Unit 1 : Water Education

Chapter 1: Environment and Ecosystem

Briefly...

The environment is a balance of biotic, abiotic, geographical and social factors that affect each other. The interaction between biotic and abiotic elements in the environment and the principles related to their interaction are studied under environmental studies.

Food, clothing and shelter are the basic human needs and are dependent on the environment.

1. Natural Environment : The various elements that are naturally formed on the earth's surface are part of the environment; e.g. water, air, soil, forest, animals, biological elements, climate, atmosphere etc. It signifies diversity in the natural environment. Such kind of variation is also seen in the structure of natural elements of Maharashtra state. Due to this variation, the *Sahyadri* in the west, the *Deccan Plateau* in the middle, the Coastal region of *Konkan* and the *Vidarbha-Khandesh* are some of the natural structures observed in the Maharashtra.

2. Man-made environment : Humans have made radical changes in the natural environment on the strength of their intellect. Such as settlement of human lives, transportation by various means like roads, airways, waterways, railways etc. along with industrial development and establishments of industries are going on rapidly. All these man made elements on this earth is collectively called as 'man-made environment'.

The relationship between Abiotic and Biotic elements and their interaction is called 'Ecosystem'.

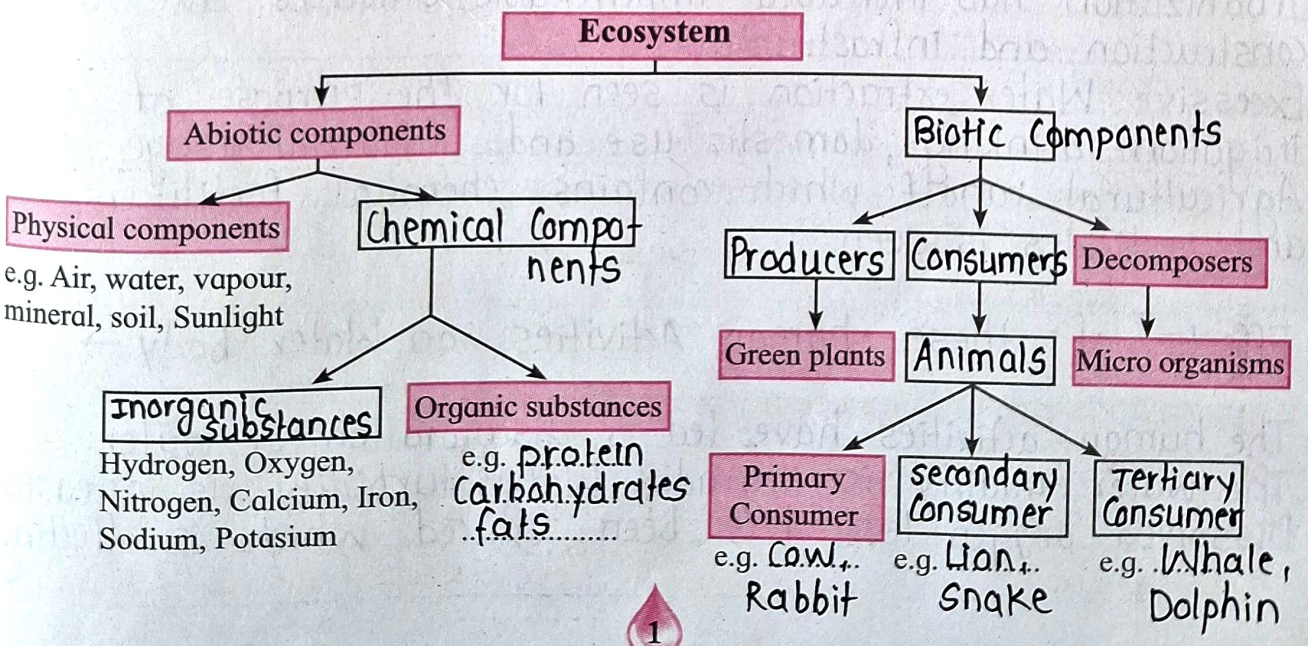
Relationships between the different elements like specific locality, area, size, climate, topography, rock - land, water flow system, etc. are responsible to define the types of ecosystem. Such as land ecosystem, aquatic ecosystem. Even a small watershed or lake can be a ecosystem.

1. Land ecosystem : Grasslands, Forests, Deserts.

2. Aquatic ecosystem : River ecosystem, Marine ecosystem, Lake ecosystem.

At present, however, human intervention is causing huge damage to the ecosystem. For this it is necessary to study it and take measures.

Activity : Complete given chart



Name of the activity : To study the impact of human intervention on the water resources/ water ecosystem in your area.

Purpose / importance of the activity :

To understand how human activities influence water availability, water quality and health of the water ecosystem

Proposed time duration for the activity :

2 to 3 days

Materials and apparatus required for the activity :

Notebook and pen for noting observations, Sample containers, Water testing kits, Mobile phone / Camera for documentation, Map of the area, Questionnaire, Gloves, boots

Methodology of the activity : Information with specific notes on damage of water ecosystem/ water resources due to human intervention and its effects.

A) Human Activities observed near the water body →

- Discharge of domestic wastewater and sewage
- Discharge of untreated or partially treated industrial effluents into water resource
- Tourism in the area led to increased waste generation and littering near the water body
- Urbanization has increased impermeable surfaces due to construction and infrastructure
- Excessive Water extraction is seen for the purpose of irrigation, drinking, domestic use and Industrial usage
- Agricultural runoff which contains chemical fertilizers and pesticides is seen.

B) Effects of these human Activities on Water body →

- The human activities have led to discoloration of water
- The water quality is degraded. Water turbidity is increased.
- Dissolved oxygen level has been reduced which is affecting

the aquatic life and aquatic biodiversity.
- Due to contamination of water there is a spread of water borne diseases like cholera and dysentary.
- Agricultural runoff is causing nutrient accumulation in the water body and eutrophication.
- There is reduction in native aquatic species.
- The increased impermeable surfaces due to construction led to reduction in groundwater level.
- Social and Economic implications are also seen. Due to declining fish population there is a loss of traditional fishing livelihoods.
- Changes in water flows and quality is affecting the process-es like sediment transport and water cycle.
- Pollution has reduced the availability of clean water for humans.
- Altering river flow, trap sediments and disrupts fish migration which affects aquatic biodiversity.
- shipping activities introduces non-native species which disrupts ecosystem.

Diagram / Photographs :






Concepts that have become clear during the activity :

- Concepts like how human activities such as Industrialisation, Infrastructural projects, Construction, Tourism, Agriculture, Overextraction of water has caused a harm to the water ecosystem have become clear during the activity.

What new things did you learn ?

- Eutraphication = Nutrient accumulation in water body.
- Introduction of non-native species which compete with native species which inturn leads to disruption of aquatic ecosystem.

Conclusion :

- A significant harm has been caused to the water resources / water ecosystem by the human intervention / activities.
- Immediate action is required to mitigate these effects.

Write your own opinion / experience about the activity :

This activity has helped to understand the concepts better by observing real world, draw conclusions and think critically.

Cooperation from the parents :

- Parents capperated by praviding required materials, encouraging to ask questions, guiding in understanding the concepts, also encouraging to think independently.

Opinion of the parents :

- Parents view this activity educational and impactful. They appreciate that this activity teaches children the importance of environmental conservation and responsible water usage.
- They feel that this activity is highly relevant.
- But they were worried about children's safety during the activity.

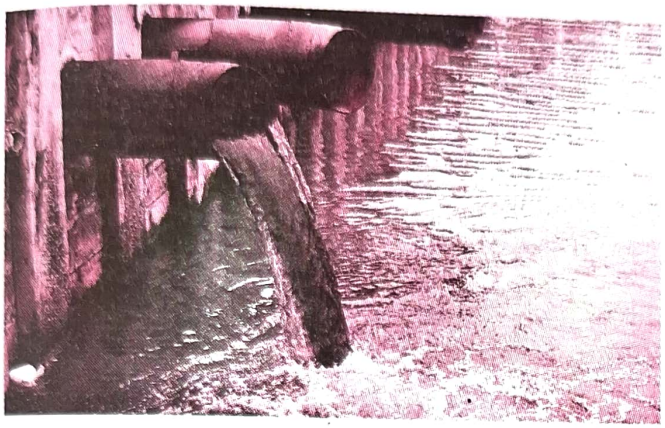
Persons who have helped you :

- Parents, Teachers, Classmates and friends helped in this activity.

List of the reference materials :

- News Articles on Water Pollution
- Documentary on Effects of Water Pollution
- Google Map and other local area map for reference

Activity : Two pictures are given below. What effect does human intervention have on the water ecosystem ? Write down their reasons. Which measures would you suggest to sustain the water ecosystem ?



Reason

Effect

A) Effects on Water Ecosystem →

- Eutrophication → Accumulation of excess nutrients leads to excessive growth of algae and plants. This reduces oxygen level in the water. Many acquatic species cannot survive in such environment.

- Water pollutants such as chemical fertilizers, pesticides, industrial wastes make water toxic and harmful for the aquatic life.

- Thermal pollution disturbs temperature of water. Some species are temperature-sensitive. They cannot survive in such environment.

- It also affects food chain as toxins accumulate through bioaccumulation.

Teacher's feedback and signature with date :

Unit 1 : Water Education

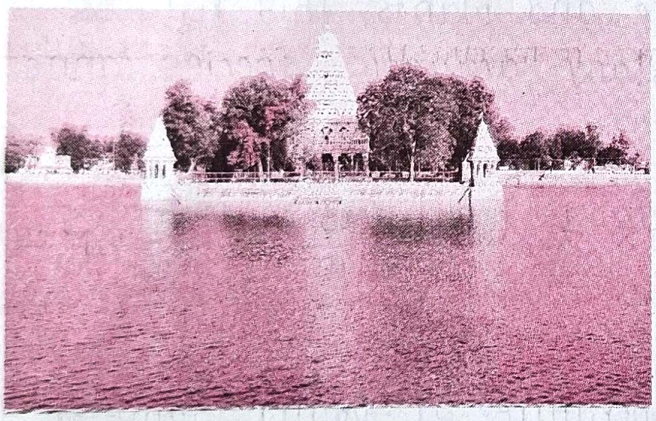
Chapter 2 : Cultural Heritage of Water Wisdom

Briefly ...

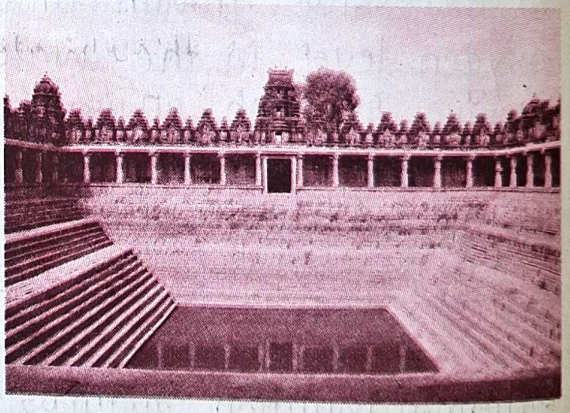
As water is one of from *Panchatatv*, just like human life water has a unique significance in Indian culture. There was plenty of water in ancient times. In the *Rigveda*, the *Yajurveda* and the *Atharvaveda* has mention construction of dams to block river water, construction of canals to supply water to remote areas, it is also recorded that wells have been constructed for ground water use.

While studying the cultural heritage of water wisdom, you have studied ancient water culture on the banks of the river Saraswati, as well as the writing *Varahmihir* and *Parashar Muni*. The culture heritage of water management is vast and you can study various structures from ancient times. These mainly includes ancient water distribution system, water storage systems (lakes, ponds, etc.). While studying cultural heritage of water management, you will also notice, that various ancient structures of water management have disappeared in recent time. Very few are exist. There must be some such examples all around you. To study them, you need to visit an ancient water managements/storage site in the area you know. Efforts must be made to revive them.

Some Examples of cultural heritage of water management/water storage :

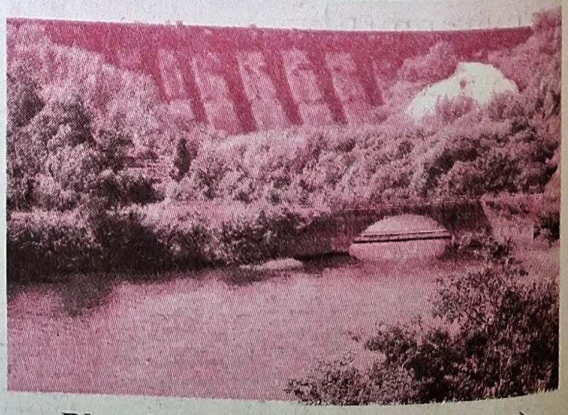


Mariyamman Teppakulam Lake

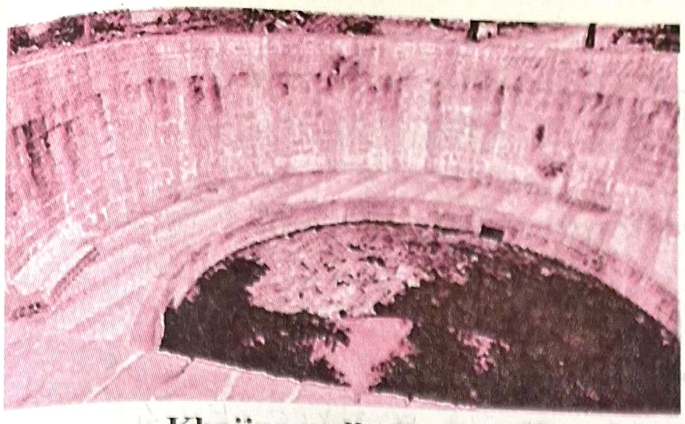


Pushkarni Temple Area

Malgujari Lake

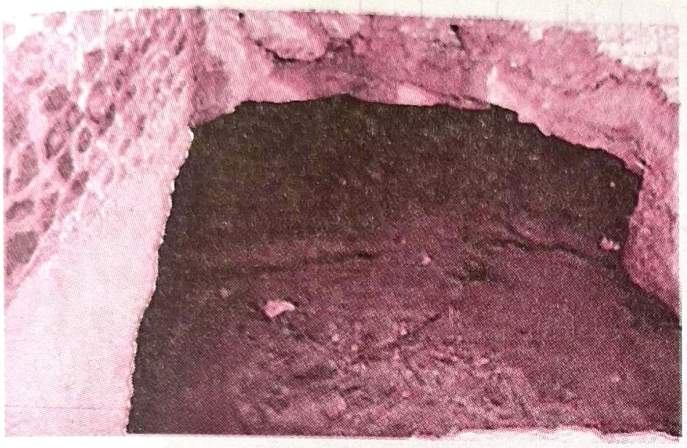


Bhandardara Dam (Wilson Dam)

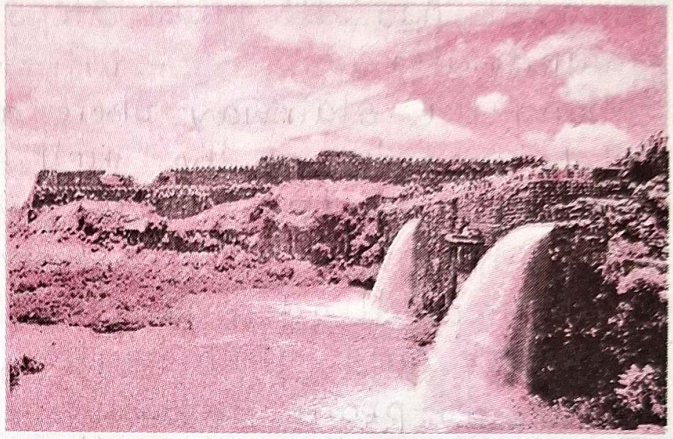


Khajina well - Beed

Trench around the fort at Kandhar in Nanded District



Water Devtake at Sinhgad District-Pune



Water falls due to water storage - Naldurg, District- Dharashiv

Name of the activity : **Studying an ancient water management/water storage system that you know or that is in your area.**

Purpose / importance of the activity :

The purpose of the activity is to understand the traditional water conservation practices which would help to address the current water scarcity, to inspire modern engineering in promating sustainability and resilience, etc.

Proposed time duration for the activity :

three to faur days

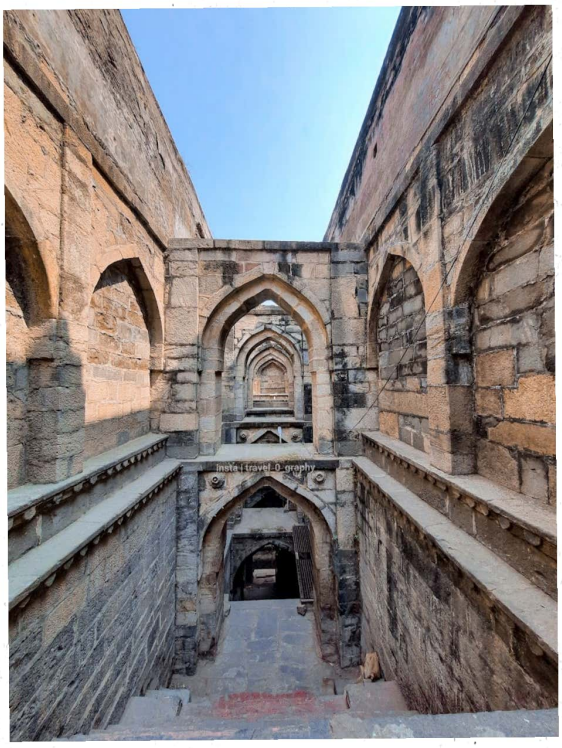
Materials and apparatus required for the activity :

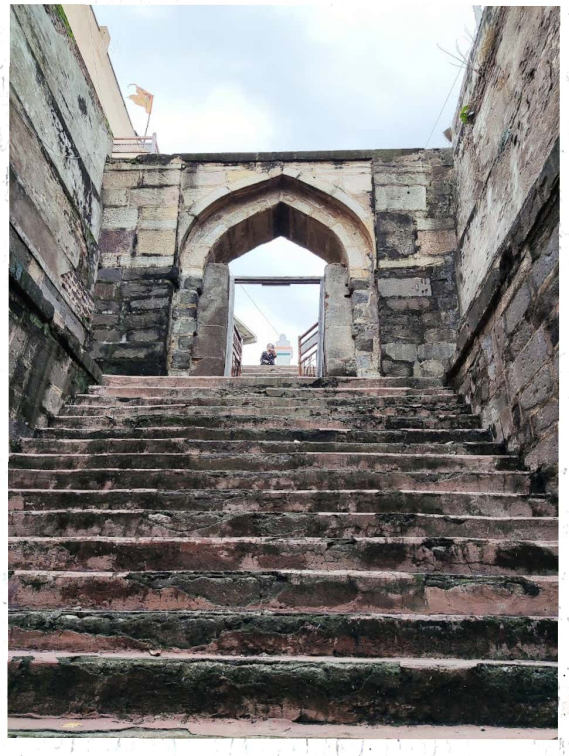
Notebook & Pen, Camera / Mobile Phone, GPS devices for mapping & documentation, Sketchpad, Pencils for site drawing, Recorders for recording Interviews, Map, Books detailing ancient Management practices etc.

Methodology of the activity : Detail information including location, arrangement etc. of ancient water management/water storage system in the area.

- Mahimapur Stepwell, Amravati, Maharashtra
- This stepwell is located in Mahimapur Village which is 40 km from Amravati district.
- This well was constructed around the 13th century.
- The well is seven storeys deep.
- The dimensions of the well are — 25 metres by 40 metres and 80 feet deep.
- The well has 85 wide steps which lead down to the groundwater.
- Along the stairway there are arches and passage around all four sides of the well.
- Reddish sandstone was used in the construction of the well, which was sourced from Madhya Pradesh.
- Such stepwell acted as reliable water reservoirs, storing rainwater and groundwater for year-round use, especially in drought-prone areas.
- The depth of the stepwell keeps the water away from direct sunlight which significantly reduces evaporation.
- The porous structure allowed water to seep into the ground, replenishing the groundwater table.

Diagram / Photographs :





Concepts that have become clear during the activity :

How Ancient Water management Systems are effective, innovative, sustainable and environment friendly has become clear during the activity

What new things did you learn ?

- There are nearly 2000 stepwells in Maharashtra, mapped and documented by Rohan Kale a HR professional from MH.
- Stone walls surraunding the well absorbed heat keeping the water cooler, reducing the rate of evaporation
- Structures like chambers, platforms & arches creat cooler climate within the well.

Conclusion :

Ancient Water Conservation Systems were environment friendly as they supported aquatic life and local ecosystems. These systems offer valuable lesson for modern water conservation and sustainable development.

Write your own opinion / experience about the activity :

- This activity creates environmental awareness. It highlights the importance of water conservation and groundwater recharge.

Cooperation from the parents :

- Parents cooperated by planning visits to historical sites such as stepwells, ancient dams etc. Shared stories about traditional Water management.

Opinion of the parents :

- They see the activity as an appartunity to raise awareness about water conservation.
- They appreciate the activity as it helped to learn about culture, tradition and history.
- They find it valuable as it can inspire to search for modern solutions to Water Conservation

Persons who have helped you :

Parents., Teachers., Classmates and friends.

List of the reference materials :

- News Articles — The Indian Express article on Rohan Kale's Project. Hindustan Times article.
- Documentary Videos on Stepwells of Maharashtra.

Activity : Make a model for an ancient water management/water storage system you have studied. Which remedies you suggest for maintaining these water management systems in future, which you studied in present.

Remedies for maintaining Water Management Systems

- Cleaning the wells, tanks, reservairs periadically. This helps to maintain water quality by removing contaminants and preventing sediment buildup.
- Regular Water testing and Water treatment is necessary.
- To prevent debris from entering the system strainers should be used.
- Any obstructions like plant roots should be removed.
- Repairing damaged pipes, joints etc. to avoid water loss.
- To evaluate system perfarmance periadic audit should be conducted.

Teacher's feedback and signature with date :

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Chapter 3 : Measurement of Water

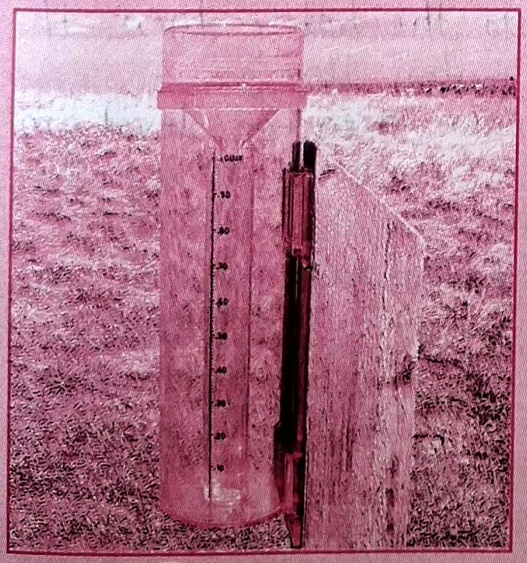
Briefly...

Groundwater resources need to be measured properly in order to be preserved properly. Since all groundwater originates from the water cycle, it is necessary to measure all the factors involved in the water cycle such as vapour, rain, flowing water, stagnant water and seeping water. 'The device used to measure rainfall is called a rain gauge.'

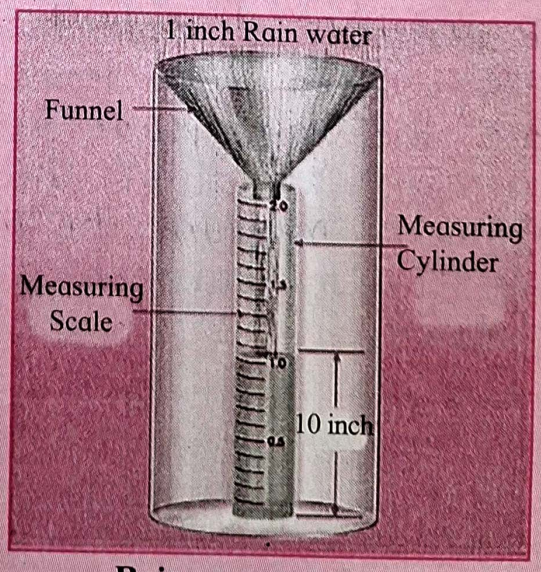
Rain - gauge structure

The rain gauge consists of a cylindrical flat bottom measuring cylinder. Some part of this gauge is buried in the ground. Part of this cylinder that stays on the ground has another cylinder inside which can be removed and placed in it. It holds a glass bottle to store water falling from the funnel pipe. The upper side is made up of funnel shape. The diameter of the funnel mouth is 127 mm (5 inches) and the height of an edge is 110 mm (4.5 inches). If there is wind during rain, the edge is sharp and high so that rain water does not flow out of the funnel. The top edge of the gauge is exactly at 30.5 cm (12 inches) above the ground. The rain water that falls on the mouth comes down through a narrow tube and collects in a cylindrical vessel or glass bottle. The diameter of the funnel pipe is made very small so that the rain water does not evaporate.

While measuring water, the height should be recorded by looking at the lower edge of its level. The height can be measured by dipping a water-proof plastic calibrated strip in bottled water. The water in the daily rain gauge is measured once a day at certain time (8.30 am as per Indian Standard Time). In some places such observations are made several times in a day. Similarly, weekly and monthly rain gauges have been made and the cylindrical vessels for storing water are of larger size. In addition, to measure water accurately, weighs the collected water and determine the amount of rainfall. Due to this method, the possibility of not to measure the amount of sewage and water sticking to the pots while pouring water from a pot into the container, is not there.



Rain - guage



Rain - guage structure

Name of the activity : Make a Rain - gauge and record the rainfall in your area for one week in rainy season.

Purpose / importance of the activity :

- The purpose is to understand the process of measuring and recording rainfall.
- Also - to understand rainfall patterns
  - to know how scientific instruments work.

Proposed time duration for the activity :

7 - 8 days

Materials and apparatus required for the activity :

Empty Plastic Bottle, Marker, Scissor / Cutter, Ruler, Cellotape, Notebook, Pen etc.

Methodology of the activity : Detail information of rain gauge preparation and use with place and duration.

Rain gauge Preparation

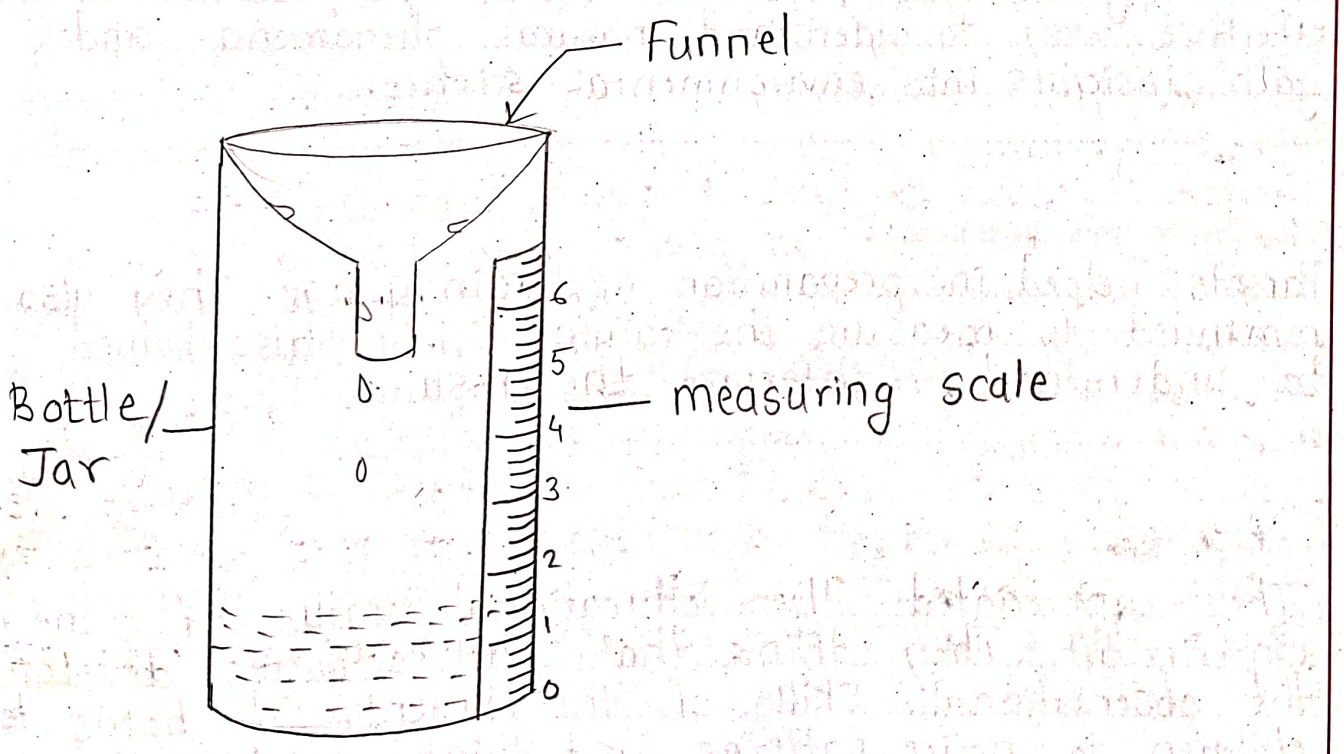
Steps

1) Cut the top part of a plastic bottle to create a funnel.
2) Place the funnel on the other part of the bottle in inverted position to direct rainwater into the bottle.
3) Using a ruler (scale) mark measurement lines on the side of the bottle with a marker starting from the bottom and label the markings.
4) (If water is already added into the bottle then the marking should start from the water line.)
4) Place the rain gauge in an open area on level ground.
5) After every 24 hours check the water level against the marking to measure the rainfall.
6) Record the measurement, empty the rain gauge and set it up again.

Rainfall measurement record for a 6-day period during Rainy Season in Latur.

Date		Rainfall
07 July	–	170 mm
08 July	–	185 mm
9 July	–	220 mm
10 July	–	120 mm
11 July	–	240 mm
12 July	–	285 mm

Diagram / Photographs :



Rain Guage

Concepts that have become clear during the activity :

The activity helped to understand how rainfall is measured., Variation in Rainfall patterns and importance of taking rainfall measurements

What new things did you learn ?

- Depth of rain collected is independent of the opening size of the guage.
- Temperature & wind speed influence evaporation which can affect accuracy of the measurement.

Conclusion :

- The rain guage provides a simple yet effective method to measure the depth of rainfall.
- The measurement data can be used to track weather patterns & analysing climate trends.

Write your own opinion / experience about the activity :

It is a good activity for educational purpose. It is an effective way to uderstand natural phenomena and gain insights into environmental science.

Cooperation from the parents :

Parents helped in preparation of rain guage. They alsa reminded to measure the rainfall. They also helped to understand & interpret the results.

Opinion of the parents :

They appreciated the educational value of the experiment. They think that such activities develop the observational skills of the students. It helps to children to notice patterns and think analytically about weather.

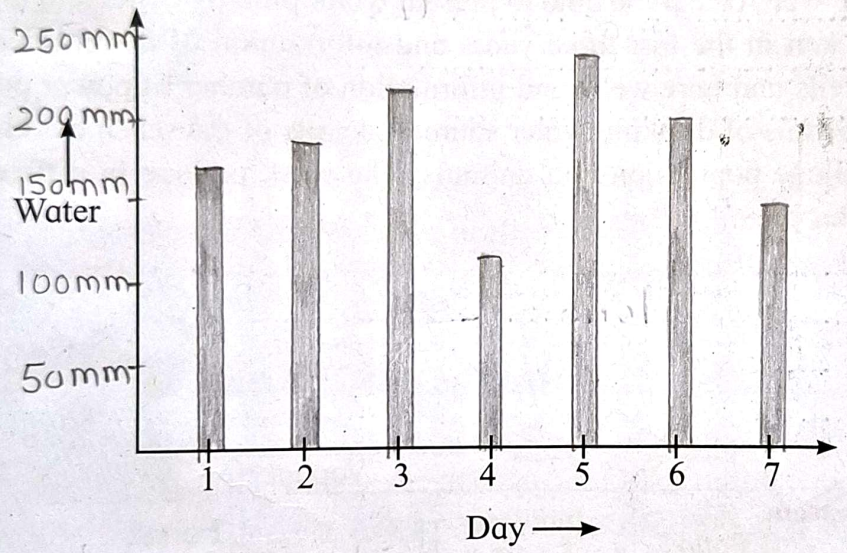
Persons who have helped you :

Parents, Teacher, Friends

List of the reference materials :

Videos about how to make a rain guage and how to measure rainfall.
website - mausam.imd.gov.in

Activity : Draw a graph based on the rainfall records you take. Why the rainfall records are different for each student in your class. Write down the reasons.



- Reasons for different rainfall records
- If students measure rainfall at different times of the day, they may capture different amounts of precipitation.
- There is always a possibility of human error which can lead to differences in results.

Teacher's feedback and signature with date :

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