Co-funded by the European Union

DISCOVERING WATER'S WORLD

THE PROJECT "DEVELOPİNG WATER LİTERACY EDUCATİON VİA STEAM AND DİGİTALİZATİON" (2023-1-EL01-KA210-SCH-000158213) İS CO-FUNDED BY THE EUROPEAN UNİON.
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INTRODUCTION

Welcome, young explorers and curious minds, to the amazing world of water! Did you know that water covers most of our planet and is essential for all life? From the tiniest raindrop to the vast oceans, water is full of wonders waiting to be discovered.

This book, "Discovering Water's World," is a key outcome of the Erasmus+ KA210-SCH project: "Developing Water Literacy Education via STEAM and Digitalization" (2023-1-EL01-KA210-SCH-000158213). This project brings together schools from Greece (10 Geniko Lykeio Kaisarianis), Turkey (Merkez Çanakkale Anadolu Lisesi), Romania (SCOALA GIMNAZIALA CRISTIAN BRASOV), and France (Lycée Polyvalent Laurent de Lavoisier) to address the critical issue of water scarcity and promote water literacy.

Our goal is to develop innovative educational resources and methods that empower students and teachers to become "water literate" citizens. This book is part of that effort, designed to integrate Science, Technology, Engineering, Arts, and Mathematics (STEAM) to help you become a true water expert.

Get ready to dive into fascinating experiments that reveal the secrets of water, embark on outdoor explorations to connect with water in nature, and unleash your creativity through art and design inspired by this precious resource.

Inside, you'll find a treasure trove of over 100 engaging activities, including mind-blowing science experiments, hands-on engineering challenges, artistic creations, mathematical investigations, and exciting outdoor explorations – all focused on understanding and appreciating water. Whether you're a budding scientist, a creative artist, a clever engineer, a tech enthusiast, or a math whiz, there's something here for you.

So, grab your pencils, gather your materials, and prepare to get your hands wet (sometimes literally!). Let's embark on this STEAM journey together and unlock the incredible secrets of our blue planet's most vital resource: water!

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AQUA DUEL

As a dynamic and interactive component of our "Developing Water Literacy Education via STEAM and Digitalization" project, we are excited to introduce "AquaDuel" – an innovative offline mobile game designed for two players on a single device! This game, created as part of our Erasmus+ initiative, emphasizes the importance of water literacy in a fun and competitive way.

In "AquaDuel," two players face off in a water-themed challenge where knowledge and quick reflexes are key. The screen is divided into two sides (Blue and Green), and players must answer water-literacy-related questions that appear in the center.

Adding to the challenge, trash will fall from the center of the screen, and players must tap the trash before it reaches the water (river) on their side. If trash pollutes a player's water, the opponent wins the round, reinforcing the importance of protecting water resources.

"AquaDuel" offers an engaging way to test your knowledge of the water cycle, water conservation, pollution, and other vital water-related topics. It's a fantastic tool to complement the hands-on activities and explorations in this book, allowing you to learn, compete, and become a water-literacy champion!

To download the game files scan the code!

GREECE: EXPLORING WATER THROUGH ANCIENT WISDOM AND MODERN CHALLENGES

"Welcome to Greece's section, where we delve into the multifaceted world of water, connecting ancient Greek knowledge with contemporary environmental concerns. The 10 Geniko Lykeio Kaisarianis, located in Athens, has a strong commitment to environmental awareness and experiential learning.

Our contributions to this book reflect our dedication to fostering ecological consciousness among students and addressing the challenges of water scarcity in the region.

Through a blend of scientific inquiry, hands-on activities, and a deep appreciation for our natural heritage, we aim to inspire the next generation of water stewards."

1. Project Title Water conductivity

2. Introduction

Water is an important part of life but the water has different characteristics according to its source and its composition. One of the most important properties of water is conductivity that is a property of water to conduct electricity. Conductivity is dependent on salinity, minerals, and other matters in solution, and therefore forms an excellent indicator of water quality.

3. Project Description

This project was inspired by a blend of environmental concerns, scientific curiosity, and personal experiences. In the experiment we try to measure the conductivity of rainwater, tap water and seawater with the help of a buzzer. Each of these water sources contains different levels of dissolved substances, affecting their ability to conduct electricity. Seawater, for example, is rich in salts and is expected to have high conductivity, while rainwater, which is naturally distilled, may have lower conductivity. Tap water, depending on its treatment and source, may fall somewhere in between.

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1. Materials Used

For the experiment we use

- electrical cords,
- a piezoelectric buzzer ,
- a power supply (from school lab)
- and three beakers (100ml) with water samples

1. STEAM Integration

The experiment explains how the presence of ions in water enables it to conduct electricity. Water from different source has different number of dissolved ions By comparing rainwater, tap water, and seawater, we explore how different dissolved substances impact water quality.

The buzzer we used acts as a simple sensor that transforms electrical conductivity into audible feedback, demonstrating how electronic components can be used to detect and communicate changes in water properties.

1. Water Literacy Focus

The main idea in this experiment is that **water quality varies based on its source, and conductivity is an important indicator of its composition and purity**. By demonstrating how different types of water (rainwater, tap water, and seawater) conduct electricity at different levels, we highlight the presence of dissolved ions and how they affect water's ability to carry an electric current. We try to understand the characteristics of water and how they impact our environment, daily lives. Our findings show that:

- **Rainwater** has no conductivity, indicating its purity (but also its lack of essential minerals).
- **Tap water** has low conductivity, meaning it contains some dissolved minerals, which can be beneficial or harmful depending on water quality.
- **Seawater** has high conductivity due to its high salt content, making it unsuitable for drinking without desalination.

1. Challenges and Problem-Solving

Initially we tried to check the conductivity of the water with a light bulb but even with the salt water the bulb did not show conductivity. By interpreting the problem we realized that we needed a more sensitive sensor and we ended up with the buzer

1. Reflection and Impact

Our project contributes to raising awareness about **water literacy** by demonstrating, in a simple way, how different types of water vary in composition and quality. By using a **buzzer to test conductivity**, we provide an easy method to show how dissolved substances impact water's ability to conduct electricity. Water conductivity is not just a scientific concept, it's used in water testing, environmental monitoring, and industrial applications.

By demonstrating how conductivity relates to ion levels, we help people recognize why water testing is essential for health and environmental protection.

1. Conclusion

Findings:

a. Rainwater had no conductivity, meaning it is nearly pure with no dissolved ions.
b. Tap water had low conductivity, indicating the presence of some dissolved minerals.
c. Seawater had high conductivity, due to its high salt content, making the buzzer sound the loudest.
d. Main Message:
e. Water varies in quality depending on its source, and conductivity is a key indicator of its composition.
f. Understanding water properties helps us make informed decisions about water use, treatment, and conservation**.**

Visuals

Developing Water Literacy Education via STEAM and Digitalization

1o Geniko Lykeio Kaisarianis

GREECE

ATHENS

Erasmus+

2023-1-EL01-KA210-SCH-000158213

Developing Water Literacy Education via STEAM and Digitalization

2023-1-EL01-KA210-SCH-000158213

1. Project Title Investigating Water Hardness

2. Introduction

Water hardness is a measure of the concentration of dissolved minerals, primarily calcium and magnesium ions, in water. Hard water can cause scaling in pipes, reduce the effectiveness of soaps and detergents, and affect industrial processes. By studying water hardness, individuals can make informed decisions about water treatment methods and their potential benefits..

3. Project Description

This specific aspect of water was chosen because it highlights the variations in water quality from different sources and emphasizes the importance of proper water management and treatment solutions

4. Materials &Methods Used

For this experiment, we used

a. water samples from different sources,

b. EDTA solution (GH-1),

c.3 beakers

d. dropper and an indicator(Eriochrome Black T GH-2).

e.3 vials of 5ml

Method Initially, a specified amount of water was poured into the 5 ml vials. Then buffer solution was added to sustain a constant pH which is conducive for the reaction to take place. An indicator that turns colors in the presence of calcium and magnesium ions was then added. The EDTA solution was added to the water sample little by little while stirring, until the omnipresent color of the solution altered, showing that all the ions that caused hardness of water had been complexed. In the end, the amount of EDTA that was used was noted to analyze the level of hardness of the sample.

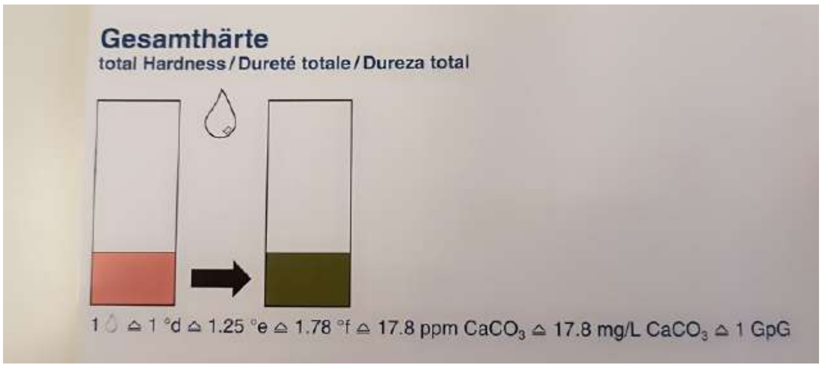
Results The results varied depending on the water source.

Tap water required 20 drops of EDTA, indicating moderate hardness.

Rainwater required only 5 drops, showing low hardness.

Sea water required more than 25 drops and never changed color, suggesting extremely high hardness due to the presence of large amounts of dissolved salts and minerals. The data collected allowed for the calculation of hardness in parts per million (ppm) using the volume of EDTA required to reach the endpoint.

Calculations



One drop of EDTA corresponds to 17.8mg/l of CaCO3, so

Tap water : 20 x 17.8mg/l=356mg/l which, according to the table below, indicates **hard water.**

Rainwater: 5 x 17.8 mg/l = 89 mg/l, which indicates soft water.

Sea water required more than 25 drops and the solution never changed colour.

Water Hardness Classification Table

Water Hardness Level	$CaCO_3$ Concentration (mg/L or ppm)	German Degrees (°dH)	French Degrees (°fH)	English Degrees (°e)	Description
Soft Water	0 - 60 mg/L (ppm)	0 - 3.5 °dH	0 - 6 °fH	0 - 3.5 °e	Low mineral content, lathers easily with soap.
Moderately Hard Water	61 - 120 mg/L (ppm)	3.5 - 7 °dH	6 - 12 °fH	3.5 - 8.4 °e	Some mineral presence, mild scaling in pipes.
Hard Water	121 - 180 mg/L (ppm)	7 - 10.5 °dH	12 - 18 °fH	8.4 - 12.6 °e	Noticeable scaling in appliances, reduced soap efficiency.
Very Hard Water	180+ mg/L (ppm)	10.5+ °dH	18+ °fH	12.6+ °e	Heavy scaling, may require water softening.

Unit Conversions for Water Hardness:

1 °dH (German degree) = 10 mg/L $CaCO_3$

1 °fH (French degree) = 10 ppm $CaCO_3$ × 0.56

1 °e (English degree) = 10 ppm $CaCO_3$ × 0.07

5. STEAM Integration

This experiment integrates various STEAM (Science, Technology, Engineering, Arts, and Mathematics) principles:

- **Science:** Understanding the chemical composition of water, its mineral content, and the titration process.
- **Technology:** Using laboratory tools such as burettes, pipettes, and indicators to analyze water samples accurately.
- **Engineering:** Applying knowledge of water hardness to design effective water treatment systems that improve water quality.
- **Mathematics:** Calculating the hardness of water samples using titration data and determining concentrations in parts per million (ppm).

By incorporating STEAM concepts, this experiment not only enhances scientific literacy but also fosters problem-solving and analytical skills relevant to real-world water quality challenges.

6. Water Literacy Focus

The water hardness has an impact on everyday life. By conducting this experiments and analyzing real-world water samples we can understand the science behind water quality and treatment. The findings encourage proactive measures such as water testing, filtration, and conservation, ultimately fostering a greater appreciation for sustainable water management. From this experiment we can learn:

- The significance of water hardness and its effects on household and industrial applications.
- How to test and analyze water quality using scientific methods.
- The importance of selecting appropriate water treatment solutions based on specific needs.
- For our area, tap water is hard, so we need more soap for house cleaning, perhaps it would be better to have rain water collection, which is soft.

7. Challenges and Problem-Solving

We did not encounter any particular difficulties everything we needed was available in the school laboratory

8. Reflection and Impact

This project contributes to raising awareness about water literacy by demonstrating the importance of understanding water hardness and its impact on everyday life.

Through this work, we learn

- .How to test and analyze water quality using scientific methods.
- How we can measure the water hardness
- The rainwater contains much less dissolved minerals

9. Conclusion

This experiment successfully measured the hardness of various water samples and highlighted the significance of mineral content in determining water quality. Understanding water hardness is crucial for managing household and industrial water usage. Future studies could explore the effectiveness of different water softening techniques and their impact on water quality and usability. By applying this knowledge, individuals and industries can make informed decisions regarding water treatment and consumption.

10. Visuals (Optional)

experiment. water hardness.mp4

11. References

https://www.realwater.gr/

Chemical analysis Kit for school lab

Developing Water Literacy Education via STEAM and Digitalization

2023-1-EL01-KA210-SCH-000158213

STEAM COMPETITION

1. Project Title

Invisible Threats in Water: A Microbial Analysis of Different Water Sources

2. Introduction

The goal of this project was to explore the microbial quality of different types of water through direct experimentation and observation. By cultivating microorganisms from various water samples, students were introduced to fundamental microbiology techniques and environmental science concepts. This project aimed to:

- Evaluate the presence of microbial life in different water sources.
- Understand the factors that affect water quality.
- Foster awareness about the impact of human activities on water cleanliness and safety.
- Promote the responsible use of water through scientific literacy and experimentation.

3. Project Description

Students conducted a hands-on microbial water analysis following a systematic procedure:

1. Preparation of nutrient media using broth and agar to support microbial growth.
2. Pouring the nutrient agar into sterile Petri dishes.
3. Inoculating each Petri dish with water samples from: seawater, tap water, bottled water, and greywater from the school sink.
4. Incubating the samples at a stable temperature for several days to allow microbial colonies to develop.

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Developing Water Literacy Education via STEAM and Digitalization

2023-1-EL01-KA210-SCH-000158213

STEAM COMPETITION

1. Project Title

"HowTemperature Affects the Density of Water"

2. Introduction

The main objective of this project is to investigate how temperature affects the density of water by measuring its changes at different temperatures.

This experiment aims to:

1. Understand the relationship between temperature and water density by conducting experiments and collecting data.
2. Demonstrate the concept of thermal expansion and contraction in liquids.
3. Analyze the environmental significance of water density changes, particularly in natural water bodies and climate systems.

This project will provide insights into the physical properties of water and their impact on real-world environmental and scientific applications.

3. Project Description

Inthisproject the students measure the mass of a specific volume of water at different temperatures and calculate its density using the formula: $d=m/V$.

They demonstrate that water's density is directly affected by temperature, which plays a crucialrole in both natural and scientific processes, like thermal expansion, buoyancy, water'sunique properties that support life, ocean currents and climate change.

4. Materials Used

Volumetriccylinder,scale, thermometer, heater, freezer

5. STEAM Integration

Science: This projectrelates to several important scientific concepts about water, including:

1. Density and Temperature Relationship

- Water density changes with temperature, reaching its maximum at **4°C** before decreasing again as it cools or heats up.
- This behavior is due to the arrangement of water molecules—at lower temperatures, they pack more closely together until hydrogen bonding causes expansion in ice formation.

2. Thermal Expansion and Contraction

- When heated, water molecules move faster and spread apart, making water less dense.
- When cooled, they move slower and come closer together, making water denser—except when freezing, where ice expands.

3. Buoyancy and Floating Ice

- Ice is less dense than liquid water, allowing it to float. This is crucial for aquatic life, as ice forms an insulating layer on lakes and oceans in winter.

4. Water Stratification in Nature

- In lakes and oceans, warmer, less dense water stays on top, while colder, denser water sinks, creating layers that affect marine ecosystems and oxygen distribution.

5. Environmental and Climate Impact

- The density of water influences ocean currents, which help regulate Earth's climate.
- Global warming affects water temperature and, consequently, ocean circulation and weather patterns.

Engineering: This project relates to engineering in several ways, particularly in fields such as environmental, mechanical, and marine engineering.

3. Graphing & Analysis

- A graph of density vs. temperature is plotted to visualize the relationship.
- The trend is typically nonlinear, showing a peak density at 4°C.

4. Percentage Error Calculation

- If comparing experimental results with theoretical values, the percentage error is calculated.

5. Rate of Change

- Using calculus or basic algebra, students can determine the rate at which density changes with temperature, analyzing slopes between data points.

6. Water Literacy Focus

Key Message: This project confirms that water's density is temperature-dependent and highlights how a simple property like water density has profound effects on

- nature and ecosystems, especially aquatic life,
- the environment and the climate
- human technology

  reinforcing that water is a truly extraordinary substance essential to life and the planet.

Target Audience: students

7. Challenges and Problem-Solving

One of the challenges encountered was the fluctuation in temperature during measurements, which could affect accuracy. This issue was resolved by measuring mass and temperature simultaneously, ensuring reliable results.

8. Reflection and Impact

This project contributes to raising awareness about water literacy by helping people understand the scientific properties of water and their real-world significance. Here's how:

- It teaches how temperature affects water density, a fundamental concept in physics and environmental science.
- Demonstrates how water behaves differently from other substances, particularly its maximum density at 4°C and why ice floats.
- Helps people recognize how water density influences oceans, lakes, and rivers, impacting marine life, weather, and climate patterns.
- Raises awareness of climate change effects, such as how rising global temperatures alter ocean currents and aquatic ecosystems.
- Shows the significance of water properties in engineering fields like hydraulics, shipbuilding, and water management.
- Encourages responsible water use and conservation by understanding how temperature affects water quality, treatment, and circulation.

9. Conclusion

The project **"How Temperature Affects the Density of Water"** provided valuable insights into the fundamental relationship between temperature and water density. Through hands-on experimentation, data collection, and analysis, students were able to observe how water's density changes with temperature and understand the underlying scientific principles that govern this phenomenon.

Key Findings

1. Temperature and Density Relationship: Water reaches its maximum density at 4°C, and its density decreases when heated or cooled beyond this point due to molecular movement and hydrogen bonding.
2. Thermal Expansion and Contraction: Water expands when heated and contracts when cooled, except when freezing, where it becomes less dense and floats as ice.
3. Environmental and Climate Impact: Water density plays a critical role in ocean currents, climate regulation, and aquatic ecosystems, influencing global weather patterns and marine biodiversity.
4. Scientific and Engineering Applications: The project demonstrated the importance of water density in fields like fluid mechanics, thermal engineering, and environmental science, which are essential for designing dams, pipelines, and ocean-related infrastructure.
5. Mathematical Application: Students applied mathematical concepts such as the density formula ($d = m/V$), graphing, and error calculation to analyze and interpret data.

Impact on Water Literacy

This project enhanced students' understanding of water literacy, helping them appreciate the significance of water beyond its everyday uses. By learning about density changes, students gained knowledge about:

- The role of water in sustaining life and maintaining environmental balance.
- How global temperature changes affect oceans, lakes, and rivers.
- The engineering challenges and solutions related to water management and conservation.
- The importance of responsible water usage and its impact on ecosystems and climate.

10. Visuals (Optional)

11. References

https://manoa.hawaii.edu/exploringourfluidearth/physical/density-effects/density-temperature-and-salinity

https://www.internetchemistry.com/chemical-data/water-density-table.php

Developing Water Literacy Education via STEAM and Digitalization

2023-1-EL01-KA210-SCH-000158213

STEAM COMPETITION

1. Project Title

Invisible Threats in Water: A Microbial Analysis of Different Water Sources

2. Introduction

The goal of this project was to explore the microbial quality of different types of water through direct experimentation and observation. By cultivating microorganisms from various water samples, students were introduced to fundamental microbiology techniques and environmental science concepts. This project aimed to:

- Evaluate the presence of microbial life in different water sources.
- Understand the factors that affect water quality.
- Foster awareness about the impact of human activities on water cleanliness and safety.
- Promote the responsible use of water through scientific literacy and experimentation.

3. Project Description

Students conducted a hands-on microbial water analysis following a systematic procedure:

1. Preparation of nutrient media using broth and agar to support microbial growth.
2. Pouring the nutrient agar into sterile Petri dishes.
3. Inoculating each Petri dish with water samples from: seawater, tap water, bottled water, and greywater from the school sink.
4. Incubating the samples at a stable temperature for several days to allow microbial colonies to develop.
5. Observing and photographing the Petri dishes to compare microbial growth across different water sources.

Findings revealed significant microbial colonies in seawater, moderate growth in greywater, and no visible growth in tap or bottled water—highlighting clear differences in microbial contamination levels.

4. Materials Used

Petri dishes, pipettes, incubation chamber, broth, agar, water samples

5. STEAM Integration

Science:

- Microbiology principles: microbial growth, nutrient requirements, and environmental conditions for life.
- Water quality assessment: understanding biological indicators of pollution.
- Environmental science: water pollution sources and their impact on ecosystems.

Technology:

- Use of laboratory tools (Petri dishes, incubators, pipettes) to perform microbial culturing.

- Digital photography to document microbial colony development.

Engineering:

- Laboratory setup and biosafety considerations.
- Design of a simple testing protocol for real-life environmental monitoring.

Art:

- Students photographed microbial growth and analyzed colony morphology (shape, color, texture), integrating visual analysis into scientific observation.

Mathematics:

- Estimating and comparing the number of colonies.
- Recording results in data tables.
- Interpreting relative differences in microbial presence across samples.

6. Water Literacy Focus

Key Message: Water is not always as clean as it appears. This project shows that even water sources perceived as "natural" (like seawater) may contain a high microbial load, while treated water (like tap or bottled) tends to be safer for consumption.

Target Audience: Students and young learners who are being introduced to water safety, pollution, and microbiology.

This experiment helps reinforce:

- The critical importance of water treatment and sanitation.
- Awareness of greywater and its reuse or hazards.
- The invisible biological world within our daily water resources.

Target Audience: students

7. Challenges and Problem-Solving

One of the main challenges in this project was maintaining sterile conditions during the preparation and inoculation of the Petri dishes, as any contamination could affect the accuracy of the results. Additionally, the difficulty in accurately counting or comparing microbial colonies, especially when growth was uneven. These challenges were addressed through teamwork, strict hygiene protocols, and consistent observation throughout the experiment.

8. Reflection and Impact

This project significantly enhanced students' awareness of water quality and the microbial risks associated with different water sources. Students learned:

- Practical lab skills in microbiology.
- The role of scientific observation in understanding environmental issues.
- That not all water is safe to drink, even when it looks clean.
- How human behavior and waste affect water systems, especially greywater sources.It fostered critical thinking, teamwork, and responsibility toward environmental stewardship and water conservation.

9. Conclusion

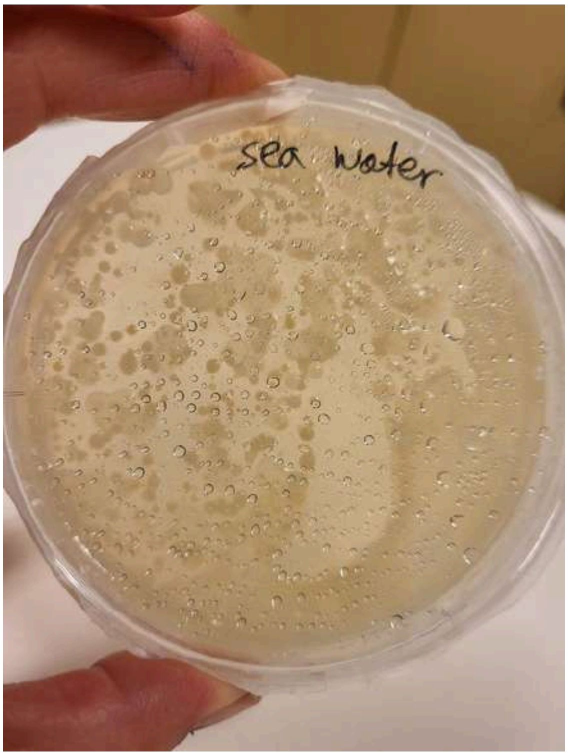
The **"Microbial Water Analysis"** project provided a powerful learning experience through direct observation of microbial growth. Students saw firsthand that:

- Seawater can harbor numerous microbial colonies.

- Greywater contains moderate microbial contamination.
- Tap and bottled water, due to treatment processes, showed no microbial growth—highlighting the effectiveness of water purification.

This project bridged microbiology with environmental education, empowering students to understand water safety and the invisible world of microbes. It also underscored the role of science in protecting public health and promoting sustainable water use.

10. Visuals (Optional)



[Testing Microbial Load of Water.mp4]

11. References

https://learning-center.homesciencetools.com/article/bacteria-experiment-guide/

https://en.wikipedia.org/wiki/Bacteriological_water_analysis

What is Water Footprint?

The water footprint is a measure of humanity's appropriation of fresh water in volumes of water consumed and/or polluted.

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Defining Water Footprint

- The water footprint quantifies the amount of water needed to produce the goods and services we consume. It encompasses the water consumed during the growth of crops, the raising of livestock, and the manufacturing of products.

Blue Water Footprint

amount of water taken n surface water sources ike rivers and lakes.

Green Water Footprint

he volume of rainwater ed for crop growth, which s not available for other uses

Grey Water Footprint

The volume of water polluted during the production process, requiring treatment before being discharged

Direct and Indirect Water Use

Direct Water Use

- Water consumed directly by individuals, such as for drinking, cooking, and washing.

Indirect Water Use

- Water used in the production of goods and services, such as the water used to grow cotton for a t-shirt.

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Measuring Water Footprint

- Measuring water footprint involves quantifying the amount of water used at each stage of the production process, from raw material extraction to final consumption.

Data Collection

Gathering data on water use in different sectors and industries.

Water Use Calculation

Calculating the amount of water used per unit of product or service.

Water Footprint Assessment

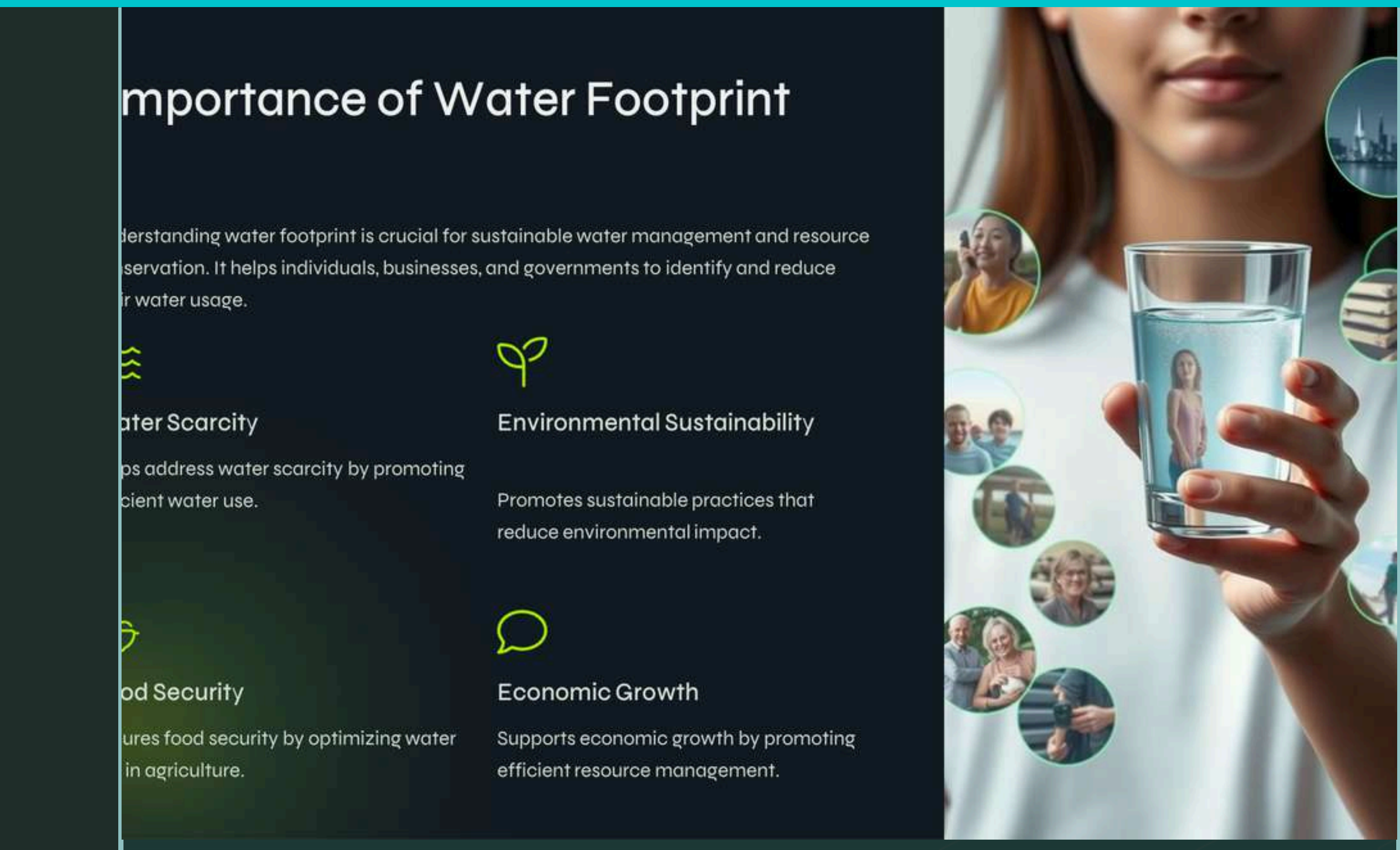
Analyzing the water footprint of different products, services, and activities.

Factors Affecting Water Footprint

Factor	Impact
Climate	Water availability and demand vary based on climate conditions.
Agricultural Practices	Water-intensive farming methods lead to higher water footprints.
Industrial Processes	Water usage in industrial activities contributes significantly to water footprint
Consumer Behavior	Consumption patterns, such as dietary choices and product preferences, affect water footprint.

Some facts and figures from reports

- The production of one kilogramme of beef requires approximately 15 thousand litres of water (93% green, 4% blue, 3% grey water footprint).
- The water footprint of a 150-gramme soy burger produced in the Netherlands is about 160 litres. A beef burger from the same country costs on average about 1000 litres.
- Japan with a footprint of 1380 cubic metres per year per capita, has about 77% of its total water footprint outside the borders of the country.
- The water footprint of US citizens is 2840 cubic meter per year per capita. About 20% of this water footprint is external


mportance of Water Footprint
lerstanding water footprint is crucial for sustainable water management and resource
servation. It helps individuals, businesses, and governments to identify and reduce
r water usage.
ater Scarcity
ps address water scarcity by promoting
cient water use.
Environmental Sustainability
Promotes sustainable practices that
reduce environmental impact.
od Security
ures food security by optimizing water
in agriculture.
Economic Growth
Supports economic growth by promoting
efficient resource management.

z

Calculate your water footprint

https://waterfootprintgreece.civil.auth.gr/

Reducing Your Water Footprint

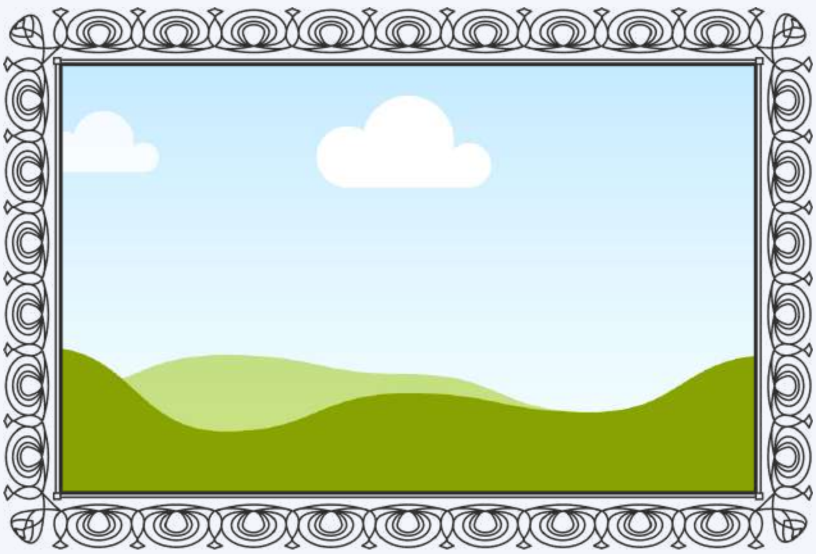
Reducing your water footprint involves making conscious choices in your daily life, such as using less water for domestic purposes, choosing water-efficient products, and supporting sustainable businesses.

Make your suggestions as to reduce your water footprint

FRANCE: INTEGRATING WATER SCIENCE WITH TECHNOLOGICAL EXPERTISE

"France's section demonstrates our commitment to providing students with a strong water science and technology foundation. Lycée Polyvalent Laurent de Lavoisier, located in Mulhouse, has close ties to the water industry and research institutions.

Our activities emphasize hands-on learning, laboratory work, and real-world applications of water management and treatment. By connecting academic knowledge with practical skills, we prepare students to become future leaders in the field of water sustainability."



LABWORK PROTOCOL
MODELİNG THE İMPORTANCE OF WATER İN DİFFERENT PROCESSES
(ARTİFİCİAL RİVER, THERMOHALİNE CİRCULATİON...)

EXPERİMENT N°1 : ARTİFİCİAL RİVER

EQUİPMENT:
A PLASTİC TROUGH (BETWEEN 50 AND 80 CENTİMETRES)
SOME MATERİALS ATTACHED TO THE TROUGH TO SİMULATE NATURAL OBSTACLES
GRAVEL 0/14 TO 0/20 MM
SAND 0/2
A BOTTLE
WATER
A SUPPORT TO TİLT THE TROUGH

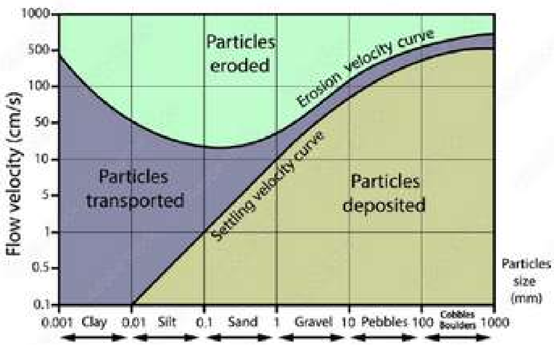
SLOPE: DEPENDİNG ON THE OBJECTİVE. FOR EXAMPLE: EROSİON CAPACİTY FOR A 30-DEGREE SLOPE.

1) Particles can be eroded, transported or sedimented. Remind the definitions of these three terms.

- Place particles of varying sizes at the top of the artificial river
- Turn on the water at a low flow rate, then gradually increase the flow rate by turning the tap further
- Observe the results

2) Describe the particles arrangement at the end of the experiment.
3) What effect does particle size have on particle fate (erosion, transport, sedimentation)?

Here is the Hjulström diagram:
This diagram illustrates particle behavior as a function of particle size and current speed.



4) What happens to a 1mm particle at a current speed of 1 cm/s?
5) At what current speed is a 10 cm particle eroded?

Experiment n°2 : Vegetation cover influence

EQUİPMENT:
3 SMALL CONTAİNERS
3 DİFFERENT SUBSTRATES: BARE SOİLS, FOREST LİTTER, MEADOW

PREPARİNG THE CONTAİNERS
PLACE A QUANTİTY OF BARE SOİLS İN THE MİDDLE OF TRAY NO. 1
PLACE THE SAME QUANTİTY OF FOREST LİTTER İN TRAY NO. 2
DO THE SAME FOR TRAY NO. 3 WİTH THE MEADOW


Floor n°1 : Bare soils


Floor n°2 : Forest litter


Floor n°3 : Meadow

1) What are the differences between the three floors observed above? Link each floor to the corresponding set-up.
2) Which of these soils is most affected by human activity? For what purpose?

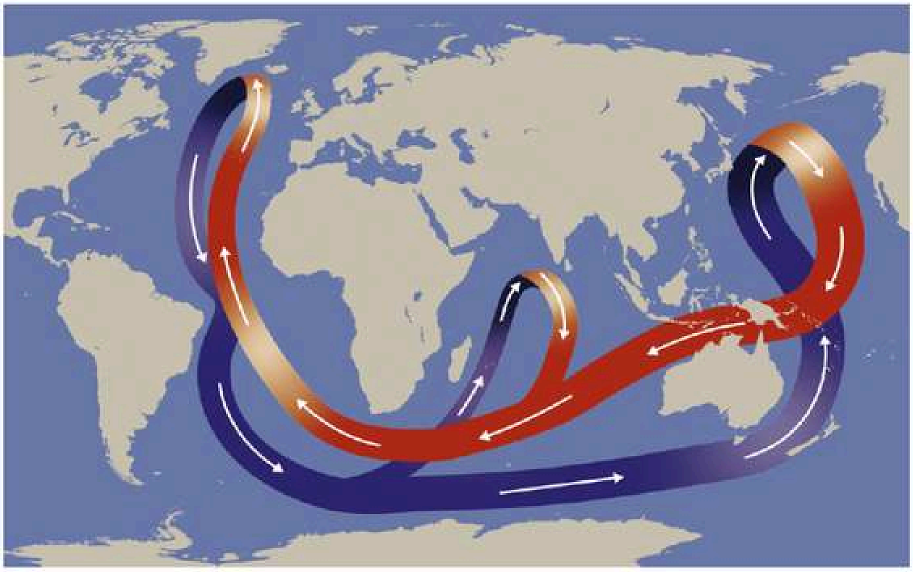
- Run the same quantity of water through each set-up (try to not vary the flow rate between the different set-ups)
- Observe the results

3) Describe the results obtained.
4) What can you deduce from these results?
5) What are the possible risks of the bare soils proliferation in our landscapes ?

Experiment n°3 : Thermohaline circulation

MATERİALS
2 ERLENMEYER FLASKS X 2
HEATİNG PLATE, POTHOLDERS
LİQUİD DYE RED WİTH MEASURİNG DEVİCE
LİQUİD DYE BLUE WİTH MEASURİNG DEVİCE
SALT

Thermohaline circulation



1) Look at the document above. Where do ocean currents change depth?
2) Propose one or more hypotheses to explain what happens in the north of the Atlantic.

- Prepare 2 Erlenmeyer flasks with 250 mL of water
- Turn on the electric burner to power 7
- Heat one of the two Erlenmeyer flasks with water to 80°C (use the electric burner)
- Once the water has reached temperature, switch off the electric burner
- Color hot water with red color (a few drops)
- Color cold water with blue color (a few drops)
- Pour cold water into the column containing crushed ice and hot water into the other column **at the same time**

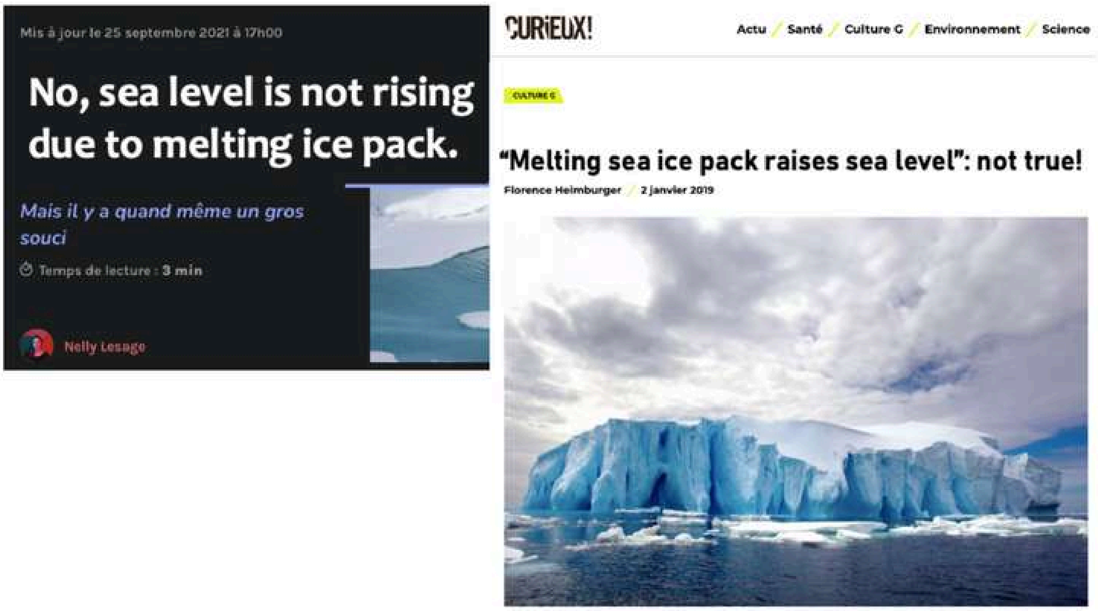
⚠ **Take care to use a potholder before touching the Erlenmeyer flask with hot water, to avoid burning yourself.**

3) Describe the results of the experiment. What do you notice?

- Prepare 2 Erlenmeyer flasks with 250 mL of water
- Weigh 25g of salt
- Place an Erlenmeyer flask on the magnetic stirrer
- Place the white magnet in this Erlenmeyer flask
- Turn on magnetic stirrer to power 5
- Dissolve the 25g of salt in the water
- Color unsalted water with yellow color (a few drops)
- Color salt water with green color (a few drops)
- Pour the salt water into one column and the unsalted water into the other column **at the same time**

4) Describe the results of this second experiment. What do you notice ?
5) What factors influence the circulation of ocean waters on the planet's surface ?

Experiment n°4 : Sea level



EQUİPMENT:
2 CRYSTALLİZERS
ICE CUBES
LİQUİD DYE BLUE

1) Remind the difference between the Antarctic and the Arctic, apart from their geographical location.

- Put water in the crystallizers
- Color the water with a color (a few drops)
- Put ice cubes floating on the water (symbolizing the Arctic)
- Put ice cubes on the cobblestone (symbolizing the Antarctic)
- Mark the water level with a marker before melting the ice cubes
- Mark the water level after the ice cubes have melted

2) To which geographical areas do the ice cubes floating in the water correspond? And those on the cobblestone?
3) Describe the results of the experiment. How did the water level change?
4) What can you conclude from this? What is your opinion about the two newspaper articles above?

Labwork Protocol
Model the relationship between water and climate using Simclimat software

Simclimat is a software program designed by climatologists to calculate climatic variables over time, based on astronomical and atmospheric parameters chosen by the user.
The variables are calculated according to physical and chemical laws. Although scientifically rigorous, this model is simplified compared to current climatology models, which require considerable computing power.

Several simulations will be carried out in the course of this exercise, representing different climate scenarios.

- **<u>1st simulation</u>: if we had continued to live as we did in the 18th century**

Steps to follow

- Launch Simclimat in full screen mode
- `Run simulations`
- Initial state : `Pre-industrial`
- Length of the simulation : `800 years`
- Simulation name: « `World before industrialization` »
- Simulation color: Choose a color
- `Astronomical parameters` / CO_2 `emissions` / `Climate feedbacks`: change nothing
- Press the yellow arrow at bottom right to start simulation

- **<u>2nd simulation</u>: if we continue to live as we do today**

Steps to follow

- Press + at top right
- Initial state : `Present-day`
- Length of the simulation : `500 years`
- Simulation name: « `Modern world` »
- Simulation color: Choose a color
- `Astronomical parameters` / CO_2 `emissions` / `Climate feedbacks`: change nothing
- Press the yellow arrow at bottom right to start simulation

- **<u>3rd simulation:</u> if we continue to live as we do today, but the oceans are saturated with CO2 and no longer absorb it**

Steps to follow

- Press + at top right
- Initial state : `Present-day`
- Length of the simulation : `500 years`
- Simulation name: « `Oceans full of CO2` »
- Simulation color: Choose a color
- `Climate feedbacks > Ocean >` select `Neglect the oceanic sink`
- Press the yellow arrow at bottom right to start simulation

Complete the following table with the values obtained for the year 2400 using Simclimat software.

	Sea level relatively to pre-industrial (m)	Extension of the Nothern ice sheet (latitude °)	CO_2 concentration (ppm)	Temperature (°C)
World before industrialization				
Modern world				
Oceans full of CO2				

<u>The climate collage</u>

Place all the cards at your disposal on a poster, using arrows to show the logical links between each event. To do this, you'll need the explanatory deck of cards associated with each image.

Labwork Protocol
Antibiogram method to test the sensitivity of a strain (*E. coli*) to different water treatments.

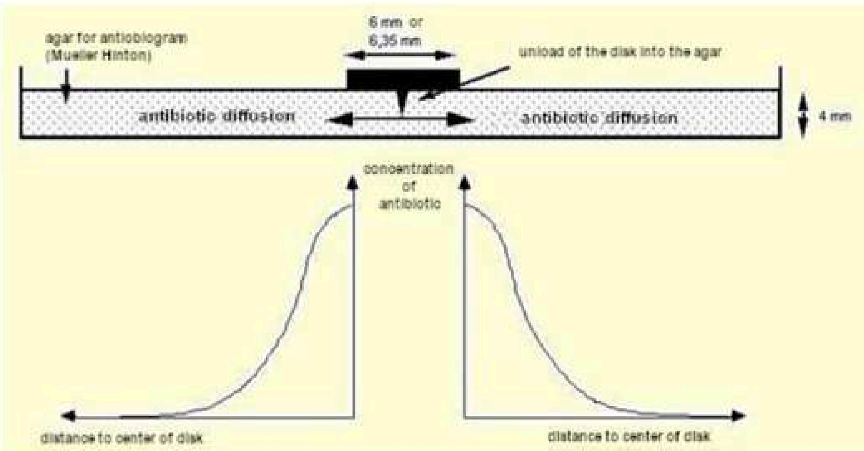
MATERIAL :	PRODUCTS :
18 sterile swabs 18 metal pliers 18 Plasticized patterns for antibiogram 5 star discs WFIW* trash can already on the bench with bags inside 18 thin markers Matches *waste from infectious risk care activities	18 hemolysis tubes with screwed cap containing 1 mL of *E. coli* à 0,5 Mcfarland rated E0,5 18 Mueller-hinton agar (or TSA) 8 x 10 disk soaked in petri dish numbered as follow : 1 : physiologic sterile water (negative control) 2 : chloramphenicol (antibiotic - positive control) 3 : bromine at 3 $mg.L^{-1}$ (pool pellet) 4 : chlorine at 2 $mg.L^{-1}$(pool pellet) 5 : natrium chloride (salt) at 5 $g.L^{-1}$

The purpose of this method is to test the sensitivity of a microbial strain to several antibiotics and thus to allow the doctor to choose the appropriate drug to treat a patient.

1. Principle and General

To achieve the antibiogram by the method of the discs, the bacterial culture is carried out on the surface of a agar named **Mueller-Hinton**. The agar must be **4 mm high and the discs a precise diameter** because it is a standardized method.

Discs pre-impregnated with a known dose of antibiotic are deposited on the surface of the agar. The antibiotic diffuses into the agar from the disc vertically and horizontally, creating a gradient of concentration.



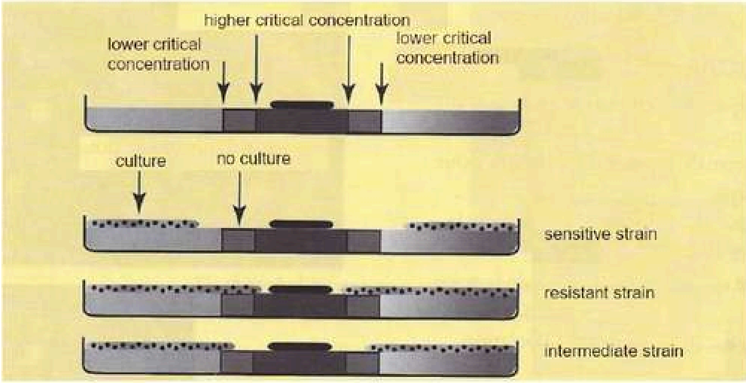
The **minimum inhibitory concentration (MICs)** is defined as the lowest antibiotic concentration for which bacterial growth is no longer visible.

The purpose of antibiotic therapy is to neutralize or destroy in the patient, the bacterium responsible for the infection. This requires that the concentration of the antibiotic in the patient is permanently higher than the IJC.

For each antibiotic, it was possible to measure the concentration in serum obtained in humans, following the administration of a non-toxic dose of antibiotic. The various statistical studies carried out have shown variations in serum concentration in individuals according to their age, their physiological status, the route of administration of the antibiotic. For each antibiotic, two values are used as a reference:

- The **higher critical concentration (C or Ccs)** corresponding to the maximum mean concentration usually obtained in the patient;
- The **lower critical concentration (c or Cci)** corresponding to the mean minimum concentration usually obtained in the patient.

By comparing these values to the MICs, we can determine the resistance or sensitivity of a bacterium to an antibiotic.



2. Procedure

The bacteriological analysis will focus on one of the indicator bacteria of water pollution, Escherichia coli, which indicates fecal contamination of the river water.
We will divert the antibiogram method to test the sensitivity of the strain (E. coli) to several antibacterial agents. This experiment allows to verify if substances tested have bactericidal activity on the water contaminant, by comparing the results obtained with different controls.

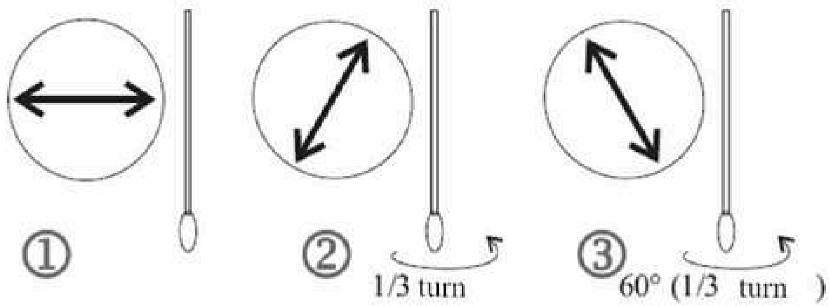
Day 1

2.1. Preparation of the suspension in bacteria **(already prepared - noted tube E0.5)**

Using a sterile oese, remove 3 to 4 well-isolated colonies from the agar and place them at the water-air interface on the wall of a sterile tube containing physiological water. Moisten the wall slightly and gradually dissolve the colonies in the water.
This suspension will have to reach a disorder equivalent to that of the standard 0.5 of the McFarland range which corresponds to a concentration of approximately 1 to $2x10^8$ bacteria. mL^{-1}.

2.2. Seeding Mueller-Hinton Agar

- Annotate the bottom of the Petri dish containing the Mueller-Hinton agar: Name, Ref: *E.coli*, date and 48hrs at 37°C.
- Immerse a sterile cotton swab in the bacterial suspension and remove excess fluid by pressing the swab onto the tube walls.
- Seed the agar with very tight ridges on the entire surface of the agar, making three runs in three different directions:



2.3. Disks Deposit

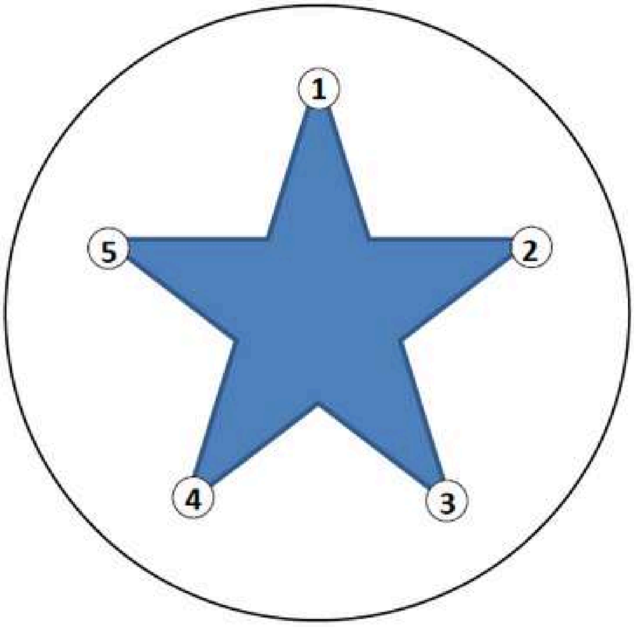
- On the bottom of the box and using the deposit template (document 1), mark the location of the 5 disks with a number.
- Using a pair of pliers, place the discs on the surface of the seeded agar. Disks once deposited should not be moved because the diffusion of antimicrobial agents is very fast.

2.4. Incubation

Flip the box and incubate it for 48 hours at 37°C.

To illustrate this, here is a link to a video: https://www.youtube.com/watch?v=PDze0hh9jsU

Document 1 : Antibiogram Handling - Deposition Model for 5 Disks



Legend :

1 : physiologic sterile water (negative control)
2 : chloramphenicol (antibiotic - positive control)
3 : bromine at 3 mg.L-1
4 : chlorine at 2 mg.L-1
5 : natrium chloride (salt) at 5 g.L-1

Day 2

Table of results obtained after 48 hours of incubation at 37°C:

Disc number	Solution tested	Measured inhibition diameter (mm)	Interpretation

Questions related to antibiogram

After reading the document provided, and using your knowledge and internet research, answer the following questions:

1. Provide a definition of antibiotic and dosage.

2. Name the agar used to make an antibiogram.

3. This agar must have a height of 4 mm. Provide an explanation for the following statement: a change in the agar height can lead to misinterpretation of the antibiogram.

4. Complete the following sentence:

The further away from the center of the disc, the higher the concentration of antibiotic ...

5. Indicate the meaning of the acronym MICs

6. Complete the following sentences:

- **If the MICs < c**: strain is called ………………………….., its development in the body may be inhibited by the antibiotic at the usual dosage.

- **If the MICs** > C: strain is called ………………………….., it cannot be reached by usual dosages.

- **If the c < MICs < C**: strain is called ………………………… , it can be achieved by increasing the usual dosages.

Treasure hunt !

Mulhouse Water Express

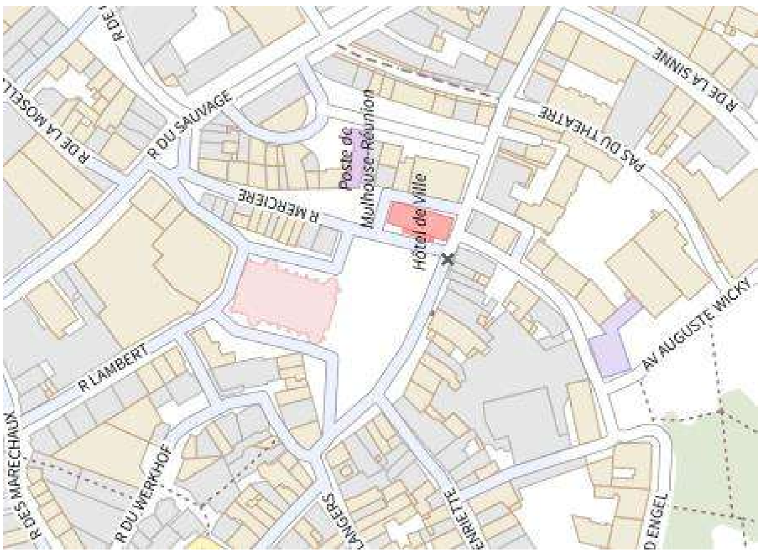
We are so happy to welcome you in Mulhouse! Today, you will face 9 difficult rounds. These will require you a lot of thinking. And this is all about water. The group that scores the most points wins. Are you ready for the Mulhouse Water Express?

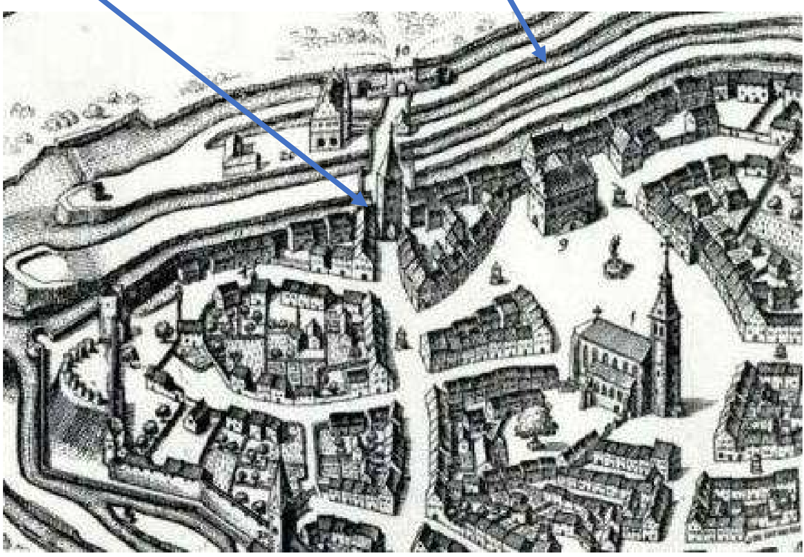
Round 1 – Go to the '*Place de la Réunion*' and find the symbol of the city (which has a direct link to water…). Then count the steps leading up to it. Remember the number! Look for the lions 2pts

Round 2 – Back in the days, dozens of rivers were running through the city. The Sinne River which was flowing right behind the town hall is no longer visible today… But it had been materialized.

You need to find how this ancient river is materialized (and how many of them are materialized…).

→ Let's find the location of the old tower first. It's near the '*Place de la Réunion*' It too has disappeared, but the place is still visible… 4pts





Round 3 – The formidable Basilisk is waiting for you in the shades of trees … (close to the '*Artichaut*' shop). Take a selfie with it and discover its origins. 4pts

Round 4 – Ask someone in the park Salvator to take a picture of you all on the bridge… Good luck! 2pts

Round 5 – Find a boat and take a selfie with it. 2pts

Round 6 - The Prince hides in the fountain… Go to the square in front of the Saint Étienne Church (not the Temple) and find the prince! Maybe you will have to do something to make the prince appear. Don't forget to take a picture of one of you while doing it

3pts

Round 7 – The Secret Garden is a living jewel. It's hidden somewhere near the 7.1.13.2.18.9.14.21.19.

When you are ahead, facing him, go left, then turn right twice

Take a group photo there. → 4pts

An old brook still flowing in the garden.

Round 8 - This stream fed the textile industry, take a picture of an old spinning mill wich became a school. Some of you could have studied there less than three years ago… 2pts

LAST ROUND – You've come a long way! Aren't you parched? The Hallebardier Fountain seems like a good place to cool off…

→ We need four people drinking on the picture 2pts

Treasure hunt complete in less than 1h30 = 2pts

Developing Water Literacy Education via STEAM and Digitalization
2023-2025
Projectnumber : 2023-1-EL01-KA210-SCH-000158213

Learning, Teaching&Training Activities
May 2024

Discussion session about a documentary movie

Before watching the documentary “Who owns water?”, https://www.youtube.com/watch?v=9edWX7TTsLw students are divided in three groups : farmers, industrials and citizens.

You represent a group of person who had to defend his own acces to water, in a period of water scarcity.

You need to defend your interests :

- by explaining why it’s important to you to keep a good access to the water for your group
- by finding common solutions to share access to the water

	Water users		
	Farmers	Industrials	Citizens
Keywords	Feeding, growing population, fighting against starvation	Employment Economic development Technological progress	Saving resource Protecting nature Quality of water
What they want What they do wrong What they could do better			

Outdoor lesson

Keep thewater quality

Water Well,water tank and UV Treatment

CityofMulhouse

This document is a translation of a press release from the Mulhouse City hall Authorities.

https://www.mulhouse.fr/wp-content/uploads/2019/02/DP-Inauguration-des-stations-de-traitement-de-l%E2%80%99eau-aux-ultra-violets.pdf

This translation is for educational purposes only.

Mulhouse benefits from high-quality natural water

The water public supply of Mulhouse's organises and ensures the production and distribution of this water without systematic chemical treatment in 13 communes in the Mulhouse conurbation, a population of almost 200,000.

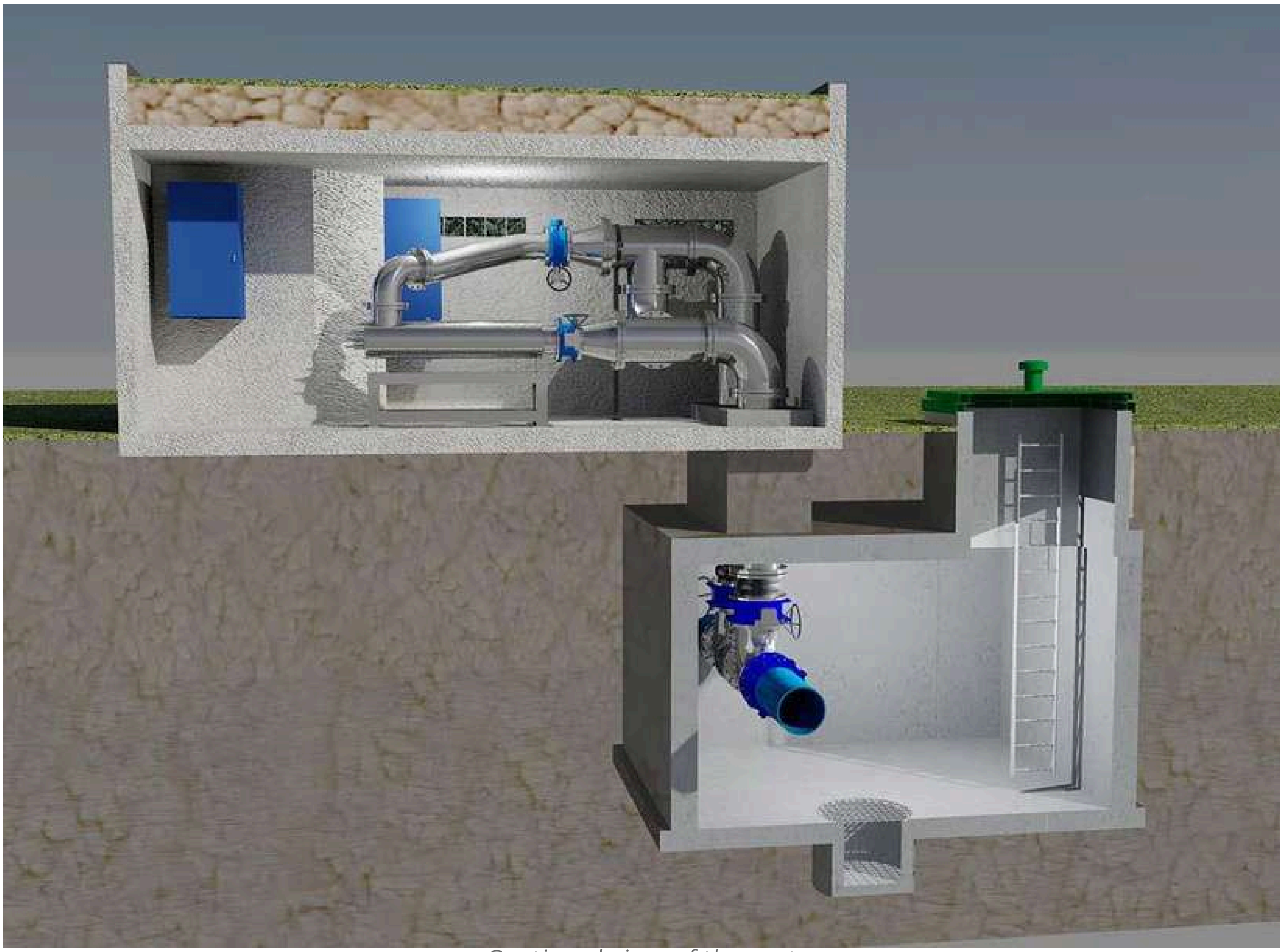
The aim is to preserve the quality of Mulhouse's water on a daily basis by maintaining and constantly improving its facilities.

In order to guarantee the sanitary quality of the water and to meet the requirements of the Regional Health Authority, the wells are equipped with water treatment devices to prevent bacterial contamination.

Since 2019, an ultraviolet treatment system has been installed on each of the 8 wells managed by the Mulhouse Water Department.

This system makes it possible to stop the permanent chemical treatment of the water with chlorine dioxide, while guaranteeing the bacteriological quality of the water distributed.

Presentation of the catchment well



Sectional view of the system

Each catchment well has a low-pressure UV reactor for preventive treatment and additional curative bleach equipment required by the prefecture.

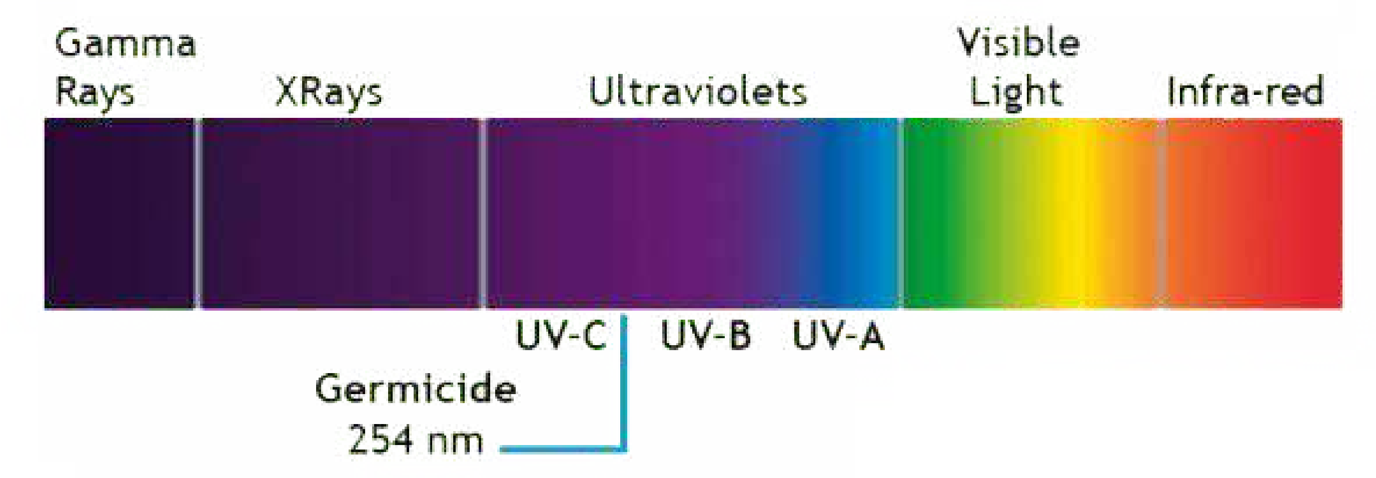
What is UV treatment ?

All water contains micro-organisms - bacteria, viruses or parasites - some of which can cause illnesses of varying degrees of seriousness.

One of the most effective methods of considerably reducing this risk is disinfection by ultraviolet radiation.

The sun emits invisible light: ultraviolet light. There are three types:

- UV-A (315-400 nm): mainly responsible for pigmentation spots and tanning, ageing of the skin and wrinkles,
- UV-B (280-315 nm): responsible for sunburn, burns, blisters, etc.
- UV-C (100-280 nm): used here for water treatment.



The advantages of UV treatment

- An effective, environmentally-friendly disinfection solution, guaranteed chemical-free
- UV-C is germicidal, eradicating micro-organisms such as viruses and bacteria.
- - The physico-chemical characteristics of the water are not altered: the original taste
- the original taste and smell of the water.
- - Flexibility of use and instant water treatment.

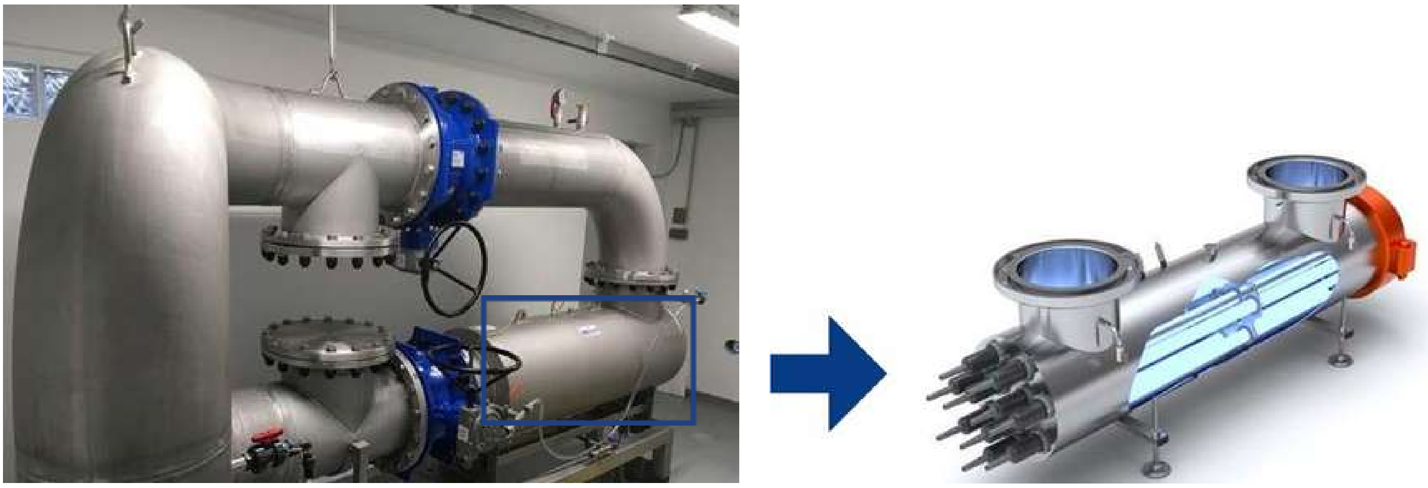
The effects of UV-C rays on DNA

UV-C rays cause an alteration in the DNA of micro-organisms (viruses, microbes), leading to their destruction.

The UV reactor

The cylindrical stainless steel UV reactor is equipped with a flow distributor, UV sensor, temperature control and drain and purge valves. The reactor can be mounted horizontally or vertically.

The reactors are sized according to the flow rates required, not least because it is the combination of contact time in the reactor and the power of the lamps that will guarantee a dose that is both necessary and sufficient to eradicate 99.9% of micro-organisms.



Connecting UV reactors to the network.

A total of 8 wells have a low-pressure UV reactor to eliminate micro-organisms. These 8 wells supply 13 municipalities (200,000 people).

The water of Mulhouse, a preserved natural resource

Mulhouse's water comes from the Doller groundwater table. It is drawn from wells and distributed to Mulhouse and 12 other towns in the conurbation, for a total population of almost 200,000, via 13 water tanks.

The water comes directly from the Vosges mountains, where it is loaded with minerals. It has the characteristics of well-balanced water, perfectly suited to daily consumption. The quality of this resource is closely monitored: almost 700 analyses are carried out every year, i.e. 10 to 12 analyses a week, twice as often as required by regulations.

Some key data about Mulhouse Water :

- 820km of water pipes
- 8wells
- 14water tanks totalling 42,500 m3
- Nearly 40,000 subscribers
- 11,000,000 m3 of water distributed each year in Mulhouse and the surrounding area
- 107 employees in the Mulhouse water and works department

From the source of the Doller to tap water

The City of Mulhouse has a protection perimeter for water catchment areas, in order to preserve this natural resource.

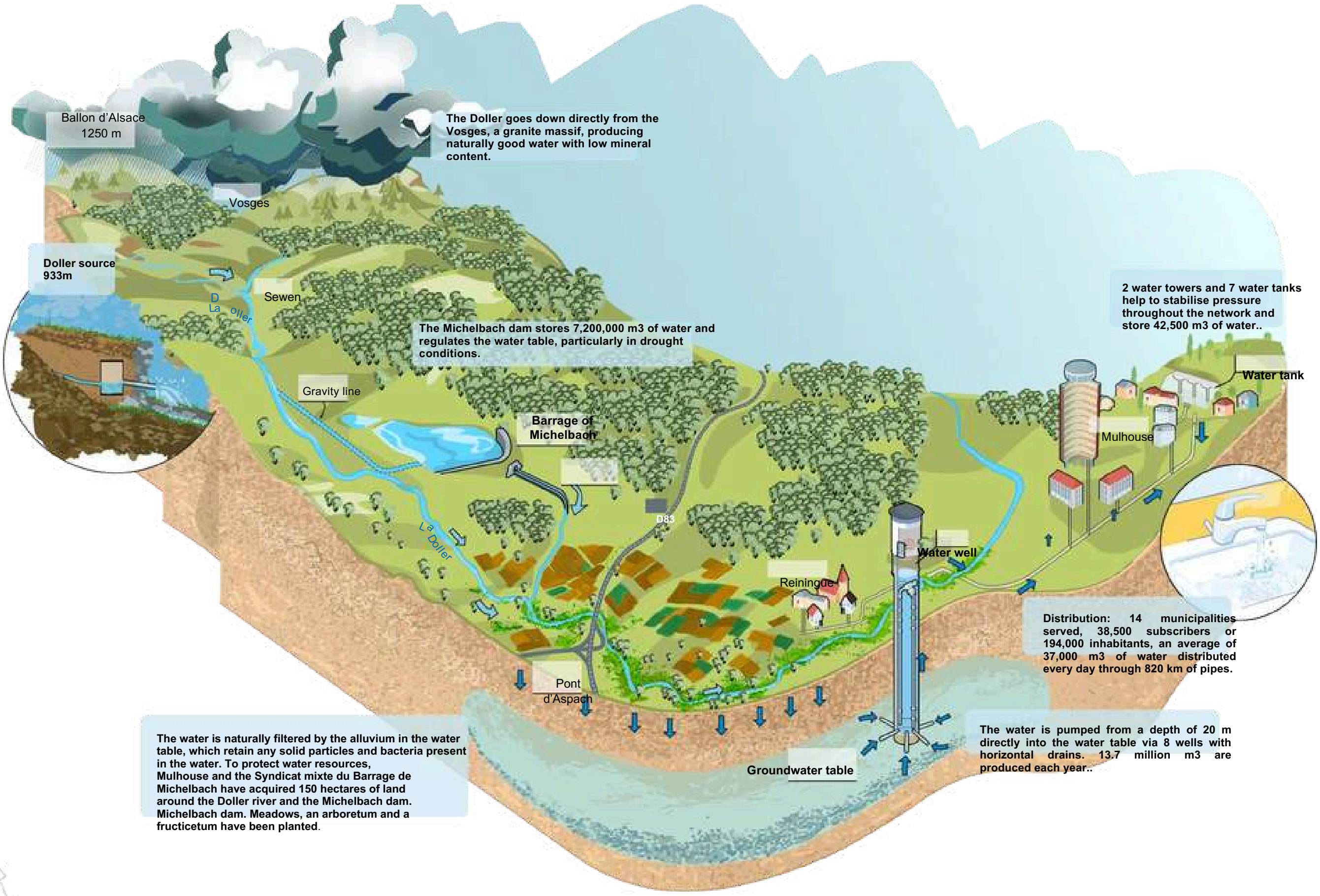
For the past 30 years, the Doller groundwater table has been protected by :

- the acquisition of 150 hectares of land with the « Syndicat Mixte du Barrage de Michelbach", around the Doller and the dam,

- the maintenance and creation of meadows located within the perimeter of the Doller to prevent the infiltration of pesticides into the groundwater table.

- The town also maintains part of the land acquired in the immediate vicinity of the wells. Flower meadows and hedgerows have been planted by the Green Spaces Department and are maintained in an environmentally-friendly manner,

- An anti-spill wall has been installed along the motorway to prevent any risk of accidental pollution.


Ballon d'Alsace
1250 m
The Doller goes down directly from the Vosges, a granite massif, producing naturally good water with low mineral content.
Vosges
Doller source
933m
Sewen
The Michelbach dam stores 7,200,000 m3 of water and regulates the water table, particularly in drought conditions.
Gravity line
Barrage of Michelbach
La Doller
D83
2 water towers and 7 water tanks help to stabilise pressure throughout the network and store 42,500 m3 of water..
Water tank
Mulhouse
Water well
Reiningue
Distribution: 14 municipalities served, 38,500 subscribers or 194,000 inhabitants, an average of 37,000 m3 of water distributed every day through 820 km of pipes.
Pont d'Aspach
The water is naturally filtered by the alluvium in the water table, which retain any solid particles and bacteria present in the water. To protect water resources, Mulhouse and the Syndicat mixte du Barrage de Michelbach have acquired 150 hectares of land around the Doller river and the Michelbach dam. Michelbach dam. Meadows, an arboretum and a fructicetum have been planted.
Groundwater table
The water is pumped from a depth of 20 m directly into the water table via 8 wells with horizontal drains. 13.7 million m3 are produced each year..

ROMANIA: NURTURING WATER AWARENESS FROM THE ROOTS

"Romania's section highlights our holistic approach to water education, integrating local environmental concerns with broader European perspectives. SCOALA GIMNAZIALA CRISTIAN BRASOV, located in Cristian, near Brasov, has a long-standing tradition of environmental engagement.

Our contributions focus on experiential learning, connecting students with their local water environments, and fostering a sense of responsibility for water conservation. By nurturing water awareness from an early age, we strive to cultivate a generation that values and protects this precious resource."

1. Mastering the Water Bottle Flip: A STEM Challenge in Physics and Precision

Introduction to Water Bottle Flip

The water bottle flip is not only a fun activity but also a fascinating STEM challenge. It combines elements of physics and precision, allowing participants to explore concepts such as gravity, momentum, and angular motion. This presentation will delve into the science behind this popular challenge.

Understanding the physics of the water bottle flip involves concepts like force, torque, and center of mass. When flipping, the bottle's momentum and the angle of release determine its flight path. Mastering these principles is key to successfully achieving the flip.

Precision and Technique

Achieving a successful flip requires
precision and the right technique. Factors such as the amount of water in the bottle, the height of the flip, and the angle of release all play crucial roles. Practicing different techniques can help improve your accuracy and success rate.

Experimenting with Variables

Objective
In this challenge, students will:
Experiment with flipping water bottles to understand the principles of force, motion, and center of gravity.

Test how different amounts of water, force, and angles affect the bottle's ability to land upright.

Materials Needed:
Plastic water bottles (0.5L or 1L)
Measuring tape or ruler
Paper and pen for data collection
Stopwatch or smartphone timer
Smartphones for slow-motion video

REAL-WORLD APPLİCATİONS

The principles learned from the water bottle flip extend to real-world applications in engineering and sports. Understanding aerodynamics and kinematics can enhance performance in various fields, making this challenge a practical exercise in applying STEM concepts to everyday life.
Key Concepts:
Force: The strength and direction applied to the bottle.
Center of Gravity: The balance point of the bottle changes based on the water level.
Angle of Launch: The angle at which the bottle is flipped affects its rotation and landing.

CONCLUSİON: FLİP TO LEARN

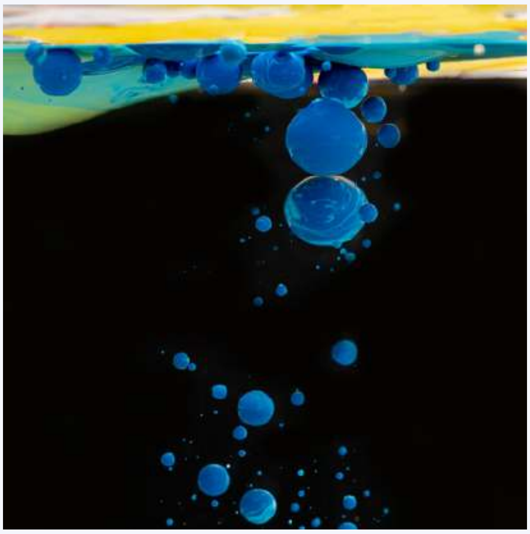
Experiment Step:
Set Up: Fill the water bottles with varying amounts of water (1/3, 1/2, or 2/3).
Flip: Students flip the bottle and attempt to land it upright.
Measure: Note the angle of the flip and force applied.
Record Results: Use the worksheet to record how many successful landings occurred with each water level and force.
Analyze the Results:
Which water level gave the best results?
How did the force and angle affect the success rate?
Were there any surprising outcomes?
Reflection Question: How would you design the perfect flip?

2. Exploring Water's Surface Tension: The coin drop experiment Precision

Surface tension is a physical property of liquids that causes them to behave as if their surface is covered with a stretched elastic membrane. This phenomenon arises due to cohesive forces between liquid molecules, making it crucial for various natural and scientific processes. Let's explore this fascinating topic through the coin drop experiment.

What is Surface Tension?

Surface tension is defined as the energy required to increase the surface area of a liquid. It is primarily caused by the attractive forces between molecules at the surface. These forces create a barrier that can support light objects, demonstrating the unique properties of liquids.



Materials needed

To conduct the coin drop experiment, you will need a coin, a shallow dish filled with water, and a pipette or dropper. Each item plays a vital role in demonstrating how surface tension can hold water droplets on a coin without spilling over.

Conducting the experiment

Begin by placing the coin flat in the center of the dish filled with water. Using the pipette, gently add water droplets onto the coin's surface. Observe how many drops can fit before the water spills over, showcasing the effects of surface tension in action.

Observations and results

During the experiment, you will notice that the water forms bulbous droplets on the coin. This occurs because the cohesive forces are stronger than the gravitational pull on the droplets, illustrating the concept of surface tension effectively. Count the maximum number of drops before overflow.

Conclusion and implications

The coin drop experiment effectively demonstrates the principles of surface tension. Understanding this property is essential in various fields, including biology, chemistry, and physics. It not only highlights the unique behavior of water but also has practical applications in everyday life.

3. DIY water cycle model

A DIY water cycle model is a hands-on educational project that helps demonstrate the stages of the water cycle in a simple and visual way. It typically includes the following stages:

Evaporation – Water is heated (usually by the sun), turning it into vapor.

Condensation – The water vapor rises, cools, and turns into droplets, forming clouds.

Precipitation – When the clouds get heavy, the water falls as rain, snow, or other forms of precipitation.

Collection – The water gathers in bodies like rivers, lakes, and oceans, where it can evaporate again.

How to Make a Simple DIY Water Cycle Model

Materials:

- A ziplock bag
- Water
- Blue food coloring (optional)
- Permanent marker
- Tape
- A sunny window

Steps:

- Use the marker to draw the sun, clouds, and water (ocean/lake) on the bag.
- Fill the bag with a little colored water to represent a body of water.
- Seal the bag and tape it to a sunny window.
- Over time, you'll see water evaporate, condense on the sides of the bag, and drip back down—mimicking the water cycle.

4. Cloud in a jar

The Cloud in a Jar experiment is a fun and visual way to demonstrate how clouds form in the atmosphere. It helps kids understand the concept of condensation—a key step in the water cycle.

Materials Needed

- A glass jar with a lid (or a clear container)
- Hot water
- Ice
- Aerosol (like hairspray) or a match (for smoke particles)
- Dark paper (optional, to help see the cloud better)

Steps

- Pour hot water into the jar — about 1/3 full. This adds heat and water vapor, similar to how the sun heats water bodies.
- Swirl the water to warm the inside walls of the jar.
- Spray a little hairspray (or quickly light a match, blow it out, and drop it in) — this introduces tiny particles (called condensation nuclei) that water vapor can cling to.
- Place the lid upside down on the jar, and fill the lid with ice cubes. The cold air from the ice cools the water vapor in the jar.
- Watch a cloud form inside the jar!

What's Happening?

This experiment models cloud formation in the real world:

Real Atmosphere	Cloud in a Jar
Warm air rises and holds moisture	Hot water produces warm, moist air
Air cools at higher altitudes	Ice on the lid cools the air in the jar
Water condenses onto particles (dust, smoke)	Hairspray/smoke provides particles
Cloud forms	Cloud appears in the jar

When the warm, moist air rises and meets the cold surface (the ice lid), it cools. The vapor then condenses into tiny water droplets, forming a cloud — just like in the sky.

5. Floating and Sinking Experiment

It is perfect for exploring density and buoyancy with kids or students. Its objective is to observe which objects float and which sink, and to understand why that happens.

Materials Needed:

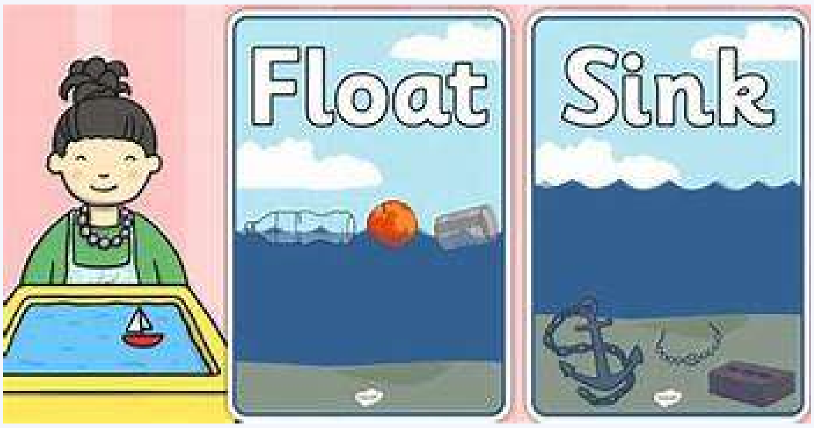
- A large clear container or bowl filled with water
- A variety of small objects (try to mix materials, sizes, and weights), such as:
- A plastic spoon
- A metal key
- A rubber band
- A small rock
- A wooden block
- A coin
- A sponge
- A paperclip
- A crayon
- A leaf
- Paper and pencil to record results (optional)

Instructions:

- Fill the container with water about 3/4 full.
- Predict: Before dropping each object in, guess if it will float or sink.
- Test: Gently place each item in the water one at a time.
- Observe and Record: Did it float or sink?
- Compare Results: See if the results match your predictions.

Why Do Objects Float or Sink?

- It all comes down to density and buoyancy:
- If an object is less dense than water, it will float.
- If it’s denser than water, it will sink.
- The shape of an object can also affect whether it floats (e.g., a flat sheet of aluminum might float, while a crumpled ball of the same foil sinks).



Example Chart (Optional for Class Use):

Object	Prediction (Float/Sink)	Result (Float/Sink)
Plastic Spoon	Float	Float
Coin	Sink	Sink
Sponge	Float	Float
Key	Sink	Sink

Extensions:

- Try the same objects in salt water to compare results.
- Shape a ball of foil into a boat and test if it floats.
- Weigh and calculate density for more advanced learners.

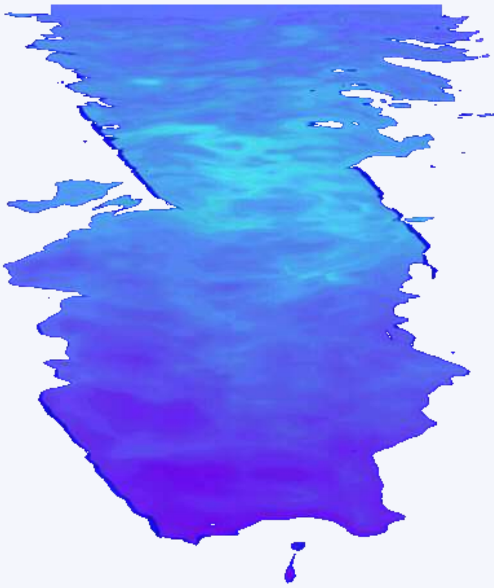
6. Water Absorption Experiment

Objective: To observe how different materials absorb water and understand the concept of absorbent and non-absorbent materials.

Materials Needed:

- Small cups or bowls of water
- Eye dropper or spoon
- A variety of materials to test, such as:
- Paper towel
- Tissue paper
- Cloth/fabric
- Plastic bag
- Aluminum foil
- Sponge
- Cotton ball

Instructions:



- Set up each material on a tray or flat surface.
- Use a dropper or spoon to place a few drops of water onto each material.
- Observe what happens:
- Does the material soak up the water?
- Does the water stay on the surface?
- Sort the materials into two groups:
- ✅ Absorbent
- ❌ Non-absorbent
- Optional: Time how long it takes for water to be absorbed completely.

Example Observation Chart:

Material	Water Absorbed?	Absorbent or Not?
Paper towel	yes	absorbent
Plastic bag	no	non-absorbent
Sponge	yes	absorbent
Foil	no	non-absorbent

What's Happening?

- Absorbent materials have tiny spaces (pores) that allow water to soak in.
- Non-absorbent materials are usually waterproof and don’t let water pass through.
- This is why we use things like sponges to clean up spills, and plastic to keep things dry.

Extensions:

- Compare how much water each absorbent material can hold (measure in milliliters).
- Test with colored water for better visibility.
- Let materials dry and reuse them for testing again.

7. Melting Race Experiment

Objective: To observe how different materials (like salt or warm water) affect the rate at which ice melts, and to understand the concept of heat transfer and state changes (solid to liquid).

Materials Needed:

- 3–4 ice cubes (similar in size)
- 3–4 small plates or trays
- Table salt
- Warm water (in a cup)
- Timer or stopwatch
- Spoon or pipette
- Paper and pencil (for recording results)

Setup Instructions:

Place one ice cube on each plate.
Label each plate:
Plate 1: Control (no treatment)
Plate 2: Salt
Plate 3: Warm water
(Optional) Plate 4: Sugar (for comparison)

Start the timer as soon as the ice cubes are placed.
Apply treatments:
Sprinkle a spoon of salt on the ice cube on Plate 2.
Pour or drop a small amount of warm water onto the ice cube on Plate 3.
Sprinkle sugar on Plate 4 (optional).
Observe and record what happens every 1–2 minutes.
Stop the timer when the ice is fully melted on each plate.

Observation Chart (Example):

Plate	Material Applied	Start Time	End Time	Total Time to Melt	Notes
1	None (Control)	0 min	20 min	20 min	Slowest melting
2	Salt	0 min	10 min	10 min	Melted faster
3	Warm Water	0 min	5 min	5 min	Melted the fastest
4	Sugar (Optional)	0 min	18 min	18 min	Slight effect, slower

What's Happening?

- Control Ice Cube: Melts slowly at room temperature — only from surrounding air.
- Salt: Lowers the freezing point of water, causing the ice to melt faster. This is why we use salt on icy roads!
- Warm Water: Transfers heat quickly, speeding up melting the most.
- Sugar: Slightly affects melting, but not as effectively as salt.

Extension Ideas:

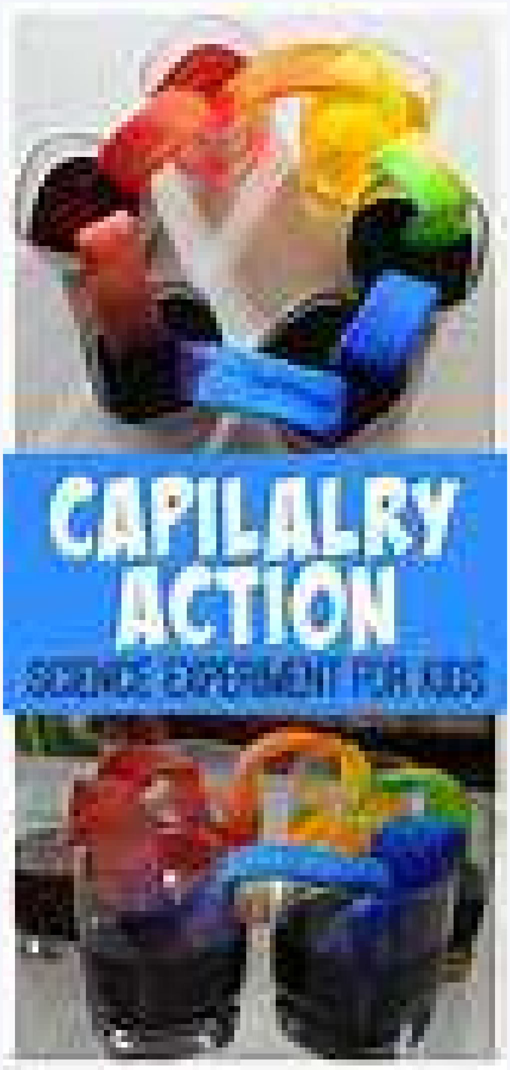
- Try crushed ice vs. whole ice cubes.
- Compare different types of salt (table salt vs. rock salt).
- Graph the results for a math-integrated science lesson.
- Add a thermometer to measure water temperature changes.

8. Walking Water (Capillary Action) Experiment

It is a colorful, exciting way to teach capillary action, color mixing, and the movement of water through materials. It's perfect for primary school students and can be done using simple household items.

Objective:

To observe how water moves from one container to another through paper towels using capillary action, and how colors mix in the process.



Materials Needed:

- 3 clear cups or jars (more if desired)
- Paper towels (2 or more)
- Water
- Food coloring (red, yellow, and blue work best)
- Spoon (for stirring)

Setup Instructions:

1. Line up 3 cups in a row:

Cup 1: Fill with water and add red food coloring.
Cup 2: Leave empty (or fill with a small amount of clear water).
Cup 3: Fill with water and add blue food coloring.

2. Fold 2 paper towels into long strips (about 1.5–2 cm wide). You can fold them lengthwise several times.
3. Place:
- One end of a paper towel in Cup 1 (red water)
- The other end in Cup 2 (empty)
- Repeat with a second paper towel between Cup 2 and Cup 3 (blue water)

4. Wait and observe. Over the next 30 minutes to 2 hours, the colored water will “walk” up the paper towel and into the empty cup.

What to observe:

- The water travels upward against gravity through the paper towel.
- Eventually, the colored water drips into the middle cup.
- In the middle cup, red and blue mix to form purple!
- If using 6 cups with red, yellow, and blue, you’ll see a rainbow effect and color mixing.

Scientific Explanation:

Capillary Action
Water can travel up thin materials like paper towels because of:
- Adhesion: Water molecules stick to the paper fibers.
- Cohesion: Water molecules stick to each other.
- Together, this pulls the water up and over, even against gravity.

This is the same process plants use to draw water from their roots to their leaves through tiny tubes called xylem.

Example Observation Chart:

Time	Cup 1 (Red)	Cup 2 (Middle)	Cup 3 (Blue)
0 mins	Full	Empty	Full
30 mins	Lower	Starting to fill with purple	Lower
1 hour	Half full	Half full (purple)	Half full

Extensions & Variations:

- Try different materials: toilet paper, coffee filters, fabric strips.
- Add more cups and colors for a rainbow!
- Use warm water to see if the walking speeds up.
- Have students predict the outcome and record results.

9. Oil and Water Lava Lamp

Objective - Students will:

- Discover how oil and water don’t mix.
- Learn about liquid density.
- Observe how a chemical reaction (effervescent tablet + water) creates gas bubbles that make water move like a lava lamp.
- Practice skills like observation, prediction, and recording results.

Materials (per student or group):

- 1 clear plastic bottle or glass jar (small soda bottles work great)
- Water
- Vegetable oil or baby oil
- Food coloring (any color)
- Effervescent tablet (e.g., Alka-Seltzer, denture cleaner)
- Spoon or funnel (optional but helpful)
- Tray or paper towel (to catch spills)

Step-by-Step Instructions:

✅ STEP 1: Add Water
Fill the bottle or jar about 1/3 full with

✅ STEP 2: Add Foo
Add 5–10 drops f needed.
💡 Tip: Use pri contrast.

✅ STEP 3: Add
Slowly pour vege ntil it's almost full (leave about 2 cm at the top).
Wait a moment — you'll notice that the oil floats above the water.

✅ STEP 4: Observe Separation
Let kids watch as the water and oil settle into layers.

- Water at the bottom (heavier)
- Oil at the top (lighter)

This demonstrates density and immiscibility (they don't mix).

✅ STEP 5: Create the Lava Lamp
Break an effervescent tablet in half. Drop one piece into the bottle and watch the reaction begin.
Bubbles will form, lifting blobs of colored water up through the oil.
When the bubbles reach the gas escapes, and the colored blobs fall back do

It looks just like a real l

🎉 You can repeat t et pieces after the bubbling stops.

Science Explanation (Simple Language):

◆ Oil and Water Don't Mix
Oil is less dense than water, so it floats.
Water molecules stick to each other, and oil molecules stick to each other — so they stay separated.

◆ Density
The heavier liquid (water) sinks below the lighter liquid (oil).

◆ Chemical Reaction
The effervescent tablet reacts with water to release carbon dioxide gas.
Bubbles of gas stick to the colored water, making it rise.
When the gas escapes at the top, the water drops back down.

Observation Chart Example

Time	What Happens
0 min	Oil and water separate into two layers
1 min	Tablet added, bubbles start to rise
2 min	Colored blobs move up and down
3 min	Bubbling slows, blobs settle

Extensions & Variations:

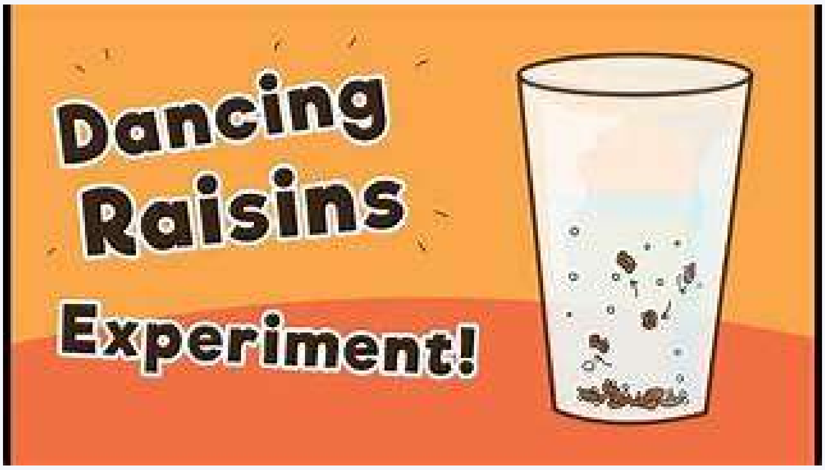
- Try different oils: Baby oil makes it even clearer.
- Use multiple colors: Add different colors in layers.
- Experiment with warm vs. cold water – Which reacts faster?
- Challenge: What happens if you shake the bottle?

10. Dancing Raisins Experiment

Objective / Purpose: To observe how gas bubbles in carbonated water affect the movement of solid objects, showing how buoyancy and density can change when gas is introduced.

Materials Needed:

- A clear glass or cup
- Carbonated water (sparkling water, soda, or lemonade)
- A few raisins (3–5)
- Optional: Other small items to test (corn kernels, dry pasta, small paper bits)



Step-by-Step Instructions:

✅ STEP 1: Pour the Liquid
Fill the clear glass about three-quarters full with carbonated water or soda.

✅ STEP 2: Drop in the Raisins
Carefully drop 3 to 5 raisins into the glass.

✅ STEP 3: Observe
Watch closely.
Within a few seconds to a minute, the raisins will begin to move, even though they sank at first.
You'll see them rise up, then drop down again — and repeat!
This creates a fun "dancing" motion.

What's Happening?:

◆ Density

Raisins are denser than water, so they sink initially.

◆ Carbon Dioxide Bubbles

Carbonated drinks contain carbon dioxide gas dissolved under pressure.
When you pour it, gas starts escaping and forms bubbles on surfaces.

◆ Bubble Attachment

Bubbles attach to the rough surface of the raisin.
This makes the raisin and the gas bubbles less dense together than the liquid.
So the raisin floats upward.

◆ Gas Escapes

At the surface, the bubbles pop, releasing the gas.
The raisin becomes heavier again and sinks.

The cycle repeats — dancing raisins!

Learning Concepts Introduced:

- Gas in liquids
- Density and buoyancy
- Surface texture and how it affects bubble formation
- Observation and prediction skills

Optional Observation Table

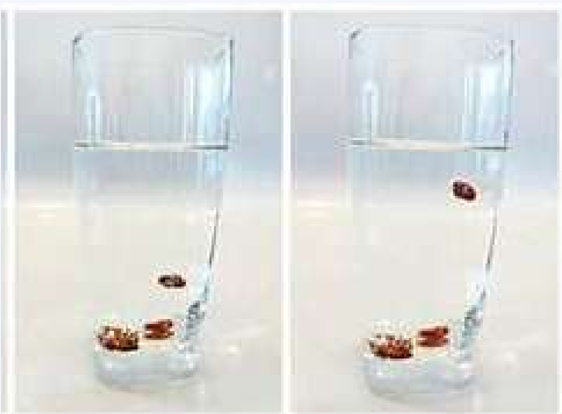
Time	What Happened
0 min	Raisins sink to the bottom
1-2 min	Bubbles form on raisins
3-5 min	Raisins rise, float, then sink
6+ min	Movement continues, slows down

Extension Activities / Variations:

- Try other objects: popcorn kernels, dry macaroni, or lentils. Do they dance?
- Compare drinks: Use soda vs. sparkling water vs. still water.
- Change glass shape: Wide glass vs. narrow tall glass.
- Make predictions: Will the raisins dance longer in cold or warm soda?

Suggested Student Questions:

- What made the raisins start moving?
- Why do the raisins go up and then down?
- What do you think would happen if we used a different object?
- What does this tell us about gas and liquids?



1. **“Water Walk” – Understanding Water Accessibility**

Age: 8–10 years

Duration: 60 minutes

Setting: Schoolyard and nearby park

Learning Objectives:
- Understand water scarcity and access issues globally.
- Appreciate the value of clean water.

Materials Needed:
1. buckets
2. plastic bottles
3. ropes
4. photos of global water access
5. maps

Organization: Groups

Activities & Steps:

Teacher:
- Introduces water access facts using a world map and pictures.

Students:
- Carry buckets of water a designated distance simulating the walk to get water.

Expected Results:

- Students grasp the difficulty of water access in some regions.
- Increased appreciation of local water availability.

Indicators of Success:

- active participation
- correct reflection responses.

Extension:

Write a letter to a local official about water conservation.

Observation Sheet

Group name	Distance walked (in m)	Water spiled (in ml)	How Did It Feel? (Easy/Hard)	What Did You Learn?

Associated Game: "Water Relay Challenge"

Description:
Teams compete to carry a bucket of water across a set distance without spilling too much.

Contextual Value:
Simulates the real-life struggle of carrying water in areas with limited access.

Rules:

- Use cups or small buckets to scoop water.
- Carry from the "source" to the "village" (marked zones).
- The team that retains the most water wins.

Learning Tie-in:
Introduces physical empathy with communities facing water scarcity.

2. “Pond Life Exploration” – Ecosystems and Water Quality

Age: 9–11 years

Duration: 90 minutes

Setting: Local pond or wetland

Learning Objectives:
- Identify pond organisms.
- Understand the connection between water quality and life.

Materials Needed:
1. nets
2. magnifying glasses
3. jars
4. ID charts
5. water test kits

Organization: Groups

Activities & Steps:
Teacher:
Demonstrates how to collect samples and test water.
Students:
Collect pond samples, observe organisms, test pH and turbidity.

Expected Results:
- Students identify 3–5 species;
- Perform a basic water test.

Indicators of Success:
- completed observation sheets
- proper use of equipment.

Extension: Create a class poster of the pond ecosystem.

Observation Sheet

Time	Area Sampled	Organisms Found (name)	Water Quality Notes (pH, turbidity)

Associated Game: “Eco-Bingo”

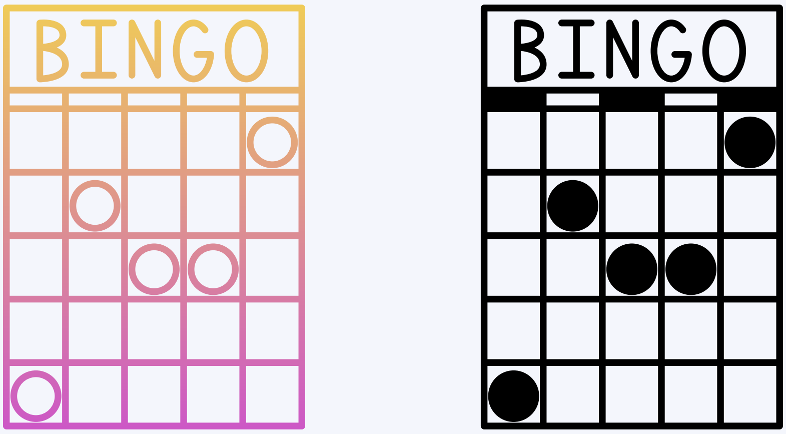
Description:
Students receive bingo cards with pictures/names of pond organisms.

Contextual Value:
Encourages focused observation and identification skills.

Rules:

- As students find organisms, they mark off their bingo sheet.
- First to complete a line (horizontal/vertical/diagonal) wins.

Learning Tie-in:
Reinforces biological diversity and observation in pond ecosystems.



3. “Water Cycle Drama” – The Journey of a Drop

Age: 6–8 years

Duration: 45 minutes

Setting: Open grassy area

Learning Objective:
Describe the water cycle (evaporation, condensation, precipitation).

Materials Needed:
- blue scarves
- name tags (sun, cloud, drop, etc.)

Organization: Whole class

Activities & Steps:
Teacher:
Explains the water cycle with a simple story.

Students: Act out being a water droplet through the cycle stages.

Expected Results:
Students can explain the water cycle in their own words.

Indicators of Success:
Accurate role-play and vocabulary use.

Extension:
Draw the cycle and label the stages.

Observation Sheet

Your Role	What Did Your Character Do?	Which Stage of the Water Cycle?	What Did You Learn About That Stage?

Associated Game: “Water Cycle Tag”

Description:
Each player is a part of the water cycle: sun, droplet, cloud, etc.

Contextual Value:
Reinforces movement through the stages of the cycle.

Rules:

- “Sun” tags “droplets” who must evaporate (run to the cloud zone).
- After enough droplets collect in the cloud, they can “precipitate” (run to Earth).

Learning Tie-in:
·Physically represents key concepts: evaporation, condensation, precipitation.
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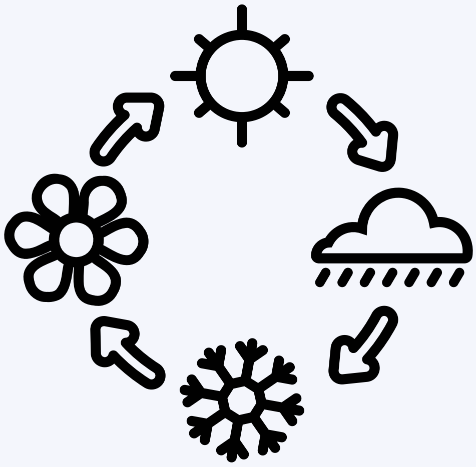

4. "Raindrop Races" – Surface Runoff and Permeability

Age: 7–9 years

Duration: 60 minutes

Setting: Playground with concrete, grass, and soil

Learning Objective:
Understand how different surfaces absorb water.

Materials Needed:
- watering cans
- stopwatches
- measuring cups

Organization: Groups

Activities & Steps:
Teacher:
Demonstrates pouring water on different surfaces.
Students:
Time how fast water is absorbed or runs off various materials.

Expected Results:
Students compare runoff and absorption rates.

Indicators of Success: Correctly recorded times and conclusions.

Extension:
Design a "green" playground with better water absorption.

Observation Sheet

Surface Type	Absorption Time (s)	Amount of Runoff (ml)	Was It Fast or Slow?	Why Do You Think That Happened?

Associated Game: “Runoff Obstacle Course”

Description:
Students navigate an obstacle course simulating water on different surfaces.

Contextual Value:
Encourages understanding of surface permeability and runoff.

Rules:
- Stations represent surfaces like concrete, soil, grass.
- Players roll dice or spin a wheel to determine where their “raindrop” must go

Learning Tie-in:
Teaches how topography and materials affect water absorption.
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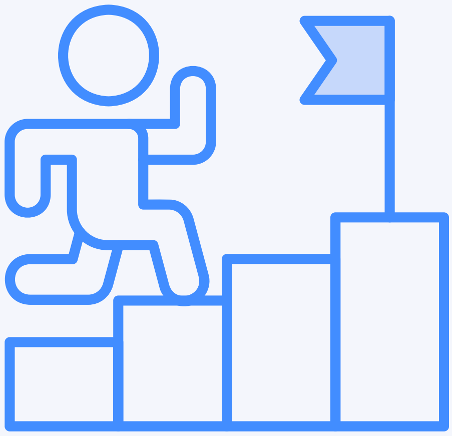


5. “Water Sound Walk” – Noticing Water in the Environment

Age: 5–7 years

Duration: 40 minutes

Setting: School garden or park with water features

Learning Objectives:
- Heighten sensory awareness of water.
- Describe water sounds.

Materials Needed:
- clipboards
- paper
- crayons

Organization:
Individually

Activities & Steps:
Teacher:
Guides a silent walk, asking students to focus on water-related sounds.
Students:
Record or draw sounds they hear (e.g., trickling, dripping).

Expected Results:
Students identify 3 or more water-related sounds.

Indicators of Success:
Detailed drawings or notes.

Extension:
Create a sound collage or poem about water.

Observation Sheet

Stop Number	What Water Sounds Did You Hear?	What Did It Remind You Of?	How Loud Was It? (1–5)

Associated Game: “Sound Matching Challenge”

Description:
After the walk, students are blindfolded and play recorded or mimicked water sounds to guess the source.

Contextual Value:
Strengthens memory and auditory learning.

Rules:
- Students listen to water sounds (dripping, rushing, bubbling, etc.).
- Match each sound with the place or item it was heard or seen.

Learning Tie-in:
Reinforces sensory experience and vocabulary for water sounds.

6. “Where Does Water Go?” – Drainage and Flow

Age: 8–10 years

Duration: 60 minutes

Setting:
Around school grounds (looking at drains, gutters)

Learning Objectives:
Observe how water flows and is managed.

Materials Needed:
- chalk
- toy boats
- sticks
- rulers

Organization: Groups

Activities & Steps:
Teacher:
Explains stormwater systems and runoff.

Students:
Track water flow paths; measure slopes and draw maps.

Expected Results:
Students explain drainage and create basic flow maps.

Indicators of Success:
Labeled maps showing drainage paths.

Extension:
Interview the janitor or a city engineer.

Observation Sheet

Location	Water Flow Direction	Evidence (arrows, objects)	Where Does It Go?	Was the Area Flooded or Dry?

Associated Game: “Follow the Flow”

Description:
A large chalk maze is drawn on the pavement, simulating a drainage system.

Contextual Value:
Helps visualize how water moves through built environments.

Rules:
- Players act as water drops navigating the maze based on conditions (e.g., “storm,” “clog”).
- Collect tokens (like debris or pollutants) along the way.

Learning Tie-in:
Reinforces understanding of stormwater systems and pollution pathways.

7. “Evaporation Stations” – Water Changing States

Age: 7–9 years

Duration: 2 sessions, 45 minutes each

Setting: Sunny outdoor area

Learning Objectives:
Investigate evaporation in different conditions.

Materials Needed:
- shallow dishes
- water
- salt
- cloth
- paper
- thermometer

Organization: Groups

Activities & Steps:
Teacher:
Sets up evaporation conditions (sun, shade, wind).

Students:
Measure and record evaporation rates over time.

Expected Results:
Students observe and explain differences in evaporation.

Indicators of Success:
Correct charts and cause-effect reasoning.

Extension:
Predict how laundry dries in various weather.

Observation Sheet

Surface/Location	Weather Conditions	Starting Water (ml)	Water Left After 1 Hour (ml)	Observations
Sunny (concrete)	Sunny, no wind			
Shade (grass)	Shaded, cool			
Windy area	Windy			

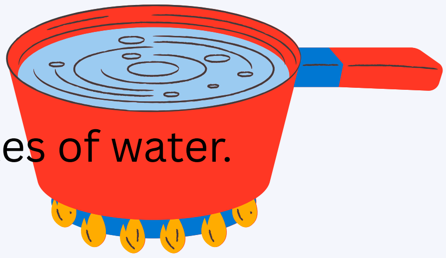
Associated Game: “Evaporation Escape”

Description:
Role-play game where students act as water molecules trying to “escape” into the air.

Contextual Value:
Helps explain how temperature, sunlight, and wind affect evaporation.

Rules:
- Players at different “stations” (sunny, shaded, windy) must complete challenges (e.g., jumping jacks for “heat”).
- The fastest team to “evaporate” and reach the cloud wins.

Learning Tie-in:
Connects physical movement to changing states of water.



8. “Build a Watershed” – Landforms and Water Flow

Age: 10–11 years

Duration: 90 minutes

Setting: Outdoor sandbox or grassy slope

Learning Objectives:
Model a watershed and understand water flow and pollution.

Materials Needed:

- trays
- dirt
- sticks
- food coloring
- spray bottles

Organization: Groups

Activities & Steps:
Teacher:
Demonstrates how landforms affect water flow.

Students:
Build model watersheds and simulate rain and pollution.

Expected Results:
Students show how water travels and collects in basins.

Indicators of Success:
Functioning models and accurate explanations.

Extension:
Brainstorm pollution prevention methods..

Observation Sheet

Group Members	Materials Used	Where Did Your "Rain" Go?	Where Was Pollution Seen?	What Would Improve the Watershed?

Associated Game: “Pollution Pursuit”

Description:
Game simulating the movement of pollution through a watershed model.

Contextual Value:
Shows how water carries pollutants across land.

Rules:
- Teams roll dice to move water drops through a watershed map.
- If they pass polluted zones, they collect “pollution tokens.”
- Goal is to reach the ocean with the cleanest drop.

Learning Tie-in:
Demonstrates how land use impacts water quality.

9. “Water Detective” – Identifying Water Sources

Age: 6–8 years

Duration: 50 minutes

Setting: Around school/neighborhood

Learning Objectives:
Identify natural and human-made water sources.

Materials Needed:
- clipboards
- checklists
- cameras/tablets

Organization: Pairs

Activities & Steps:
Teacher:
Gives clues or riddles about different sources.

Students:
Search and record evidence of each source.

Expected Results:
Students name and locate 4–5 sources.

Indicators of Success:
Completed checklists and photos.

Extension:
Create a class map of water sources.

Observation Sheet

Water Source Spotted	Type (Natural/Human-Made)	What Is It Used For?	Photo Taken (Yes/No)	Notes

Associated Game: “Clue Quest: Water Edition”

Description:
Scavenger hunt game with clues about natural and human-made water sources.

Contextual Value:
Encourages exploration and inference skills.

Rules:
- Students follow riddles or clues to find water-related objects or systems.
- Each clue teaches a water fact (e.g., “I carry rain off the roof – what am I?”).

Learning Tie-in:
Builds environmental awareness and reinforces vocabulary.

10. “Rain Catcher Engineering” – Water Conservation

Age: 9–11 years

Duration: 75 minutes

Setting: School garden or outdoor space

Learning Objectives:
Understand rainwater collection and reuse.

Materials Needed:
- plastic bottles
- scissors
- mesh
- tape
- rulers

Organization: Groups

Activities & Steps:
Teacher:
Discusses water conservation and demonstrates a basic rain catcher.

Students:
Design, build, and test their own rain catchers.

Expected Results:
Functioning catchers; volume recorded after a rain.

Indicators of Success:
Collected water, design explanations.

Extension:
Calculate water savings over a month.

Observation Sheet

Group Members	Materials Used	Volume Collected (ml)	Design Strengths	What Would You Change Next Time?

Associated Game: “Design Duel

Description:
A timed design-and-build challenge between groups.

Contextual Value:
Gamifies the engineering process and encourages iterative thinking.

Rules:
- Limited materials and time.
- Rain catchers are tested by pouring water from a set height.
- The most efficient collector (by volume and design creativity) wins.

Learning Tie-in:
Promotes engineering thinking and understanding of water conservation.

STEM PROJECTS

STEAM 1: Water density

1. Project Title
Water density experiments

2. Introduction
The project is about water density, water is very important because we can t live without it.

3. Description of Your Project
In this project I showed that the salt in water makes the water density rise and it can hold to the surface objects.

4. Materials Used
- water
- salt
- eggs
- 2 cups

5. STEAM Parts of the Project
- Science: It shows things and facts about water density
- Technology: I used some research sites for the facts about density
- Art: I didn t use any art, just science.
- Math: I used measurements for the water.

6. Water Message
Don t waste water and keep it clean.

7. Challenges

The hardest part about the project was remembering the facts about water density.

8. What You Learned

I learned that a dense water can hold a lot of weight.

STEAM 2: Using Water for Producing Electric Energy

1. Project Title

Using Water for Producing Electric Energy

2. Introduction

My project is about how useful water can be to produce electric energy, using some basic objects. I consider that water is important because it is one of the most important and valuable resource on the planet.

3. Description of Your Project

In my project I have created and tried to show how to obtain electric energy by using the most precious resources of our days, that is water and a wheel made of cardboard and plastic materials. Hydropower is one of the oldest forms of energy and has been used by humans since 4000 B.C. Hydropower is a mechanical energy, generated by the use the motion of water caused by gravity.

4. Materials Used

- cardboard
- plastic bottle
- glue gun
- scissors
- 2 wooden chopsticks
- plastic teaspoons
- metal stick
- a plastic box
- 3-4 bottle caps
- a plastic tube
- an engine
- a light bulb
- a cutter

5. STEAM Parts of the Project

- **Science:** The project includes scientific elements (engine, electric energy)
- **Technology:** I used different sites to learn how to create a mill
- **Art:** I glued the necessary elements to create the mills, I used the collage and decoupage technique to create the working system.
- **Math:** I used measurements for the water.

6. Water Message

Water is the most indispensable and powerful resource.

7. Challenges

While making my project I have not encountered any problems.

8. What You Learned

While doing this project, I learned that we have to preserve water, for without it life can no longer bet.

9. References

- www.google.com
- www.youtoube.com
- https://letstalkscience.ca/educational-resources
- www.education.com

STEAM 3: Water purification

1. Project Title
Using Water for Producing Electric Energy

2. Introduction
Water is important to all living beings, because without it we wouldn’t be able to live.

3. Description of Your Project
My project shows how we can purify water

4. Materials Used
- dirty water
- stones
- sand
- cotton
- straw
- glasses

5. STEAM Parts of the Project
- **Science:** My project explains the process of purification
- **Technology:** I used capcut app, to edit my video
- **Art:** I prepared the cups**.**
- **Math:** I used measurements and shapes in my experiment.

6. Water Message
Water is very important in our lives and we have to try to pollute the nature less to have clean water.

7. Challenges
While making my project I have not encountered any problems.

8. What You Learned
I learned haw easy I can purify water whenever I need to.

9. References

- www.youtoube.com

STEAM 4: The Vinegar and Baking Soda Reaction

1. Project Title

The Vinegar and Baking Soda Reaction

2. Introduction

This experiment is designed to illustrate fundamental chemical and physical principles in an engaging, classroom-style setting. The presentation aims to make scientific phenomena more accessible and visually memorable through interactive demonstrations.

3. Description of Your Project

My project showcases the classic chemical reaction between vinegar (acetic acid) and baking soda (sodium bicarbonate). Two household substances are combined in a container, leading to an immediate fizzing effect caused by the rapid release of carbon dioxide gas. This visible bubbling reaction is used to demonstrate the concept of acid-base reactions and the production of gas as a chemical change.

4. Materials Used

- pipette
- food coloring
- jar
- water
- oil
- vinegar
- baking soda

5. STEAM Parts of the Project

- **Science:** The core of the experiment is a chemical reaction: an acid-base interaction between acetic acid and sodium bicarbonate. It demonstrates key scientific concepts such as gas formation, reaction rates, and observable chemical change.

- **Technology:** While no advanced devices are used, basic tools represent applied technology in a simple lab setup. The video recording and editing also fall under the umbrella of using technology.
- **Art:** The visual and possibly creative presentation of the experiment (e.g., use of colors, engaging layout, or expressive explanation) supports the Art aspect.
- **Math:** Measuring quantities of vinegar and baking soda.

6. Water Message

Water is not just a common substance — it is a powerful scientific medium that enables discovery and understanding.

7. Challenges

The first time I tried this experiment, the vinegar and baking soda weren't mixed in the right proportions, so the reaction was too weak.

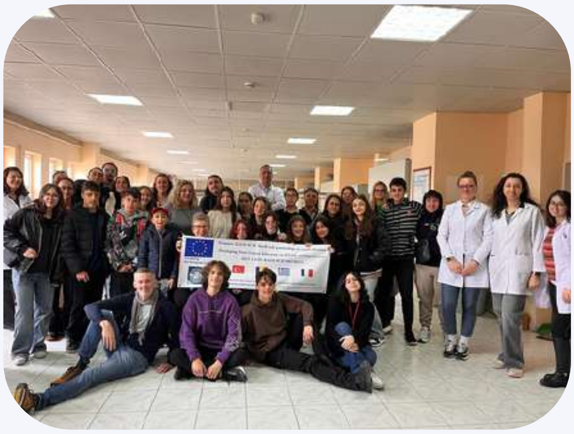
8. What You Learned

I learned how combining an acid (vinegar) and a base (baking soda) produces a gas (carbon dioxide), water, and a salt (sodium acetate). By adjusting the amount of vinegar or baking soda, I learned how reaction intensity depends on concentration and volume.

TÜRKİYE: BRIDGING WATER EDUCATION WITH INNOVATION AND COMMUNITY ENGAGEMENT

"In Türkiye's section, we showcase our efforts to enhance water literacy through innovative educational approaches and strong community involvement. Merkez Çanakkale Anadolu Lisesi, situated in Çanakkale, recognizes the importance of preparing students for both higher education and responsible citizenship.

Our activities emphasize interdisciplinary learning, social responsibility, and the use of technology to address water-related issues. We are committed to empowering students to become active participants in creating a sustainable water future."



1- SEASIDE CSI: UNVEILING SEA POLLUTION

Age Group: 14-18 years old
Subject: Environmental Science, Marine Biology (adaptable for other classes)
Time: 1.5 hours (can be extended)
Learning Objectives:
Students will analyze natural and man-made materials found on the beach.
Students will evaluate the impact of pollution on the ocean ecosystem using scientific reasoning.
Students will propose data-driven solutions to mitigate ocean pollution.
Materials:
Gloves (optional)
Ziplock bags for collecting samples
Data collection sheets (see below)
Clipboards with pens or pencils
Magnifying glasses (optional, for detailed observation)
Hand sanitizer (optional)

Location:
A clean beach area with a variety of natural and man-made debris

Lesson Plan:
Introduction (15 minutes):
Gather the students at the beach and initiate a discussion about current ocean pollution issues.
Briefly introduce the concept of microplastics and their growing threat to marine life.
Explain the scenario: They are environmental scientists conducting a beach debris analysis to assess the severity of pollution and its potential impact.

Seaside CSI Investigation (45 minutes):

Divide students into small groups and distribute gloves, Ziplock bags, data collection sheets, and clipboards.
Define clear boundaries for the investigation area and reiterate beach safety guidelines.
Students work collaboratively to collect data on various beach items. Encourage careful observation, documentation, and responsible collection (minimal samples, leaving the beach undisturbed).

Data Collection Sheet:
Item: Describe the object (material, size, shape, etc.)
Quantity: Record the number of similar items found.
Possible Source: Discuss where this item might have originated (natural vs. man-made).
Potential Impact: Brainstorm how this item could negatively affect the marine environment.
Photo (optional): Students can capture images of interesting finds for further analysis.

Analysis and Discussion (45 minutes):
Gather the groups back together. Have each team present their data and discuss their findings.
Analyze the data collectively. What types of debris were most abundant? Were there any surprising discoveries?
Discuss the potential ecological consequences of the collected pollution, focusing on microplastics and their impact on the food chain.
Challenge students to propose evidence-based solutions to mitigate sea pollution.
Encourage them to consider both individual actions and broader policy changes.

Extension Activities:
Research and present on a specific technology or initiative aimed at cleaning plastic pollution from the ocean.
Conduct a water quality test at the beach (with proper guidance) and analyze the results for potential pollutants.
Organize a beach clean-up event and involve the local community.

Safety Considerations:

Ensure adult supervision throughout the activity.
Provide gloves for students who prefer extra protection while handling debris.
Instruct students not to touch or collect any unknown objects.
Be aware of tides and currents and stay clear of the water.
Apply sunscreen and wear hats if necessary.
Consider bringing hand sanitizer for after the activity (optional).
Remember: Leave the beach cleaner than you found it! By fostering critical thinking and scientific inquiry, we can empower high school students to become responsible stewards of our oceans.

Links to the necessary forms:
https://1drv.ms/w/c/c7c286b84dc6add4/EdStxk24hslggMfacAAAAAAB9Mh8MfpX5yrrOC-b1klGNw?e=pPam3n
https://1drv.ms/w/c/c7c286b84dc6add4/EdStxk24hslggMezcAAAAAABOP2XiClRDEtJzQGqRvV-iA?e=ZiwEa4
https://1drv.ms/w/c/c7c286b84dc6add4/EdStxk24hslggMfacAAAAAAB9Mh8MfpX5yrrOC-b1klGNw?e=h5qzJY

2- WATER BOTTLE XYLOPHONE: SCİENCE OF SOUND MEETS MUSİC

Lesson Duration: 45 minutes
Subjects: Physics (Sound), Music, Art (optional)
Learning Objectives:

- Students will explore the science of sound by building and playing a water bottle xylophone.
- Students will understand how the physics of vibration affects pitch and create music based on these principles.
- Students will develop their musicality and creativity by composing and performing their own pieces.
- (Optional) Students will explore visual design by customizing their water bottle instruments (Art).

Materials:

- 8-10 empty plastic water bottles of various sizes (ideally clear)
- Water
- Food coloring (optional)
- Spoons, chopsticks, or other mallets
- Markers or paint (optional)
- Tuning forks (optional)

Procedure:
1. Introduction (10 minutes):

- Science Connection: Begin by discussing sound waves. Explain that sound is a form of energy that travels through vibrations. Ask students for examples of how vibrations create sound (e.g., plucking a guitar string, tapping a table). Introduce the concept of frequency and how it relates to pitch: higher frequencies create higher-pitched sounds.
- Demonstration: Demonstrate the concept with tuning forks (if available). Strike two tuning forks of different frequencies and discuss the difference in pitch. You can also show videos of sound wave visualizations.

2. Building the Water Bottle Xylophone (15 minutes):

- Science in Action: Explain that the water level in a bottle affects its resonant frequency, thus its pitch. Have students choose bottles of different sizes and fill them with varying amounts of water.
- Tuning the Xylophone: Guide students in arranging the bottles in order from lowest to highest pitch by tapping them with spoons or chopsticks. You can use a piano app or online tone generator to help them identify the pitches.
- Optional: Artistic Expression: (Art Integration) Allow students to personalize their water bottle instruments with markers or paint.

3. Composition and Performance (20 minutes):

• Music Creation: Encourage students to experiment by tapping the bottles to create melodies. Discuss scales and simple musical patterns. Provide them with short, easy-to-follow melodies as inspiration (optional).
• Composing their own Music: Have students create their own short musical pieces using the water bottle xylophone. They can work individually or in groups.
• Performance Time: Each student or group gets to perform their composition for the class. Encourage them to be creative and expressive with their performance.

Wrap-up and Reflection (5 minutes):
• Discuss the challenges and successes of the activity.

• Ask students questions like:
o How did the amount of water in the bottle affect the sound?
o What did you learn about the relationship between frequency and pitch?
o How did you use creativity in making music with everyday objects?

• Encourage students to reflect on the connections between science, music, and (optionally) art in this activity.

Differentiation:
• Provide pre-made water bottle xylophones with pre-determined pitches for students who need more structure.
• Challenge advanced students to compose more complex pieces with multiple parts or harmonies.
• Allow students to research and incorporate additional objects like straws or bells into their instruments.

Extension Activities:
• Research different types of instruments and how they produce sound.
• Create a short presentation explaining the science behind the water bottle xylophone.
• Compose a song about sound waves or the connections between science and music.

Assessment:
• Observe student participation in building and playing the water bottle xylophone.
• Evaluate the creativity and complexity of their compositions.
• Assess their understanding of the science concepts through discussions and reflections.

Wrap-up and Reflection (10 minutes)

1. Group Discussion (5 minutes):
Challenges and Successes: Begin by facilitating a class discussion. Ask open-ended questions like:
"What were some of the challenges you faced while building and playing the water bottle xylophone?" (e.g., tuning the bottles, creating a melody)
"What were you most successful at during this activity?" (e.g., creating a cool sound, working together as a group)
"Did anything surprise you about the sounds you were able to create?"
How did the amount of water in the bottle affect the sound?
What did you learn about the relationship between frequency and pitch?
How did you use creativity in making music with everyday objects?

2. Connecting the Dots (5 minutes):

Science of Sound: Ask specific questions to solidify their understanding of the scientific principles:
"How did the amount of water in the bottle affect the sound? Did more water create a higher or lower pitch?" (Lower pitch)
"Can you explain the relationship between the frequency of vibration and the pitch of the sound?" (Higher frequency = higher pitch)
Music and Creativity: Shift the focus to the musical aspect:
"How did you use your creativity to compose your piece?" (e.g., choosing rhythms, using different parts of the xylophone)
"Did this activity change your perception of how music can be created?" (Discussion about using everyday objects)





3- ARCHİMEDES' SCREW: LİFTİNG WATER UPWARD

Subject: Science
Grade Level:
Time Allotment: 45 minutes
Learning Objectives:
Students will be able to explain the concept of Archimedes' screw.
Students will be able to design and build a simple model of an Archimedes' screw.
Students will be able to observe and explain how their model lifts water.
Materials:
Two 0.5 liter PET bottles
1 meter long and 1 cm diameter clear hose
Duct tape
Two clear containers
Food coloring
One bucket or box
Scissors (for teacher use only)
Optional: Wooden dowels, tape, various sized pebbles or sand
Procedure:
Introduction (10 minutes):
Engage: Begin by showing students a short video or picture of an Archimedes' screw in use. Ask them what they think it is and how they think it works.
Explain: Briefly explain the history and purpose of the Archimedes' screw. Discuss how it is used to move water from a lower level to a higher level without electricity.
Elicit: Ask students questions to gauge their prior knowledge. What are some other ways we can move water? What are some challenges of moving water uphill?
Activity (30 minutes):

1. Divide: Divide students into pairs or small groups.
2. Construct: Provide each group with the materials. Instruct them to use the PET bottles, hose, and duct tape to build a model of an Archimedes' screw. Guide them by explaining that the hose should wrap spirally around the bottles, creating an inclined plane. (Pre-cut the bottles if necessary for younger students)
3. Experiment: Fill one container with water and add a few drops of food coloring. Have students hold their Archimedes' screw model at an angle with one end submerged in the colored water and the other end positioned over the empty container.
4. Observe: Instruct students to slowly rotate the model. Ask them to observe what happens to the water. Encourage them to discuss why the water moves upwards.
5. Challenge (Optional): For a deeper understanding, provide optional materials like wooden dowels, tape, and pebbles/sand. Challenge students to design and build different models, varying the length of the screw, the angle of tilt, or the size of the "steps" created by the hose. Observe and compare how these changes affect the water flow.

Wrap-up (5 minutes):
Discussion: Lead a class discussion about the observations. How does the inclined plane design within the Archimedes' screw work to lift water?
Real-world connections: Discuss real-world applications of Archimedes' screws, such as irrigation and wastewater treatment.
Assessment: Briefly assess student understanding by asking questions about the Archimedes' screw's function and how their models demonstrated its principles.
Differentiation:
For younger students, provide pre-cut bottles or assist with the construction process.
For advanced students, provide more challenging materials and encourage them to research and present on different uses of Archimedes' screws.
Extension Activities:
Students can create a drawing or model depicting how water flows through a larger, functional Archimedes' screw.
Research other historical inventions that utilize inclined planes for water movement.
Write a short story about how an Archimedes' screw is used in a specific situation.
This lesson plan provides a framework for a fun and engaging activity that allows students to explore the science behind Archimedes' screw.

Understanding the Concept:
•Can you explain how the Archimedes screw works to move water uphill?
•What is the role of the spiral shape in the Archimedes screw?
•Can you identify different applications where the Archimedes screw principle is used?
Performance and Design:
•How effectively did your Archimedes screw move water? Did it meet your expectations?
•What were the challenges you faced during the construction of your Archimedes screw? How did you overcome them?
Analysis and Problem-solving:
•What factors do you think might influence the efficiency of the Archimedes screw (e.g., material, size, angle of tilt)?
Creativity and Innovation:
•Can you think of any alternative materials that could be used to build a functional Archimedes screw?
•Can you design a variation of the Archimedes screw with a different purpose (e.g., transporting grain or sand)?

Reflection and Communication:
•What did you learn from building and testing your Archimedes screw?
•How would you explain the Archimedes screw and its principles to someone who has never seen one before?
•What was the most enjoyable or challenging part of this activity?

4- EXPLORING WATER QUALITY

Topic: Introduction to Water Quality Analysis
Time Allotment: 1-2 class periods (adaptable based on depth of exploration)
Learning Objectives: By the end of this lesson, students will be able to:
Identify key parameters used to assess water quality.
Understand the units of measurement for common water quality parameters.
Recognize ideal ranges or reference standards for freshwater and marine water for certain parameters.
Explain potential causes of low and high values for selected water quality parameters.
Appreciate the importance of water quality monitoring.
Materials:
Water Quality Analysis Datasheet (provided) - printed copies or digital access
Optional: Real water samples (if available and safe to handle)
Optional: Basic water testing kits (e.g., pH strips, simple conductivity meters)
Optional: Visual aids (diagrams, pictures of water sources, pollution examples)
Optional: Computers or tablets for research
Procedure:
Day 1: Introduction to Water Quality (Approx. 45-60 minutes)
(1) Engaging Introduction (10 minutes):
Begin by asking students about their experiences with water (e.g., drinking water, rivers, the sea).
Discuss why water quality is important for human health and the environment.
Show visuals of different water sources and potential pollution scenarios.
(2) Introducing Key Water Quality Parameters (15 minutes):
Distribute or display the "WATER QUALITY ANALYSIS DATASHEET."
Guide students through the first section, focusing on the "Parameter," "Units," and "Ideal Range or Reference Standard" columns.
Discuss each parameter briefly:
pH: Explain the concept of acidity and alkalinity and its importance for aquatic life. Highlight the ideal ranges for freshwater and marine water.
Conductivity: Explain that it measures the ability of water to conduct electricity, indicating the presence of dissolved ions (salts and minerals). Compare typical values for freshwater and seawater.
Dissolved Oxygen (DO): Discuss its importance for aquatic organisms to respire. Explain the different ideal ranges for freshwater and marine water.
Water Hardness: Introduce the concept of dissolved minerals (calcium and magnesium) and the categories of soft, moderately hard, and hard water.
Salinity: Explain it as the measure of salt content, distinguishing between freshwater, brackish water, and seawater.
Bicarbonate (HCO_3^-) and Alkalinity: Briefly introduce their role in buffering pH changes in water.

(3) Understanding Units of Measurement (10 minutes):
Emphasize the importance of units in scientific measurements.
Go through the units for each parameter (e.g., pH units, µS/cm, mg/L, ppt).
For conductivity and salinity, highlight the differences between freshwater and marine water units/ranges.

(4) Initial Questions and Discussion (10–15 minutes):
Facilitate a class discussion using questions like:
Why do you think the ideal pH range is different for freshwater and marine water?
What might cause high conductivity in a freshwater source?
Why is dissolved oxygen important for fish?
Have you ever noticed differences in water hardness?
Day 2: Exploring Causes of Water Quality Changes (Approx. 45–60 minutes)
(1) Review of Parameters (10 minutes):
Briefly review the water quality parameters discussed on Day 1.
Ask students to recall the ideal ranges for a few parameters.

(2) Analyzing Causes of Low and High Values (20 minutes):
Direct students' attention to the second table in the datasheet: "Parameter, Causes of Low Values, Causes of High Values."
Go through each parameter and discuss the potential reasons for deviations from the ideal ranges:
pH: Discuss acid rain, industrial waste, limestone, and agricultural runoff.
Conductivity: Explain the impact of deionized water, ocean water, industrial wastewater, and agricultural fertilizers.
Dissolved Oxygen (DO): Discuss stagnant water, temperature, organic matter decomposition, algae blooms, and photosynthesis.
Water Hardness: Explain naturally soft/hard water sources and industrial discharges.
Salinity: Focus on the difference between freshwater and saltwater environments and the concept of saltwater intrusion.
Bicarbonate (HCO_3^-) and Alkalinity: Briefly explain the influence of geological formations.

(3) Group Activity/Discussion (15–20 minutes):
Divide students into small groups.
Assign each group one or two water quality parameters.
Ask them to brainstorm real-world scenarios where the values for their assigned parameters might be low or high.
Encourage them to think about human activities and natural processes.
Have each group share their scenarios with the class.

(4) Conclusion and Importance of Water Quality Monitoring (5-10 minutes):
Summarize the key water quality parameters and the factors that can influence them.
Discuss the importance of monitoring water quality for:
Protecting human health (drinking water safety).
Maintaining healthy aquatic ecosystems.
Identifying and addressing pollution sources.
Sustainable water management.

Assessment:
Informal Assessment: Observe student participation in discussions and group activities.
Optional Formal Assessment:
A short quiz on the key water quality parameters, their units, and ideal ranges.
A worksheet where students match causes with low/high values for different parameters.
A short research project on a local water source and potential water quality concerns.
Extension Activities:
If possible, conduct basic water quality testing on a local water sample (under appropriate supervision and safety guidelines).
Research local water quality reports and regulations.
Investigate the impact of specific pollutants on water quality and aquatic life.
Explore careers related to water quality monitoring and management.
Connect this lesson to broader topics like the water cycle, pollution, and conservation.

5- Exploring Fish Diversity at the Marine Museum

Objective: Students will be able to:

Identify different species of fish.
Describe the physical characteristics of fish (fins, scales, body shape).
Compare and contrast different fish adaptations to their environments.
Understand the importance of marine biodiversity.
Learn about the roles of marine museums in education and conservation.

Location: Marine Museum

Materials:
Clipboards
Observation worksheets (see example below)
Pencils/pens
Cameras (optional)
Magnifying glasses (optional)
Field guides or identification keys for local fish (optional, check if the museum provides any)

Procedure:
Before the Trip:

1. **Pre-visit Activity: Introduction to Fish (1 class period):**
    - **Discuss the characteristics of fish (gills, fins, scales, cold-blooded).**
    - **Introduce basic fish anatomy.**
    - **Show pictures or videos of different types of fish and their habitats.**
    - **Prepare students for the museum visit by discussing what they might see.**
    - **Distribute the observation worksheets and explain how to use them.**

During the Trip:

1. **Introduction at the Museum (15 minutes):**
    - **Gather students in a central area of the museum.**
    - **Welcome and introduce the museum's exhibits and focus.**
    - **Review the learning objectives and observation worksheet.**
    - **Emphasize the importance of respecting the exhibits and not disturbing the animals.**
    - **Explain any specific rules or guidelines of the museum.**
2. **Exploration and Observation (60-90 minutes):**
    - **Divide students into small groups (with adult chaperones).**
    - **Assign each group to explore specific exhibits or areas of the museum.**
    - **Instruct students to use their observation worksheets to:**
        - **Identify different fish species.**
        - **Draw pictures of the fish.**
        - **Describe the fish's physical characteristics (size, shape, color, fins).**
        - **Note the fish's habitat (e.g., coral reef, deep sea).**
        - **Record any interesting behaviors (e.g., swimming patterns, feeding).**
    - **Encourage students to ask questions and interact with museum staff or volunteers.**
    - **Optional: Have students take photos of the fish (if allowed).**

3- Group Check-in and Discussion (30 minutes):

Regroup at a designated time and location.
Have each group share their most interesting observations.
Facilitate a discussion about the diversity of fish:
What were the biggest fish you saw? The smallest?
What were some of the most colorful fish?
How were the fish adapted to their different environments?
What are some of the threats facing fish populations?
Relate the observations to concepts like adaptation, biodiversity, and conservation.

After the Trip:
Post-visit Activity: Fish Research and Presentation (1-2 class periods):
Have students choose a fish species they observed at the museum.

Instruct them to research the fish in more detail:
Scientific name and common name
Habitat and distribution
Diet and feeding habits
Physical characteristics and adaptations
Conservation status and threats
Interesting facts

Have students create a presentation (e.g., poster, slideshow, oral presentation) to share their findings with the class.

Assessment:
Observation Worksheet: Evaluate the completeness and accuracy of student observations.
Participation: Assess student engagement in discussions and activities.
Presentation: Evaluate the quality of the research, content, and presentation skills.

6- Water Filtration Challenge

Objective: Students will design and build a model water filtration system using natural materials.

Location: An outdoor area with space for groups to work (e.g., schoolyard, park).

Materials:
Large plastic bottles (cut in half) or other containers
A variety of filter materials:
Sand (various sizes)
Gravel (various sizes)
Activated charcoal (if available)
Cotton balls or fabric
Grass
Leaves
"Polluted" water (water mixed with soil, leaves, and other non-toxic debris)
Beakers or collection containers
Measuring cups
Optional: Coffee filters

Procedure:

1. **Introduction (15 minutes):**
    - **Discuss the importance of clean drinking water and the natural processes of water filtration.**
    - **Show examples of natural filtration (e.g., how water filters through soil and rock).**
    - **Introduce the challenge: to design a filter that can clean the "polluted" water.**
    -
2. **Design and Build (45 minutes):**
    - **Divide students into groups.**
    - **Provide each group with the materials.**
    - **Have them plan and build their filtration systems by layering different materials in the plastic bottles.**
    - **Encourage creativity and experimentation.**

Testing and Evaluation (30 minutes):
Have each group test their filter by pouring the "polluted" water through it and collecting the filtered water in a beaker.
Compare the appearance of the filtered water from different groups.
Discuss the effectiveness of different filter designs and materials.
Evaluate the filters based on clarity, speed of filtration, and amount of water filtered.

Discussion and Improvement (15 minutes):
Discuss the following questions:
Which filter design worked best? Why?
What materials were most effective at removing the pollutants?
How could you improve your filter design?
Relate the activity to real-world water treatment processes.

7- Water Pollution – What Harms Our Water?

Objective: Students will identify common sources of water pollution and understand its impact on living things and the environment.

Materials:
Pictures or short video clips showing different types of water pollution (e.g., litter in rivers, oil spills, factory discharge, agricultural runoff).
Large clear jar or container
Water
Various "pollutants" (e.g., soil, glitter, small pieces of paper, cooking oil, dish soap, food coloring)
Gloves (optional)
Chart paper or whiteboard
Markers

Procedure:
Introduction – Clean vs. Dirty Water (10 minutes): Start by asking students what "clean water" looks like and what "dirty water" might contain. Discuss why clean water is essential.
Visual Exploration & Discussion (15 minutes): Show pictures/videos of water pollution. For each visual, ask: "What do you see?" "Where do you think this pollution came from?" "What might happen if animals or people use this water?" List different sources of pollution on the chart paper (e.g., litter, chemicals from factories, pesticides/fertilizers from farms, oil from cars/boats).

Activity – Pollution in a Jar (20 minutes):
Fill the clear jar with water. Explain this represents a clean body of water.
Gradually add small amounts of the "pollutants" one by one, discussing what each represents and its potential impact.
For example:
Soil: Runoff from construction or erosion.
Glitter/Paper: Litter.
Cooking Oil: Oil spills or improper disposal of cooking grease.
Dish Soap: Chemicals from homes.
Food Coloring: Industrial dyes or chemical waste.
Observe how the water changes and discuss the difficulty of cleaning it once polluted.

Impact Discussion (10 minutes): Lead a discussion on the impact of water pollution:
On animals: Harm to aquatic life, loss of habitat.
On plants: Contaminated crops, harm to ecosystems.
On humans: Sickness from drinking contaminated water, impact on recreation.

Wrap-up (5 minutes): Emphasize that pollution is a serious problem and that preventing it is much easier than cleaning it up. Brainstorm simple actions students can take to prevent pollution (e.g., not littering, proper waste disposal).

Assessment: Students' ability to identify sources of pollution and discuss their impacts.

Links to the useful videos for the activities:

Content is no longer available

8- Global Water Challenges and Solutions

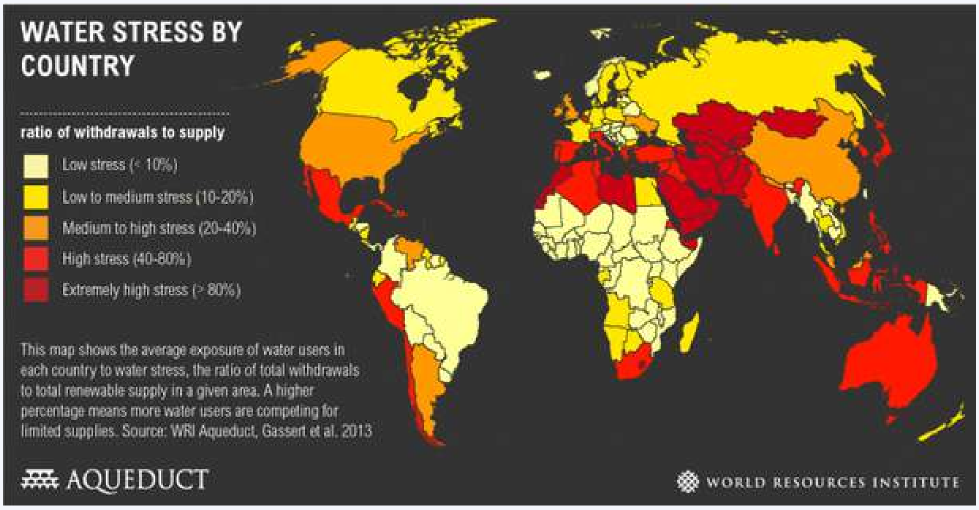
Objective: Students will understand that water scarcity is a global issue and identify community-level and global solutions for sustainable water management.

Materials:
World map or globe
Pictures/videos showing regions with water scarcity or innovative water solutions (e.g., drought-stricken areas, desalinization plants, rainwater harvesting, community wells).
Index cards or small pieces of paper
Markers
Optional: Case studies (simplified) of water issues in different parts of the world.

Procedure:
Introduction - Water Around the World (10 minutes): Start with the world map/globe. Ask students if they think everyone in the world has easy access to clean water. Introduce the idea that water is not evenly distributed and that many places face "water scarcity" (not enough water).

Exploring Global Challenges (20 minutes):
Show visuals of areas affected by water scarcity or pollution. Discuss factors contributing to these challenges (e.g., climate change, population growth, pollution, inefficient use).
Introduce the concept of "water footprint" — the total amount of fresh water used to produce the goods and services we consume.

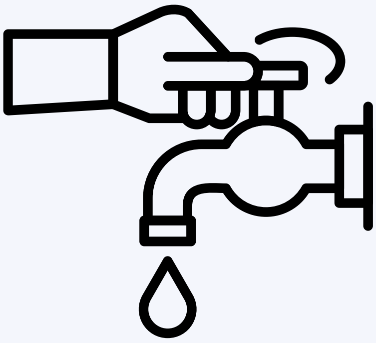
Brainstorming Solutions (15 minutes): Ask students, "What can people and communities do to solve water problems?" Guide them to think about:
Individual actions: (reiterate from previous lesson)
Community actions: Fixing leaks in public pipes, building rainwater harvesting systems, educating the public, water treatment plants.
Technological solutions: Desalination (removing salt from seawater), efficient irrigation systems.
Global cooperation: Sharing resources, international agreements.

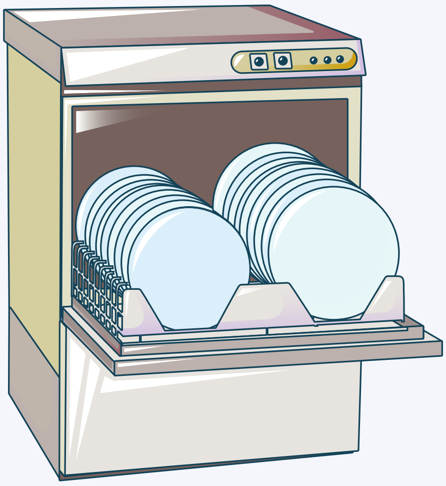
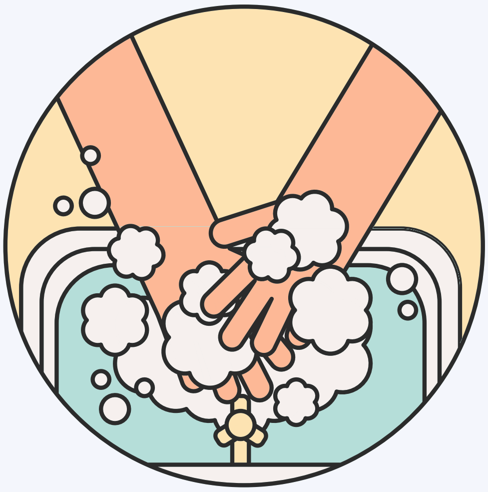


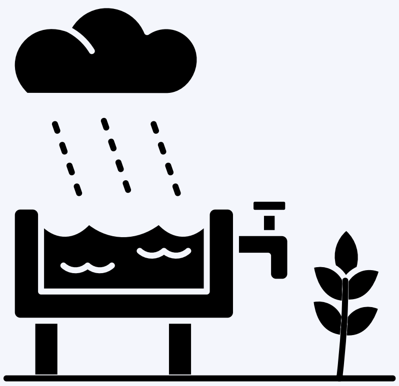
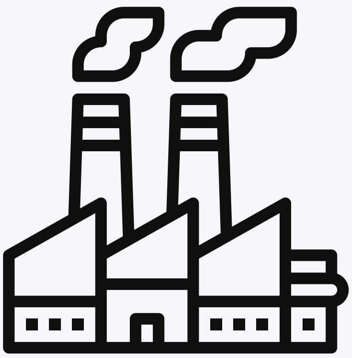
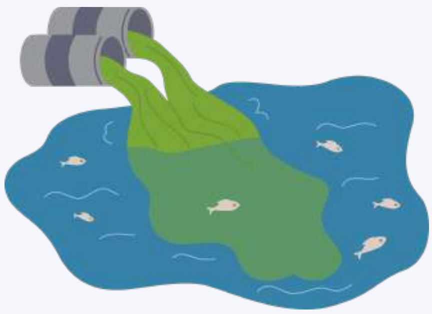
"Solution Cards" Activity (15 minutes):
Give each student a few index cards.
Have them write or draw one water solution on each card.
Collect the cards and create a "Solutions Wall" or "Solutions Box," categorizing them into individual, community, or global solutions.

Wrap-up & Call to Action (5 minutes): Reiterate that water is a shared global resource and that working together at all levels is crucial for ensuring everyone has access to clean water. Encourage students to think about their own water footprint.

Assessment: Students' ability to contribute relevant solutions to the "Solution Cards" activity and participate in discussions about global water issues.

9- My Hidden Water Footprint

Objective: Students will understand that water is used to produce almost everything they consume and will identify ways to reduce their "hidden" water footprint.

Materials:
Pictures of everyday items (e.g., a T-shirt, a pair of jeans, a chocolate bar, a smartphone, a hamburger, a sheet of paper, an apple)
Index cards or small pieces of paper
Markers
"Water Footprint Facts" handout or chart (e.g., 1 T-shirt = 2,700 liters, 1 kg beef = 15,000 liters, 1 apple = 70 liters)

Optional: Scales or visual representations for larger numbers (e.g., a large bucket for 100 liters)

Procedure:
Introduction - Beyond the Tap (10 minutes): Ask students: "Besides drinking and washing, how else do we use water?" Guide them to think about the water used to make things. Introduce the term "Water Footprint" – the total amount of water used to produce the goods and services consumed by an individual or community.

Guess the Footprint (15 minutes): Show pictures of everyday items one by one. Ask students to guess how much water they think was used to produce each item. Write down their guesses.

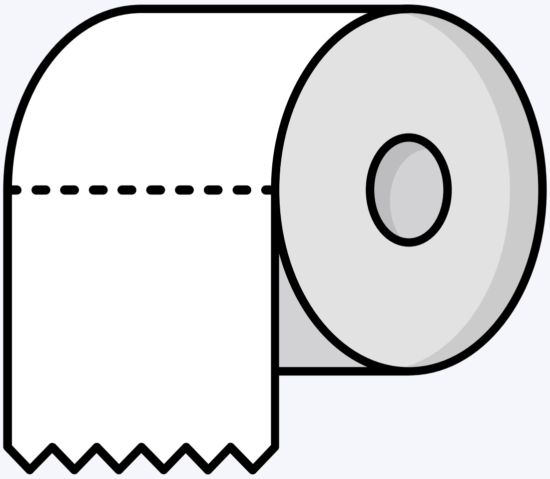
Reveal the Facts (15 minutes): Reveal the actual water footprints for each item using the "Water Footprint Facts" handout. Discuss how surprising some of the numbers are. Explain that this includes "virtual water" used in growing, manufacturing, and transporting.

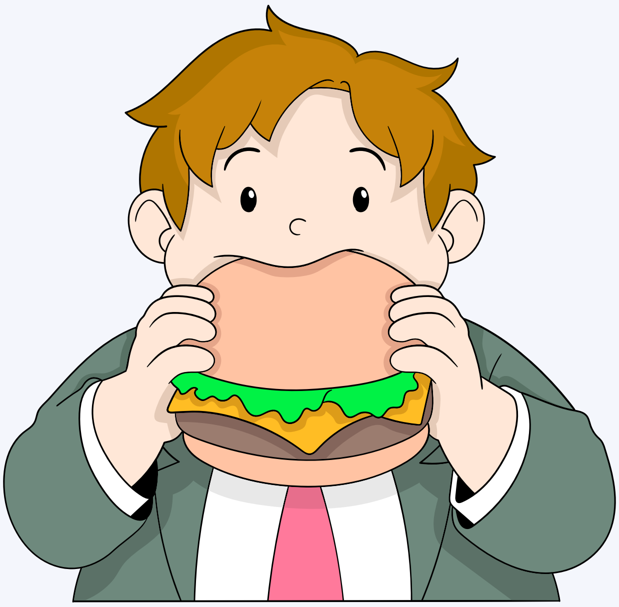
Game: "Water Footprint Challenge" (15 minutes):
Divide students into small groups.
Give each group a set of index cards with different actions or choices (e.g., "Eat a hamburger," "Eat a vegetable burger," "Buy a new T-shirt," "Buy a used T-shirt," "Recycle a plastic bottle," "Throw away a plastic bottle").
Challenge them to arrange the cards from "highest water footprint" to "lowest water footprint."
Discuss their arrangements and the reasoning behind them.

Wrap-up (5 minutes): Emphasize that every choice we make has a water cost. Brainstorm ways to reduce their hidden water footprint (e.g., buying less, recycling, eating more plant-based foods, choosing sustainable products).

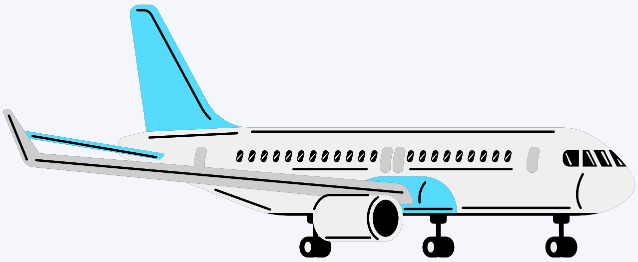
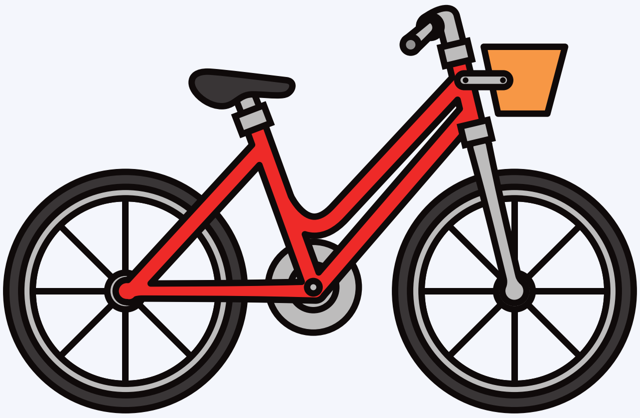
Assessment: Students' participation in the "Water Footprint Challenge" and their ability to identify at least two ways to reduce their hidden water footprint.

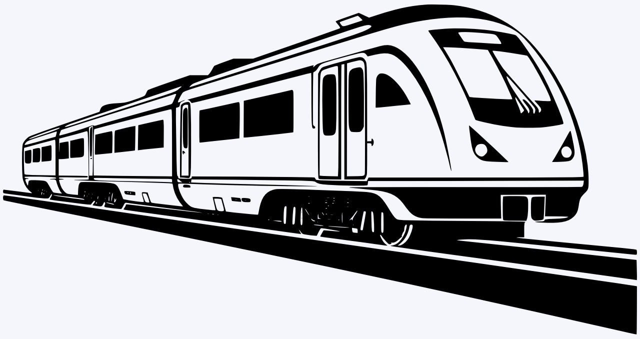
Cards for the activities










10- Water Cycle Drama

Grade Level:
Ages 10–14 (can be adapted for younger/older students)

Duration:
60–75 minutes

Location:
Schoolyard, amphitheater, or any open outdoor space
Subject Areas:
Science, Drama, Art, Environmental Education

Key Concepts:

- **Stages of the water cycle: Evaporation, Condensation, Precipitation, Collection**
- **Physical changes in states of matter (solid, liquid, gas)**
- **Creative expression through movement and performance**

Learning Objectives:
By the end of this lesson, students will be able to:

1. **Identify and describe the four main stages of the water cycle.**
2. **Demonstrate understanding of water's physical state changes through dramatization.**
3. **Collaborate to design simple costumes/props representing water processes.**
4. **Reflect on the importance of water in natural systems.**

Materials:

- **Colored scarves (yellow for sun, white for clouds, blue for water drops)**
- **Optional: face paint, hula hoops, umbrellas, spray bottles**
- **Printed cue cards or prompt sheets (with keywords: evaporate, condense, etc.)**
- **Large poster or whiteboard for diagramming**
- **Camera (optional, for recording performances)**
- **Drawing paper and markers (for post-activity reflection)**

Preparation (15 min):

1. **Mark four performance zones in the outdoor area for each stage of the cycle.**
2. **Place props at each zone (e.g., blue scarves in the precipitation zone).**
3. **Prepare short water cycle fact cards for each student or group.**

Procedure:

1. Warm-Up / Introduction (10 min):
Gather students in a circle.
Briefly explain the water cycle stages using a large diagram.
Introduce the idea of using movement and drama to bring science to life.
Ask: "What does it feel like to be a water droplet?"

2. Group Division & Role Assignment (10 min):
Divide students into 4–6 small groups.
Each group will represent the entire cycle or a stage depending on class size.
Assign one or two students per role: sun, cloud, raindrop, river, etc.

3. Creative Workshop (15–20 min):
In groups, students plan a short 1–2 minute skit acting out the water cycle.
Encourage use of movement (e.g., rising for evaporation, swirling for condensation).
Students can use scarves, umbrellas, and other props.
Emphasize transitions between states: liquid → gas → liquid → ground collection.

4. Performance Time (15 min):
Groups perform their skits in the outdoor theater space.
Audience watches and identifies stages shown.
Optional: Record performances or take photos for a digital reflection.

5. Reflection & Discussion (10 min):
Gather again and ask:
"What did you learn by acting it out?"
"Which stage was easiest/hardest to show?"
"How does this help you understand the water cycle better?"
Students can draw or write a short creative journal entry titled:
"A Day in the Life of a Water Drop"

Assessment:

- Formative: Observe group collaboration and understanding during planning and performances.
- Summative: Use a short quiz, drawing, or creative writing piece to assess understanding of the water cycle stages and transitions.

Water Cycle Drama – Quiz

✏️ **Student Name:** ________________
📅 **Date:** ________________
⏰ **Time:** 15–20 minutes
Instructions: Answer all the questions. Think about what you learned during the Water Cycle Drama activity.

Part A: Multiple Choice (1 point each)

1. What causes water to evaporate from oceans, rivers, and lakes?
 A. Wind
 B. Sun's heat
 C. Clouds
 D. Gravity

2. When water vapor cools down in the air, it turns into:
 A. Rain
 B. Ice
 C. Clouds
 D. Steam

3. Which of the following is NOT a stage in the water cycle?
 A. Condensation
 B. Transpiration
 C. Precipitation
 D. Combustion

4. What happens during precipitation?
 A. Water droplets form clouds
 B. Water vapor rises into the sky
 C. Water falls from the sky as rain or snow
 D. Water flows underground

5. What is collection in the water cycle?
 A. Water turning into vapor
 B. Water falling from the sky
 C. Water gathering in oceans, lakes, and rivers
 D. Water being absorbed by plants

Part B: Short Answer (2 points each)

6. Describe what happens to water during evaporation.

7. In your own words, explain how clouds form.

8. Think about the drama activity. Which part of the water cycle was the most fun to act out, and why?

Part C: Matching (1 point each)
Match the stage of the water cycle with its description.

9–12 A. Water gathers in oceans, rivers, or lakes

Evaporation ______
Condensation ______
Precipitation ______
Collection ______

A. Water gathers in oceans, rivers, or lakes
B. Water changes into vapor and rises
C. Water vapor cools and forms clouds
D. Water falls as rain, snow, sleet, or hail

13. What would happen if the sun didn't shine for a week? How would it affect the water cycle?

11- Escape the Drought!

Grade Level:
Ages 11–16 (adaptable for upper primary or secondary levels)

Duration:
60–90 minutes (including briefing and debrief)

Setting:
Outdoor space (school yard, garden, or park)

Subject Areas:
Environmental Science, Math, Engineering, Problem-solving, Citizenship

Learning Objectives:
By the end of the activity, students will be able to:

1. Explain the concept of water scarcity and its causes.
2. Analyze daily activities that contribute to their water footprint.
3. Collaborate to solve STEAM-based challenges related to water.
4. Propose simple water-saving actions.

Materials Needed:

- Envelopes with printed puzzle clues (laminated if outdoors)
- Puzzle pieces (e.g., math problems, riddles, decoding tasks)
- Plastic pipes or flexible tubing (for pipeline model challenge)
- Stopwatch or phone timer for each team
- Game instructions and roles cards
- Clipboards, pencils
- Printable water footprint cards
- Reward for winning team (e.g., “Water Guardians” certificate)
- Lockable box with final “solution scroll” inside (optional)

Preparation (30–60 min):

1. Set up 4 game stations, each with a STEAM-related task.
2. Prepare laminated clue cards and hide them around the space.
3. Prepare any physical models (e.g., pieces for pipeline building).
4. Test timing (15 minutes per station is ideal for a 60-min session).

Scenario Introduction: (5–10 min)

Story Setting:
It's the year 2050. In the fictional city of Aquatropolis, water is extremely scarce due to years of misuse and climate change. The government has entrusted your team of young innovators to unlock the secret to saving water. You must complete all 4 missions and escape the drought before it's too late!

Team Instructions:
Divide students into teams of 4–6.
Each team receives a map, clipboard, and their first clue.
Teams rotate between 4 task stations.
Each solved puzzle gives them a code piece or word. All 4 must be solved to escape.

🧩 Mission Tasks (4 Stations)

🧠 Station 1: Water Footprint Challenge
Focus: Math, Data Literacy
Task:
Teams match common daily activities (e.g., eating a burger, taking a shower) to their water footprint using clue cards.
They must solve 3 math questions involving total water use.

Example Question:
If one hamburger uses 2,400 L of water and a shower uses 10 L per minute, which uses more water: 1 burger or a 15-minute shower?
✅ Correct answer gives them their first puzzle piece.

🔧 Station 2: Pipeline Engineering Puzzle
Focus: Engineering, Collaboration
Task:

- Teams assemble a simple working "pipeline" from point A to B using limited materials (tubes, connectors, tape).
- They must transport 500 ml of water through the pipeline without spilling.

✅ If the water reaches the endpoint, they earn the second clue.

🔐 Station 3: Decode the Water Cycle
Focus: Science, Cryptography
Task:

- A water cycle diagram is encrypted using a simple cipher (e.g., Caesar code).
- Teams decode 3 keywords like "condensation," "evaporation," and "precipitation" to reveal the third part of the message.

✅ Correct decoding gives the third code word.

♻️ Station 4: Sustainability Puzzle Lock

Focus: Environmental Solutions
Task:
Students solve a riddle or match solution cards to problems related to water waste (e.g., dripping taps → fix leaks).
A puzzle box may be locked and opens only when correct answers are given.
✅ Inside is the final code piece or message.

🏁 Final Task: Escape and Reflection (10–15 min)
When all teams return with their 4 pieces, they combine them to reveal a hidden message:
"Conserve. Protect. Act. Water is Life."
Teams present 1 idea to reduce water use at school/home.

Assessment & Debrief (10–15 min):
Discussion Prompts:
What did you learn about how we use water?
Which task challenged you the most?
How can our school reduce water usage?

<u>Ready-to-print decoding task for Station 3: Decode the Water Cycle</u>

🔐 Station 3: Decode the Water Cycle
STEAM Focus: Science + Cryptography
Goal: Learn about the water cycle while using problem-solving and decoding skills.
📖 Instructions to Students (printable card):
The ancient knowledge of the water cycle has been encrypted to protect it from being lost during the great drought.
Use the Caesar Cipher shift of +3 to decode each word and discover the missing key terms.
Each correct word will bring you closer to the final message that will help you "Escape the Drought!"
🔐 Cipher Code Explanation (can be on a poster or clue card):
Caesar Cipher Shift +3 = Each letter is replaced by the letter 3 positions ahead in the alphabet.
Example: A → D, B → E, C → F ... X → A, Y → B, Z → C

🔐 Station 3: Decode the Water Cycle
STEAM Focus: Science + Cryptography

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Example: A → D, B → E, C → F ... X → A, Y → B, Z → C

💧 Clue Sheet: Decode the Words markdown
1. HFRQGHQVDWLRQ → ____________________

2. HYDSRUDWLRQ → ____________________

3. SUHFLSLWDWLRQ → ____________________

4. FROOHFWLRQ → ____________________

BONUS:
Decode this full sentence to reveal part of the escape message:

ZDWHU LV WKH NHB WR OLIH → ___________________________

✅ Answer Key (for teachers):
CONDENSATION
EVAPORATION
PRECIPITATION
COLLECTION
Bonus: WATER IS THE KEY TO LIFE

12– Microscopic Water World

Grade Level:
Ages 11–16 (adaptable for upper primary and secondary)
Duration:
90–120 minutes
Setting:
Outdoor area near a pond, stream, school garden water source, or container water collection station with microscope access

🎯 Learning Objectives:
By the end of this lesson, students will be able to:
Understand the concept of microorganisms in freshwater ecosystems.
Collect and prepare simple water samples for microscope observation.
Identify basic aquatic microscopic life forms (e.g., protozoa, algae, rotifers).
Record observations through scientific sketching or digital art.
Reflect on the importance of invisible life in water ecology.

🧰 Materials Needed:
For Field Collection:
Plastic pipettes/dropper bottles
Clear sampling jars or tubes (labelled)
Gloves (optional but recommended)
Buckets or nets (for scooping water)
For Microscope Station:
Microscopes (basic optical or digital)
Glass slides and cover slips
Droppers
Labels and markers
Cleaning tissues/alcohol swabs
For Recording Observations:
Field sketchbooks or printed observation sheets
Colored pencils or digital tablets (if available)
Waterproof clipboards (optional)
For Art Extension:
Poster paper or cardboard
Acrylic or watercolor paints, pens
Tablets/laptops (for digital aquarium creation)
Labels for naming organisms/artwork

📋 Lesson Procedure
⏱ 1. Introduction – What's in a Drop? (10–15 min)
Discuss with students:
"What do you think lives in a single drop of pond water?"
Show short video or image (e.g., tardigrades, euglena, paramecium).
Explain that many water organisms are microscopic but vital for ecosystems.

🧪 2. Water Sample Collection (20–30 min)
Guide students to a safe water source (pond, rain barrel, stream, artificial water collection containers).
Students work in pairs or small groups to:
Collect small water samples in labelled containers.
Note collection location and time.

🔬 3. Microscope Lab: Observe & Discover (30–40 min)
Students prepare slides from their samples using pipettes.

Under supervision, they:
Observe organisms under the microscope.
Draw/sketch what they see in their observation sheet.

Try to identify (or guess!) what they found using reference charts or photos.

📌 Optional Identification Guide:

Organism Shape Movement
Euglena Oval + tail Wiggles/swims
Paramecium Slipper-like Zooms around
Rotifer Wheel-head shape Rotating motion
Algae (e.g., Volvox) Round/cluster Floats/spins

🎨 4. Artistic Reflection: Create Your Micro-Aquarium (20–30 min)
Two options:

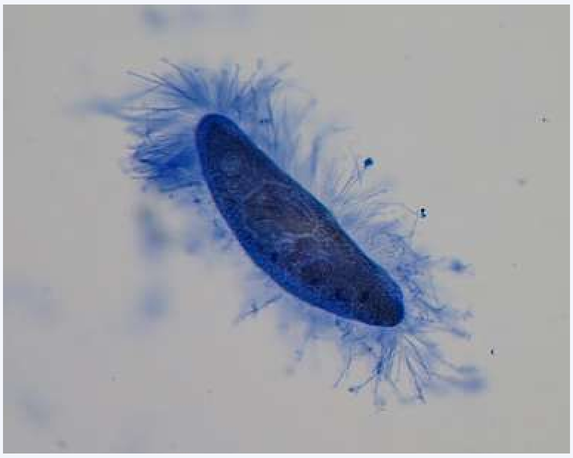
🖌 Traditional Art – Students sketch and paint their microorganisms on a poster sheet to create a class micro-aquarium exhibit.

💻 Digital Art – Using tablets/laptops, students recreate what they observed in Canva, Procreate, Paint, or similar tools.

Each student or group names their organism and writes a creative label:

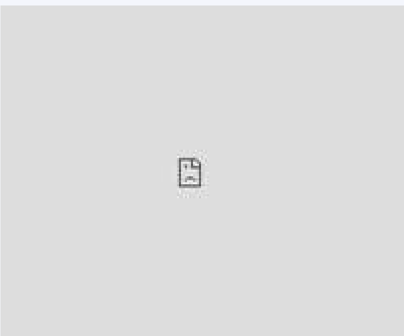
🗣 5. Gallery Walk & Reflection (10–15 min)
Display all artwork on a classroom wall or school hallway.
Invite students to walk around and:
Leave sticky notes: "I love how you drew..." / "That one looks like..."
Discuss: Why is microscopic life important?

Some example pictures of microorganisms for your "Microscopic Water World" lesson



ACC Common Pond Water Sample Organisms – iNaturalist Guide

Quizlet Flashcards:



13- Water Footprint Collage – How Much Water Do You Use?

🧭 Lesson Overview
Title: Water Footprint Collage
Theme: Water Literacy, Sustainable Use
Subject Integration: Math, Environmental Science, Visual Arts
Grade Level: 10–12 (can be adapted for younger groups)
Duration: 2 class periods (90 minutes total)
Setting: Classroom & Outdoor (if you include research surveys)

🎯 Learning Objectives
By the end of the lesson, students will be able to:
Understand the concept of water footprint.
Calculate approximate personal daily water usage.
Visually represent their findings in a collage art piece.
Compare global water consumption patterns.
Reflect on how lifestyle choices impact water use.

📚 Materials Needed
Old magazines, newspapers, flyers
Scissors, glue sticks, markers, A3 or A2 drawing paper
Access to computers or tablets for quick research
Pre-prepared chart of common water uses (see below)
Optional: real objects (bottle caps, wrappers, textile scraps) for 3D collage
Sample "Water Use Infographic" (print or project)

🧠 Background Information (Teacher Prep)
Create or download a visual reference table for daily activities, such as:

Activity	Water Used (Liters)
1 shower (5–10 min)	65 L
1 toilet flush	6–12 L
1 load of laundry	90–150 L
1 glass of milk (indirect)	200 L
1 hamburger (indirect)	2400 L
10 minutes of dishwashing	30–50 L

⏳ Lesson Procedure

Day 1 (45 minutes)

1. Warm-Up Discussion (10 mins)
Ask: “How much water do you think you use every day?”
Show a short video or infographic on virtual water (e.g., how much water is needed to make a T-shirt or grow a tomato).

2. Mini-Research Task (15 mins)
In pairs or small groups, students:
Use a chart or online calculator to estimate their personal water footprint.
Focus on 5–7 daily activities (eating, washing, clothes, etc.).
Note values and keywords on a worksheet.

3. Collage Planning & Brainstorming (20 mins)
Students sketch a rough design of how they want to represent their “Water Day.”
Plan the layout: e.g., split page into "Morning / Afternoon / Night" or by activity type.

Day 2 (45 minutes)

4. Collage Creation (35 mins)
Students use recycled materials (magazine cutouts, symbols, numbers, labels) to create a water footprint collage.
Add estimates for each activity (e.g., “Shower – 65L” with a bathtub image).
Encourage creativity: water drop shapes, timelines, pie charts, etc.

5. Gallery Walk + Reflection (10 mins)
Display all collages around the room.
Students walk around, observe, and use sticky notes to leave comments or questions on each other's work.
Teacher-led discussion:
“Which activity surprised you the most?”
“How can we reduce our water footprint?”
“Do all countries use water the same way?”

🔁 Extension Activities

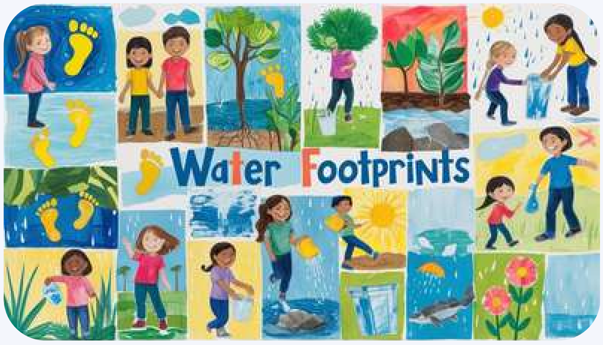
Compare & Contrast: Provide example water footprints from different countries (e.g., USA, India, Netherlands) and discuss inequalities.

Solutions Poster: In groups, students design posters suggesting 5 ways to reduce water use.

Digital Adaptation: Create a digital collage using Canva or Google Slides.

🧮 STEAM Connections
Math: Estimate, compare, and visualize quantities.
Art: Collage design, symbolism, mixed-media creativity.
Geography: Global water use comparisons.
Environmental Science: Sustainability, conservation, and human impact.

📝 Assessment
Formative: Participation in research, collage planning.
Summative: Collage presentation evaluated on:
Accuracy of information (data included)
Creativity and clarity of design
Reflection or self-assessment response



14. Melting Ice, Rising Seas

📘 Overview
Grade Level: 9–12 (adaptable for middle school)
Subject Areas: Physics, Geography, Environmental Science
Duration: 1 class period (45–60 minutes)
SETTING: CLASSROOM OR OUTDOOR SCIENCE SPACE

🎯 Learning Objectives
By the end of this lesson, students will:
Understand how melting land ice and melting sea ice affect sea levels differently.
Conduct a simple experiment to observe and record water displacement.
Interpret data to visualize sea-level rise.
Propose resilient coastal city designs in response to climate change.

🧪 Materials Needed (per group)
2 clear plastic containers or bowls
Ice cubes (enough to fill part of both bowls)
Small rock or brick (to simulate land in one bowl)
Water (room temperature)
Ruler or measuring tape
Marker for marking water levels
Worksheet (to record observations and data)
Optional: Digital scale for precision measurements
Colored pencils/graph paper or digital graphing tool

⏳ Lesson Procedure
1. Engage (5–10 minutes)
Warm-Up Question:
“If all the ice in the Arctic melted, would sea levels rise?”

- Let students brainstorm and share predictions.
- Show a short video or infographic about the difference between glacier ice (on land) and sea ice (floating).

https://www.youtube.com/watch?v=Kp5OqedXIGA

https://www.youtube.com/watch?v=2m_d1J5XrT8

2. Explore (15–20 minutes)
Hands-on Experiment:

Step 1 – Sea Ice Bowl (Floating Ice):

Fill Bowl A with water.

Add several ice cubes so they float.

Mark the water level with a marker or tape.

Step 2 – Land Ice Bowl (Ice on Rock):

Place a large rock or brick in Bowl B.

Add ice cubes on top of the rock (not in the water).

Fill with water just below the rock's edge and mark the water level.

Wait 10–15 minutes while ice melts.
Students observe and record changes in water level every 5 minutes.

3. Explain (5–10 minutes)
Discuss the science behind observations:

In Bowl A, melting sea ice does not significantly raise water level (Archimedes' principle).

In Bowl B, melting land ice causes noticeable water level rise.

Connect this to Antarctica and Greenland vs. Arctic sea ice.

4. Elaborate (10–15 minutes)
Data Interpretation & Graphing:

Students plot the water level change over time for both bowls.

Discuss real-world implications: Which type of ice poses a bigger threat for sea-level rise?

📝 Written Reflection Prompts
Have students respond to 1–2 of these in a journal or exit slip:

1. What did you learn about the difference between sea ice and land ice?
2. Why is sea-level rise a concern for people living near the coast?
3. What are some ways cities can adapt to rising seas?
4. How do your experiment results connect to what's happening in the real world?

15- Water Detectives – Exploring Local Water Pollution

📘 Overview
Grade Level: 7–12
Subjects: Chemistry, Environmental Science, Geography
Type: Outdoor Fieldwork + Lab Analysis
Duration: 90–120 minutes (can be split into two sessions)

🎯 Learning Objectives
Students will:
Understand different types of water pollutants (chemical, biological, physical).
Perform basic tests on water samples (pH, turbidity, nitrates, etc.).
Identify potential pollution sources based on local observations.
Propose solutions to reduce or prevent water pollution.
Advocate for clean water through communication and art/media.

🧪 Materials Needed
For Field Collection:
Clean, labeled containers or bottles (for samples)
Disposable gloves
Clipboards + pens/pencils
GPS app or printed maps
Digital camera or smartphone (optional)
Sample collection worksheet

For Lab Testing:
Water testing kits (pH strips, turbidity tubes, nitrate/phosphate test kits)
Beakers, measuring cylinders
Funnels and filters (if needed)
Gloves and safety goggles

For Reporting:
Poster paper, markers, glue (for physical posters)
Laptops/tablets (for digital poster or video making, optional)
Internet for research

⏳ Lesson Procedure

🔹 1. Engage – Introduction & Hypothesis (15 minutes)

Discussion prompts:

What types of water pollution do we know?

Where might local water sources be affected?

Why does water pollution matter for ecosystems and human health?

Brainstorm: Students hypothesize about pollution sources near your school/neighborhood.

🔹 2. Explore – Outdoor Sample Collection (30–45 minutes)

Instructions:

Split into small groups (3–5 students).

Assign each group a location (pond, tap, drain runoff, etc.).

Students collect water samples using gloves and label containers with:

Date

Time

Location

Weather conditions

Document the site with:

GPS location (use phone maps)

Site observations (nearby roads, farms, litter, wildlife)

Safety reminder: Avoid direct contact with unknown water; handle samples carefully.

🔹 3. Explain – Lab Testing & Analysis (30–45 minutes)

Back in the classroom/lab:

Each group performs water quality tests:

pH Test: Use strips or meters.

Turbidity Test: Use turbidity tube or shine flashlight to observe clarity.

Nitrate/Phosphate Test: Use color test kits.

Optional: Test temperature, conductivity, or presence of detergent/oil (if kits are available).

Record findings on a data table and compare across sites.

🔹 4. Elaborate – Map & Source Analysis (15–20 minutes)

Create a pollution map:
Plot all sample locations on a local map.
Add icons or notes about test results and nearby potential pollution sources (e.g., traffic, agriculture, industry).
Discussion:
Which samples showed more pollution?
What human activities are likely causing it?
How can the community help prevent it?

🔹 5. Extension – Advocacy Posters or Videos (Optional homework or follow-up)
Task: Create a campaign product:
Option A: Poster advocating for water protection
Option B: Video (1–2 min) explaining the importance of clean water and their findings
Focus on:
Pollution sources and solutions
Data from the activity
Emotional appeal to protect water systems

16- Water Music – Sounds of the Hydrosphere

🧩 **Overview**

Grade Level: 6–12

Subjects: Physics (sound), Music, Art, Environmental Science

Type: Sound experiment + Music Creation + Artistic Expression

Duration: 2 class sessions (45–60 min each)

Location: Indoor + Outdoor (for sound collection)

🎯 **Learning Objectives**

Students will:

Explore the physics of sound using water and various containers.

Identify and record water-related sounds from their environment.

Create and perform an original water-themed music composition or soundscape.

Express water conservation and awareness through lyrics or spoken word.

Use digital tools for recording, mixing, and presenting their work.

📦 **Materials Needed**

For Sound Exploration:

Water bottles, bowls, glasses, jars

Droppers, spoons, small stones

Pitch pipes or tuning forks (optional)

Smartphone/tablet with voice recording apps (e.g., Voice Memos, GarageBand)

Sound editing software (optional): Audacity, Soundtrap, BandLab, GarageBand

Headphones or speakers for playback

Clipboards or journals for sound notes

For Art/Music Creation:

Paper and pens for lyrics or poetry

Access to Canva/Google Slides for album art or lyric visuals (optional)

Instruments (optional): drums, shakers, keyboards

Projector and speakers for final performance

⏳ Lesson Procedure

🔹 Session 1: Sound Exploration & Experimentation (45–60 min)

1. Engage (10 min)
Discussion:
Where do we hear water in nature or daily life?
How does water sound different in various contexts (dripping vs. crashing waves)?
What does water mean to us emotionally?
Goal: Build emotional and sensory awareness of water.

2. Explore (25–30 min)
Outdoor/Indoor Activity:
Students explore around the school (or use pre-recorded sounds) to identify and record:
Rain or dripping from gutters
Running taps or fountains
Splashing water
Waves (if near a coast or audio files provided)
Optional: Play high-quality samples (via YouTube or Sound libraries) of:
Ocean waves, rainstorms, rivers, melting glaciers.
Water Instrument Lab:
Students experiment with filling containers at different levels to create tones.
Use droppers, spoons, and hands to create rhythm and sound.
Record sounds and label them with names like "water bass," "bottle chime," etc.

3. Explain (10–15 min)
Introduce basic sound concepts:
Pitch (depends on amount of water in container)
Volume (depends on force of action)
Timbre (material of container: glass vs. plastic)
Echo, reverb, and rhythm

🔹 Session 2: Creation & Performance (45–60 min)
1. Elaborate – Composition Time (25–30 min)
Creative Choices:
Students choose one of the following tasks (individually or in teams):
Create a Water Symphony: A rhythmic water performance using bottles/jars
Write Water Lyrics or Poem: Include themes like scarcity, beauty, conservation
Mix a Digital Water Soundscape: Combine field recordings + music software
Compose a Spoken Word Piece: Express emotional connection to water
Encourage students to use rhythms, layering, and real water sounds for authenticity.

2. Extend – Performance or Presentation (15–20 min)
Perform music/sound in class or record and share digitally.
Optional: Display as a sound art installation (paired with water-themed drawings, facts, or digital visuals).

STEAM PROJECT 1

WATER FILTRATION THROUGH STEAM

Introduction
– Objective:
The main goal of this project is to raise awareness about the importance of water conservation and understanding the water cycle using a STEAM (Science, Technology, Engineering, Art, and Math) approach. By engaging students and the public, we aim to foster a deeper connection to water management practices and create innovative solutions to water-related challenges.

– Why this topic?
Water literacy is crucial as it plays a vital role in addressing global water scarcity, pollution, and the overall sustainability of ecosystems. We chose to focus on water conservation and the water cycle as key aspects of water literacy because these concepts directly affect our daily lives, communities, and the environment. Educating others about these topics is the first step towards creating a more sustainable future.

3. Project Description
: – Concept:
The project integrates various STEAM components, particularly focusing on creating an accessible, interactive learning experience. The project showcases how simple, everyday materials can be used to create water filtration systems, helping the audience understand the purification process, water treatment, and the importance of clean water.

– Inspiration:
The inspiration for this project came from personal experiences and environmental concerns regarding water pollution, climate change, and water scarcity. Additionally, the project draws on the scientific concept of the water cycle and sustainable water practices, seeking to educate others about how we can reduce water waste and enhance water quality

.4. Materials Used
– Physical Materials:
- Plastic bottles
- Cotton (e.g., makeup pads)
- Sand
- Pebbles
- Activated charcoal

– Digital Tools:
- Video editing software (e.g., Adobe Premiere, iMovie)
- Digital art tools (e.g., Photoshop, Canva) for visual representation and infographics
- Augmented Reality (AR) elements for interactive learning
- Data analysis tools (Excel, Google Sheets) for water data visualization

5. STEAM Integration
Science: How does your project relate to scientific concepts about water (e.g., water cycle, pollution, ecosystems)?
Technology: Describe any technological tools or techniques used (e.g., digital art software, interactive elements, AR).
Engineering: How did you think about structure or design when making your work (e.g., making it durable, functional, or interactive)?
Art: Explain the artistic choices you made (e.g., color palette, composition, symbolism).
Math: Describe any mathematical elements involved (e.g., proportions, measurements, data used in your work).

6. Water Literacy Focus
– Science:
The project explains scientific concepts such as the water cycle, water pollution, and filtration techniques. The use of materials such as activated charcoal and sand highlights water purification processes.

– Technology:
Digital tools, including video editing software and AR technology, allow for creating interactive educational content and simulations, making the learning process more engaging and accessible.

– Engineering:
The design of the water filtration system required careful planning and testing to ensure it was functional and effective in purifying water. Structural choices were made to ensure the system was durable and could be easily replicated using common materials.

– Art:
The project utilizes visual elements to communicate the importance of water. The use of colors and composition in the water filtration model emphasizes the clarity and purity that can be achieved through proper filtration. Infographics and diagrams were used to simplify complex water-related concepts.
– Math:

Mathematical concepts were involved in determining the proportions of materials used in the filtration system. Measurements and data analysis were performed to evaluate the efficiency of the filtration process, including comparing water clarity before and after filtration.

7. **Challenges and Problem-Solving**

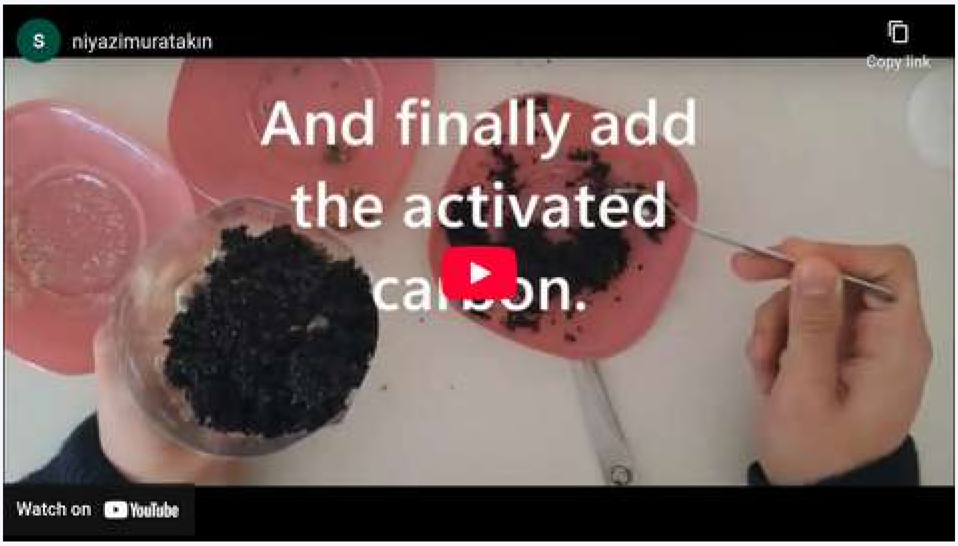
- **Challenges:**
 One of the main challenges faced during the project was ensuring that the water filtration system was effective enough to clean the water. Testing different combinations of materials required multiple trials to achieve the desired results. Additionally, integrating interactive digital elements into the project posed challenges in terms of accessibility and technical knowledge.

8. **Reflection and Impact**
- **Contribution to Water Literacy:**
 This project contributes to raising awareness about the importance of understanding and conserving water. It demonstrates that simple, creative approaches can be effective tools in educating people about water conservation and the science behind water purification.

- **Expected Outcomes:**
 By participating in this project, the audience will better understand the processes involved in water filtration and gain practical knowledge about how to conserve and protect water. The project aims to inspire students and communities to engage in environmentally friendly practices that benefit water resources.

9. **Conclusion**
- **Summary:**
This project not only educates about water literacy but also inspires action towards improving water sustainability through innovative approaches. The process of designing and testing the filtration system helped deepen our understanding of water science, and the integration of digital tools enhanced the accessibility and impact of the project.

- **Learning Outcome:**
 By working on this project, we learned the importance of interdisciplinary collaboration in STEAM fields, how digitalization can enhance educational experiences, and the crucial role that water plays in environmental sustainability.



STEAM PROJECT 2
THE WATERGLASS

1- Introduction
Using water to use our time effectively while recycling water and plastic bottles.

2- Project Description
My reason to do this project is to be aware of our time and wastes. If we don't use our resources effectively we won't be able to drink or use water.

3- Materials Used
A water bottle, a measurement cup, blue tac/gum, water, thumbtack, marker, scissors, a phone to calculate the time and a tape (not a must).

4- STEAM Integration
Science: It relates to recycling of water because we're able to reuse the water we used.

Technology: I used a mobile phone to calculate the time.

Engineering: It was based off a hourglass.

Art: I used a specific type of water bottle because it has stripes that represents waves to me.

Math: I used time as an mathematical element.

5- Water Literacy Focus
Key Message: We can recycle water while using our time effectively
Target Audience: Anyone that uses time as a resource

6- Challenges and Problem-Solving
I didn't face any problems while making my project.

7- Reflection and Impact
I hope it helps people to be aware of recycling water and help them use their time effectively.

8- Conclusion
Instead of wasting water it helps you with your daily activities based on time and is reusable because it only works with water.

STEAM PROJECT 3
FILTERING PETROL OIL SPILLS

1- Introduction:

The main goal of this project is to detect which sorbent absorbs oil the best in order to find the right material. With the help of the material we found petrol oil spills can be cleaned easily.
I choose this topic because im aware that petrol oil spills is a great danger for our water sources. With the help of this experiment, Im making a reminder for this issue and also finding a good absorber material to help us clean the spills.

2- Project Description:

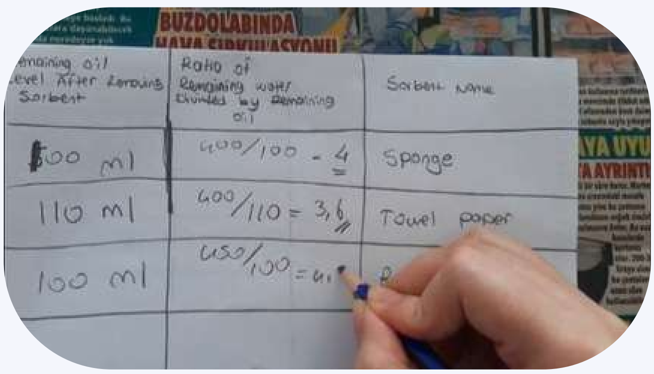
Im trying to communicate about the danger of petrol oil spills. This problem causes our water sources to get pollution and makes our sources less useable.
My inspiration was a science experiment I saw on tv. Then I decided to research about it.

3- Materials Used

- Fork
- Tea filter
- Rope pieces
- Banana peels
- Towel papers
- Sponge pieces
- A big cup
- Water, oil
- A glass
- Phone for recording + timer.

4- STEAM Integration:

It relates to water pollution and I used a phone for recording. Ratios, measuraments are used in this work.



5– Water Literacy Focus:
The main idea is to understand the importance of our water sources and try to keep our envoirenment clean. Cleaning petrol oil spills with the right sorbents is a part of this cleaning plan.
My target audience is everyone, no limits. Because the safety of our planet is crucial for anyone.

6– Challenges and Problem–Solving:
I Didn't face with a challenge, I was planned and organised so nothing went out of hand.

7– Reflection and Impact
My project raises awareness about the water pollution caused by petrol oil spills. With this project, we can detect great materials that holds oil rather than water.

8– Conclusion
This steamwork helped me to understand the danger of water pollution better.

STEAM PROJECT 4
Solar Water Purifier

1. Introduction
Objective: Our main goal is turning dirty water into clean,drinkable one with solar energy
Why this topic?: Water literacy is crucial because it helps people understand the importance of clean water and sustainable water practices. We chose this topic to highlight how solar-powered purification can contribute to water conservation, reduce pollution, and support communities with limited access to clean water.

2. Project Description
Concept: Our project focuses on designing a solar water purifier that transforms contaminated water into clean, drinkable water using only solar energy. The main message we aim to convey is the importance of sustainable and accessible solutions for clean water, especially in areas where clean water is scarce or unavailable.
Inspiration: This project was inspired by the global water crisis and the growing need for sustainable, low-cost purification methods.

3. Materials Used
A big bowl
A smaller cup
Stretch film
Any small object (rock etc.)
Dirty water

5. STEAM Integration
Science: Our project relates to scientific concepts such as the water cycle and pollution. The solar purifier uses evaporation and condensation—just like the natural water cycle—to separate clean water from contaminants.
Engineering: We carefully thought about the structure to make our purifier both durable and functional. We used simple, accessible materials but focused on a design that ensures maximum sunlight capture.

6. Water Literacy Focus
Key Message: The main idea is to highlight the importance of conserving water and understanding the water cycle to promote sustainable living
Target Audience: People from all ages

7. Challenges and Problem-Solving
Understanding the water purification process was complex.

8. Reflection and Impact
The project helped highlight water-saving habits and encouraged behavioral changes in the target group.
I hope the audience learns how their daily choices impact water resources and adopts more responsible habits.

9. Conclusion
Through this project, I gained a deeper understanding of the challenges related to water conservation and the importance of educating others about sustainable water use.

10. References
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National Geographic. (n.d.). Freshwater 101. Retrieved from https://www.nationalgeographic.org

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