the business owner. Keep in touch with them.



You will take decisions for each element of the advertisement. Use Table 6.3 to record these decisions and reasons for the same.

**Table 6.3: Record your decision on the design of an advertisement**

| Element/ Consideration                                                                               | Your decision | Any reasons for your decision |
|------------------------------------------------------------------------------------------------------|---------------|-------------------------------|
| Logo                                                                                                 |               |                               |
| Tagline                                                                                              |               |                               |
| Call to action                                                                                       |               |                               |
| Visuals                                                                                              |               |                               |
| Jingle (a reference to specific music if making an audio-visual advertisement –with due permissions) |               |                               |
| Creating emotional connect                                                                           |               |                               |
| Target audience – who is the advertisement meant for?                                                |               |                               |

## Medium for making the advertisement

We have discussed that advertisements can be made using various mediums, for example, print, audio, audio-visual.

Whatever medium you choose, some elements will remain the same. If you think of a print advertisement and a television advertisement for the same product/service (e.g., advertisement for polio vaccination or for Incredible India/Atulya Bharat), the logo, tagline and call to action remain the same. With the change in medium, it is possible for elements to be showcased in different ways. For example, in a video, the logo can appear suddenly and the tagline can be shown like a ticker tape; however, in print, they will stay in the same position.

But, whatever the medium, the key messages conveyed by the advertisement will remain the same.



Try more than one medium for creating an advertisement - it will be interesting to compare the two, once you are done.

## Advertisements without using technology

### *Poster advertisements*

Posters are the simplest form of advertisements, which play a decisive role in conveying the message at a glance. Refer to Table 6.3 to develop the advertisement.

The following questions will help you think through the advertisement.

1. What will be the title of the poster? Write a title, which will immediately grab the attention of the viewers.

.....  
.....

2. What will be the visual elements in the poster? List the visuals that would support the message.

.....  
.....

3. If you are using photographs, where will you get them from? Do you need to attribute them to someone?

.....  
.....

4. How will you establish an emotional connect?

.....  
.....

5. What will be the colours and design elements in your poster? Think how you can make your poster eye-catching by adding relevant colour and design elements.

.....  
.....  
.....



6. Considering the above criteria, sketch the layout of the poster in the space below.



### ***Digital advertisements***

You have already designed an advertisement for a poster. Replicate the poster using technology. You may use tools like MS-PowerPoint or Canva.

What were the differences between making a poster by hand and using digital tools?

### ***Animated advertisements***

You can make advertisements using technology that either uses animations or record videos to create advertisements.

While most elements will remain the same, as you noted in Table 6.2, certain new elements will also need to be considered, such as:

#### **1. Music and sound**

What background music or sound effects will you include to make your advertisement appealing?

.....



## 2. Scriptwriting

Write the dialogue, voiceover, or narration for your advertisement. If there is no dialogue, explain what will happen in each part.

(For example, “Do you know we waste gallons of water daily? Imagine the impact on our future.”)

.....  
.....

## 3. Storyboard

Draw a rough sketch of the key frames of your advertisement in Table 6.4. Note the action or text that will appear in each frame. Some examples are indicated in Table 6.4; these are simply examples—please choose your own theme.

Table 6.4: Record key frames of an advertisement

| Frame 1                                                                             | Frame 2                                                                                   | Frame 3 | Frame 4 |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|---------|---------|
|  |        |         |         |
| Do you know how much water we waste every day? (Music fades in)                     | Small changes can make a big difference. (Frame slides in from the left, music fades out) |         |         |

## 4. Design and animation

(a) Which elements will you use?

- Text
- Images/Illustrations



- Backgrounds
  - Animations
  - Jingles
  - Music/Sound effects
  - Any other element .....
- (b) What type of animation will you apply to the text or images? (e.g., fade in, zoom, slide)
- (c) Will you use the animation to develop an emotional connect? If yes, how?

### Activity 7: Review

Before sharing the advertisement with the small business owner, it is essential to review it and ask others to take a look and give feedback.

A few criteria are given below–please add to these:

- **Creativity:** Is the advertisement unique and engaging?
- **Clarity of message:** Are the tagline and call to action easy to understand? Does the advertisement clearly communicate the product's or service's benefits?
- **Visual appeal:** Are the visuals attractive and aligned with the theme?

Now, share the final advertisement with the small business owner. You can ask them the following questions:

1. Would you use this advertisement for your business? If yes, why? If not, why not? Note their response.

.....

.....

.....

.....

.....





## What did I learn from others?

- What are the three things you learnt about what small business owners in the community think about advertising?
- Did you apply any learning from other subjects to this project? If yes, briefly describe what and how.



## What did I do and how long did it take?

It is important to understand how much time is required for an activity to be completed.

Calculate the approximate number of hours you spent on each activity. Mark them on the timeline below. If you did more than the activities suggested in the book, please add the number and time taken.

| Activity             | 1   | 2   | 3   | 4   | 5   | 6   | 7   |
|----------------------|-----|-----|-----|-----|-----|-----|-----|
|                      |     |     |     |     |     |     |     |
| Time taken (Periods) | --- | --- | --- | --- | --- | --- | --- |



## What else can I do?

1. *Nukkad natak* or street plays are a powerful way of advertising social causes. Identify a social cause, something that is related to your locality. It could be a need to generate awareness (e.g., maintaining cleanliness, increasing enrolment and attendance in schools) or to remind the community of reasons to take pride in their culture and heritage. Identify the key elements of what you want to convey and develop a script around these and the key messages.



2. Search for advertisements that are written in Braille. You can also search for video advertisements using sign languages. Observe your surroundings - do you see signages for *divyangjan*?

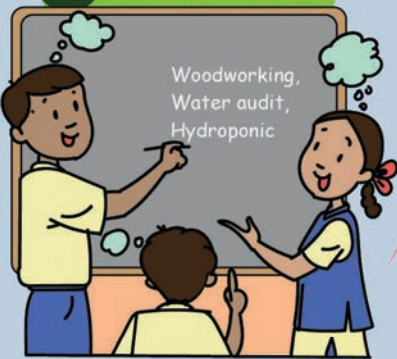


### Think and Answer

1. Did you enjoy doing this project?
2. What did you like doing?
3. What would you do differently next time?
4. Since advertisements are a powerful way of persuading people to do something, what are the responsibilities of the persons making advertisements, and what are the rights of the audience?
5. Examples of jobs related to the work you did are marketing, graphic designing, public relations, and social media management. What are the other kinds of work that are related to advertising? Look around, speak to people and give examples.



### 1 Brainstorming



### 2 Timeline



### 3 Checklist



### 4 Execution of tasks



## Planning for *Kaushal Mela*

### 5 Preparation of displays



### 6 Event day



### 7 Post-event activities...



# Planning for *Kaushal Mela*



0885CH07

You have worked on your projects and are now ready to share what you did, and how you did it, with others.

You may have shared something with other students and teachers during classroom presentations or school assemblies. You can also invite your family members and others to see your work. You can do this through *Kaushal Mela*. But first, you must plan each detail carefully.

Planning is essential since it helps you decide how to reach your goal. You must think about what needs to be done and when it needs to be done so that everything goes smoothly. For example, if you are planning a presentation on water usage in the community, you need to decide when and where, keeping in mind that the maximum number of people should watch it. Planning also helps prevent wastage of time and resources. For example, if you want to demonstrate the process of home automation, you must ensure that all the materials are available in one place in the correct quantity.

Completing every activity at the given time is crucial for success. Different activities need different times for completion. Some materials need more time to procure, and some processes need more time than others. Further, some of the activities depend on others for completion. Therefore, plan in such a way that you will be able to achieve your goal.

Since *Kaushal Mela* will involve a lot of planning and coordination, you must plan each detail carefully. Responsibilities must be assigned for each activity, and the process for each activity must be discussed in detail. You must also develop a plan to work together as a team.

Table 7.1 below will help you plan for *Kaushal Mela*. Do add more details based on your discussions. You can do this planning on a chart or A3 size paper and post it on a notice board to track the activities.

**Table 7.1: Record basic information for planning *Kaushal Mela***

| Basic details                                                                                     |
|---------------------------------------------------------------------------------------------------|
| 1. Date and Time:                                                                                 |
| 2. Venue:                                                                                         |
| 3. Who will attend:                                                                               |
| 4. What will you present in <i>Kaushal Mela</i> ?                                                 |
| 5. Additional support required (e.g., electricity/table/chairs/carpet/computer/open space, etc.): |

| S. No.             | Component of planning                                                                        | Details | Time required:<br>Start Date & End Date | Tick if completed the activity ✓ / Mark red if delayed |
|--------------------|----------------------------------------------------------------------------------------------|---------|-----------------------------------------|--------------------------------------------------------|
| <b>Preparation</b> |                                                                                              |         |                                         |                                                        |
| 6.                 | Presentation of the work done (e.g., project documentation, poster, journey video)           |         |                                         |                                                        |
| 7.                 | Setting up stall and decoration                                                              |         |                                         |                                                        |
| 8.                 | Seating arrangements (if needed)                                                             |         |                                         |                                                        |
| 9.                 | Setting up displays (e.g., in stalls, labelling components in the garden)                    |         |                                         |                                                        |
| 10.                | Signboards: list of signboards (toilet, entry, etc.)                                         |         |                                         |                                                        |
| 11.                | Inviting guests (e.g., designing an invitation, list of guests, how the invite will be sent) |         |                                         |                                                        |
| 12.                | Any safety precautions                                                                       |         |                                         |                                                        |
| 13.                | Cleanliness and waste management                                                             |         |                                         |                                                        |
| 14.                | First aid station (e.g., location, what kind of first aid will be available)                 |         |                                         |                                                        |
| 15.                | Anchoring (e.g., script, anchor[s])                                                          |         |                                         |                                                        |
| 16.                | Preparation of the stage (setting up, decoration, sound equipment)                           |         |                                         |                                                        |
| 17.                | Preparing the schedule for the entire duration of <i>Kaushal Mela</i>                        |         |                                         |                                                        |
| 18.                | Information about <i>Kaushal Mela</i> (e.g., layout, information pamphlets)                  |         |                                         |                                                        |
| 19.                | Registration of guests (how, when, details to be collected)                                  |         |                                         |                                                        |
| 20.                | Feedback from guests (questions to take feedback, collection of feedback)                    |         |                                         |                                                        |
| 21.                | Cleaning up after <i>Kaushal Mela</i> (e.g., returning equipment, removing waste)            |         |                                         |                                                        |

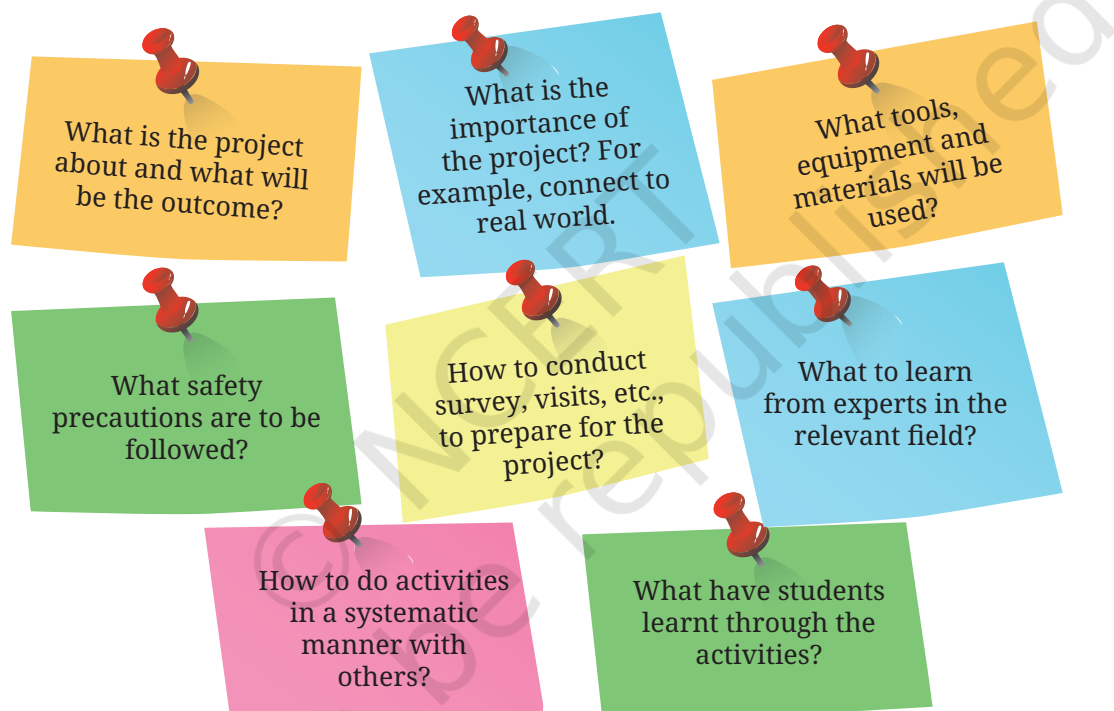
At the end of *Kaushal Mela*, check whether your preparation was adequate. You can plan similarly for any other activity or project. Making a list of tasks, and the time and resources required will help you achieve your goals.

# ANNEXURE 1

## Project Template

Developing practical projects in schools requires careful planning, clear objectives, and engaging activities that align with educational goals.

The diagram below summarises the key questions that must be addressed while developing the project.



## Write about your project

Choose a descriptive and engaging title that gives a clear idea of the broad purpose of the project.

1. Explain why the project is essential.
2. Highlight its relevance to the students' lives, education, or the community.
3. Address the benefits of the project.
4. Describe how the project relates to the real-world scenarios, tasks or problems.
5. Explain the practical implications and potential impact of the project.



## What will I be able to do?

Achievable and measurable objectives aligned with the curricular goal, competencies and grade-wise learning outcomes have to be defined for each project. Activities must be designed to fulfil these objectives.

Define two or three simple objectives in words that students can understand. These objectives indicate what students can do at the end of the project. Students must be able to respond to the following questions:

1. What will you be able to do by the end of the project?
2. What will you learn?



## What will I need?

Ensure that the required resources are accessible and locally available, and help students identify what is needed for the project. Students must be able to:

1. Provide a brief overview of the tools, equipment, material and other resources needed for the project.



## How do I keep myself and others safe?

This section should include all the safety precautions to be taken during the project, including cyber security and Internet safety measures. Students should also wear appropriate clothing, such as long sleeves, pants, and sturdy shoes, while doing activities in the field.

Safety precautions for tools, material, equipment, and Internet use must be explained and demonstrated. Students must be able to respond to the following questions:

1. How will you ensure your safety and that of others during the project?
2. How will you ensure no one is physically or emotionally hurt?
3. How will you ensure the safety of plants and animals, if relevant?
4. How will you maintain confidentiality? (For example, You will not share information about anyone without checking with them first.)
5. What will you do to keep yourself safe on the Internet?



## What do I need to know before I start?

Prepare students to begin work by recalling prior knowledge, introducing concepts through activities that require them to work with tools and material, exploring the environment and basic skills related to the project, and so on. Clearly define roles and responsibilities for all participants and ensure everyone understands their tasks and how they contribute to the project. Students must be able to respond to the following questions:

1. Is there anything you need to learn before starting your project?
2. Do you need to meet an expert who can teach you how to do the activities related to the project?
3. Is there anything you need to find out about in your locality?
4. Do you need to conduct a survey, take up field visits, or something similar before you start?



## What do I have to do?

Students need to take up various activities required to complete the project. Frame questions that will help them to think about what is to be done and subsequently, record data or information related to the project. Students must be able to do the following:

1. Follow the project plan and execute tasks according to the timelines.
2. Observe others to learn practical skills and techniques, such as proper tool usage, effective planting methods, and maintenance practices.
3. Monitor progress regularly and adjust as necessary.
4. Keep records of all activities and challenges faced during the activities.
5. Document what they have learnt, success, and challenges for future reference.

As they complete each activity, students can be asked the following:

- (a) The material you used and how you used them.
- (b) The tools you used and how you used them.
- (c) The process you followed, such as selection of material/tools, sequence of tasks, and how you completed each one.
- (d) If you collected information/data/objects, describe them and explain their usefulness.
- (e) If you made something, include a photograph or a sketch.
- (f) If you grew a plant, record its growth.
- (g) What safety precautions did you take while doing the activities?
- (h) Did you use any AI tools? If yes, which ones did you use, and how did you use them?
- (i) Did you share the outcome of your project with others outside the school? Describe your plan and how you executed it.
- (j) Did you do something to keep the environment clean or to recycle waste? Record the details.



## What did I learn from others?

Learning from others is a crucial aspect of any project. Therefore, students should reflect on what they have learnt from others. It can help improve their soft skills, deepen their understanding, and enhance the project's overall success.

Engaging with others enables students to communicate effectively, share ideas, and collaborate on tasks. Diverse perspectives and ideas are introduced, which help students learn from the viewpoints of others. This can help them approach problems in a new way and enhance their creativity and problem-solving skills. Listening to others, such as experts and professionals, provides valuable insights that can help improve learner's practices.

Students must identify what they learnt during field trips, online and offline interactions with experts, family and friends, community members, and other sources. They must be able to respond to the following questions:

1. What did you learn from field trips, interactions, video lectures, or experts?
2. What did you learn from your friends? Did you help them with something?
3. What did you learn from family members, siblings, and community elders?
4. What did you learn from people in the community?



## What did I do and how long did it take?

To develop the capacity for time-based planning, students must record the entire process followed, the sequence of activities, and the time taken for each activity. This can be done as they proceed or at the end of the project. Students must be able to respond or reflect on what they did and how long it took them to plan and execute the activities.



## What else can I do?

Students need to think of another setting to apply their learning from the projects, especially outside the school. For example, students can participate in workshops, coding classes, and exhibitions or fairs. They can also apply what they have learned from the projects at home and in various other places. They can celebrate cultural heritage months, international days, or multicultural

festivals and organise cultural events, culinary events, skill exhibitions, etc. They can integrate subjects through interdisciplinary projects, like historical re-enactments, science and art collaborations, or literary functions through performances. Students must be able to respond to the following questions:

1. What else can you do to apply your learning from the project?
2. Do you see any scope to expand the current project? How?



## Think and Answer

Students must reflect on what they have learned from their recent experiences. A set of questions must be designed to assess learning of key aspects of the project and related concepts across curricular areas. Some of the questions that can be asked include the following:

1. What did you enjoy doing?
2. What were the challenges you faced?
3. Question(s) related to the project itself.
4. What are some examples of jobs related to your activities? What other jobs are related to the project?



## Planning a Project

Since planning is integral to all work, all projects contain planning components. However, to ensure students can detail the steps required in planning, the planning section can be used as it is given in the Activity Book. If the school plans an alternative approach to meet this outcome, it must be ensured that students can respond to the following questions:

1. What is the final event you are planning?
2. When and where will it be held?
3. Who will be the invitees?
4. What will the final event involve?
5. What steps are required to ensure the final event goes as planned and when do they have to be fulfilled?
6. What are the resources involved, and who will be responsible for each step?

## ANNEXURE 2

### Curricular Goals and Learning Outcomes for Grade 8

The table below details the Competencies (C) for the Middle Stage and Learning Outcomes defined for Grade 8 to attain of each Curricular Goal (CG).

| Competency                                                                                                       | Learning Outcomes                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CG-1 Develops in-depth basic skills and allied knowledge of work and their associated material/procedures</b> |                                                                                                                                                         |
| C-1.1 Performs procedures competently through required tools/equipment.                                          | LO 1 – Selects tools appropriate for a specific task.<br>LO 2 – Uses tools correctly to complete a given task.                                          |
| C-1.2 Approaches tasks in a planned and systematic manner.                                                       | LO 3 – Demonstrates appropriate stepwise process for completing the given task.<br>LO 4 – Develop a time-based plan for the completion of the task.     |
| C-1.3 Maintains and handles material/equipment for the required activity.                                        | LO 5 – Describes the steps necessary to keep material and equipment ready for use.<br>LO 6 – Follows the safety protocol while handling tools/material. |
| <b>CG-2 Understands the place and usefulness of vocational skills and vocations in the world of work</b>         |                                                                                                                                                         |
| C-2.1 Describes the contribution of vocation in the world of work.                                               | LO 7 – Describes the importance of vocation in the world around them.<br>LO 8 – Explains what interests them in a vocation.                             |
| C-2.2 Applies skills and knowledge learned in the area.                                                          | LO 9 – Explains how prior knowledge and skills have been used to complete the task.                                                                     |
| C-2.3 Evaluates and quantifies the associated products and materials.                                            | LO 10 – Identifies criteria for evaluating the quality of products.<br>LO 11 – Identifies criteria for evaluating the quantity of products.             |

| <b>CG-3 Develops essential values while working across areas</b>                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>C-3.1 Develops the following values while engaging in work:</p> <ul style="list-style-type: none"> <li>• Attention to detail</li> <li>• Persistence and focus</li> <li>• Curiosity and Creativity</li> <li>• Empathy and sensitivity</li> <li>• Collaboration and teamwork</li> <li>• Willingness to do physical work</li> </ul> | <p>LO 12 – Keenly observes the usage of tools and material during the demonstration and asks relevant questions.</p> <p>LO 13 – Demonstrates care and respect towards people doing physical labour, irrespective of gender.</p> <p>LO 14 – Plans tasks with peers and helps others during difficulties at work.</p> <p>LO 15 – Reworks/redoes task for improved efficiency.</p> <p>LO 16 – Asks questions about the functioning of tools and machines and gives suggestions for alternative use.</p> <p>LO 17 – Willingness to do physical work while enjoying working with tools and material.</p> |
| <b>CG-4 Develops basic skills and allied knowledge to run and contribute to a home</b>                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <p>C-4.1 Applies the acquired vocational skills and knowledge in home settings.</p>                                                                                                                                                                                                                                                 | <p>LO 18 – Identifies where skills and knowledge are relevant at home.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

## ANNEXURE 3

### Additional Projects

#### Work with Life Forms

##### Keyhole Garden

Related areas: Agriculture, gardening, landscaping

Subject Teacher most suitable for this project: Any subject

| Activity                                                                                                                                                                                                                                                                                                                                                    | Required periods: 50 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b><i>What will I be able to do?</i></b>                                                                                                                                                                                                                                                                                                                    | 5                    |
| Develop a keyhole garden.                                                                                                                                                                                                                                                                                                                                   |                      |
| <b><i>What will I need?</i></b>                                                                                                                                                                                                                                                                                                                             |                      |
| Soil testing kit<br>Organic manure (cow dung, vermicompost)<br>Material for keyhole garden structure (stones, compost, mulch)<br>Seeds (traditional/local varieties)<br>Water filter for greywater reuse<br>Neem leaves for organic pesticide preparation<br>Notebook for market study and cost chart preparation                                           |                      |
| <b><i>How do I keep myself and others safe?</i></b>                                                                                                                                                                                                                                                                                                         |                      |
| Use gloves and protective gear while handling soil and manure.<br>Be careful while preparing and applying natural pesticides.<br>Follow hygiene practices when handling vegetables.<br>Ensure proper disposal of waste material.<br>Be cautious when visiting local markets and handling money.                                                             | 15                   |
| <b><i>What will I need to know before I start?</i></b>                                                                                                                                                                                                                                                                                                      |                      |
| Basics of farming and the importance of soil health.<br>The concept of keyhole gardens and their historical significance.<br>How to test soil pH and improve soil fertility?<br>Vegetable crop cycle and planting methods.<br>Sustainable water reuse techniques (greywater filtration).<br>Natural pest control methods using locally available materials. |                      |

|                                                                                           |           |
|-------------------------------------------------------------------------------------------|-----------|
| <b>What do I have to do?</b>                                                              | <b>20</b> |
| Visit a local farm to observe farming techniques and soil quality.                        |           |
| Test soil pH and discuss its impact on plant growth.                                      |           |
| Prepare organic manure using cow dung and vermicompost.                                   |           |
| Learn about different types of vegetable gardens, focusing on the keyhole garden concept. |           |
| Build a keyhole garden structure using available material.                                |           |
| Plan a vegetable crop cycle for efficient planting.                                       |           |
| Layer material in the keyhole garden to ensure soil fertility.                            |           |
| Choose and treat seeds using traditional methods.                                         |           |
| Reuse water efficiently by setting up a greywater filter.                                 |           |
| Sow vegetable seeds in the keyhole garden.                                                |           |
| Monitor plant health, identifying common pests and insects.                               |           |
| Make a natural pesticide using neem ark.                                                  |           |
| Learn proper harvesting methods to minimise damage and loss.                              |           |
| Estimate the cost of making a keyhole garden and track expenses                           |           |
| Visit the local market, observe vegetable prices, and note harvesting losses.             |           |
| Prepare a cost chart based on market research.                                            |           |
| <b>What did I learn from others and how did I use it?</b>                                 | <b>5</b>  |
| Incorporating inputs from observation, interaction, discussion and feedback.              |           |
| <b>What did I do and how long did it take?</b>                                            | <b>1</b>  |
| As per project template.                                                                  |           |
| <b>Think and Answer</b>                                                                   | <b>3</b>  |
| As per project template.                                                                  |           |
| <b>What else can I do?</b>                                                                | <b>1</b>  |
| Expand the keyhole garden to grow a wider variety of vegetables.                          |           |
| Experiment with different organic pesticides and composting methods.                      |           |

### Microbes for Healthy Food Preparation

Related areas: Food microbiology, food processing, biotechnology, chemistry, home science and food preservation

Subject Teacher most suitable for this project: Any subject

| Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Required periods: 50 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>What will I be able to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5                    |
| Prepare healthy food using microbes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |
| <b>What will I need?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                      |
| Tools – basic cooking utensils, gas stove, weighing scale<br>Material – food items as per selected recipe<br>Any four locally preferred recipes                                                                                                                                                                                                                                                                                                                                                                                                                      |                      |
| <b>How do I keep myself and others safe?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |
| Wash hands thoroughly before and after food preparation.<br>Wear a clean apron and tie your hair to avoid contamination.<br>Ensure all utensils and tools (e.g., knife, stove) are clean and handled carefully.<br>Maintain cleanliness of the workspace; avoid leaving food out for too long.<br>Use safe and fresh ingredients to prevent food spoilage.<br>When handling gas stoves or hot equipment, take adult supervision if needed.<br>Maintain proper hygiene when doing group tasks — avoid cross - contamination.                                          | 15                   |
| <b>What will I need to know before I start?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      |
| What is fermentation, and how do microbes help in food preparation?<br>How are different traditional Indian foods made using fermentation (e.g., curd, dosa, idli).<br>Basics of food safety and hygiene.<br>How to measure ingredients and keep simple records?<br>Understanding of local or traditional recipes used at home or by the community.<br>Basic knowledge of the role of temperature and time in food fermentation.<br>How to observe changes in smell, texture, and taste due to microbial action?                                                     |                      |
| <b>What do I have to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |
| Interact with local cooks or visit a food-related place like a dairy, bakery, or kitchen.<br>Work in groups to observe and experiment with making curd and fermented dishes.<br>Record changes in pH, texture, and flavour during fermentation.<br>Create at least four fermented food items from two different groups.<br>Maintain cleanliness, prepare ingredients, follow recipe steps, and collect feedback.<br>Design food label packaging and calculate the cost of selling.<br>Participate in a 'Kaushal Mela' to share or sell products and receive reviews. |                      |
| <b>What did I learn from others and how did I use it?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 5                    |
| Incorporating inputs from observation, interaction, discussion and feedback.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |

|                                                                                                  |          |
|--------------------------------------------------------------------------------------------------|----------|
| <b>What did I do and how long did it take?</b>                                                   | <b>1</b> |
| As per project template                                                                          |          |
| <b>Think and Answer</b>                                                                          | <b>3</b> |
| As per project template                                                                          |          |
| <b>What else can I do?</b>                                                                       | <b>1</b> |
| Try innovative versions of traditional fermented recipes (e.g., flavoured lassi or millet dosa). |          |
| Make a fermentation experiment book with different temperatures/times.                           |          |
| Start a mini 'health recipe club' at home or school to share fermented recipes.                  |          |

## Biogas and Solar Operation

Connect to broad areas: Agriculture, green energy, environmental engineering  
Subject Teacher most suitable for this project: Science

|                                                                                                                                                                                                                                                                                                                                                                                                  |                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| <b>Activity</b>                                                                                                                                                                                                                                                                                                                                                                                  | <b>Required periods: 50</b> |
| <b>What will I be able to do?</b>                                                                                                                                                                                                                                                                                                                                                                | <b>5</b>                    |
| Develop a biogas production and solar operation system.                                                                                                                                                                                                                                                                                                                                          |                             |
| <b>What will I need?</b>                                                                                                                                                                                                                                                                                                                                                                         |                             |
| Notebook, pens, measuring containers for feed input.<br>Stopwatch or clock for boiling/cooking time comparisons.<br>Material for DIY solar cooker: Cardboard box, black paper, foil, plastic sheet, tape/glue<br>Thermometer to record heat inside the solar cooker.<br>Access to the Internet (phone/computer).<br>Protective gloves and masks.                                                 |                             |
| <b>How do I keep myself and others safe?</b>                                                                                                                                                                                                                                                                                                                                                     |                             |
| Wear protective gear (gloves, masks, closed shoes) when visiting or working near biogas units.<br>Keep a safe distance from operational machinery and gas outlets.<br>Wash hands thoroughly after handling feed materials (e.g., dung, kitchen waste).<br>Work in well-ventilated areas when dealing with gas.<br>Handle sharp tools and solar materials carefully when making the solar cooker. |                             |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>What will I need to know before I start?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |    |
| Basics of biogas production and plant components.<br>Common feed types and how they impact gas output.<br>Role of temperature, pressure, and moisture in biogas generation.<br>How solar cookers work—principles of reflection, absorption, and insulation?<br>Simple math for unit conversions (L to m <sup>3</sup> ).                                                                                                                                                                                                                                                                                                                                                                                                    | 15 |
| <b>What do I have to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |    |
| Visit a biogas plant to observe working and safety protocols.<br>Find out about biogas operation.<br>Learn how to feed the plant, measure and record inputs.<br>Follow do's and don'ts while feeding biogas units.<br>Record daily gas output for 20 days (volumetric method).<br>Track and compare feed vs gas production.<br>Research DIY solar cookers and how they operate.<br>Build a solar cooker using household materials.<br>Experiment: Boil water using wood, kerosene, LPG, and solar energy<br>Compare the time and cost of cooking using each fuel.<br>Calculate total gas output in m <sup>3</sup> and efficiency of various feeds.<br>Explore alternative feeds (kitchen waste, cow dung, oil cake, etc.). | 20 |
| <b>What did I learn from others and how did I use it?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |    |
| Incorporating inputs from observation, interaction, discussion and feedback.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5  |
| <b>What did I do and how long did it take?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1  |
| <b>Think and Answer</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3  |
| <b>What else can I do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |    |
| Start a mini composting or organic waste project at home.<br>Calculate how much LPG a family uses in a month and estimate the cost saved if biogas was used.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1  |

### **Oyster Mushroom (*Pleurotus ostreatus*) Cultivation**

Connect to broad areas: Agriculture

Subject Teacher most suitable for this project: Science

| Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Required periods: 50 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>What will I be able to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 5                    |
| Cultivate oyster mushrooms.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |
| <b>What will I need?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      |
| Plastic bags, knife/scissors, tubs or drums, steamer or chemical steriliser, thermometer/hygrometer to monitor humidity and temperature, water sprayer, stand to stack bags in cultivation room.<br>Spawn sourced from a certified lab.<br>Clean space or room with good ventilation.                                                                                                                                                                                                                                         |                      |
| <b>How do I keep myself and others safe?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      |
| Wear gloves and mask for substrate preparation and handling spawn.<br>Use clean water and sanitised tools to avoid contamination.<br>Be cautious when using boiling water, steam, or chemicals for sterilisation.<br>Maintain hygiene in the cultivation area to prevent infections in the crop.<br>Avoid touching mushrooms directly with bare hands during growth or harvesting.<br>Store harvested mushrooms properly to avoid spoilage.                                                                                   | 10                   |
| <b>What will I need to know before I start?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |
| Oyster mushroom cultivation: Life cycle and environmental needs.<br>Basic understanding of spawn and how it functions in mushroom growth.<br>Types of substrate/stalks used (wheat straw, paddy straw, etc.).<br>Conditions for growth: Humidity, temperature, cleanliness.<br>Common pests or infections and how to prevent them.                                                                                                                                                                                            |                      |
| <b>What do I have to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 25                   |
| Visit a mushroom farm or interview a mushroom cultivator.<br>Source oyster mushroom spawn from a reliable laboratory.<br>Prepare the substrate: Select, chop, soak overnight, and sterilise.<br>Fill plastic bags with spawn and substrate for cultivation.<br>Stack bags in the cultivation area and ensure after-care: Water spraying, controlling temperature and humidity, removing infected parts.<br>Observe mushroom growth and harvest at the right time.<br>Calculate cost of cultivation (materials, time, output). |                      |
| <b>What did I learn from others and how did I use it?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                      |
| Incorporating inputs from observation, interaction, discussion and feedback.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      |
| <b>What did I do and how long did it take?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1                    |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      |
| <b>Think and Answer</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1                    |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      |

|                                                                             |          |
|-----------------------------------------------------------------------------|----------|
| <b>What else can I do?</b>                                                  | <b>1</b> |
| Try growing farming with other types of mushrooms (e.g., Button, Shiitake). |          |
| Record a video tutorial on home-based mushroom farming.                     |          |

## Art with Bacteria

Connect to broad areas: Biotechnology, microbiology  
Subject Teacher most suitable for this project: Biology

| Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                | Required periods: 50 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>What will I be able to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>5</b>             |
| Create bacterial art designs.                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |
| <b>What will I need?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                      |
| Notebook and pen, internet access.<br>Agar powder, gelatin, or nutrient media, beaker, glass rods, stirrer, cooker/ steamer.<br>Petri dishes or clean plastic containers, cotton swabs, spoons, droppers.<br>Soil, curd, and compost samples for bacterial growth.<br>Markers/labels for plates; Gloves, mask, sanitiser/soap.                                                                                                                          |                      |
| <b>How do I keep myself and others safe?</b>                                                                                                                                                                                                                                                                                                                                                                                                            |                      |
| Wear gloves and a mask while handling bacterial cultures.<br>Always wash hands before and after lab activities.<br>Sterilise equipment before and after use.<br>Keep petri dishes sealed while observing and dispose of them safely.<br>Label all samples clearly and avoid cross-contamination.<br>Handle curd/compost samples hygienically to prevent spoilage or unwanted exposure.                                                                  | <b>15</b>            |
| <b>What will I need to know before I start?</b>                                                                                                                                                                                                                                                                                                                                                                                                         |                      |
| What are good and bad bacteria? Examples and functions.<br>Basic needs of bacteria for survival and growth (moisture, nutrients, warmth).<br>Agar media and its role in growing bacteria.<br>Difference between bacterial and fungal colonies.<br>Common household uses of bacteria (curd, composting).                                                                                                                                                 |                      |
| <b>What do I have to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |
| Learn and list conditions required for the selected bacterial growth.<br>Prepare agar or nutrient media, sterilise tools, and pour into dishes.<br>Grow bacteria using swabs from objects, serial soil dilution, and curd samples.<br>Create bacterial art using safe cultures and petri dishes.<br>Explore home uses of bacteria: Make curd, start compost using kitchen waste.<br>Practice safe cleaning and disposal of used petri dishes and tools. | <b>20</b>            |

|                                                                              |   |
|------------------------------------------------------------------------------|---|
| <b>What did I learn from others and how did I use it?</b>                    | 5 |
| Incorporating inputs from observation, interaction, discussion and feedback. |   |
| <b>What did I do and how long did it take?</b>                               | 1 |
| As per project template.                                                     |   |
| <b>Think and Answer</b>                                                      | 3 |
| As per project template.                                                     |   |
| <b>What else can I do?</b>                                                   | 1 |
| Explore antibiotic zones (how garlic or neem affect bacterial growth).       |   |

## Work with Machines and Materials

### Making a Tree Guard

Connect to broad areas: Construction

Subject Teacher most suitable for this project: Any subject

| Activity                                                                         | Required periods: 53 |
|----------------------------------------------------------------------------------|----------------------|
| <b>What will I be able to do?</b>                                                | 5                    |
| Plan and execute the construction of the tree guard project.                     |                      |
| <b>What will I need?</b>                                                         |                      |
| Measuring tools: Plumb bob, spirit level, meter tape, right-angle scale, rope.   |                      |
| Construction materials: Bricks, cement, sand, water, binding wire, nails, paint. |                      |
| Safety equipment: Gloves, goggles, masks, work shoes.                            |                      |
| Sketchbook or graph paper for project planning.                                  |                      |
| Access to a construction site for observation and interaction.                   |                      |
| <b>How do I keep myself and others safe?</b>                                     |                      |
| Wear safety gear like gloves and goggles while handling tools and materials.     |                      |
| Follow proper guidelines for lifting and handling construction material.         |                      |
| Use measuring tools carefully to avoid accidents.                                |                      |
| Ensure proper supervision while working with cement and bricks.                  |                      |
| Keep the work area clean and organised to prevent hazards.                       |                      |
| Follow safety protocols while painting to avoid inhalation of toxic fumes.       |                      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>What will I need to know before I start?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |    |
| <p>Basics of masonry work and the role of masons in construction.</p> <p>Different types of buildings and materials used in construction.</p> <p>Functions and proper usage of measuring and masonry tools.</p> <p>The process of making a project plan, including design thinking.</p> <p>Importance of curing and painting in construction.</p> <p>Cost estimation techniques and market analysis.</p>                                                                                                                                                                                                                                                                                                                                                                           | 17 |
| <b>What do I have to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |    |
| <p>Discuss masonry work and visit a construction site.</p> <p>Identify and list types of buildings and materials used.</p> <p>Learn to use measuring tools and list the required materials.</p> <p>Plan the tree guard project, watch related videos, and use design thinking.</p> <p>Measure the area, draw a sketch, and finalise dimensions in teams.</p> <p>Prepare a material list and estimate the cost based on market prices.</p> <p>Purchase the required materials and document actual costs.</p> <p>Build a simple tree guard under supervision.</p> <p>Work in teams to create their own tree guard.</p> <p>Understand the importance of curing and practice watering construction.</p> <p>Learn about types of paint, application methods, and complete painting.</p> | 20 |
| <b>What did I learn from others and how did I use it?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |
| Incorporating inputs from observation, interaction, discussion and feedback.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 5  |
| <b>What did I do and how long did it take?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1  |
| <b>Think and Answer</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |    |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3  |
| <b>What else can I do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |    |
| <p>Explore other small construction projects like making benches or compost pits.</p> <p>Experiment with sustainable and eco-friendly building material.</p> <p>Research different architectural styles and their impact on construction.</p> <p>Volunteer for community-based construction projects.</p> <p>Learn advanced masonry techniques for future vocational opportunities.</p>                                                                                                                                                                                                                                                                                                                                                                                            | 1  |

### Image Recognition AI Model (Flower and Plants)

Connect to broad areas: Artificial Intelligence

Subject Teacher most suitable for this project: Atal Tinkering Laboratory (ATL) In-charge

| Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Required periods: 52 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b><i>What will I be able to do?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 5                    |
| Build an AI app or model for image recognition.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |
| <b><i>What will I need?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |
| A computer or laptop with internet access.<br>Google Teachable Machine (online tool).<br>Google search engine for research.<br>Videos on how Google search works.<br>Flowchart creation tools (Lucidchart, Draw.io, or paper and pencil).<br>Pre-collected images of flowers/plants for AI training.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |
| <b><i>How do I keep myself and others safe?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |
| Ensure ethical AI usage (avoid using biased or harmful datasets).<br>Use trusted sources for data collection.<br>Protect personal information while using online AI tools.<br>Use reliable AI models and be aware of AI limitations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 14                   |
| <b><i>What will I need to know before I start?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |
| Basic understanding of AI concepts (machine learning, algorithms).<br>How search engines work and how AI enhances them?<br>The difference between machines and robots.<br>How flowcharts and algorithms help in problem-solving?<br>How AI models are trained using labelled datasets?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |
| <b><i>Planning</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1                    |
| <b><i>What do I have to do?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 20                   |
| Watch a video on how Google's search engine works and discuss insights.<br>Learn about algorithms and create a basic algorithm for a simple task.<br>Understand flowcharts and draw a simple one using flowchart elements.<br>Compare machines vs. robots and discuss how to convert a machine into a robot.<br>Explore AI assistants – What capabilities would you want in your AI assistant?<br>Compare human learning vs. machine learning – How does a computer learn?<br>Analyse human senses vs. machine sensors – How does a machine recognise objects?<br>Create an AI image recognition model:<br><ul style="list-style-type: none"> <li>• Upload images to Google's Teachable Machine</li> <li>• Split data into training and testing sets</li> <li>• Train the model to recognise flowers/plants</li> <li>• Test and analyse the AI's accuracy in recognising images</li> <li>• Practice using Google's Teachable Machine with different image datasets</li> </ul> |                      |

|                                                                                       |   |
|---------------------------------------------------------------------------------------|---|
| <b>What did I learn from others and how did I use it?</b>                             | 5 |
| Incorporating inputs from observation, interaction, discussion and feedback.          |   |
| <b>What did I do and how long did it take?</b>                                        | 1 |
| As per project template.                                                              |   |
| <b>Think and Answer</b>                                                               | 1 |
| As per project template.                                                              |   |
| <b>What else can I do?</b>                                                            | 5 |
| Train an AI model to recognise different handwriting styles.                          |   |
| Create an AI chatbot using simple coding platforms like Scratch or PictoBlox.         |   |
| Explore AI-powered speech recognition (train AI to recognise different voices).       |   |
| Research how AI is used in self-driving cars, healthcare, and intelligent assistants. |   |

## Household Water Connection

Connect to broad areas: Plumbing

Subject Teacher most suitable for this project: Science

| Activity                                                                                                                                                                                                               | Required periods: 45 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>What will I be able to do?</b>                                                                                                                                                                                      | 5                    |
| Learn skills related to plumbing systems and repair issues.                                                                                                                                                            |                      |
| <b>What will I need?</b>                                                                                                                                                                                               |                      |
| PVC pipes and joints<br>Plumbing tools: Pipe wrench, pipe cutter, Teflon tape.<br>Safety gear: Gloves, goggles, and protective clothing.<br>Material for making plumbing models and objects.                           |                      |
| <b>How do I keep myself and others safe?</b>                                                                                                                                                                           | 10                   |
| Wear safety gear while cutting or assembling PVC pipes.<br>Use tools correctly to prevent injuries.<br>Maintain hygiene while working with plumbing material.<br>Ensure proper handling and storage of plumbing tools. |                      |
| <b>What will I need to know before I start?</b>                                                                                                                                                                        |                      |
| Types of PVC pipes and joints and their common uses.<br>Functions of plumbing tools and their applications.<br>Common plumbing problems and their solutions.                                                           |                      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>What do I have to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                         | 20 |
| Learn about different types of PVC pipes and joints.<br>Practice cutting and assembling PVC pipes.<br>Make useful objects from PVC pipes, like a bangle stand, cloth hangar, mobile stand or book holder.<br>Work with a plumber to understand plumbing connections in a house.<br>Draw a representation of water transport in a house.<br>Build a simple tap connection model.<br>Identify and fix minor plumbing issues in school. |    |
| <b>What did I learn from others and how did I use it?</b>                                                                                                                                                                                                                                                                                                                                                                            |    |
| Incorporating inputs from observation, interaction, discussion and feedback.                                                                                                                                                                                                                                                                                                                                                         |    |
| <b>What did I do and how long did it take?</b>                                                                                                                                                                                                                                                                                                                                                                                       |    |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                             |    |
| <b>Think and Answer</b>                                                                                                                                                                                                                                                                                                                                                                                                              |    |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                             | 3  |
| <b>What else can I do?</b>                                                                                                                                                                                                                                                                                                                                                                                                           | 1  |
| Design a water-saving plumbing system for home use.<br>Explore innovative ways to use PVC pipes in creative projects.<br>Research water conservation techniques in plumbing and apply them to real-world scenarios.<br>Learn about advanced plumbing techniques and tools.<br>Experiment with DIY plumbing repairs at home.                                                                                                          |    |

## Apparel Design

Connect to broad areas: Textile

Subject Teacher most suitable for this project: Arts/Home Science

| Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Required periods: 45 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>What will I be able to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 5                    |
| Develop fabric items with different techniques.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                      |
| <b>What will I need?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |
| Cotton, silk, and other natural fabrics.<br>Natural dyeing materials, like turmeric, beetroot, and indigo.<br>Tools for dyeing: Pots, tongs, gloves, strainers, wooden blocks for fabric painting, paints and brushes.<br>Weaving materials: Loom, cardboard, yarn.<br>Crochet material: Crochet hooks, yarn of different colours.<br>Scissors, measuring tape, needles, and thread.                                                                                                                                                                                                                                                                                                                                  |                      |
| <b>How do I keep myself and others safe?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |
| Wear gloves and aprons while dyeing fabrics.<br>Work in a well-ventilated area to avoid inhaling fumes.<br>Handle weaving and crochet tools carefully to avoid injuries.<br>Use fabric paints and dyes safely, following usage instructions.<br>Keep workspaces clean and organised.                                                                                                                                                                                                                                                                                                                                                                                                                                  | 10                   |
| <b>What will I need to know before I start?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                      |
| The basics of different textile fibres and fabrics.<br>The process of dyeing and setting natural colours on fabric.<br>The techniques of weaving and how looms function.<br>The basics of crochet and different stitches.<br>How to use block painting techniques for fabric design.                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      |
| <b>What do I have to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |
| Learn about different types of fibres and fabrics.<br>Visit workshops/production units – dyeing, tailoring, printing.<br>Learn about material, tools, and dyeing techniques.<br>Dye cotton fabric using turmeric and wash after dyeing.<br>Experiment with dyeing different fabrics like cotton and silk.<br>Learn block painting techniques on scarves or dupattas.<br>Use wooden blocks and fabric paints for printing designs<br>Practice weaving using a loom or cardboard to create a small woven item such as a bookmark or handkerchief; alternatively, make DIY pom-poms.<br>Learn about crochet tools and basic crochet patterns.<br>Practice making simple items, like a potholder, hand belt, or keychain. | 20                   |
| <b>What did I learn from others and how did I use it?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 5                    |
| Incorporating inputs from observation, interaction, discussion and feedback.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |
| <b>What did I do and how long did it take?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1                    |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |

|                                                                   |          |
|-------------------------------------------------------------------|----------|
| <b>Think and Answer</b>                                           | <b>3</b> |
| As per project template.                                          |          |
| <b>What else can I do?</b>                                        | <b>1</b> |
| Experiment with other natural dyes like pomegranate and indigo.   |          |
| Design and make customised tote bags using block painting.        |          |
| Try advanced crochet patterns to create intricate fabric designs. |          |
| Develop a small business plan for handmade fabric products.       |          |
| Explore traditional weaving techniques from different regions.    |          |
| Research and present on sustainable fabric production methods.    |          |

## Food Preservation through Organic Techniques

Connect to broad areas: Food preservation

Subject Teacher most suitable for this project: Science

|                                                                                                                                                      |                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| <b>Activity</b>                                                                                                                                      | <b>Required periods: 47</b> |
| <b>What will I be able to do?</b>                                                                                                                    | <b>5</b>                    |
| Preserve food through organic techniques.                                                                                                            |                             |
| <b>What will I need?</b>                                                                                                                             |                             |
| Survey forms for collecting data on food preferences and shelf life.                                                                                 |                             |
| Ingredients and tools for food preservation.                                                                                                         |                             |
| Recipes for food preservation techniques.                                                                                                            |                             |
| Packaging materials such as jars, vacuum-seal bags, and labels.                                                                                      |                             |
| <b>How do I keep myself and others safe?</b>                                                                                                         | <b>12</b>                   |
| Maintain hygiene while handling food items to prevent contamination.                                                                                 |                             |
| Use gloves and clean utensils during food processing.                                                                                                |                             |
| Follow proper food safety guidelines to avoid spoilage and food-borne illnesses.                                                                     |                             |
| Store preserved food items in suitable conditions (temperature, humidity, and airtight containers).                                                  |                             |
| Label food items with dates and ingredients to ensure proper tracking and consumption.                                                               |                             |
| <b>What will I need to know before I start?</b>                                                                                                      | <b>12</b>                   |
| Basic understanding of food spoilage and preservation.                                                                                               |                             |
| Different methods of food preservation (drying, freezing, pickling, canning, etc., can use freezing and canning if specific equipment is available). |                             |
| Importance of packaging and labelling for food safety.                                                                                               |                             |
| Strategies for marketing food products effectively.                                                                                                  |                             |

|                                                                                           |    |
|-------------------------------------------------------------------------------------------|----|
| <b>What do I have to do?</b>                                                              | 20 |
| Interaction with a professional or experienced individual.                                |    |
| Survey to determine popular food choices and the shelf life of different food items.      |    |
| Analyse survey results and decide on food items to preserve.                              |    |
| Research and obtain recipes and necessary ingredients.                                    |    |
| Learn the science behind food preservation techniques.                                    |    |
| Interact with an expert to gain practical knowledge.                                      |    |
| Perform food preservation processes (drying, pickling, fermenting, etc.).                 |    |
| Package and label preserved food products.                                                |    |
| Organise a presentation or exhibition to showcase preserved products.                     |    |
| <b>What did I learn from others and how did I use it?</b>                                 | 5  |
| Incorporating inputs from observation, interaction, discussion and feedback.              |    |
| <b>What did I do and how long did it take?</b>                                            | 1  |
| As per project template.                                                                  |    |
| <b>Think and Answer</b>                                                                   | 3  |
| As per project template.                                                                  |    |
| <b>What else can I do?</b>                                                                | 1  |
| Experiment with different preservation methods on various food items.                     |    |
| Research eco-friendly packaging options for preserved foods.                              |    |
| Start a small business selling homemade preserved food items.                             |    |
| Learn about international preservation techniques and compare them with local methods.    |    |
| Explore the role of food preservation in disaster preparedness and emergency food supply. |    |

## Work in Human Services

### Creating Content on Heritage Sites/Old Homes

Connect to broad areas: Creative writing, media and journalism, online content creation

Subject Teacher most suitable for this project: Social Science, ICT, Science

| Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Required periods: 50 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b><i>What will I be able to do?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5                    |
| Identify heritage sites and old buildings in the locality and document them.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |
| <b><i>What will I need?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |
| Notebook, pens, and sketchbook for documentation.<br>Camera or smartphone for photography and videography.<br>Recording device for interviews.<br>Access to books, official records, and online sources.<br>Computer with editing software (Canva, PowerPoint, or video editing tools).<br>Internet access for editing and research.<br>Permission and guidance for visiting heritage sites/old homes.                                                                                                                                                                                                                                 |                      |
| <b><i>How do I keep myself and others safe?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |
| Follow safety guidelines while visiting heritage sites/old homes.<br>Seek permission before conducting interviews or clicking photos.<br>Handle historical artefacts or old structures with care.<br>Follow ethical practices while collecting and sharing information.<br>Work in teams to ensure safety and support.<br>Verify information before publishing online.                                                                                                                                                                                                                                                                 | 15                   |
| <b><i>What will I need to know before I start?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |
| Basics of historical research and different types of sources.<br>Importance of oral history and how to conduct interviews.<br>How to document findings effectively?<br>Basics of photography and videography.<br>How to write blog or podcast techniques for creating engaging presentations?                                                                                                                                                                                                                                                                                                                                          |                      |
| <b><i>What do I have to do?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 20                   |
| Identify and research local heritage sites or old buildings.<br>Find and use primary and secondary sources of information.<br>Prepare a questionnaire and conduct interviews with elderly individuals.<br>Develop worksheets for different stages of the field visit.<br>Create a graphic organiser or sketchbook.<br>Conduct a field visit, take photographs, and record videos.<br>Edit and create a video documentary or PowerPoint presentation.<br>Reflect on collected data and document insights.<br>Edit and update the blog with verified information and images.<br>Prepare and deliver engaging storytelling presentations. |                      |
| <b><i>What did I learn from others and how did I use it?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                      |
| Incorporating inputs from observation, interaction, discussion and feedback.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |
| Improved teamwork and collaboration during field visits.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |

|                                                       |   |
|-------------------------------------------------------|---|
| <b>What did I do and how long did it take?</b>        | 1 |
| As per project template.                              |   |
| <b>Think and Answer</b>                               | 3 |
| As per project template.                              |   |
| <b>What else can I do?</b>                            | 1 |
| Organise a heritage walk for the school or community. |   |
| Create a digital archive of local history.            |   |
| Start a blog or social media page to share findings.  |   |

## Personal Grooming and Art of *Mehndi*

Connect to broad areas: Beauty care, Design

Subject Teacher most suitable for this project: Arts

| Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Required periods: 46 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>What will I be able to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 5                    |
| Prepare and use natural skincare and haircare products, practice personal grooming, and create beautiful <i>mehndi</i> designs on hands.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |
| <b>What will I need?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |
| For skincare and haircare — Natural ingredients: turmeric, curd, honey, lemon, <i>multani mitti</i> , <i>besan</i> , aloe vera; Herbal items: <i>amla</i> , <i>reetha</i> , <i>shikakai</i> , hibiscus flowers/leaves, curry leaves, coconut oil.<br>Basic Materials — Bowls, spoons, towel, mirror, comb, water, soap.<br>For Nail care — Nail clippers, nail files, moisturiser or natural oil for massage (coconut oil); Bowl for soaking hands (optional, with warm water and a few drops of lemon or oil).<br>For <i>Mehndi</i> Design — <i>Mehndi</i> powder at school, fresh <i>mehndi</i> leaves, a flat tray for drying, grinder or mortar and pestle, fine sieve or cloth for straining.<br><i>Mehndi</i> cone — Transparent plastic sheet, scissors, tape or rubber band, spoon (to fill paste), pin (to make a hole at the tip); sugar and lemon mixture. |                      |
| <b>How do I keep myself and others safe?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |
| Maintain personal hygiene to prevent infections.<br>Use natural and skin-friendly ingredients for homemade remedies.<br>Be cautious while using grooming tools to avoid cuts or injuries.<br>Follow correct hand washing techniques to maintain cleanliness.<br>Test any new product on a small patch of skin before full use.<br>Use natural <i>mehndi</i> without harmful chemicals.<br>Test <i>mehndi</i> on a small skin patch to check for allergies.                                                                                                                                                                                                                                                                                                                                                                                                            |                      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>What will I need to know before I start?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |    |
| <p>The importance of grooming and self-care for overall well-being.</p> <p>The role of hygiene in preventing diseases.</p> <p>Different skin and hair types and their specific care requirements.</p> <p>The benefits and potential side effects of homemade skin care and hair care remedies.</p> <p>The history and cultural significance of <i>mehndi</i> art, including the types of <i>mehndi</i> (Indian, Arabic, Moroccan, etc.).</p> <p>How to make a smooth and dark-staining <i>mehndi</i> paste.</p> <p>The correct method to hold and control a <i>mehndi</i> cone.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 10 |
| <b>What do I have to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |    |
| <p><b>Personal Grooming:</b></p> <p>Learn about personal grooming, healthy eating, and the benefits of exercise.</p> <p>Practice basic hygiene techniques like hand washing and personal cleanliness.</p> <p>Identify different skin types and understand skincare practices.</p> <p>Prepare and apply homemade skincare remedies such as cleansing lotions and face packs.</p> <p>Practice nail care by cleaning, trimming, filing, and moisturising the nails and cuticles.</p> <p>Understand different hair types and their specific care needs.</p> <p>Make homemade hair care products like hair oil and hair masks.</p> <p>Learn the importance of manicures and pedicures and practice them at home.</p> <p>Maintain a grooming routine and track improvements in personal care</p> <p><b>Mehndi Design:</b></p> <p>Discuss <i>mehndi</i> techniques and best practices with an artist.</p> <p>Practice drawing different lines, shapes, and symbols on paper.</p> <p>Prepare <i>mehndi</i> paste using traditional ingredients.</p> <p>Make <i>mehndi</i> cones for application.</p> <p>Learn and practice the correct way to hold and press a <i>mehndi</i> cone.</p> <p>Try drawing simple <i>mehndi</i> designs on your hands and progress to full-hand <i>mehndi</i> designs with intricate details.</p> <p>Learn the proper way to remove dried <i>mehndi</i> for the best colour.</p> | 20 |
| <b>What did I learn from others and how did I use it?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |
| Incorporating inputs from observation, interaction, discussion and feedback.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2  |
| <b>What did I do and how long did it take?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2  |
| <b>Think and Answer</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |    |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2  |
| <b>What else can I do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |    |
| <p>Create a daily or weekly self-care routine.</p> <p>Experiment with different homemade skincare and hair care products.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 5  |

## Create a School Magazine

Connect to areas: Media and communication, publishing, design, journalism, ICT, art and creative writing

Subject Teacher most suitable for this project: Language, Art, ICT/Computer

| Activity                                                                                                                                                                                                                                                                                                                 | Required periods: 50 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b><i>What will I be able to do?</i></b>                                                                                                                                                                                                                                                                                 | 5                    |
| Create a school magazine.                                                                                                                                                                                                                                                                                                |                      |
| <b><i>What will I need?</i></b>                                                                                                                                                                                                                                                                                          |                      |
| Paper, pens, markers<br>Computers/laptops with basic publishing or word processing software with Internet access.<br>Printers (optional for hard copies)<br>Camera/phone for photos<br>Stationery for layout and artwork, glue, scissors, old magazines.                                                                 |                      |
| <b><i>How do I keep myself and others safe?</i></b>                                                                                                                                                                                                                                                                      |                      |
| Use digital devices responsibly — protect eyes, avoid unsafe sites and respect copyright.<br>Be respectful and empathetic during interviews and when writing about people.                                                                                                                                               | 15                   |
| <b><i>What will I need to know before I start?</i></b>                                                                                                                                                                                                                                                                   |                      |
| Types of magazines, structure (cover, editorial, features, photo spreads).<br>Role of content writer, editor, photographer, designer, illustrator.<br>How to structure an article, write catchy headlines, and edit for clarity.<br>Understanding design principles—fonts, colours, white space, balance in layout, etc. |                      |
| <b><i>What do I have to do?</i></b>                                                                                                                                                                                                                                                                                      | 20                   |
| Choose themes, articles, interviews.<br>Write poems, articles, etc.<br>Take photos, draw or design visuals.<br>Edit and proofread content.<br>Showcase the magazine and reflect on learning.                                                                                                                             |                      |
| <b><i>What did I learn from others and how did I use it?</i></b>                                                                                                                                                                                                                                                         | 5                    |
| Incorporating inputs from observation, interaction, discussion and feedback.<br>Collect and review guest feedback to understand strengths and areas for improvement.<br>Reflect on the experience and compile a final report.                                                                                            |                      |
| <b><i>What did I do and how long did it take?</i></b>                                                                                                                                                                                                                                                                    | 1                    |
| As per project template.                                                                                                                                                                                                                                                                                                 |                      |

|                                                                                                            |          |
|------------------------------------------------------------------------------------------------------------|----------|
| <b>Think and Answer</b>                                                                                    | <b>3</b> |
| As per project template.                                                                                   |          |
| <b>What else can I do?</b>                                                                                 | <b>1</b> |
| Start a personal blog (if closed group available in school).<br>Design a home newsletter or greeting card. |          |

## Fundraising by Providing Services

Connect to broad areas: Banking and finances, Social sector  
Subject Teacher most suitable for this project: Any subject

| Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Required periods: 50 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b>What will I be able to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>5</b>             |
| Plan and organise a fundraising drive for a cause by providing valuable services.                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |
| <b>What will I need?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                      |
| Notebook, pen/pencil, Chart paper or whiteboard (for group brainstorming), Calculator (for budgeting),<br>Items for providing services, for example: <ul style="list-style-type: none"> <li>Cultural programme: Traditional costumes, musical instruments (<i>dhol/tasha/lezim</i>, etc.).</li> <li>Cleaning services: Buckets, mops, cloths, soap, disinfectant, water, sponge, car shampoo, detergent, tools for basic repair work (if offering repair services), bags/boxes for collecting and organising scrap.</li> </ul> |                      |
| <b>How do I keep myself and others safe?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>10</b>            |
| Safety while performing operations: Following safety protocol using protective gear, viz hand gloves, and shoes, and maintaining space and discipline during public events.<br>Hygiene safety: Wash hands after using cleaning materials, dispose of waste properly in bags or boxes.<br>Financial safety: Keep money safe in a box or use digital payments.<br>Never share passwords for digital tools.<br>Sensitivity: Respect customs and traditions while performing.                                                      |                      |
| <b>What will I need to know before I start?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                      |
| The purpose or cause for fundraising (e.g., donation, picnic, sports items).<br>Good examples of providing the selected services.<br>Key points related to giving quality services to clients or customers.<br>Understanding selected services (e.g., folk dance performances, cleaning, or repair camps).<br>Giving cost estimates of service to clients/customers.<br>Taking feedback after providing the service.                                                                                                           |                      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>What do I have to do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |    |
| <p>Estimate how much money is needed to achieve the goal.</p> <p>Discuss and choose the type of services to offer through group brainstorming.</p> <p>Explore volunteer-based services for events or functions.</p> <p>Choose services to be provided (e.g., folk dance performances, cleaning, or repair camps).</p> <p>Plan, prepare, and practice the selected services.</p> <p>Design posters and flyers using Canva to promote selected services.</p> <p>Choose platforms for the dissemination of promotional materials.</p> <p>Learn how to give a cost estimate and draw a simple contract with clients/customers.</p> <p>Deliver the service responsibly and politely.</p> <p>Create bills and collect payments correctly.</p> <p>Ask for customer/client feedback after providing the services.</p> <p>Keep records of earnings and expenses for the fundraiser.</p> <p>Document project with photos and short videos.</p> | 25 |
| <b>What did I learn from others and how did I use it?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |    |
| Incorporating inputs from observation, interaction, discussion and feedback.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 5  |
| <b>What did I do and how long did it take?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |    |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1  |
| <b>Think and Answer</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |    |
| As per project template.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3  |
| <b>What else can I do?</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |    |
| <p>Do promotional or add-on services to attract/retain clients/customers.</p> <p>Share work through a class blog, school wall magazine, or newsletter.</p> <p>Invite local leaders or parents to support and spread the word.</p> <p>Plan a small event to celebrate the completion of the drive.</p> <p>Encourage other students to start similar initiatives.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1  |

### Set up a School Restaurant

Connect to areas: Hospitality management, customer relations, event management, food and beverage services, tourism

Subject Teacher most suitable for this project: Any subject

| Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Required periods: 46 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| <b><i>What will I be able to do?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5                    |
| Set up a school restaurant during an event.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |
| <b><i>What will I need?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                      |
| Stationery (notebooks, pens, planning sheets)<br>Hospitality setup props (menus, tablecloths, cutlery, trays, notepads)<br>Computer/Tablet for menu designing, record keeping, customer feedback forms.<br>Aprons, name tags, or uniforms (optional)<br>Reception setup<br>Feedback forms and checklists<br>Charts or visual aids for service etiquette and standard procedures.                                                                                                                                                                                                                            |                      |
| <b><i>How do I keep myself and others safe?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |
| Follow hygiene and cleanliness standards while handling food, props, or equipment.<br>Wash hands before service activities and after handling shared material<br>Wear aprons (or uniforms, if available), and keep workspace organised and clutter-free.<br>Practice respectful and calm communication with guests and team members.<br>Maintain a safe and respectful environment.                                                                                                                                                                                                                         | 8                    |
| <b><i>What will I need to know before I start?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      |
| Understand the basics of hospitality—greeting guests, polite communication, and professional appearance.<br>Learn about different roles in a hospitality setting: Receptionist, server, host, etc.                                                                                                                                                                                                                                                                                                                                                                                                          | 20                   |
| <b><i>What do I have to do?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |
| Visit hospitality services (hotels, restaurants) and discuss what makes them successful.<br>Know how to plan a service setup—from menu design to taking orders and guest handling.<br>Understand the importance of customer feedback and service improvement.<br>Be familiar with materials and tools for use: checklists, trays, menus, etc.<br>Learn basic service etiquette and how to handle common guest scenarios.<br>Plan and set up a hospitality station—like a café or reception desk.<br>Create menus, feedback forms, and service scripts.<br>Welcome and serve guests during the school event. |                      |
| <b><i>What did I learn from others and how did I use it?</i></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |
| Incorporating inputs from observation, interaction, discussion and feedback.<br>Collect and review guest feedback to understand strengths and areas for improvement.<br>Reflect on experience and compile a final report.                                                                                                                                                                                                                                                                                                                                                                                   |                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2                    |

|                                                                                                                                                                                                                |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| <b>What did I do and how long did it take?</b>                                                                                                                                                                 | 2 |
| As per project template.                                                                                                                                                                                       |   |
| <b>Think and Answer</b>                                                                                                                                                                                        | 2 |
| As per project template.                                                                                                                                                                                       |   |
| <b>What else can I do?</b>                                                                                                                                                                                     | 6 |
| Organise home-based events like family dinners or celebrations where students plan the setup, welcome guests, serve food and manage the overall experience, simulating a hotel or restaurant-like environment. |   |

## ANNEXURE 4

### Time Allocation and Mapping of Learning Outcomes

The tables below indicate the allocation of time and mapping of Learning Outcomes for the activities included in the projects for Grade 8.

**Time Allocation:** The time allocated for each activity is a suggestion, and teachers can adjust it based on class size and the complexity of the project.

**Cross-curricular Connections:** The projects can be drawn from other subjects in the Middle Stage—Language, Mathematics, Science, Social Science, Art Education and Physical Education and Well-being. This allows for a more holistic learning experience. Connection to other curricular areas is also indicated in the ensuing tables.

**Student Reflection:** Reflection prompts are included ('What did I learn?', and 'What else can I do?') to encourage students to think critically about their work.

**Safety:** The tables emphasise safety precautions (LO 6) for activities involving tools or potential hazards.

**Open-ended Learning:** The 'What else can I do?' section (LO 18) encourages students to explore connecting to home and extend their learning.

**Learning Outcomes:** Each project focuses on developing specific skills and knowledge (LO 1–11) along with essential values related to work (LO 12–17).

Please note that LO 12–17, which refer to the essential values while working across areas, are applicable across all activities.

## Project 1: Hydroponics: Growing Plants Without Soil

### Connection with other curricular areas: Science

| Activity                                                                                | Required periods: 54 | Related Learning Outcomes         |
|-----------------------------------------------------------------------------------------|----------------------|-----------------------------------|
| <i>What will I be able to do?</i>                                                       | 2                    | LO 1, 2, 3, 7                     |
| <i>What will I need?</i>                                                                |                      |                                   |
| <i>How do I keep myself and others safe?</i>                                            |                      | LO 6                              |
| <i>What will I need to know before I start?</i>                                         | 2                    | LO 1, 3, 5, 7                     |
| Field visit to learn about the use of new technologies in farming.                      |                      |                                   |
| <i>What do I have to do?</i>                                                            |                      |                                   |
| Growing micro-greens for preparing a healthy salad.                                     | 8                    | LO 1, 2, 3, 4, 5, 6, 7, 9, 10, 11 |
| Building hydroponics system — wall hanging pet bottle hydroponics garden (wick method). | 8                    |                                   |
| Building hydroponics system — Deep-Water-Culture (DWC) or Bucket method.                | 10                   |                                   |
| Building hydroponics system — Simple Nutrient Film Technique (NFT).                     | 10                   |                                   |
| Making compost tea to use as an organic liquid fertiliser.                              | 6                    |                                   |
| Measuring water pH and its effect on plant growth in hydroponics.                       | 4                    |                                   |
| <i>What did I learn from others, and how did I use it?</i>                              | 1                    | LO 1, 5, 7                        |
| <i>What did I do, and how long did it take?</i>                                         | 1                    | LO 4                              |
| <i>What else can I do?</i>                                                              | 1                    | LO 7, 9, 10, 11, 18               |
| <i>Think and Answer</i>                                                                 | 1                    | LO 7, 8, 18                       |

LO 12, 13, 14, 15, 16 and 17 to be observed, throughout the project.

## Project 2: Feeding and Caring For Farm Animals

### Connection with other curricular areas: Science

| Activity                                                                          | Required periods: 54 | Related Learning Outcomes         |
|-----------------------------------------------------------------------------------|----------------------|-----------------------------------|
| <i>What will I be able to do?</i>                                                 | 2                    | LO 1, 2, 3, 7                     |
| <i>What will I need?</i>                                                          |                      |                                   |
| <i>How do I keep myself and others safe?</i>                                      |                      | LO 6                              |
| <i>What will I need to know before I start?</i>                                   |                      | LO 1, 3, 5, 7, 8                  |
| Taking care of livestock.                                                         | 2                    |                                   |
| Field visit to a veterinary clinic/animal healthcare centre in your village.      | 3                    |                                   |
| Participation in vaccination or health check-up drives of animals in the village. | 5                    |                                   |
| <i>What do I have to do?</i>                                                      |                      |                                   |
| Preparing a health record for the selected animal.                                | 5                    | LO 3, 4                           |
| Estimating the weight of selected animals.                                        | 5                    | LO 3, 4                           |
| Preparing a feeding chart.                                                        | 3                    | LO 1, 2, 3, 4, 5, 6, 7, 9, 10, 11 |
| Feed formulation— Making of silage and cost calculation.                          | 10                   |                                   |
| Feed formulation— Making healthy dry fodder mixture.                              | 10                   |                                   |
| Offering feed to animals and observing their response.                            | 3                    | LO 3, 10, 11                      |
| Preparing home remedies for livestock.                                            | 2                    | LO 1, 2, 3, 4, 5, 6, 7, 9, 10, 11 |
| <i>What did I learn from others, and how did I use it?</i>                        | 1                    | LO 1, 5, 7                        |
| <i>What did I do, and how long did it take?</i>                                   | 1                    | LO 4                              |
| <i>What else can I do?</i>                                                        | 1                    | LO 7, 9, 10, 11, 18               |
| <i>Think and Answer</i>                                                           | 1                    | LO 7, 8, 18                       |

LO 12, 13, 14, 15, 16 and 17 to be observed, throughout the project.

## Project 3: Working With Wood And Bamboo

Connection with other curricular areas: Mathematics, Arts

| Activity                                                   | Required periods: 50 | Related Learning Outcomes         |
|------------------------------------------------------------|----------------------|-----------------------------------|
| <i>What will I be able to do?</i>                          | 2                    | LO 1, 2, 3, 7                     |
| <i>What will I need?</i>                                   |                      |                                   |
| <i>How do I keep myself and others safe?</i>               |                      | LO 6                              |
| <i>What will I need to know before I start?</i>            |                      | LO 1, 3, 5, 7, 8                  |
| Visit a local woodworking/bamboo workshop.                 | 3                    |                                   |
| Understanding products made of wood/ bamboo.               | 6                    |                                   |
| <i>What do I have to do?</i>                               |                      |                                   |
| Make a prototype of the article you want to make.          | 5                    | LO 1, 2, 3, 4, 5, 6, 7, 9, 10, 11 |
| Making a product from Wood.                                | 10                   |                                   |
| Make a product from bamboo.                                | 10                   |                                   |
| Costing–How much did we spend?                             | 5                    |                                   |
| Basic repairs around the school.                           | 5                    |                                   |
| <i>What did I learn from others, and how did I use it?</i> | 1                    | LO 1, 5, 7                        |
| <i>What did I do, and how long did it take?</i>            | 1                    | LO 4                              |
| <i>What else can I do?</i>                                 | 1                    | LO 7, 9, 10, 11                   |
| <i>Think and Answer</i>                                    | 1                    | LO 7, 8, 18                       |

LO 12, 13, 14, 15, 16 and 17 to be observed, throughout the project.

## Project 4: Home Automation

### Connection with other curricular areas: Science

| Activity                                                   | Required periods: 52 | Related Learning Outcomes         |
|------------------------------------------------------------|----------------------|-----------------------------------|
| <i>What will I be able to do?</i>                          | 2                    | LO 1, 2, 3, 7                     |
| <i>What will I need?</i>                                   |                      |                                   |
| <i>How do I keep myself and others safe?</i>               |                      | LO 6                              |
| <i>What will I need to know before I start?</i>            |                      | LO 1, 3, 5, 7, 9                  |
| Exploring automation in our surroundings.                  | 3                    |                                   |
| Explore circuits using simulation Platform.                | 5                    |                                   |
| <i>What do I have to do?</i>                               |                      |                                   |
| Building circuits using physical components.               | 10                   | LO 1, 2, 3, 4, 5, 6, 7, 9, 10, 11 |
| Make the circuit smart.                                    | 9                    |                                   |
| Exploring automation cycle.                                | 9                    |                                   |
| Making your own automation system using a microcontroller. | 10                   |                                   |
| <i>What did I learn from others, and how did I use it?</i> | 1                    | LO 1, 5, 7                        |
| <i>What did I do, and how long did it take?</i>            | 1                    | LO 4                              |
| <i>What else can I do?</i>                                 | 1                    | LO 7, 9, 10, 11                   |
| <i>Think and Answer</i>                                    | 1                    | LO 7, 8, 18                       |

LO 12, 13, 14, 15, 16 and 17 to be observed, throughout the project.

## Project 5: Water Audit

**Connection with other curricular areas: Science, Mathematics, Social Science**

| Activity                                                                                | Required periods: 43 | Related Learning Outcomes         |
|-----------------------------------------------------------------------------------------|----------------------|-----------------------------------|
| <i>What will I be able to do?</i>                                                       | 2                    | LO 1, 2, 3, 7                     |
| <i>What will I need?</i>                                                                |                      |                                   |
| <i>How do I keep myself and others safe?</i>                                            |                      | LO 6                              |
| <i>What will I need to know before I start?</i>                                         |                      | LO 1, 3, 5, 7, 9                  |
| Water measurement methods.                                                              | 4                    |                                   |
| Interview with water supply official.                                                   | 2                    |                                   |
| <i>What do I have to do?</i>                                                            |                      |                                   |
| Estimating average consumption in a household.                                          | 5                    | LO 1, 2, 3, 4, 5, 6, 7, 9, 10, 11 |
| Rainwater availability in your district/ town/village/ward (Secondary data collection). | 8                    |                                   |
| Compare and analyse the data.                                                           | 3                    |                                   |
| Identify wastage points and amount of wastewater.                                       | 4                    |                                   |
| Reusing water                                                                           | 8                    |                                   |
| Estimate future water requirements.                                                     | 3                    |                                   |
| <i>What did I learn from others, and how did I use it?</i>                              | 1                    |                                   |
| <i>What did I do, and how long did it take?</i>                                         | 1                    | LO 4                              |
| <i>What else can I do?</i>                                                              | 1                    | LO 7, 9, 10, 11                   |
| <i>Think and Answer</i>                                                                 | 1                    | LO 7, 8, 18                       |

LO 12, 13, 14, 15, 16 and 17 to be observed, throughout the project.

## Project 6: Advertising For Small Businesses

Connection with other curricular areas: Language, Arts, Social Science

| Activity                                                   | Required periods: 50 | Related Learning Outcomes         |
|------------------------------------------------------------|----------------------|-----------------------------------|
| <i>What will I be able to do?</i>                          | 2                    | LO 1, 2, 3, 7                     |
| <i>What will I need?</i>                                   |                      |                                   |
| <i>How do I keep myself and others safe?</i>               |                      | LO 6                              |
| <i>What will I need to know before I start?</i>            |                      | LO 1, 3, 5, 7, 9                  |
| Exploring advertisements in our surroundings.              | 2                    | LO 1, 2, 3, 4, 5, 6, 7, 9, 10, 11 |
| Elements comprising advertisements.                        | 4                    |                                   |
| Meeting an expert.                                         | 3                    |                                   |
| <i>What do I have to do?</i>                               |                      |                                   |
| Identification of client.                                  | 8                    |                                   |
| Understanding the small business.                          | 5                    |                                   |
| Designing the advertisement.                               | 20                   |                                   |
| Review                                                     | 2                    |                                   |
| <i>What did I learn from others, and how did I use it?</i> | 1                    | LO 1, 5, 7                        |
| <i>What did I do, and how long did it take?</i>            | 1                    | LO 4                              |
| <i>What else can I do?</i>                                 | 1                    | LO 7, 9, 10, 11                   |
| <i>Think and Answer</i>                                    | 1                    | LO 7, 8, 18                       |

LO 12, 13, 14, 15, 16 and 17 to be observed, throughout the project.

# CONSTITUTION OF INDIA

## Part III (Articles 12 – 35)

(Subject to certain conditions, some exceptions and reasonable restrictions)

guarantees these

## Fundamental Rights

### Right to Equality

- before law and equal protection of laws;
- irrespective of religion, race, caste, sex or place of birth;
- of opportunity in public employment;
- by abolition of untouchability and titles.

### Right to Freedom

- of expression, assembly, association, movement, residence and profession;
- of certain protections in respect of conviction for offences;
- of protection of life and personal liberty;
- of free and compulsory education for children between the age of six and fourteen years;
- of protection against arrest and detention in certain cases.

### Right against Exploitation

- for prohibition of traffic in human beings and forced labour;
- for prohibition of employment of children in hazardous jobs.

### Right to Freedom of Religion

- freedom of conscience and free profession, practice and propagation of religion;
- freedom to manage religious affairs;
- freedom as to payment of taxes for promotion of any particular religion;
- freedom as to attendance at religious instruction or religious worship in educational institutions wholly maintained by the State.

### Cultural and Educational Rights

- for protection of interests of minorities to conserve their language, script and culture;
- for minorities to establish and administer educational institutions of their choice.

### Right to Constitutional Remedies

- by issuance of directions or orders or writs by the Supreme Court and High Courts for enforcement of these Fundamental Rights.

