

GUARDIANS OF THE ENVIRONMENT (LEVEL 3)

Description	Learners will create a conservation tool like a rainwater harvesting tool or any method of forest conservation based on their understanding of water and forests. They will explore the concepts of water cycle, sources of water, water scarcity, uses of water, deforestation and afforestation to come up with this tool.
Leading question	What can we do to protect the environment in which we live?
Subjects covered	Science, Math, English, Art and Design
Total time required	40-60 mins a day for 5 days
Resources required	Pen/marker, plastic bag or wrap, cup or mug, warm water, a large bowl or container, heat source (for example candles), sand/soil, gravel, water, sticks, watch, an empty shampoo or cream pump, a rubber band or tape, seeds to plant at home
Learning outcomes:	<p>By the end of this project, learners will be able to:</p> <p>Knowledge-Based Outcomes:</p> <ol style="list-style-type: none"> 1. Draw the water cycle and describe the process involved in it. 2. Identify the various sources of water and the availability of freshwater. 3. Understand water scarcity and explore water usage. 4. Define deforestation and afforestation. <p>21st Century Skill Outcomes:</p> <ol style="list-style-type: none"> 1. Critically think of environmental issues and design a conservation tool. 2. Communicate effectively and present their findings through various visual media and speeches. 3. Be creative in designing and building a conservation product.
Previous Learning	State of matter - solid, liquid, and gas
Supervision required	Medium

Day 1 -

Today, you will learn about the water cycle, sources of water, and water usage.

Time	Activity and Description
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10 minutes

Introduction:

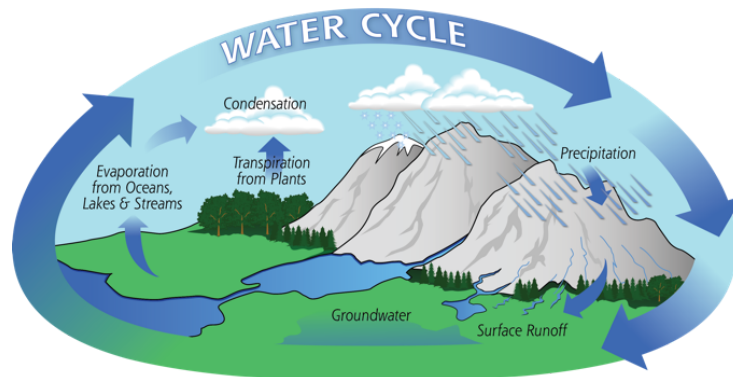
Have you ever wondered why it rains?

Why do you think we have a water shortage in spite of $\frac{3}{4}$ th of our planet being covered with water?

In this project, we will find out the answers to these questions and also learn ways to become the guardians of this environment by conserving our water and forests.

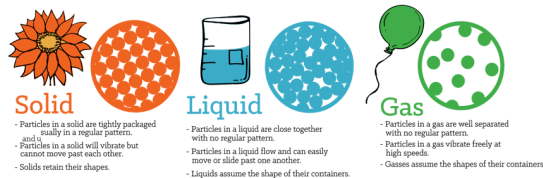
Note: Ask learners to read the story of [The Water Cycle](#) (See **Appendix 1**) or read the story for learners and answer the following question after reading.

- What is the water cycle?
- The **water cycle** is a natural process that manages the flow of water in nature. It involves several stages: **evaporation**, where water turns into vapour; **condensation**, where vapour turns into tiny water droplets forming clouds; **precipitation**, where the droplets fall back to the Earth in different forms such as rain or snow; and the cycle repeats.



Tip: Revise the state of matter with learners in relation to the water cycle if needed:


Three States of Matter



Note: Ask learners to draw and label the water cycle in their notebooks based on this description. If they struggle, you can help them with the drawing.

Why is water important?

- What would happen if the water cycle did not function properly? Look at your drawing and explain what would happen if any stage of the water cycle stopped working.

	<p>Water is essential to life on this planet. Without water, there is no life. The water cycle sustains plants, animals, and habitats in our community. If there is no condensation, all the water will evaporate and the earth will dry up. It would not rain either. Plants and animals will not have water to survive. Hence each process in the water cycle is important.</p>
5 minutes	<p>Sources of water</p> <p>Where does the water you drink come from? Sure, water is easily accessible from a sink faucet or hand pump, but where was it before that?</p> <p>Based on your understanding of the water cycle, what do you think is the source of water?</p> <ul style="list-style-type: none"> - A water source refers to any natural or artificial location from which water can be extracted, obtained, or accessed for various purposes. <p>Note: Ask learners to list down various sources of water. You can ask learners to think of various natural bodies of water that they have come across to help answer the question. After listing, ask learners to sort them into fresh or salty water.</p> <ul style="list-style-type: none"> - Water sources can be classified into two main categories based on their composition: freshwater and saline water. Each category encompasses various sources of water: - Freshwater: This includes surface water (rivers, lakes, ponds, streams), groundwater (wells, springs), glaciers, and ice caps - Saline water: This includes oceans, seas, estuaries
5 minutes	<p>Water Scarcity</p> <p>Look at this picture.</p> <ul style="list-style-type: none"> - How much water do you think there is on Earth? - Can you think what fraction of our planet's water covers? - Almost $\frac{3}{4}$th of our planet is covered with water. If there is so much water on earth, why do people struggle to get it and work hard on conserving it? - Even though water seems to be everywhere, not all of it is suitable for use. Only about 3% is freshwater (in ice, lakes, rivers, and groundwater) and less than 1% is available for consumption. Therefore, freshwater is a scarce and valuable resource. Humans use it for almost everything – agriculture, power generation, and personal use. 
20 minutes	<p>Exploring Water Usage</p> <p>To understand how to use water wisely, we need to first find out how much water we use in our daily lives for different activities.</p> <p>Step 1: Identifying Water Usage</p> <p>Note: Ask learners to create a table similar to the one below and list all the activities for which they use water in a day. Add any activities that they may have missed from the sample shown below.</p>

Activity	Amount of Water Needed
<i>Drinking</i>	
<i>Brushing teeth</i>	
<i>Bathing</i>	
<i>Washing utensils</i>	
<i>Washing clothes</i>	
<i>Flushing and cleaning toilets</i>	
<i>Cleaning floor</i>	
<i>Any other activity</i>	
<i>Total water used in a day</i>	

Step 2: Measuring Water Usage

1. Think and write down the amount of water that you need for each activity. Think about the amount in terms of a standard-sized tumble or container (a bucket/ a mug etc). Make sure you express all measurements in terms of the same container so you can compare the amounts easily later.
Note: Learners can take the help of their family to record the amount of water used.
2. Record the amount of water used for each activity in the column titled "Amount of Water Needed".

Step 3: Making Inferences and Reflecting on Water Usage

1. Write down your observations on which activity uses the most and the least amount of water.
2. Think about the importance and frequency of these activities. Are they essential? Do you perform them daily or occasionally?
3. What are some ways to reduce water usage during different activities?
4. Create a water diary to keep track of your water usage over the next few days. A water diary is a table noting down your intake of water like the one created for this activity. Note any reductions or changes you make in your water consumption.

Water is a precious resource that should be used wisely. By understanding our daily water usage and considering ways to reduce it, we can contribute to water conservation efforts. Remember to complete your water diary and be mindful of the importance of water in our lives.

At home activities	<ul style="list-style-type: none"> - Water diary: Fill out the table with your daily water usage. In your water diary, note your observations and reflections on water usage and conservation for the next 3 days. - Water Cycle Visual Representation: Learners work on their posters or diagrams of the water cycle.
Optional Literacy/ Numeracy Activity	<p>Numeracy: There are about 326 million cubic miles of water on the planet out of which only about 0.5% of freshwater is available for human consumption. The population of the earth is around 8 billion. How much freshwater does one person have available? (Hint: divide the total available freshwater in cubic miles by 8 billion)</p>

Day 2

Today, you will learn about the importance of forests and how deforestation leads to water scarcity.

Time	Activity and Description
10 minutes	<p>In the previous class, we learned about the water cycle and how important it is to make water available to all organisms. Today, we will learn about forests and how they conserve water and bring balance to our ecosystem.</p> <p>Note: Ask learners to read the following story or read the story for them and answer these questions: Uses of Trees (See Appendix 2)</p> <ul style="list-style-type: none"> - Why are forests and trees important? - Are humans the only ones that depend on trees? How do other organisms depend on them? - How can we protect forests? <p>Forests and trees purify the air, provide us with food and wood, prevent erosion, and act as an important buffer against climate change.</p> <ul style="list-style-type: none"> - Can you guess what the term “deforestation” means? Try to break the word down: De-forest-ation (<i>the decrease of forest areas across the world</i>) - Reforestation is the opposite. It's when we plant trees in deforested areas. - Afforestation is also the opposite of deforestation, but it is the process of planting trees in areas that were not forested. - What happens to the soil during deforestation? Let's see this through an experiment
10 minutes	<p>Deforestation & Afforestation</p> <p>Note: Gather the materials required for the experiment, draw the table and follow the steps. Materials required: Three plastic bottles, three plastic cups, a knife to cut the bottle, thread, water, soil, leaves and twigs, and a plant.</p> <p>Steps:</p> <ol style="list-style-type: none"> 1. First, lay the bottles down and then make a horizontal cut to remove the top section and turn the bottles into planters.

2. Place soil in the first bottle.
3. In the second bottle, place the soil and cover it with leaves and twigs.
4. In the third bottle, carefully insert the plant with all the soil attached to its roots.
5. Tie a thread around the cup and hang them from each bottle.

What do you think will happen when we pour water into each of these bottles? What will come out? Write down your hypotheses in the table below.


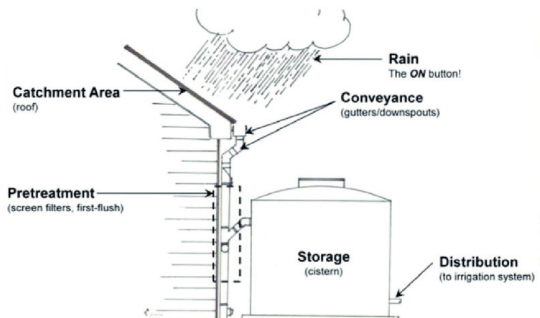
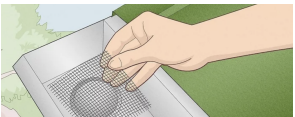
6. Now pour water to simulate rain and observe. Write your observations and conclusions



Hypothesis:	
Materials Needed:	
Method:	
Observations:	
Inferences:	

- The water from the bottle with the plant should be the clearest and its flow should be slowest.
- The water from the other two bottles will be polluted with soil and other materials.
- This is what happens in nature. Forests help filter sediments and other pollutants from the water in the soil before they reach a water source, such as a stream, lake, or river.
- Based on this experiment, how can we prevent soil erosion? (*Reforestation is one solution to conserve forests. It helps conserve water and the environment.*)

Note: Carefully place the plant back in the soil after the experiment.

5 minutes	<p>Water Conservation</p> <ul style="list-style-type: none"> - Today, we will learn about one of the most common tools that help conserve water. We know that by conserving water, we are also conserving our forests. - This is an example of what you make as your final product for this project. You can design similar tools. - What are some ways you can think of that can help preserve and protect our precious water resources and forests?
15 minutes	<p>Rainwater Harvesting Tool:</p> <ul style="list-style-type: none"> - One way of increasing the availability of water is to collect rainwater and store it for later use. Collecting rainwater in this way is called rainwater harvesting. - Rainwater Harvesting tool is used to collect the rainwater and store it. (<i>usually used for rainwater that falls on roofs</i>) - Can you think of uses for this water? (<i>Water collected is generally used for irrigation, livestock, and toilet flushing though it can also be used for drinking water if it is adequately treated and clean enough</i>) <p>Tip: Challenge learners to create their own tool to collect rainwater using cardboard and paper (e.g. they can fold the paper into a cylinder for the container and make smaller paper tubes for the pipes). See the points below if you will be demonstrating this activity:</p> <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p>Note: Ask learners to look at the picture and explain the process in which water is collected and stored.</p> <ul style="list-style-type: none"> - A simple rainwater harvesting tool has 3-4 main parts: <ol style="list-style-type: none"> 1. A roof or other catchment area: this is the area where water is collected (e.g. the roof of a house) 2. A storage tank(s): the storage tank is placed in three positions: on the ground, underground, and above the ground. The size of the tank should fit the amount of rainwater you need to collect 3. A pipe that directs the water from the catchment area to the tank 4. Advanced/optional): a pump to pull water from the tank and a water purifying system. A filter is useful for filtering rainwater because it 



	<p>prevents dirt and debris from the catchment area from entering into the storage tank.</p> <p>Note: Ask learners to design their rainwater harvesting tool on a piece of paper. They can draw how the rainwater harvesting tool would look like and make a note of the materials they will require to create it. They can use paper to make a cylinder for the storage tank and they can make smaller tubes using paper as well or use a plastic tube if available. They can make a hole in the tank and insert the pipe.</p>
At home activities	Interviews: Learners conduct 2-3 interviews with their community or family members to understand if rainwater harvesting tools will be useful for their community.
Optional Literacy Activities	<p>Numeracy: Catchment Area Calculation: You are designing a rainwater harvesting tool on your roof. The catchment area for collecting rainwater is rectangular, measuring 10 meters in length and 8 meters in width. Calculate the area of the catchment area in square meters.</p> <p>Answer: The formula to calculate the area of a rectangle is: $Area = Length \times Width$. $Area = 8 \times 10 = 80$ square meters.</p>

Day 3 –

Today, you will learn more about forest conservation and start designing your conservation products.

Time	Activity and Description
5 minutes	<p>Forest conservation We saw how we can create a tool to conserve water, but what can we do to conserve forests and trees? Note: Ask learners to think and write/draw how they think they can conserve forests and trees.</p>
15 minutes	<p>Forest Simulation Let's play a game to maintain a balanced forest ecosystem by making quick decisions to protect different elements.</p> <p>Steps:</p> <ol style="list-style-type: none"> 1. Draw a simple representation of a forest on paper with labelled sections for trees, animals, and water. You must have at least 50 trees in your forest. 2. Assign each component a numerical value representing its health or vitality (e.g., Trees = 10, Animals = 15, Water = 12).

	<p>3. The player starts with a certain number of points (e.g., 50 points). On each turn, the player quickly decides how to allocate their points among trees, animals, and water to maintain balance.</p> <p>4. Read out an event and resolve it by adjusting points based on the card's instructions. Note: <i>Teachers can add more events if required. Read out events randomly and ask learners to take action.</i></p> <p>5. If a component's points drop to zero, it represents a decline in the health of that part of the ecosystem.</p> <p>Note: <i>After playing the game for 7-8 minutes, ask learners to count the remaining points and state the condition of the forest. Were they able to maintain the balance of the forest ecosystem? Ask learners to reflect on the following questions:</i></p> <ul style="list-style-type: none"> - What did you learn from this game? - Do you think this happens in real life? - What are some reasons people cut down trees? - What would happen if we lost trees due to various activities regularly? 	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; padding: 5px;"> Deforestation Alert: <i>Event:</i> Illegal logging has been reported in a nearby area. Lose 5 trees unless you take immediate action! <i>Player Action:</i> Choose to plant new trees or invest resources in anti-deforestation measures. </td> <td style="width: 25%; padding: 5px;"> Rainfall Boost: <i>Event:</i> Heavy rainfall provides a boost to your water supply. All plants receive extra nutrients. <i>Player Action:</i> Take advantage of the increased water availability to plant additional trees. </td> <td style="width: 25%; padding: 5px;"> Pollution Spike: <i>Event:</i> A factory upstream has caused pollution in the water. Lose water quality points. <i>Player Action:</i> Invest in water purification methods or launch a cleanup initiative. </td> <td style="width: 25%; padding: 5px;"> Wildfire Outbreak: <i>Event:</i> A wildfire has started in a part of the forest. It's spreading rapidly <i>Player Action:</i> Deploy firefighting resources or let it burn, potentially rejuvenating the ecosystem afterward. </td> </tr> <tr> <td style="padding: 5px;"> Drought Period: <i>Event:</i> A prolonged period of drought is forecasted. Prepare for decreased water availability. <i>Player Action:</i> Conserve water resources, focus on drought-resistant plant species, or dig new water sources. </td> <td style="padding: 5px;"> Community Collaboration: <i>Event:</i> Local communities express interest in supporting your conservation efforts. Gain additional resources. <i>Player Action:</i> Allocate resources wisely to benefit both the forest and the local community. </td> <td style="padding: 5px;"> Forest Research Breakthrough: <i>Event:</i> A research team discovers a new method to enhance soil fertility. Gain soil nutrient points. <i>Player Action:</i> Apply the newfound knowledge to improve the overall health of the forest. </td> <td style="padding: 5px;"> Nature Reserve Designation: <i>Event:</i> A portion of your forest is designated as a nature reserve. 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10 minutes	<p>conservation of Forests</p> <p>What are some ideas you can think of to conserve forests and trees?</p> <p>We can find various creative ways to conserve trees and forests!</p> <ul style="list-style-type: none"> - One idea for forest and tree conservation includes the promotion of eco-friendly products. By encouraging the use of sustainable and eco-friendly products we can reduce the demand for goods that contribute to deforestation. - Paper recycling - trees are used to produce paper. To reduce wasting paper, we can reuse it and create products out of it like paper baskets and necklaces. 									

	<ul style="list-style-type: none"> - We can also create our own organic fertilizer (biofertilizer) to take to the forest on our next visit and help plants that appear weak or struggling by giving them more nutrients. <div style="display: flex; justify-content: space-around; align-items: center;">   </div> <ul style="list-style-type: none"> - You can make a fertilizer out of dried and crushed eggshells to provide calcium to plants. You can create your own compost out of vegetable and fruit waste and use that as a fertilizer. You can also add coffee grounds to add nitrogen, an essential nutrient to plants.
10 minutes	<p>Ideas for Final Product</p> <p>Now that we have seen both water and forest conservation ideas, you will finalise which conservation tool you want to create.</p> <p>If you are working on a water conservation tool:</p> <ul style="list-style-type: none"> - You are going to work on the design today and in the next class, you will finalize it and build your model. - Think of the availability of the material required to create this model. <p>There are 3 important considerations for your tool:</p> <ul style="list-style-type: none"> - How good and strong is the tool? - How much water can it hold? - What can the water be used for? (E.g., irrigation) <p>If you are working on a forest conservation tool:</p> <ul style="list-style-type: none"> - Decide the type of product you want to create - Think about how this can be used - Think how you will convince others to use it to protect forests and trees - What is the message you want to share with your community to encourage them to conserve forests and trees? <p>Note: Ask learners to decide which conservation tool they would like to work on and get started on creating a design for the same.</p>
At home activities	<ul style="list-style-type: none"> - Learners present their ideas to their parents/siblings and get their feedback. - Bring all of the resources needed to create your final product - If you are working on: <ul style="list-style-type: none"> - A water conservation tool: think with your parents/elders about the uses of water that is collected using this tool such as gardening/irrigation, cleaning etc. Avoid designing a tool for collecting drinkable water since that could be hazardous.

	<ul style="list-style-type: none"> - A forest conservation product: look for items you can use to create your final product - for example, a product using scrap paper or paper products (e.g. newspapers)
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Day 4 –

Today, you will build your conservation product and receive feedback. You will also create a guide to show others how and why they should use your tool.

Time	Activity and Description
5 minutes	<p>Introduction</p> <ul style="list-style-type: none"> - Yesterday you discussed product ideas with your families. If there was any feedback they shared, take some time to incorporate the feedback into your design. - Are you excited to build your model? - Today, you will design and build your product and test it. - What materials will you use to design your products?
25 minutes	<p>Creation of final product</p> <p>Note: Learners will work to create their products. They can think about the following as they work on their products.</p> <ul style="list-style-type: none"> - What problem does this tool solve? (<i>deforestation, water scarcity, pollution etc.</i>) - How is this tool going to help solve the problem? - How does the tool work? - Optional: Learners can create a guide/flyer for their model or a poster about the bigger issue they are trying to solve. They can present the guide or poster during their final presentation the following day - If they are designing a guide, they can design a simple flyer containing key information about the product such as: <ul style="list-style-type: none"> - Group name and school name - Product name - Paragraph about water or forest conservation - How the tool was designed - How it works - How it helps solve the issue - The flyer should be visually appealing
10 minutes	<p>Feedback</p> <p>Note: Ask learners to share their product with a family member to receive feedback. They can provide feedback on the following questions:</p> <ul style="list-style-type: none"> - Is the product the same as what was designed? - Does this product represent a way of conserving forests/water? - What did you like about the product? - What can be done better? <p>Note: Ask learners to make any necessary changes to the product based on the feedback.</p>

Day 5 -

Today, you will present your final project to your audience.

Time	Activity and Description
10 minutes	<p>Preparation</p> <p>Note: Ask learners to set up their model and practice what they will be sharing with the audience. During the presentation, they need to share:</p> <ul style="list-style-type: none"> - The name of the product - Why it was designed - The environmental issues it addresses - How it works and how it can be used
20 minutes	<p>Presentation</p> <p>Note: Ask learners to present their models and share what they prepared.</p>
10 minutes	<p>Reflection:</p> <p>Note: Encourage learners to think about what they have learned, their growth, and the impact of their work.</p> <ul style="list-style-type: none"> - What did you learn from this project? - What did you enjoy doing the most during this project? - Do you think you will be mindful of your water usage going forward? - Do you think you will be mindful of the products you buy and how they impact forests? - What are some steps you are going to take to ensure you are being a guardian of the environment? <p>Note: Acknowledge and celebrate the efforts and achievements of the learners. Recognize outstanding projects, creativity, teamwork, and engagement throughout the week.</p>

Additional enrichment activities:	<ul style="list-style-type: none"> - Learners can be introduced to the importance of forests and trees in maintaining balance in the ecosystem through an introduction to food chains and food webs.
Modifications for simplification	<ul style="list-style-type: none"> - If your learners are unable to write, encourage them to draw pictures to show their ideas, and communicate verbally. - Allow learners to choose the format in which they present their data, such as a traditional oral presentation, a visual poster, a slideshow, or a written report. This accommodates different learning preferences and skills. - Adapt your explanations based on learners' prior knowledge and comprehension levels. Simplify the language or provide additional examples for struggling learners, while challenging more advanced learners with higher-level explanations or connections to other scientific concepts.

ASSESSMENT CRITERIA

A majority of my learners were able to:

- Illustrate and describe the processes involved in the water cycle.
- Understand the various sources of water and the availability of fresh water.
- Understand water scarcity and explore water usage.
- Define deforestation & afforestation.
- Design and build a successful water conservation tool or forest conservation product.
- Present their findings on environmental issues and conservation methods for water/forest to an audience.

APPENDIX 1

Story 1 - [The Water Cycle](#)

APPENDIX 2

Story 2 - [Uses of Trees](#)